Gold Standard for the Global Goals

Climate Security & Sustainable Development

METHODOLOGY

GS4GG PAA M400-06

SDG 13

JOINED UP SUSTAINABLE TRANSITION (JUST): FOSSIL FUEL GENERATORS

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SUMMARY

This methodology is globally applicable to project activities that replace operational fossil-fuel-based electricity generators (Baseline Generation Systems) with new renewable energy systems. The primary aim is to quantify the greenhouse gases (GHGs) emission reductions achieved by displacing electricity that would have otherwise been generated by fossil fuels combustion, such as diesel, gasoline, or natural gas.

Key Methodological Components:

- **Integrated Replacement:** The activity shall structurally link the accelerated and permanent decommissioning of an existing fossil-fuel generator or fossil-fired mini-grid with the commissioning of a greenfield Renewable Energy System (RES), ensuring direct displacement of fossil generation.
- **Conservative Baselines:** Baseline emissions are determined using a tiered framework applying site-specific historical data where available and conservative standardized defaults where data constraints exist. The baseline emissions adjusted annually using a Downward Adjustment Factor (DAF) aligned with the host country's Net Zero trajectory.
- **Comprehensive Leakage Accounting:** The methodology accounts for system-wide impacts, including leakage during transition periods where RES output temporarily falls short of baseline generation levels (gap leakage).

- **Just Transition Compliance:** Central to the activity is a Just Transition Plan, developed in accordance with GS4GG requirements. This ensures that the financial benefits of carbon finance directly ensure maintained or improved energy access.
- **Financial Additionality:** Activities shall demonstrate additionality in accordance with GS4GG requirements, applying positive list provisions where eligible and investment or barrier analysis where required.
- **Applicability:** The methodology covers the installation and operation of renewable energy technologies, including solar photovoltaic (PV) and wind power systems, with or without integrated energy storage (e.g., batteries). It applies to a range of contexts, such as providing power for off-grid communities, commercial and industrial facilities, and institutional or residential buildings that rely on captive fossil fuel generators for primary, supplementary, or backup power.

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1| KEY INFORMATION

1.1.1 | The following table describes the key information for the application of this methodology.

Table 1. Key information

Term	Description
Activity summary	The activity shall involve the accelerated and permanent decommissioning (phase-out) of operational fossil-fuel-based electricity generation systems (e.g., gensets, fossil-fired mini-grids) and their integrated replacement with new (greenfield) Renewable Energy Systems (RES). The activity shall align with the principles of a Just Transition and ensure maintained or improved energy access.
Mitigation activity (project) type	☒ Emissions reductions ☐ Emission removals
Applicable activity (project) scale	☒ Micro scale (≤10,000 tCO_2 eq per year) ☒ Small scale (≤15 MW installed capacity) ☒ Large scale (>15 MW installed capacity)
Sectoral scope	SS 1: Energy Industries (renewable/non-renewable sources)
Activity Requirement	☒ Community Service Activity (CSA) ☒ Renewable Energy Activity Requirements
Activity start date	- **For mini-grid activities:** The earliest date of a contractual commitment for expenditure related to the implementation of the mitigation activity (e.g., equipment purchase orders, EPC contracts). Preliminary expenditures such as land acquisition, feasibility studies, or permitting do not constitute the start date. - **For other Distributed Renewable Energy (DRE) activities:** The date the first renewable energy system distributed or installed under the design certified activity or the earliest contractual date for expenditure directly linked to implementation of activity (e.g. purchase orders, installation agreements).
Crediting period start date	The start date of the crediting period is the date of the start of operations of the RES or a maximum of two years prior to the date of Design Certification, whichever occurs later. The crediting period start date shall not be earlier than the activity start date.
Applicable Gold Standard for	☒ Gold Standard Verified Emissions Reduction (GSVERs) ☒ Certified impact statement

Global Goals (GS4GG) products	
Geographical applicability	Global
Crediting period length	Five years, renewable twice (maximum 15 years). The maximum crediting period length is limited by the earliest of the following: - The end of the chosen crediting period (if different from standard 15 years). or - The end of the technical lifetime of the activity equipment, unless it is justified that the equipment is replaced by similar activity equipment that can meet equal to or higher service level, or - The end of the remaining lifetime (RLT) of the baseline system, unless it is robustly justified that the baseline system would have been replaced by a similar fossil-fuel generator, or - The date a legal mandate requiring the activity comes into force.
Additional requirements	Activities applying this methodology shall comply with the GS4GG: Just Transition Requirements, adapted for the scale and socio-economic context of the activity. Refer to Annex 5 Guidance: Proportionate Just Transition (JT) Implementation for Decentralized Energy Transitions.

2| DEFINITION

2.1.1 | In addition to the terms and definition listed in the GS4GG Glossary, and the referenced standards and tools, the following definitions shall apply in the context of this methodology.

Table 2. Terms and definitions

Term	Definition
Baseline Generation System	The existing electricity generation system (e.g., individual genset, fossil-fired mini-grid) that uses fossil fuels (e.g., diesel, petrol, natural gas, LPG, HFO) as its primary energy source and is subject to accelerated decommissioning under the activity.
Battery Energy Storage Systems (BESS)	A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls, and power conditioning systems.

Captive Generation	An electricity generation facility used by an industrial, commercial, or institutional consumer primarily for its own consumption. Captive generation systems may be grid-connected, provided that the grid is used solely for supplementary power or backup during outages, and the baseline generation system was the primary source of electricity for the consumer. In case of supply to grid, the facility shall not export more than 10 per cent on a yearly basis of its generation to a grid
Consumers	End-users or facilities (e.g., households, commercial entities, industrial facilities, public institutions) that consumed electricity from the baseline generation system and are served by the renewable energy system (RES) in the activity scenario. Consumers are categorized as Type I or Type II for the purpose of baseline determination when using standardized defaults. Consumers shall receive equivalent electricity services in the activity scenario. - **Type I Consumer (Residential and Community Services)** - End-users/facilities that include households (residential use only), schools, healthcare centers, public administration buildings, and small local shops providing essential commodities (e.g., food, medicines). - **Type II Consumer (Commercial and Productive Use)** - End-users/facilities that include small, micro, and medium enterprises (SMMEs), industrial facilities, commercial offices, agricultural facilities (e.g., irrigation pumps), street lighting, and any household engaged in significant commercial activity (e.g., running a commercial workshop).
Distributed Renewable Energy Generation system	Decentralized, modular renewable energy systems that generate electricity close to the point of consumption, typically serving individual consumers, households, communities, or small commercial entities. These typically operate as stand-alone (off-grid) systems or isolated mini-grids and are not connected to a national or regional grid.
Genset	A stationary, but potentially movable, electricity generating system that converts fossil fuel (chemical energy) to electricity.
Grid	An interconnected system that enables the delivery of electricity from producers to consumers. It consists of power stations, substations, transmission, and distribution infrastructure and is typically managed by a system operator. In the context of this methodology, the grid refers to a national or regional system and does not include isolated grid systems.
Integrated Replacement	The coordinated process wherein the commissioning of the RES is causally linked to, and contractually bound with, the permanent decommissioning of the baseline generation system within a defined implementation period. This linkage ensures that the displacement of fossil fuel generation is a direct result of the activity implementation, preventing activity shifting or leakage.

Isolated Mini-Grid	A small-scale power system with a total installed capacity not exceeding 15 MW (i.e. the sum of installed capacities of all electricity generating units connected to the mini grid is equal to or less than 15 MW) which is not connected to a national or a regional grid.
Unreliable Grid	A grid connection where the supply of electricity is documented as - available for an average of less than 4 hours per day over the most recent 12-month period or less than 1460 hours in a calendar year for which data is available. OR - available to consumers (by number of households or connections) to be less than 15% of the project location at the time of project start date. Evidence for this shall be provided through official utility records, independent studies, or, if such data is unavailable, through a robust, on-site monitoring campaign over 3 months period conducted prior to the project start.

3| SCOPE, APPLICABILITY, AND ENTRY INTO FORCE

3.1 | Scope

3.1.1 | This methodology is globally applicable to activities that achieve greenhouse gases (GHGs) emission reductions through the transition to renewable energy in decentralized energy contexts (off-grid, unreliable grid, and captive generation).

3.1.2 | The scope of the activity encompasses the following interconnected components:

a. **Accelerated Phase-out:** The early and permanent decommissioning of existing, operational fossil-fuel-based electricity generation systems (i.e., baseline generation systems), including individual gensets and fossil-fired mini-grids.

b. **Renewable Energy Deployment:** The installation and operation of a new (greenfield) RES—which may include energy storage systems (e.g., BESS)—designed to replace the electricity generation and ensure the service level previously provided by the baseline generation system.

c. **Just Transition Implementation:** The execution of measures to ensure the transition is fair and inclusive, in compliance with the GS4GG Just Transition Requirements, proportionate to the scale and context of the activity (Annex 05).

3.1.3 | The mitigation outcome is the reduction of GHG emissions achieved by displacing the electricity that would have been generated by the Baseline Generation System (and the unreliable grid, if applicable) with the electricity generated by the RES.

3.2 | Applicability

3.2.1 | The methodology is applicable to an activity that meets all the following criteria.

A. General Activity Requirements

3.2.2 | **Integrated Transition and Linkage:** The activity shall involve the installation of a greenfield RES implemented specifically to displace the baseline generation system. Evidence shall be provided demonstrating the linkage between the decommissioning and the RES installation (e.g., integrated project plans, programmatic implementation frameworks, or consumer contracts linking the replacement).

3.2.3 | **Capacity Adequacy and Service Level:** The activity shall demonstrate that the RES configuration ensures equivalent or improved energy service compared to the baseline. This requires:

a. The expected annual net electricity generation of the RES configuration shall be sufficient to meet the baseline demand (historical generation EG_{BAS}) or the suppressed demand of the consumers.

b. A demonstration that the RES configuration maintains or improves the Service Level, ensuring the reliable supply of electricity. This includes:

i. **Availability:** Meeting or exceeding baseline hours of availability (h/day);

ii. **Power Quality:** Delivering electricity within standard voltage and frequency tolerances (e.g., ±0.25 Hz) suitable for the consumer's appliances.

iii. **Dispatchability:** For Off-Grid Type 1 consumers (residential/community), the RES shall include energy storage (e.g., BESS) or equivalent dispatchable generation capability to ensuring power availability during peak demand periods (e.g., evening lighting). Solar-only systems without storage are not eligible for full replacement claims in this category.

3.2.4 | **Just Transition Compliance:** The activity developer shall comply with the latest version of the GS4GG Just Transition Requirements. A Just Transition (JT) Plan, proportionate to the scale, socio-economic impact, and context of the activity, shall be developed and implemented. The progress of the implementation of the JT Plan shall be monitored throughout the crediting period.

B. Baseline Generation System Criteria

3.2.5 | The baseline generation system (BGS) shall meet the following criteria.

3.2.5.1 | **Fuel Type:** The system shall use fossil fuel (e.g., diesel, petrol, natural gas, LPG, Heavy Fuel Oil) as its primary energy source. "Primary energy source"

is defined as providing >80% of the total energy input (on a net calorific value basis) during the historical reference period.

3.2.5.2 | **Grid Connection Status and Context:** The BGS shall operate in one of the following contexts:

a. **Off-Grid:** Consumers are not connected to a national or regional grid.

b. **Unreliable Grid:** Consumers are connected to an unreliable grid (as defined in Section 2) and use the BGS as a primary or essential supplementary source of electricity.

c. **Captive Generation:** An industrial, commercial, or institutional facility relies on the baseline generation system for its primary power supply. Grid connection is permitted for backup or supplementary power only.

3.2.5.3 | **Operational Status and History:** The BGS shall be operational and commercially viable at the time of the activity start date.

a. **Tier 1 (Preferred - Detailed Data):** The system has a representative history of operation during the historical reference period (12-36 months – at minimum 12 months) with verifiable operational data (e.g., fuel logs, maintenance records, metered output).

b. **Tier 2 (Simplified - Limited Data):** Where detailed historical data is unavailable, operational status shall be verified through evidence of recent operation listed below. Visual inspection alone is insufficient:

i. Fuel purchase receipts from the 12 months prior to the start date; OR

ii. Operational load logs; OR

iii. Physical inspection e.g., a successful "test run" witnessed by the VVB during validation; OR

iv. Dated photographic/video evidence of operation.

3.2.5.4 | **Regulatory Surplus:** The BGS shall be free of any pre-existing legal mandate for early closure or replacement. Where a legal mandate is in place, the activity may be eligible if the mandate is systematically not enforced. Systematic non-enforcement is demonstrated if <50% of applicable entities in the region comply with the regulation, or through official government reports confirming widespread non-compliance.

3.2.5.5 | **Remaining Lifetime (RLT):** The baseline generation system shall have a remaining technical/operating lifetime of at least five years. The RLT shall be determined using one of the following options (detailed in Section 7):

a. **Detailed Assessment:** According to the procedures in A6.4 AMT -006.

b. **Simplified Assessment (for systems < 1MW):** Based on standardized tables of default technical lifetimes by technology, adjusted for the asset's age and verified physical condition (Annex -1).

3.2.5.6 | **Permanent Decommissioning and Disposal:** The baseline generation system shall be permanently phased out. This requires:

a. **Inoperability and Leakage Prevention:** The system shall be rendered permanently inoperative. Major components (e.g., engine, alternator) and auxiliary infrastructure essential for operation (e.g., bases, dedicated fuel tanks, LNG vaporizers) shall not be reused or sold for use in other fossil fuel combustion activities.

b. **Phase-out Timelines:** The phase-out (cessation of generation and decommissioning/collection) shall be completed within the following maximum deadlines after the RES commences operation:

i. Mini-Grids and Commercial/Industrial Systems: 12 months.

ii. Individual/Household distributed systems: 24 months.

iii. Credits associated with that specific baseline generation system shall only be issued after decommissioning is verified.

C. Renewable Energy System (RES) Criteria:

3.2.6 | The Renewable Energy System (RES) shall meet the following criteria.

3.2.6.1 | **Technology Eligibility:** The RES shall utilize one or a combination of the following renewable energy technologies: Solar (PV), Wind, Hydro (run-of-the-river only), or Tidal/Wave power. Associated BESS may be included as part of the RES configuration.

3.2.6.2 | **Greenfield Requirement:** The RES shall be a newly constructed system (Greenfield).

3.2.6.3 | **Location:** The RES shall be located to serve the same consumers or the same geographical area previously served by the Baseline Generation System.

3.2.6.4 | **Permitted Backup and Supplementary Sources:** Grid electricity or on-site fossil-fuel-based generation may be used as a backup source only when the RES generation is insufficient to meet the required Service Level.

a. The share of non-renewable electricity in the activity's total net annual electricity generation shall not exceed 10%.

b. Emissions associated with these sources shall be monitored and fully deducted as Activity Emissions.

D. Exclusions

3.2.7 | The following project activities are ineligible under this methodology:

a. Project activities[1] using biomass, geothermal, or hydro power with reservoirs.

b. Portable renewable energy systems (e.g., solar lanterns).

3.3 | Mandatory Compliance and Safeguards

3.3.1 | **GS4GG Requirements:** The activity shall adhere to the Principles & Requirements, Safeguarding Principles & Requirements, applicable Activity Requirements (Renewable Energy and/or Community Services), and the Just Transition Requirements.

3.3.2 | **Regulatory Compliance:** The project activity shall comply with all applicable national and local laws, regulations, and environmental standards in the host country.

3.3.3 | **Double Counting Mitigation and EACs**:

a. **General:** To mitigate the risk of double issuance and claims, the activity developer shall conform with the requirements set forth in the GHG Emissions Reduction & Sequestration Product Requirements.

b. **Energy Attribute Certificates (EACs):** If Energy Attribute Certificates (e.g., RECs) are issued for energy generated by the RES, the activity developer may only claim GS-VERs if verifiable evidence is provided (e.g., cancellation of EACs) ensuring that the same MWh of electricity generation is not claimed for both EACs and GS-VERs.

3.3.4 | **Health, Safety, and Waste Management**:

a. **Health and Safety:** Activities shall comply with the most stringent applicable health and safety requirements (e.g., local laws, relevant international standards such as IFC EHS Guidelines) in line with Principle 3 of the Safeguarding Principles & Requirements.

b. **Genset Decommissioning:** A specific plan shall be implemented for the safe decommissioning of BGS, including the prevention and control of hazardous material releases (e.g., lubricants, fuels) and the management of all waste streams.

c. **End-of-Life Battery Management:** For activities utilizing BESS, a specific end-of-life management plan for batteries shall be in place. This plan shall ensure the proper collection, transport, and disposal or recycling of batteries, adhering to national regulations or international best practices (e.g., Basel Convention guidelines).

[1] Note: These technologies involve distinct baseline scenarios, such as thermal applications or baseload profiles, and feedstock sustainability complexities that are addressed in separate, dedicated methodologies.

3.4 | Entry into force

3.4.1 | The date of entry into force on its publication date.

4| NORMATIVE REFERENCES

4.1.1 | The following standards, tools, and guidelines are normative references for the application of this methodology. Activity developers shall apply the latest valid version of these documents available:

a. GS4GG Methodology/ TOOL/ Resources:

i. Methodology Standard: Just Transition Requirements
ii. Methodological Tool 01: Emissions from Fossil Fuel Combustion
iii. Methodological Tool 02: Emissions from Freight Transportation
iv. Methodology Tool 05: Downward Adjustment Factor Determination

b. CDM/ PACM A6.4 Methodology/TOOL: References to CDM tools are valid until equivalent tools are published under Article 6.4 Mechanism (A6.4). Upon publication of an A6.4 tool, it shall supersede the corresponding CDM tool.

i. A6.4 – AMT-002: Investment analysis;
ii. A6.4-AMT-006: Determination of the technical lifetime of equipment
iii. A6.4 – AMT-007: Emissions from electricity generation and/or consumption
iv. CDM TOOL28: Calculation of baseline, project and leakage emissions from the use of refrigerants (hereinafter referred to as TOOL28) or Equivalent A6.4 AMT

c. Other References:

i. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 1.4, Chapter 1, Volume 2 (Energy)
ii. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
iii. ISO 14040: Environmental management — Life cycle assessment — Principles and framework
iv. ISO 14044: Environmental management — Life cycle assessment — Requirements and guidelines

5| ACTIVITY BOUNDARY AND GHGS SOURCES/SINKS

5.1 | Activity boundary

5.1.1 | The activity boundary encompasses all anthropogenic emissions by sources of GHGs that are under the control of the activity developer, are related to the activity, or are significantly affected by the activity.

A. Physical and Geographical Boundary

5.1.2 | The spatial extent of the activity boundary includes the physical infrastructure and sites directly involved in the activity, as well as the upstream processes relevant for assessing the activity's full GHG impact.

Table 3. Delineation of the Physical and Geographical Boundary

Component	Included in the Activity Boundary?	Description/Justification
Physical Infrastructure and Sites		
Baseline Generation System Site(s)	Yes	The physical location(s) of the baseline fossil fuel system(s).
RES Site(s)	Yes	The physical site(s) of the RES and associated infrastructure (e.g., BESS).
Electricity Grid (National/Regional)	Conditional	Included if the activity falls under the "Unreliable Grid" context or if the grid is used for backup or supplementary power.
Processes and Activities		
Baseline System Operation (Baseline Scenario)	Yes	The counterfactual operation of the Baseline Generation System (and the Unreliable Grid, if applicable).
Baseline System Decommissioning and Disposal	Yes	Activities related to the dismantling/collection of the baseline system and the transport/disposal/recycling of materials.
RES/BESS Manufacturing (Upstream)	Yes	The cradle-to-gate manufacturing processes for the RES/BESS infrastructure. Included for calculating embodied emissions.
RES Installation and O&M	Yes	Construction, installation, operation, and maintenance activities of the RES, including associated transport.
Land Use		

Land Area for RES	Yes	The land area occupied by the RES infrastructure. Included for the assessment of direct Land Use Change (LUC) emissions.

5.2 | GHG Sources

5.2.1 | The following tables identify the relevant GHG sources for the baseline scenario, the activity scenario, and leakage.

A. Materiality Thresholds for Inclusion

5.2.2 | **Baseline Emissions (CH_4/N_2O):** Exclusion of CH_4 and N_2O emissions from the operation of the Baseline Generation System is conservative default. They may be included only if their combined contribution is demonstrated to be material (≥1% of the total baseline emissions).

5.2.3 | **Activity Emissions**:

a. Emissions from direct land use change shall always be included (if applicable).

b. Embodied emissions shall always be included. Simplified default factors shall be used, particularly for small-scale and micro-scale activities.

c. For other activity emission sources, individual sources representing <2% of the total estimated activity emissions may be omitted, provided that the sum of all omitted sources does not exceed 5% of the total activity emissions.

B. Baseline Emissions

5.2.4 | The following table details the GHGs included in, or excluded from, the baseline scenario(s):

Table 4. Sources of Baseline Emissions

SOURCE	Description	GAS	INCLUDED?	JUSTIFICATION
Baseline Generation System Operation				
Fuel Combustion	Combustion of fossil fuels by the Baseline Generation System.	CO_2	Yes	Major source of baseline emissions.
		CH_4	Conditional	Conservative exclusion is default. Included only if the materiality threshold (≥1% combined) is demonstrated.
		N_2O	Conditional	Conservative exclusion is default. Included if the materiality threshold (≥1% combined) is demonstrated.

Grid Electricity Generation (If applicable)				
Grid Electricity	Electricity generation by the grid in the baseline scenario (Applicable only in the "Unreliable Grid" or "Captive" context).	CO_2	Yes	Calculated using the grid emission factor
		CH_4	No	Excluded for simplicity/conservativeness.
		N_2O	No	Excluded for simplicity/conservativeness.
Upstream Emissions				
Fuel Transport	Transportation of fossil fuels to the project site.	CO_2	No	Excluded for conservativeness.
		CH_4		
		N_2O		

5.3 | Activity emissions

5.3.1 | The following table details the GHGs in the activity scenario(s):

Table 5. Sources of Activity Emissions

SOURCE	Description	GAS	INCLUDED?	JUSTIFICATION
Process Operations				
Electricity/Fuel Consumption (General)	Grid electricity or fossil fuels consumed during decommissioning, RES installation, and O&M.	CO_2	Yes	Included unless exempted by the materiality threshold (2%/5% rule).
		CH_4	Yes	
		N_2O	Yes	
Fuel Combustion (Backup)	Fossil fuels consumed by permitted backup generators (if installed).	CO_2	Yes	Included if backup generators are used. Limited to 10% of total annual generation.
		CH_4	Yes	
		N_2O	Yes	
Transport Activities				
Transport of Materials	Transport of decommissioned baseline system materials and	CO_2	Yes	Included unless exempted by the materiality threshold (2%/5% rule).
		CH_4	Yes	
		N_2O	Yes	

	RES/BESS infrastructure.			
Embodied Emissions				
Manufacturing	Cradle-to-gate emissions from the manufacturing of RES components and BESS.	Various GHGs (CO_2e)	Yes (Mandatory)	Significant lifecycle emissions. Calculated using simplified defaults (Section 8) or supplier data. Amortized over the 1st crediting period.
Other Emissions				
Land Use Change (LUC)	Changes in biomass and soil carbon stocks due to direct land clearing for the RES installation.	CO_2	Conditional	**Included only if material.** Deemed de minimis for activities with negligible footprints (e.g., rooftop solar, wind on existing farmland).
Fugitive Emissions/Waste Disposal	Leakage of GHGs from equipment or decomposition of non-recyclable materials.	Various GHGs	Yes	Included unless exempted by the materiality threshold (2%/5% rule).

5.4 | Leakage emissions

5.4.1 | The following table details the GHG emissions included in, or excluded from, the leakage scenario:

Table 6. Sources of Leakage Emissions

SOURCE	Description	GAS	INCLUDED?	JUSTIFICATION
Physical Displacement				
Reuse of Baseline Equipment	Relocation and reuse of the Baseline Generation System infrastructure (or major components) outside the boundary.	CO_2 CH_4 N_2O	No	Excluded by the applicability criteria (Section 3.2.11), which mandate the permanent decommissioning and rendering inoperable of the baseline system.
Supply-Demand Gap				

Compensatory Generation	Electricity generation by other sources to compensate for a gap during the transition phase (e.g., if the baseline system is removed before the RES is fully operational).	CO_2 CH_4 N_2O	Yes	Ensures accounting for emissions during the transition phase if a gap occurs.
Market Leakage				
Displacement of Fuel	Consumption of the displaced fossil fuel by other users.	CO_2 CH_4 N_2O	No	The impact of decentralized fuel displacement on regional or global fuel markets is considered negligible for this scope.

6| DEMONSTRATION OF ADDITIONALITY

6.1 | Requirements

6.1.1 | The activity developer shall demonstrate that the activity—comprising the early decommissioning of the BGS, the installation and operation of the RES, and the implementation of the JT plan—would not have occurred in the absence of the incentives provided by the carbon revenues.

6.1.2 | The demonstration of additionality shall be conducted in accordance with the GS4GG: Requirements for Additionality Demonstration.

6.1.3 | **Approach Selection based on Scale and Context**

6.1.3.1 | The approach for demonstrating additionality depends on the scale of the activity and the geographical context.

Table 7. Additionality Demonstration Approaches

Activity Scale	Geographical Context	Required Approach
Micro-scale or Small-scale	LDCs, SIDS, or Vulnerable Regions*	Positive List (Deemed Additional) (Section 6.1.4), OR Investment Analysis (Section 6.4) OR Barrier Analysis (Section 6.5)
Micro-scale or Small-scale	All other regions	Investment Analysis (Section 6.4) OR Barrier Analysis (Section 6.5)
Large-scale	All regions	Mandatory Investment Analysis (Section 6.4)

**Vulnerable Regions are defined as sub-national regions within Lower-Middle-Income Countries (World Bank classification) officially recognized by the national government as underdeveloped or characterized by an electrification rate of less than 20%.*

6.1.4 | **Positive List (Deemed Additionality)**

6.1.4.1 | Activities meeting the criteria established based on the Methodology-Level Barrier Analysis (Annex 04), defined in Table 7 (Micro/Small-scale in LDCs, SIDS, or Vulnerable Regions) are deemed additional. These activities are exempt from the requirements of Sections 6.4 (Investment Analysis) and 6.5 (Barrier Analysis). They shall still comply with Section 6.2 (Regulatory Analysis) and Section 6.6 (Common Practice Analysis).

6.1.5 | **Additionality Assessment**

6.1.5.1 | Activities requiring additionality assessment shall robustly establish that:

a. The baseline scenario (continued operation of the BGS, as identified in Section 7) is the most plausible and economically attractive scenario; and

b. The proposed activity is economically less attractive than the baseline scenario or faces prohibitive barriers without the revenues from carbon credits.

6.1.6 | The assessment shall follow the stepwise approach as detailed in below sections.

6.2 | Regulatory Analysis

6.2.1 | The activity developer shall demonstrate that the emission reductions achieved by the activity are regulatory surplus, meaning they are not required by any existing laws, regulations, or mandates (legal requirements) within the host Party's jurisdiction. The assessment shall be conducted at start of 1st crediting period and at each renewal of the crediting period.

6.2.1.1 | **Host Country Eligibility:** The activity type shall not be excluded or declared ineligible by the host country (e.g., via a negative list) for the issuance of carbon credits.

6.2.1.2 | **Legal Mandates:** It shall be demonstrated that the early phase-out of the Baseline Generation System is not mandated by any existing legal requirement.

6.2.1.3 | **Systematic Non-Enforcement:** Where a legal mandate is in place, the activity may still be considered eligible if the mandate is systematically not enforced. Systematic non-enforcement is demonstrated if <50% of applicable entities in the region comply with the regulation, or through official government reports confirming widespread non-compliance.

6.3 | Lock In Risk Analysis

6.3.1 | A methodology-level Lock-In Risk Analysis has been conducted (refer to Annex 03). Activities that comply with all applicability criteria (Section 3.2) and the safeguards in this methodology (e.g., mandatory decommissioning,

EoL management) are deemed to meet the lock-in risk requirements and are exempt from conducting a project-specific analysis.

6.4 | Investment Analysis

6.4.1 | The activity developer shall conduct an investment analysis to demonstrate that the implementation of the proposed activity is not financially attractive without the carbon credits revenues. This is mandatory for large-scale activities and optional for small/micro-scale activities not on the Positive List.

6.4.2 | **Methodological Standard:** The investment analysis shall be conducted in conformity with the requirements of the A6.4-AMT-002: Investment analysis.

6.4.3 | **Analysis Method:** The analysis shall use an appropriate financial indicator, such as project IRR or NPV. The use of project IRR (pre-finance) is required to remove the subjective impact of specific debt structures.

6.4.3.1 | **Option A - Investment Comparison Analysis**: Compare the financial attractiveness of the activity against the baseline scenario (continued operation of the fossil fuel system). Demonstrate that the activity scenario (without carbon) is economically less favorable than the baseline scenario.

6.4.3.2 | **Option B - Benchmark Analysis:** Compare the financial attractiveness of the activity against a standard financial benchmark (e.g., Weighted Average Cost of Capital - WACC). This option is permitted for all activities and is recommended for third-party developers (e.g., ESCOs) who do not own the baseline equipment.

6.4.4 | **Input Parameters**: The analysis shall include all relevant costs and revenues:

6.4.4.1 | **Costs (CAPEX):** Decommissioning costs of the BGS, RES investment, infrastructure (including BESS, distribution upgrades, if applicable), O&M and Just Transition (JT) implementation costs.

6.4.4.2 | **Revenues/Savings:** Projected revenues from the sale of electricity generated by the RES (based on tariffs or market forecasts). For captive activities, financial savings from avoided fossil fuel purchase costs shall be explicitly included as a revenue stream.

6.4.5 | **Impact of Carbon Finance:** The analysis shall demonstrate that carbon revenues decisively improve the financial viability of the activity.

6.4.5.1 | **Objective Guidance:** "Decisiveness" is defined as carbon revenues enabling the project to cross the required financial benchmark (e.g., raising Project IRR from below the hurdle rate to above it) or providing a material increase in cash flows (e.g., >10% of revenue) that is decisive for the investment decision.

6.4.6 | **Sensitivity Analysis:** A sensitivity analysis shall be performed to demonstrate the robustness of the conclusion against reasonable variations (±10%) in critical parameters (e.g., fuel costs, CAPEX). It shall be demonstrated that the conclusion (that the activity is not financially attractive

without carbon revenues) holds true even under favorable variations of these parameters for the activity scenario.

6.5 | Barrier Analysis

6.5.1 | This option is available for micro-scale and small-scale activities not on the Positive List.

6.5.2 | The developer shall demonstrate that implementation is prevented by specific barriers (Financial, Institutional, or Technological)[2] and that carbon revenues are crucial to overcoming them, following the requirements in the GS4GG additionality standard.

6.6 | Common Practice Analysis:

6.6.1 | The activity developer shall conduct a common practice analysis following the GS4GG Methodology Tool: Common Practice Analysis (MT400-06).

6.6.2 | **Technology Classification and Exemptions:** While distributed renewable energy technologies are increasingly mature, the integrated mitigation activity defined in this methodology—which mandates the accelerated decommissioning and verifiable physical destruction of operational fossil-fuel assets coupled with a formal Just Transition Plan—faces significant ongoing adoption and structural barriers. Consequently, this methodology formally pre-classifies the integrated activity as a **Technology Maturity Category 2 (TMC-2: Early Adopter)**.

6.6.3 | Due to the highly nascent nature of this comprehensive transition mechanism globally, the following exemptions apply:

6.6.3.1 | **First-of-its-Kind Exemption:** The first three (3) project activities globally to successfully apply this methodology and submit for validation are deemed

[2] Barriers may include, but are not limited to:

Financial Barriers: High upfront capital costs for RES and BESS infrastructure compared to the lower operational costs of the baseline system; lack of access to affordable financing for renewable technologies, particularly in off-grid or high-risk markets.

Technological Barriers: Lack of local technical expertise for RES installation and maintenance; perceived or actual risks associated with the reliability of intermittent renewables requiring complex storage solutions; logistical challenges in deploying and maintaining systems in remote areas.

Institutional Barriers and Market Barriers: Lack of supportive policies or regulatory frameworks for decentralized renewable energy; high transaction costs associated with aggregating distributed consumers; prevailing practice of relying on familiar fossil fuel technologies.

The developer shall provide verifiable evidence (e.g., loan rejection letters, market studies, expert testimonies, documented technical failures of similar initiatives) demonstrating how the identified barriers prevent the implementation of the proposed activity, and how carbon revenues directly help overcome these barriers.

to have satisfied the common practice requirement and are fully exempt from further analysis under this section.

6.6.3.2 | While micro/small-scale activities in vulnerable regions may be deemed additional against investment/barrier analyses via the Positive List in Section 6.1, all activities shall still satisfy this Common Practice Analysis unless qualifying for the exemption above.

6.6.4 | **Stepwise Market Penetration Analysis:** For large-scale activities not exempted under Section 6.6.3, the developer shall determine the Common Practice Factor (F) using the stepwise approach defined in Section 6 of the Tool, applying the following mandatory parameters:

a. **Assessment Approach & Indicator (P):** A Stock-Based Approach using a capacity-based metric (Installed kW or MW).

b. **Applicable Geographical Area (AGA):** The Host Country.

c. **Target Market Size** (P_{all}): The total cumulative installed capacity (kW/MW) of all operational, decentralized fossil-fuel electricity generation systems (e.g., individual captive gensets, fossil mini-grids) matching the baseline context within the AGA.

d. **Similar Activities** (P_{sim}): The total cumulative capacity (kW/MW) of decentralized activities within the AGA meeting all criteria in the Attribute Matrix below. (Note: Activities supported by carbon finance or dedicated international climate ODA shall be excluded).

Table 8. Attribute Matrix for Similar Activities

Attribute	Description of Objective Technical Characteristics	Required
1. Fossil Asset Phase-out	Permanent decommissioning and verifiable physical dismantling/destruction of an operational fossil-fuel generation system prior to the end of its remaining lifetime.	Yes
2. Replacement	Integrated replacement of the decommissioned baseline capacity with a newly constructed (greenfield) Renewable Energy System (RES).	Yes
3. Just Transition	Execution and full funding of a formalized Just Transition (JT) Plan for affected workers and consumers ensuring maintained or improved energy access.	Yes
4. Scale / Economics	Specific kW/MW capacity size, investment cost, or socioeconomic target segment.	No

6.6.5 | **Calculation and Threshold (F_{max}):**

6.6.5.1 | The developer shall calculate the market penetration ratio using the formula:

$$F = \frac{P_{sim}}{P_{all}}$$

6.6.5.2 | Based on the TMC-2 classification and the Stock-Based Approach, the following fixed Common Practice Thresholds (F_{max}) apply (per Table 3 of the Tool):

- F_{max} = 15.0% for Least Developed Countries (LDCs) and Small Island Developing States (SIDS) and vulnerable communities in other countries.
- F_{max} = 10% for all Other Countries.

6.6.5.3 | If $F < F_{max}$, the proposed activity is considered "not common practice." All data sources and calculations shall be transparently documented in the PDD.

6.7 | Ongoing Financial Needs (OFN) Assessment:

6.7.1 | At the time of crediting period renewal, the activity developer shall conduct OFN assessment to demonstrate continued compliance with

a. Regulatory surplus (mandatory), AND

b. Investment analysis or Barrier analysis (whichever approach was applied for the first crediting period).

6.7.2 | Activities initially deemed additional via the Positive List shall conduct a full Investment or Barrier analysis at the first renewal if the host country/region no longer meets the criteria defined in **Table 7** at the time of renewal.

6.7.3 | The OFN assessment shall consider the prevailing technological costs, market conditions, policy context, and the remaining financial commitments to the Just Transition plan implementation at the time of renewal.

7| BASELINE SCENARIO

7.1 | Selection of Baseline Approaches

7.1.1 | In accordance with GS4GG methodological standard, the baseline scenario shall be determined using approach (c): An approach based on existing actual or historical emissions, adjusted downwards.

7.2 | Justification for the Baseline Approach

7.2.1 | The selection of approach (c) is justified as the most appropriate for this methodology:

7.2.2 | **Appropriateness to Activity Context:** The core of the activity is the retirement of existing fossil fuel systems. Emissions depend on site-specific factors (vintage, maintenance, load factor). This methodology allows for a tiered approach: utilizing historical data when available (Tier 1), or applying conservative, standardized defaults (Tier 2) when data is scarce. This ensures

practicality for decentralized assets where detailed records are often unavailable.

7.2.3 | **Ensuring Conservativeness and Ambition:** Conservativeness is ensured through:

a. **Ambitious Performance Check:** When using historical data (Tier 1), the emission factor is capped by conservative defaults (Tier 2) to prevent rewarding historical inefficiency (Section 7.4.14).

b. **Downward Adjustment:** The baseline is adjusted downwards over time using the Downward Adjustment Factor (DAF) (Section 7.5) to align with long-term climate strategies of host country.

7.3 | Identification of the Baseline Scenario

7.3.1 | The baseline scenario represents the most likely scenario that would occur in the absence of the activity.

7.3.2 | **Identification of Plausible Alternatives:** The activity developer shall identify realistic and credible alternative scenarios for the provision of equivalent electricity services, including:

a. A.1: The continuation of the operation of the existing BGS until the end of its remaining lifetime (Business-as-Usual).

b. A.2: The early closure and replacement with the proposed RES (the project activity implemented without carbon finance).

c. A.3: The early closure and replacement with alternative generation technologies.

7.3.3 | **Assessment and Identification of the Baseline:** The baseline scenario is determined based on the assessments conducted under the Demonstration of Additionality (Section 6). Given that the applicability criteria require the BGS to be operational and additionality confirms that early replacement (A.2, A.3) is not viable without carbon revenues, the representative baseline scenario is the continuation of the operation of the existing BGS (A.1).

7.4 | Calculation of the Baseline emissions Prior to Downward Adjustments ($BE_{unadj,y}$)

This section details the procedures for calculating the unadjusted baseline emissions ($BE_{Unadj,y}$). Key parameters (RLT, EF_{BL}, EG_{BAS}, EF_{Grid}) shall be fixed ex-ante for the duration of the crediting period, unless otherwise specified.

7.4.1 | **Determination of Remaining Lifetime (RLT)**

7.4.1.1 | The Remaining Lifetime (RLT) shall be determined ex-ante using one of the following options.

a. **Option A: Detailed Assessment**: Mandatory for systems ≥ 1MW; Optional for others. Use the latest version of A6.4-AMT-006.

b. **Option B: Simplified Assessment:** For systems < 1MW. The RLT is determined based on the age of the equipment (Age_y), a default total technical lifetime ($TL_{Default}$), and a Condition Factor (CF).

$$RLT = MAX(5, (TL_{default} - Age_y) \times CF) \quad \text{(eq 1)}$$

Where:

RLT	=	Remaining Lifetime (RLT) of the BGS.
$TL_{Default}$	=	Sourced from Annex 01 of this methodology.
Age_y	=	Determined based on verifiable evidence (e.g., purchase records, commissioning dates).
CF	=	Determined based on a physical inspection and verifiable maintenance history, using the standardized criteria defined in Table 8 and detailed in Annex 01.

Table 9. Condition Factors (CF)

Condition	Description	Quantitative Indicator (Optional)	CF
Good	System is well-maintained, fully operational with no significant defects.	Output derating < 5% vs nameplate.	1.0
Average	System is operational but shows signs of wear; requires regular maintenance.	Output derating 5-15% vs nameplate.	0.75
Poor	System has significant defects, requires major repairs, but is still economically viable to repair.	Output derating > 15% vs nameplate.	0.5

7.4.2 | Determination of Baseline Parameters (Tiered Approach)

7.4.2.1 | The baseline annual electricity generation (EG_{BAS}) and the baseline emission factor (EF_{BL}) shall be determined using a tiered approach, based on the availability of verifiable historical data.

a. Tier 1: Site Specific Data (preferred)

7.4.2.2 | This tier is used when verifiable data on historical fuel consumption and electricity generation is available for the historical reference period (12-36 months).

7.4.2.3 | **Historical Electricity Generation (EG_{BAS}):** EG_{BAS} is the average annual net electricity supplied by the BGS during the historical reference period (MWh/year). This value serves as the cap for baseline generation if suppressed demand is not claimed.

7.4.2.4 | **Historical Emission Factor (EF_{BL}):** EF_{BL} (tCO_2e/MWh) is calculated based on the measured historical performance.

$$EF_{hist} = \left(\sum_i \left(FC_{hist,i} \times NCV_i \times EF_{CO2e}\right)\right) / EG_{BAS} \qquad \text{(eq 2)}$$

Where:

$FC_{hist,i}$ = Average annual quantity of fuel type *i* consumed (mass or volume unit).

NCV_i = Net calorific value of fuel type *i* (GJ/unit)

EF_{CO2e} = CO_2 equivalent emission factor of fuel type *i* (tCO_2e/GJ) IPCC defaults shall be used if national data is unavailable.

b. Tier 2: Conservative Defaults (Data Unavailable)

7.4.2.5 | This tier is used when verifiable historical data is unavailable. It utilizes standardized, conservative default parameters to determine the Default Emission Factor ($EF_{Default}$) using Annex 01.

7.4.2.6 | **Eligibility and Safeguards for Annex 01 Defaults:** Application is strictly conditional upon meeting all the following criteria:

a. **Geographic Scope:** The project activity is located in a Least Developed Country (LDC), a Small Island Developing State (SIDS), or a country classified as lower-middle-income by the World Bank.

b. **Fuel Type:** The baseline technology uses diesel or petrol fuel.

c. **Regulatory Supremacy:** It shall be demonstrated that the host country does not have legally binding and enforced regulations on generator efficiency or emissions applicable to the baseline equipment. If such regulations exist, the baseline emission factor shall be derived from those regulations, and the defaults in Annex 01 cannot be used.

7.4.2.7 | **Determination of $EF_{Default}$ using Annex 01:** If eligible, the $EF_{Default}$ shall be determined using the following procedure:

a. **Step 1: Categorize the Consumer:** Categorize the Consumer Type I (Residential/Community Services) or Type II (Commercial/Productive Use).

b. **Step 2: Identify Fuel Type and Power Rating**: Identify the fuel (diesel/petrol) and the nameplate capacity (kVA or kW) of the BGS.

c. **Step 3: Determine Load Factor Scenario:** Select the appropriate load factor scenario from Annex 01.

d. **Step 4:** Select $EF_{Default}$: Select the corresponding emission factor (tCO_2e/MWh) from the tables in Annex 01.

7.4.2.8 | **Fallback Option:** If the eligibility criteria in 7.4.2.6 are not met, the $EF_{Default}$ shall be sourced from the latest version of CDM Tool 33 (e.g., Table 1) or latest corresponding A6.4 Methodology Tool, if available.

7.4.2.9 | **Baseline Electricity Generation (EG_{BAS}) for Tier 2:** EG_{BAS} shall be determined based on the estimated annual generation of the installed RES, subject to a capacity cap. This value serves as the cap for baseline generation if suppressed demand is not claimed.

7.4.2.10 | **Capacity Cap:** EG_{BAS} cannot exceed the theoretical maximum physical output of the decommissioned BGS:

$$EG_{BAS} \leq P_{genset} \times 8760 \times AF \qquad \text{(eq. 3)}$$

Where P_{genset} is the rated capacity (MW) and AF is the standard Availability Factor (assumed 0.9 unless justified).

7.4.3 | **Determination of the Baseline Emission Factor (EF_{BL})**

7.4.3.1 | EF_{BL} used for calculating baseline emissions shall be determined as follows to ensure conservativeness (ambitious performance check):

a. **If Tier 1 is used:** EF_{BL} shall be the lower value between the historical emission factor (EF_{Hist}) and the corresponding default emission factor ($EF_{Default}$). This acts as a cap to ensure that historical inefficiency is not rewarded.

$$EF_{BL} = MIN(EF_{Hist}, EF_{default}) \qquad \text{(eq. 4)}$$

b. **If Tier 2 is used:** EF_{BL} shall be the default emission factor.

$$EF_{BL} = EF_{default} \qquad \text{(eq. 5)}$$

7.4.4 | **Grid Emission Factor (EF_{Grid})**

7.4.4.1 | For activities in the "Unreliable Grid" context, the grid emission factor (EF_{Grid}) shall be calculated in accordance with the latest version of A6.4-AMT-007 or equivalent CDM TOOL. EF_{Grid} shall be determined ex-ante.

7.4.5 | **Calculation of Unadjusted Baseline Emissions ($BE_{Unadj,y}$)**

7.4.5.1 | The unadjusted baseline emissions are calculated based on the context of the activity and the electricity generated by the RES ($EG_{RES,y}$).

7.4.5.2 | **Suppressed Demand Adjustment:** If the activity developer demonstrates that the baseline energy supply was insufficient (suppressed demand), the cap EG_{BAS} (used in equations below) may be omitted. The demonstration shall be based on robust evidence documented in the PDD and subject to validation.

a. Scenario A: Off-Grid and Captive Generation

7.4.5.3 | The RES displaces only the Baseline Generation System. Emissions are credited during the RLT.

If y ≤ RLT:

$$BE_{Unadj,y} = MIN(EG_{RES,y}, EG_{BAS}) \times EF_{BL} \qquad \text{(eq. 6)}$$

If y > RLT:

$$BE_{Unadj,y} = 0 \text{ (unless conditions in 7.4.2.7 are met)} \quad \text{(eq. 7)}$$

b. Scenario B: Unreliable Grid

7.4.5.4 | The baseline is a mix of the BGS (i.e., Genset) and the Unreliable Grid. The RES displaces both sources proportionally.

7.4.5.5 | **Determine Baseline Proportions:** The share of electricity provided by the grid (S_{Grid}) and the genset (S_{Genset}) shall be determined ex-ante based on historical grid availability data (as per Section 2 definition).

$$S_{Grid} = {(Hours\ of\ Grid\ availabilty\ per\ year)}/{8760} \quad \text{(eq. 8)}$$

$$S_{Genset} = 1 - S_{Grid} \quad \text{(eq. 9)}$$

7.4.6 | **Calculate Unadjusted Baseline Emissions:**

7.4.6.1 | Unadjusted baseline emissions are calculated as follows:

$$BE_{Unadj,y} = BE_{Genst,y} + BE_{Grid,y} \quad \text{(eq. 10)}$$

a. Genset Displacement ($BE_{Genst,y}$): Credited only during the RLT.

If y ≤ RLT:

$$BE_{Genset,y} = (MIN(EG_{RES,y}, EG_{BAS}) \times S_{Genset}) \times EF_{BL} \quad \text{(eq. 11)}$$

If y > RLT:

$$BE_{Genset,y} = 0 \text{ (unless conditions in 7.4.22 are met)} \quad \text{(eq. 12)}$$

b. Grid Displacement ($BE_{Grid,y}$): Credited for the entire crediting period.

$$BE_{Grid,y} = MIN(EG_{RES,y}, EG_{BAS}) \times S_{Grid} \times EF_{grid} \quad \text{(eq. 13)}$$

7.4.6.2 | **Baseline Continuation Beyond RLT:** Baseline emissions (Scenario A or the Genset portion of Scenario B) may be claimed beyond the RLT (y > RLT) only if it is robustly demonstrated and validated ex-ante that the BGS would have been replaced by a similar fossil-fuel generator at the end of its RLT. In this case, the EF_{BL} used for the period beyond RLT shall reflect the emission factor of the likely replacement technology, determined using the Tier 2 (Default) approach.

7.5 | Application of Downward Adjustment

7.5.1 | The baseline emissions shall be adjusted downward to ensure conservativeness and encourage ambition over time.

A. Step 1 – Uncertainty Accounting

7.5.1.1 | Uncertainty is addressed through the application of conservative principles, including the conservative cap on the emission factor and the use of conservative defaults (Tier 2).

B. Step 2 – Application of the Downward Adjustment Factor (DAF)

7.5.1.2 | The Downward Adjustment Factor (DAF) shall be applied using the default values provided in the latest version of the GS4GG Methodology Tool: Downward Adjustment Factor Determination.

7.5.1.3 | The activity developer shall source the applicable default $DAF_{NetZero}$ value corresponding to the host country and the calendar year of the monitoring period (Year y).

C. Step 3 – Calculation of Adjusted Baseline Emissions (BE_y)

7.5.1.4 | The final Adjusted Baseline Emissions (BE_y) are calculated by applying the DAF to the unadjusted baseline emissions ($BE_{Unadj,y}$).

$$BE_y = BE_{Unadj,y} \times (1 - DAF_{NetZero}) \quad \text{(eq. 14)}$$

7.6 | Identification and Calculation of the Conservative BAU Scenario

7.6.1 | The Conservative BAU emissions ($BAU_{cons,y}$) shall account for policy-mandated efficiency improvements using a Regulatory Adjustment Factor (RAF).

$$BAU_{cons,y} = BE_{Unadj,y} \times RAF \quad \text{(eq. 15)}$$

RAF = 1.0: If no enforced minimum efficiency standards exist (verified via Regulatory Analysis).

RAF < 1.0: If enforced standards require higher efficiency than the baseline unit, RAF adjusts the baseline to the compliant level.

7.7 | Difference between BAU and baseline emissions or removals

7.7.1 | The difference between the crediting baseline and BAU emissions in monitoring period:

$$\Delta_d = BAU_{cons,y} - BE_y \quad \text{(eq 162)}$$

Where:

Δ_d	=	Difference between BAU and baseline emissions in year y (tCO_2/year)
BAU_{consy}	=	Conservative BAU Scenario emissions in year y (tCO_2)
BE_y	=	Final Baseline Emissions based on the most conservative factor in year y (tCO_2)

7.7.2 | This parameter is reported strictly for transparency to demonstrate the level of ambition and the impact of the Downward Adjustment Factor (DAF). A value of zero or less does not affect project eligibility or credit issuance.

8| ACTIVITY EMISSIONS

8.1 | Calculation of Total Activity Emissions

8.1.1 | Activity emissions are all anthropogenic emissions of GHGs occurring within the activity boundary that are attributable to the activity. This includes emissions associated with the decommissioning of the BGS and the manufacturing, installation, operation, and maintenance of the RES.

8.1.2 | The total activity emissions in the monitoring period y (AE_y) shall be determined by summing the emissions from operations ($AE_{op,y}$), transport activities ($AE_{tr,y}$), embodied emissions of the RES/BESS infrastructure ($AE_{em,y}$), and other relevant sources, including land use change and decommissioning ($AE_{other,y}$).

$$AE_y = AE_{op,y} + AE_{tr,y} + AE_{em,y} + AE_{other,y} \quad \text{(eq. 17)}$$

Where:

AE_y	=	Total activity emissions in monitoring period y (tCO_2e)
$AE_{op,y}$	=	Activity emissions from process operations (electricity and fuel consumption, including backup) (tCO_2e)
$AE_{tr,y}$	=	Activity emissions from transport activities (tCO_2e)
$AE_{em,y}$	=	Embodied activity emissions of the RES/BESS infrastructure, amortized (tCO_2e)
$AE_{other,y}$	=	Other activity emissions (Land Use Change, Decommissioning, Fugitive Emissions) (tCO_2e)

8.1.3 | **Materiality:** The materiality thresholds defined in Section 5.2.3 shall apply. Embodied emissions ($AE_{em,y}$) and Land Use Change emissions ($AE_{LUC,y}$), included within $AE_{other,y}$ are mandatory.

8.2 | Activity Emissions from Process Operations ($AE_{op,y}$)

8.2.1 | Activity emissions from process operations include the consumption of electricity and fossil fuels during decommissioning, installation, maintenance, and the operation of permitted backup systems.

$$AE_{op,y} = AE_{op,general,y} + AE_{op,backup,y} \quad \text{(eq. 18)}$$

A. General Operations ($AE_{op,general,y}$)

8.2.2 | This includes electricity and fuel consumed by machinery and vehicles during decommissioning, RES installation, and O&M (excluding transport covered in 8.3).

8.2.3 | Emissions shall be calculated according to:

a. **Electricity Consumption:** A6.4-AMT-006: Determination of the technical lifetime of equipment.

b. **Fuel Consumption:** GS4GG Methodological Tool 01: Emissions from Fossil Fuel Combustion.

8.2.4 | If direct measurement of fuel quantities (e.g., for subcontractors) is not feasible, consumption may be estimated based on equipment operating hours and standardized efficiency values, subject to validation.

B. Backup Systems ($AE_{op,backup,y}$)

8.2.5 | If permitted backup fossil fuel generators are used, the associated emissions shall be calculated based on monitored fuel consumption, using GS4GG Methodology Tool 01.

8.3 | Activity Emissions from Transport Activities ($AE_{tr,y}$)

8.3.1 | Activity emissions associated with the transportation of materials and equipment (e.g., transport of RES infrastructure to the site, transport of decommissioned materials to disposal/recycling sites) shall be calculated according to the Methodological Tool 02: Emissions from Freight Transportation.

8.4 | Embodied Emissions ($AE_{em,y}$)

8.4.1 | Embodied emissions ('cradle-to-gate') associated with the manufacturing and production of the RES infrastructure (e.g., Solar PV modules, inverters, mounting structures) and BESS (if applicable) shall be accounted for.

A. Determination of Lifecycle Emission Factors ($EF_{LCA,k}$)

8.4.2 | The activity developer shall determine the emission factors using one of the following options, in order of preference:

a. **Option 1 (Supplier-Specific):** Use Environmental Product Declarations (EPDs) (Type III) provided by the equipment supplier, verified in accordance with ISO 14025.

b. **Option 2 (verified LCA):** Use a project-specific Life Cycle Assessment (LCA) report conducted in accordance with ISO 14067 or ISO 14040/44, verified by an independent third party.

c. **Option 3 (Conservative Defaults):** Use the standardized conservative default factors provided in Annex 02. These are derived from median values of harmonized international literature (e.g., NREL, IEA).

8.4.3 | **Calculation:** The total embodied emissions for the activity ($AE_{em,total}$) shall be calculated based on the installed capacity and the selected emission factors ($EF_{LCA,k}$).

$$AE_{em,total} = \sum_k (Q_k \times EF_{LCA,k}) \quad \text{(eq. 19)}$$

Where:

$AE_{em,total}$	=	Total embodied emissions of the RES/BESS infrastructure (tCO_2e)
Q_k	=	Installed capacity of technology component k (e.g., MWp, MWh)
$EF_{LCA,k}$	=	Default LCA-based emission factor for technology component k (tCO_2e per unit of Q_k)
k	=	Index for technology component.

B. Amortization

8.4.4 | The total embodied emissions ($AE_{em,total}$) shall be amortized linearly over the duration of the 1st registered crediting period (CP_{1st}, i.e., 5 years or RLT or technical life whichever is shorter).

$$AE_{em,y} = AE_{em,total} / CP_{1st} \qquad \text{(eq. 20)}$$

8.4.5 | If components are replaced during the crediting period, the embodied emissions of the new components shall be calculated and amortized over the remaining duration of the crediting period.

8.5 | Other Emissions ($AE_{other,y}$)

8.5.1 | Other emissions include emissions from decommissioning activities (if a default factor is used), direct Land Use Change, and fugitive emissions.

$$AE_{other,y} = AE_{decom,y} + AE_{LUC,y} + AE_{fugitive,y} \qquad \text{(eq. 21)}$$

A. Emissions from Decommissioning ($AE_{decom,y}$)

8.5.2 | Emissions related to the energy use for the collection, decommissioning, and disposal process of the Baseline Generation Systems shall be accounted for using one of the following options:

a. **Option 1: Direct Measurement:** Calculate emissions based on actual fuel and electricity consumption using the methods described in Section 8.2 (Operations) and 8.3 (Transport). In this case, $AE_{decom,y}$ = 0 here to avoid double counting.

b. **Option 2: Simplified Default Factor (For distributed gensets only):** To ensure practicality when collecting numerous distributed assets, a default emission factor (EF_{Decom}) shall be used from Annex 02.

$$AE_{decom,y} = N_{Decom,y} \times EF_{decom} \qquad \text{(eq. 22)}$$

Where:

$N_{Decom,y}$	=	Number of gensets decommissioned in year y

EF_{decom} = Default emission factor for decommissioning/disposal (tCO_2e/genset) sourced from Annex 02

B. Emissions from Land Use Change ($AE_{LUC,y}$)

8.5.3 | If the installation of the RES involves direct land use change (e.g., deforestation, conversion of grassland), the resulting emissions from changes in biomass and soil carbon stocks shall be calculated.

8.5.3.1 | **Materiality:** $AE_{LUC,y}$ shall be calculated only if the activity involves the conversion of land with significant carbon stocks.

8.5.3.2 | **De Minimis:** $AE_{LUC,y}$ may be deemed zero for :

a. Activities installed on existing buildings or structures (e.g., rooftop solar).

b. Activities installed on land with negligible carbon stocks (e.g., deserts, degraded land).

c. Activities with a minimal direct footprint where agricultural or ecosystem activity continues undisturbed (e.g., wind turbines on existing farmland).

8.5.4 | **Calculation:** The total emissions from LUC ($AE_{LUC,y}$) shall be calculated ex-ante as the difference between the carbon stocks before and after conversion, summed over all affected land parcels *i*.

$$AE_{LUC,total} = \sum_i((C_{before,i} - C_{after,i}) \times A_i \times 44/12) \qquad \text{(eq. 23)}$$

Where:

$C_{before,i}$ = Total carbon stock per unit area before conversion (tonnes C/ha)

$C_{after,i}$ = Total carbon stock per unit area after conversion (tonnes C/ha)

A_i = Area of land parcel i undergoing conversion (ha)

8.5.4.1 | **Data Sources:** Carbon stock values (C) shall be determined using the IPCC Tier 1 approach (global default values from the latest IPCC Guidelines), unless verifiable, region-specific data (Tier 2) is available.

8.5.5 | **Amortization:** The total LUC emissions shall be amortized linearly over a fixed period of 20 years ($T_{Amor,LUC}$), consistent with IPCC good practice guidance.

$$AE_{LUC,y} = {AE_{LUC,total}}/{T_{Amor,LUC}} \qquad \text{(eq. 24)}$$

C. Fugitive Emissions ($AE_{Fugitive,y}$)

8.5.6 | If the RES utilizes equipment containing GHGs (e.g., SF_6 in switchgear), potential leakage shall be calculated based on manufacturer specifications or IPCC default leakage rates, if deemed significant under the materiality assessment (Section 8.1.3).

9| LEAKAGE EMISSIONS

9.1 | Identification and Assessment of Leakage Sources

9.1.1 | Leakage is the net change of GHG emissions occurring outside the activity boundary, attributable to the activity. The following sources shall be assessed.

A. Leakage from Physical Displacement (Activity-Shifting) ($LE_{physical,y}$)

9.1.2 | The applicability criteria require that the BGS is permanently decommissioned, rendered inoperative, and not reused for fossil fuel combustion. Therefore, leakage relating to the reuse of the equipment is considered zero ($LE_{physical,y}$ = 0). Compliance is ensured through the monitoring and verification of decommissioning (Section 14).

B. Market Leakage (Displacement of Feedstock) ($LE_{market,y}$)

9.1.3 | The cessation of fuel consumption (e.g., diesel, petrol) by the BGS releases that fuel into the market. As determined in Section 5.2.6, the impact of decentralized fuel displacement on regional or global fuel markets is considered negligible for this scope. Therefore, market leakage is considered zero ($LE_{market,y}$= 0).

C. Leakage from the Supply-Demand Gap During Transition ($LE_{gap,y}$)

9.1.4 | During a transition phase, if the BGS has ceased operation and the RES has not yet reached the equivalent baseline generation level (EG_{BAS}), a supply-demand gap may occur. This gap necessitates electricity generation from other sources (e.g., the grid, temporary gensets). The emissions associated with this compensatory generation shall be accounted for as leakage ($LE_{gap,y}$).

9.2 | Calculation of Leakage from the Supply-Demand Gap ($LE_{gap,y}$)

9.2.1 | This leakage shall be monitored and calculated during any period where the net electricity delivered by the RES ($EG_{RES,y}$) is less than the baseline electricity generation level (EG_{BAS}).

$$LE_{gap,y} = MAX(0, (EG_{BAS} - EG_{RES,y}) \times EF_{LE,gap,y}) \quad \text{(eq. 25)}$$

Where:

$LE_{gap,y}$ = Leakage emissions due to the supply-demand gap (tCO_2e)

EG_{BAS} = Quantity of electricity that would have been generated in the baseline scenario (MWh)

$EG_{RES,y}$ = Net electricity delivered by the RES in monitoring period y (MWh)

$EF_{LE,gap,y}$ = Emission factor of the compensatory electricity source (tCO_2e/MWh)

9.2.2 | Determination of $EF_{LE,gap,y}$:

a. If the compensatory source is the Grid: $EF_{LE,gap,y} = EF_{grid}$.

b. If the compensatory source is a temporary fossil fuel generator, or if the source cannot be identified: A conservative default factor of 1.3 tCO_2/MWh (sourced from A6.4-AMT-006: Determination of the technical lifetime of equipment) shall be applied.

9.3 | Calculation of Total Leakage Emissions (LE_y)

9.3.1 | The total leakage emissions in monitoring period y (LE_y) shall be calculated as follows:

$$LE_y = LE_{physical,y} + LE_{market,y} + LE_{gap,y} \quad \text{(eq. 26)}$$

$$LE_y = 0 + 0 + LE_{gap,y} \quad \text{(eq. 27)}$$

10| NET GHG EMISSION REDUCTIONS

10.1 |Calculation of Net GHG Emission Reductions

10.1.1 | The net GHG emission reductions in monitoring period y (ER_y) shall be calculated as the difference between the total adjusted baseline emissions (BE_y), the total activity emissions (AE_y), and the total leakage emissions (LE_y).

$$ER_y = BE_y - AE_y - LE_y \text{.....(eq 283)}$$

Where:

ER_y = Net emission reductions during the monitoring period y (tCO_2e)

BE_y = Total Adjusted Baseline Emissions (tCO_2e)

AE_y = Total Activity Emissions (tCO_2e)

LE_y = Total Leakage Emissions (tCO_2e)

11| METHODOLOGIES PRINCIPLES

11.1 |Encouraging ambition over time:

11.1.1 | The methodology encourages increasing ambition through the following mechanisms:

a. **Downward Adjustment Factor (DAF):** The mandatory application of the DAF (Section 7.5) ensures that the baseline emissions trajectory declines over time, consistent with the host country's progress towards long-term climate goals (e.g., Net-Zero targets). This ensures the mitigation activity goes beyond Business-as-Usual (BAU).

b. **Conservative Baseline Setting**:

   i. **Tier 1 (Historical Data):** Historical emissions are capped by conservative default emission factors (Ambitious Performance Check) to ensure that historical inefficiencies are not rewarded.

   ii. **Tier 2 (Defaults):** The standardized defaults (Annex 01) utilize high-efficiency assumptions by default, ensuring conservativeness.

c. **Transparency:** The difference between the BAU scenario and the adjusted baseline emissions is calculated and reported (Section 7.7), providing transparency on the level of ambition achieved.

11.2 |Equitable Sharing of Mitigation Benefits

11.2.1 | The methodology contributes to the equitable sharing of mitigation benefits through:

a. **Contribution to NDCs:** By setting the baseline below BAU (via the DAF and conservative checks), the methodology ensures a direct contribution to the host country's Nationally Determined Contributions (NDCs) that is not claimed for carbon credits.

b. **Just Transition:** The mandatory implementation of a proportionate Just Transition Plan (Section 3.2.4) ensures that the socio-economic benefits of the transition are shared fairly with affected stakeholders and communities.

c. **Improved Energy Access:** The requirement for the RES to provide an equivalent or improved Service Level ensures the transition enhances energy reliability for consumers.

d. **Long-Term Benefits:** The technical lifetime of the RES infrastructure typically exceeds the crediting period, ensuring that the host country continues to benefit from the emission reductions beyond the duration of the carbon market engagement.

11.3 | Avoidance of Double Counting

11.3.1 | The methodology requires adherence to the latest version of the GHG Emissions Reduction & Sequestration Product Requirements to mitigate risks of double issuance, double use, and double claiming. Specific provisions address the management of Energy Attribute Certificates (EACs) to ensure the same MWh is not claimed twice.

11.4 | Aligning with NDCs and LT-LEDS

11.4.1 | The activity inherently aligns with the long-term goals of the Paris Agreement by replacing high-emission fossil fuel generation with zero-emission renewable energy sources, thereby avoiding carbon lock-in (Section 6.3).

11.4.2 | The application of the DAF explicitly links the baseline emissions trajectory to the long-term decarbonization pathways required to achieve national Net-Zero targets.

11.5 | Encouraging Broad Participation

11.5.1 | The methodology is designed to encourage broad participation by being applicable globally and across all scales. It includes practical implementation features to address common barriers in decentralized energy contexts:

a. **Tiered Data Approach:** Allows participation even when historical data is scarce by providing conservative defaults (Section 7.4).

b. **Simplified Assessments:** Offers simplified procedures for RLT assessment and Activity Emission calculations (Section 8).

c. **Positive List:** Deems micro/small-scale activities in vulnerable regions as additional (Section 6.7), reducing transaction costs.

d. **Scalable Implementation:** The methodology is suitable for application to Programmes of Activities (PoAs) and allows sampling for the verification of decommissioning of distributed assets.

11.6 | Including Data Sources, Accounting for Uncertainty, and Monitoring

11.6.1 | The methodology specifies required data sources (Section 14), incorporates procedures for accounting for uncertainty (Section 13), and defines a robust monitoring methodology. Uncertainty is managed through the rigorous application of conservative assumptions, defaults, and adjustments.

11.7 | Taking into Account Policies, Measures, and Relevant Circumstances

11.7.1 | The methodology requires a thorough assessment of the policy and regulatory context. The Regulatory Analysis (Section 6.2) ensures that emission reductions are surplus to existing mandates.

11.7.2 | The methodology ensures that national policies are respected. The application of default baseline parameters (Annex 01) is explicitly restricted if the host country has enforced regulations (e.g., efficiency standards) that are stricter than the defaults (Regulatory Supremacy Clause)

12| REVERSALS

12.1 |Assessment of Reversal Risks

12.1.1 | A reversal (non-permanence) occurs when the net GHG benefits of an activity are reversed. While this methodology covers emission reduction (avoidance) rather than removals (sequestration), a reversal risk exists in the context of technology substitution.

12.1.2 | **Identification of Risk:** The primary reversal risk is the failure (technical or financial) of the Renewable Energy System (RES) during the crediting period, leading consumers to revert to using fossil-fuel-based generation systems (new or existing) to meet their energy needs.

12.1.3 | **Excluded Risks:** The risk of the original Baseline Generation System being reused is fully mitigated through the strict applicability criteria requiring permanent decommissioning and verification (Section 3.2.11).

12.2 |Mitigation and Management of Reversal Risks

12.2.1 | The activity developer shall implement robust measures to mitigate the risk of reversal due to technology failure. These measures shall be documented in the PDD and monitored throughout the crediting period.

12.2.1.1 |Technical Reliability and Maintenance:

a. **Quality Standards:** The RES equipment shall comply with relevant international (e.g., IEC) or equivalent national quality standards.

b. **Operation and Maintenance (O&M) Plan:** A comprehensive O&M plan shall be implemented, detailing scheduled maintenance, monitoring protocols, and procedures for rapid response to technical failures.

c. **Component Replacement Strategy:** The plan shall include provisions for the timely replacement of key components (e.g., batteries, inverters) to ensure the continued operation of the RES at the required Service Level (Section 3.2.3).

d. **Financial Sustainability:** The activity developer shall demonstrate the long-term financial viability of the project, ensuring sufficient resources are allocated for ongoing O&M and component replacement costs.

12.3 |Addressing Reversals

12.3.1 | **Monitoring of Reversals:** The continuous operation and performance of the RES shall be monitored (Section 14). A cessation of operation or a significant decline in the Service Level that results in electricity generation below the baseline level constitutes a reversal event.

12.3.2 | **Quantification and Compensation:** Emission reductions are calculated ex-post based on the actual monitored generation of the RES (Section 7.4). If a reversal event occurs (i.e., the RES stops generating or generates less than the baseline level), the calculated emission reductions (ERy) for that monitoring period will be automatically reduced accordingly.

13| UNCERTAINTY QUANTIFICATION

13.1 |Approach to Uncertainty Management

13.1.1 | Uncertainty in the quantification of emission reductions shall be managed through a combination of conservative methodological design, rigorous data quality requirements, and parameter-specific adjustments where necessary.

13.2 |Sources of Uncertainty and Mitigation

13.2.1 | The following key sources of uncertainty shall be addressed:

A. Uncertainty in Baseline Assumptions (Tier 2)

13.2.1.1 |**Uncertainty:** When site-specific data is unavailable (Tier 2), uncertainty arises from the use of assumptions for the baseline emission factor (EF_{BL}) and Remaining Lifetime (RLT).

13.2.1.2 |**Mitigation:** This is mitigated by the mandatory use of conservative default factors (Annex 01) and the application of the DAF.

B. Uncertainty in Historical Data (Tier 1)

13.2.1.3 |**Uncertainty:** When using site-specific data (Tier 1), uncertainty arises from the accuracy of historical records.

13.2.1.4 |**Mitigation:** This is mitigated by the Ambitious Performance Check, which caps the baseline emission factor at a conservative default level, ensuring that historical efficiency does not lead to over-crediting.

C. Measurement Uncertainty

13.2.1.5 |**Uncertainty:** Uncertainty associated with the monitoring of key parameters, such as the electricity generation of the RES ($EG_{RES,y}$) and fuel consumption of backup systems.

13.2.1.6 |**Mitigation**:

a. **Accuracy Requirements:** All measurement equipment shall comply with relevant national or international standards and shall be calibrated according to the manufacturer's recommendations.

b. **Conservative Adjustment:** If the accuracy level of the measurement equipment does not meet the required threshold (typically ≤5% for electricity metering at a 95% confidence level), the monitored value shall be adjusted conservatively:

i. For parameters contributing to emission reductions (e.g., $EG_{RES,y}$): The lower bound of the 95% confidence interval shall be used.

ii. For parameters contributing to activity emissions (e.g., backup fuel consumption): The upper bound of the 95% confidence interval shall be used.

D. Sampling Uncertainty

13.2.1.7 | **Uncertainty:** If sampling is used for monitoring (e.g., verifying decommissioning of distributed assets), uncertainty arises from the extrapolation of sample results.

13.2.1.8 | **Mitigation:** Sampling shall be conducted in accordance with the requirements of Section 14.5, ensuring that the sampling plan achieves a specified confidence/precision level. If the required precision is not achieved, the results shall be adjusted conservatively using the appropriate bound of the confidence interval.

14| MONITORING METHODOLOGY

14.1 |Requirements

14.1.1 | **Monitoring Plan:** The activity developer shall develop and implement a Monitoring Plan, included in the PDD. The plan shall detail the procedures for collecting, recording, analyzing, and managing all data required for the quantifying emission reductions, verifying applicability criteria, and monitoring safeguards.

14.1.2 | **Data Quality and Reliability:** All data collected shall be verifiable and derived from reliable sources.

14.1.2.1 | **Measurement Equipment and Calibration**: All equipment used for monitoring (e.g., electricity meters, fuel meters) shall comply with relevant national or international standards (e.g., IEC standards for electricity meters, requiring Accuracy Class 1.0 or better for primary energy metering) and be calibrated according to manufacturer recommendations. Calibration records shall be maintained and made available for verification.

14.1.2.2 | **Digital Monitoring, reporting and Verification (DMRV):** The use of digital technologies (e.g., smart meters, remote sensors, GPS tracking, geotagged photographic evidence, data platforms) is encouraged to enhance accuracy and efficiency, particularly for distributed assets.

14.1.3 | **Data Archiving:** All data collected, including raw measurements, calibration records, calculation spreadsheets, decommissioning evidence, and JT reports, shall be archived electronically. Data shall be retained for the duration of the crediting period and for at least five years thereafter.

14.2 | Data and Parameters Not Monitored (Fixed Ex-Ante)

14.2.1 | The following parameters are determined ex-ante at the time of validation and remain fixed for the duration of the crediting period (unless a reassessment is required at renewal, see Section 17).

A. Baseline System Characteristics

Parameter ID	1
Data/Parameter	RLT
Description	Remaining Lifetime of the Baseline Generation System
Data unit	Years or Hours
Purpose of data	☒Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Historical records (age, maintenance), manufacturer data, physical inspection
Source of data	☒ Calculated
	Option A (Detailed): A6.4-AMT-006: Determination of the technical lifetime of equipment. Option B (Simplified <1MW): Eq. 1, using defaults ($TL_{Default}$, CF) from Annex 01.
Choice of data or measurement methods and procedures	Determines the duration for which baseline emissions from the displaced system can be claimed.
Additional comments	*N/A*

Parameter ID	2
Data/Parameter	$TL_{Default}$
Description	Default Total Technical Lifetime
Data unit	Years or Hours
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	Selected based on technology, capacity, and usage pattern.
Source of data	☒ Default
	Annex 01 (Table A1.1).
Choice of data or measurement methods and	Used in the Simplified RLT calculation (Option B).

procedures	
Additional comments	*N/A*

Parameter ID	**3**
Data/Parameter	CF
Description	Condition Factor
Data unit	Dimensionless (0.5, 0.75, 1.0)
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	Annex 01 (Table A1.2). Determined based on physical inspection and maintenance history assessment.
Source of data	☒ Default
	Selected based on technology, capacity, and usage pattern.
Choice of data or measurement methods and procedures	Used in the Simplified RLT calculation (Option B).
Additional comments	*N/A*

Parameter ID	**4**
Data/Parameter	Age_y
Description	Age of the Baseline Generation System at Activity Start Date
Data unit	Years
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Determined from verifiable evidence.
Source of data	☒ Measured
	Purchase records, commissioning documents, nameplate data.
Choice of data or measurement methods and procedures	Used in the Simplified RLT calculation (Option B).
Additional comments	*N/A*

B. Baseline Performance (Tier 1 - Site Specific Data)

Parameter ID	**5**
Data/Parameter	EG_{BAS} (Tier-1)
Description	Average annual net electricity generation supplied by the Baseline Generation System during the Historical Reference Period.
Data unit	MWh/year
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	Baseline Annual Electricity Generation. Average annual net generation during the Historical Reference Period (12-36 months).
Source of data	☒ Calculated
	Metered electricity output records or verifiable operational logs from the reference period.
Choice of data or measurement methods and procedures	Establishes the historical generation level, serving as a cap (unless suppressed demand is claimed).
Additional comments	*N/A*

Parameter ID	**6**
Data/Parameter	$FC_{Hist,i}$
Description	Historical Annual Fuel Consumption (Fuel type i)
Data unit	Mass or volume unit/year
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Average annual consumption during the Historical Reference Period.
Source of data	☒ Measured
	Fuel purchase receipts, calibrated flow meters, operational logs.
Choice of data or measurement methods and procedures	Used to calculate the Historical Emission Factor (EF_{Hist}).
Additional comments	N/A

Parameter ID	7
Data/Parameter	EF_{Hist}
Description	Historical Emission Factor
Data unit	tCO_2e/MWh
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level.
Source of data	☒ Calculated
	EG_{BAS}, $FC_{Hist,i}$, NCV_i, $EF_{CO2e,i}$ Calculated using Eq. 2 based on measured historical performance.
Choice of data or measurement methods and procedures	Represents the actual historical efficiency of the baseline system.
Additional comments	*N/A*

C. Baseline Performance (Tier 2 - Defaults)

Parameter ID	8
Data/Parameter	EG_{BAS} (Tier-2)
Description	Baseline Annual Electricity Generation (Proxy)
Data unit	MWh/year
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. RES design specifications, generation modeling
Source of data	☒ Calculated
	Eq. 3. Estimated annual generation of the RES ($EG_{RES,Estimated}$).
Choice of data or measurement methods and procedures	Serves as a proxy for baseline demand when historical data is unavailable.
Additional comments	*N/A*

Parameter ID	9
Data/Parameter	$EF_{Default}$

Description	Default Emission Factor
Data unit	tCO2e/MWh
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Selected based on eligibility criteria (Sec 7.4.10), Consumer Type, Load Factor, and technology (Sec 7.4.11-12).
Source of data	☒ Default
	Annex 01 (Tables A1.3, A1.4) or CDM Tool 33.
Choice of data or measurement methods and procedures	Used when Tier 1 data is unavailable, and serves as a conservative cap for Tier 1.
Additional comments	*N/A*

D. Baseline Emission Factor (Consolidated)

Parameter ID	**10**
Data/Parameter	EF_{BL}
Description	Baseline Emission Factor
Data unit	tCO_2e/MWh
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Tier 1: $MIN(EF_{Hist}, EF_{Default})$ (Eq. 4). Tier 2: $EF_{Default}$ (Eq. 5).
Source of data	☒ Calculated
	$EF_{Hist}, EF_{Default}$
Choice of data or measurement methods and procedures	The final, conservatively adjusted emission factor used for baseline calculations.
Additional comments	*N/A*

E. Fuel Properties

Parameter ID	**11**
Data/Parameter	NCV_i

Description	Net Calorific Value of fuel type i
Data unit	GJ/unit
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. IPCC defaults (preferred), national standards, or laboratory analysis.
Source of data	☒ Default/Measured
	Selected from the hierarchy of sources defined in relevant Tools (e.g., Tool 01).
Choice of data or measurement methods and procedures	Required for calculating emissions from fuel consumption (Baseline and Activity).
Additional comments	*N/A*

Parameter ID	**12**
Data/Parameter	$EF_{CO2e,i}$
Description	CO_2 equivalent Emission Factor of fuel type i
Data unit	tCO2e/GJ
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. IPCC defaults (preferred), national standards, or laboratory analysis.
Source of data	☒ Default/Measured
	Selected from the hierarchy of sources defined in relevant Tools (e.g., Tool 01).
Choice of data or measurement methods and procedures	Required for calculating emissions from fuel consumption (Baseline and Activity).
Additional comments	N/A

F. Grid Parameters (If applicable)

Parameter ID	**13**

Data/Parameter	EF_{Grid}
Description	Grid Emission Factor
Data unit	tCO2e/MWh
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. National utility data, official government reports, published standardized baseline values.
Source of data	☒ Calculated
	Calculated according to A6.4 – AMT-007.
Choice of data or measurement methods and procedures	Required for "Unreliable Grid" baseline calculations and activity emissions if grid backup is used.
Additional comments	N/A

Parameter ID	**14**
Data/Parameter	S_{Grid}
Description	Share of time the grid was available in the baseline
Data unit	% or fraction
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Utility records of grid availability, independent studies, or on-site monitoring.
Source of data	☒ Calculated
	Eq. 9. Based on historical availability data (shall meet "Unreliable Grid" definition).
Choice of data or measurement methods and procedures	Determines the proportion of baseline electricity supplied by the grid.
Additional comments	*N/A*

Parameter ID	**15**
Data/Parameter	S_{Genset}

Description	Share of time the genset operated in the baseline
Data unit	% or fraction
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level.
Source of data	☒ Calculated
Choice of data or measurement methods and procedures	Determines the proportion of baseline electricity supplied by the genset.
Additional comments	*N/A*

G. Activity Emissions Parameters

Parameter ID	**16**
Data/Paramete	Q_K
Description	Installed capacity of technology component k (RES/BESS)
Data unit	MWp, MW, MWh
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Nameplate data, commissioning reports, purchase records.
Source of data	☒ Measured
	Total installed capacity of the system components.
Choice of data or measurement methods and procedures	Used to calculate total embodied emissions ($AE_{em,total}$).
Additional comments	N/A

Parameter ID	**17**
Data/Parameter	$EF_{LCA,k}$
Description	Default LCA-based emission factor for component k
Data unit	tCO_2e/unit of Q_K
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Annex 03.

Source of data	☒ Default
	Selected based on the technology type.
Choice of data or measurement methods and procedures	Used to calculate total embodied emissions.
Additional comments	N/A

Parameter ID	**18**
Data/Parameter	$AE_{em,total}$
Description	Total embodied emissions of the infrastructure
Data unit	tCO_2e
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Eq. 19.
Source of data	☒ Calculated
	$EF_{LCA,k}$, Q_K
Choice of data or measurement methods and procedures	The total cradle-to-gate emissions of the installed system. Updated if components are replaced.
Additional comments	*N/A*

Parameter ID	**19**
Data/Parameter	CP_{1st}
Description	Total registered crediting period duration for 1st CP
Data unit	Years
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. As defined in the PDD (e.g., 5 years).
Source of data	☒ Calculated
Choice of data or measurement methods and procedures	Used for amortizing embodied emissions (Eq. 20).

Additional comments	N/A

Parameter ID	**20**
Data/Parameter	EF_{decom}
Description	Default emission factor for decommissioning (Option 2)
Data unit	tCO_2e/ genset
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Annex 01 (Table A1.5).
Source of data	☒ Default; Annex 01 (Table A1.5).
Choice of data or measurement methods and procedures	Used for simplified calculation of decommissioning emissions for distributed assets (Eq. 22).
Additional comments	N/A

H. Land Use Change (LUC) Parameters (If applicable)

Parameter ID	**21**
Data/Parameter	A_i
Description	Area of land parcel i undergoing conversion
Data unit	ha
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. GPS coordinates, satellite imagery, official land records.
Source of data	☒ Measured
	Physical measurement or analysis of geospatial data.
Choice of data or measurement methods and procedures	Required for calculating LUC emissions (if applicable).
Additional comments	N/A

Parameter ID	**22**

Data/Parameter	$C_{before,i}$ $C_{after,i}$
Description	Carbon stock per unit area before/after conversion
Data unit	tonnes C/ha
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. IPCC Tier 1 defaults (preferred), national inventories, or field measurements (Tier 2).
Source of data	☒ Measured
	Determined according to Section 8.5.4.
Choice of data or measurement methods and procedures	Required for calculating LUC emissions.
Additional comments	N/A

Parameter ID	**23**
Data/Parameter	$AE_{LUC,total}$
Description	Total emissions from Land Use Change
Data unit	tCO_2e
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Eq.23
Source of data	☒ Calculated
	$C_{before,i}$ $C_{after,i}$ A_i
Choice of data or measurement methods and procedures	Total carbon stock change due to the activity.
Additional comments	N/A

Parameter ID	**24**
Data/Parameter	$T_{AMOR,LUC}$
Description	Amortization period for LUC emissions

Data unit	Years
Purpose of data	☐ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level. Section 8.5.9.
Source of data	☒ Fixed
	Fixed at 20 years.
Choice of data or measurement methods and procedures	Used for amortizing LUC emissions (Eq. 25).
Additional comments	N/A

Parameter ID	**25**
Data/Parameter	*Connected Load Assessment*
Description	Total rated capacity of all appliances and equipment connected to the Baseline Generation System.
Data unit	kW
Purpose of data	☒ Baseline emissions ☐ Activity emissions ☐ Leakage emissions
Value(s) applied	To be determined at the activity level.
Source of data	☒ Fixed
	Physical survey or inventory of appliances.
Choice of data or measurement methods and procedures	Required only if the project opts to use the ≤25% Load Factor emission factor in Tier 2. The assessment shall demonstrate that $\frac{Connected\ Load}{Generator\ Capacity} < 25\%$.
Additional comments	N/A

14.3 | Data and parameters monitored (Ex-post)

14.3.1 | The following parameters shall be monitored during the crediting period.

A. RES Performance

Parameter ID	**26**

Data/Parameter	$EG_{RES,y}$
Description	Net electricity delivered by the RES
Data unit	MWh
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Measurement methods and procedures	☒ Measured Measured at the output point of the RES (for mini-grids) or at the point of consumption (for individual systems).
Measuring instrument(s)	Calibrated electricity meters (Accuracy Class 1.0 or better).
Monitoring intervals	Continuously, aggregated monthly and annually.
QA/QC procedures	Regular meter calibration (Sec 14.1.3). Cross-check with inverter readings. Data validation for outliers.
Additional comments	-

Parameter ID	**27**
Data/Parameter	*Service Level*
Description	Hours of availability and power capacity (kW) of the RES.
Data unit	h/day, kW
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Measurement methods and procedures	☒ Measured Large/Small Scale: continuous system monitoring (smart meters). Micro Scale: Proxy monitoring is permitted (e.g., inverter uptime logs or statistical sampling of user satisfaction) where advanced metering is cost-prohibitive.
Measuring instrument(s)	System monitoring data (remote/smart meters preferred), consumer feedback logs.
Monitoring intervals	Continuously or periodically (e.g., quarterly review).
QA/QC procedures	Review of downtime logs. Verification of response times to failures. Ensures reversal risk mitigation.
Additional comments	*N/A*

Parameter ID	**28**

Data/Parameter	*Decom_Status (Large)*
Description	Verification of permanent decommissioning (Systems ≥ 100 kVA).
Data unit	Status (Yes/No)
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Measurement methods and procedures	☒ Recorded Inspection reports, geotagged photos, disposal/recycling records.
Measuring instrument(s)	Confirmation that the system is inoperative and major components are not reused (Sec 3.2.11).
Monitoring intervals	Once per asset, by the 12-month deadline.
QA/QC procedures	100% verification required. Audit of disposal chain. Cross-check of serial numbers.
Additional comments	*N/A*

Parameter ID	**29**
Data/Parameter	*Decom_Status (Distributed)*
Description	Verification of permanent decommissioning (Systems < 100 kVA).
Data unit	Status (Yes/No)
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☐ Leakage emissions
Measurement methods and procedures	☒ Recorded **Large Systems:** 100% verification via inspection reports/disposal records. **Distributed Systems:** Geotagged photographic evidence or centralized collection records. Sampling is permitted for verification (95/5 confidence).
Measuring instrument(s)	Confirmation that the system is inoperative and major components are not reused (Sec 3.2.11).
Monitoring intervals	Once per asset, by the 24-month deadline.
QA/QC procedures	Verification via sampling allowed (Sec 14.5). Audit of disposal chain. Cross-check of serial numbers.
Additional comments	*N/A*

Parameter ID	**30**

Data/Parameter	$N_{decom,y}$
Description	Number of gensets decommissioned in year y.
Data unit	Number
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☒ Leakage emissions
Measurement methods and procedures	☒ Counted Decommissioning records.
Measuring instrument(s)	Count of assets verified as decommissioned.
Monitoring intervals	Annually (if Option 2 for $AE_{Decom,y}$ is used).
QA/QC procedures	Cross-check with decommissioning Status records.
Additional comments	*N/A*

B. Activity Emissions (Operations and Backup)

Parameter ID	**31**
Data/Parameter	$EC_{op,y}$
Description	Electricity consumption for general operations (if from grid/fossil sources).
Data unit	MWh
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☒ Leakage emissions
Measurement methods and procedures	☒ Measured Calibrated electricity meters, purchase records.
Measuring instrument(s)	Measured consumption for installation, O&M activities.
Monitoring intervals	Monthly or Annually.
QA/QC procedures	Meter calibration. Cross-check with activity logs. Apply materiality assessment.
Additional comments	*N/A*

Parameter ID	**32**
Data/Parameter	$FC_{op,i,y}$

Description	Fuel consumption for general operations (Fuel type i).
Data unit	Mass or volume unit
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☒ Leakage emissions
Measurement methods and procedures	☒ Measured/ Recorded Fuel purchase receipts, calibrated flow meters, equipment logs.
Measuring instrument(s)	Measured consumption for installation, O&M machinery/vehicles.
Monitoring intervals	Monthly or Annually.
QA/QC procedures	Cross-check fuel invoices with activity logs. Apply materiality assessment.
Additional comments	*N/A*

Parameter ID	**33**
Data/Parameter	$EG_{backup,y}$
Description	Total electricity generated by backup systems (fossil fuel or grid).
Data unit	MWh
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☒ Leakage emissions
Measurement methods and procedures	☒ Measured Calibrated electricity meters.
Measuring instrument(s)	Measured continuously using calibrated electricity meters..
Monitoring intervals	Continuously, aggregated monthly and annually.
QA/QC procedures	Meter calibration. Verify that generation is ≤10% of total annual generation
Additional comments	If backup generation exceeds 10% of total annual generation, the activity is ineligible for that year. All backup emissions ($AE_{op,backup}$) shall be deducted from emission reductions.

Parameter ID	**34**
Data/Parameter	$FC_{backup,i,y}$
Description	Fuel consumption by backup generators (Fuel type i).
Data unit	Mass or volume unit

Purpose of data	☒ Baseline emissions ☒ Activity emissions ☒ Leakage emissions
Measurement methods and procedures	☒ Measured Calibrated flow meters, purchase receipts.
Measuring instrument(s)	Measured consumption by backup generators.
Monitoring intervals	Monthly or Annually.
QA/QC procedures	Cross-check with $EG_{backup,y}$ for consistency.
Additional comments	*N/A*

C. Activity Emissions (Transport - If material)

Parameter ID	**35**
Data/Parameter	*Transport Data*
Description	Distance, vehicle type, and load for transport activities.
Data unit	km, Type, tonnes
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☒ Leakage emissions
Measurement methods and procedures	☒ Recorded Vehicle logs, GPS tracking, transport invoices.
Measuring instrument(s)	Data collection as required by GS4GG Methodological Tool 02.
Monitoring intervals	Per trip or aggregated annually.
QA/QC procedures	Review of transport logs and invoices. Apply materiality assessment.
Additional comments	N/A

D. Leakage (Supply-Demand Gap)

Parameter ID	**36**
Data/Parameter	$EF_{LE,gap,y}$
Description	Emission factor of the compensatory electricity source.
Data unit	tCO_2e/MWh
Purpose of data	☒ Baseline emissions ☒ Activity emissions ☒ Leakage emissions

Measurement methods and procedures	☒ Default/ Calculated EF_{grid} or conservative default (1.3 tCO_2e/MWh).
Measuring instrument(s)	Determined according to Section 9.2.2 based on the source of compensatory generation.
Monitoring intervals	Annually (if a gap occurs).
QA/QC procedures	Verification of the source of compensatory generation.
Additional comments	*N/A*

14.4 | QA/QC and Data Management

14.4.1 | **Data Validation and Consistency Checks:** Procedures shall be established for the validation of monitored data. This includes cross-checking data from different sources (e.g., comparing metered electricity output with inverter readings or consumer billing records), identifying outliers, and investigating discrepancies.

14.4.2 | **Internal Audits and Training:** The activity developer shall conduct periodic internal audits of the data collection and management system to ensure compliance with the Monitoring Plan. Roles and responsibilities shall be clearly defined, and personnel shall receive adequate training.

14.4.3 | **Corrective Actions and Data Gaps:** Procedures shall be in place for addressing data gaps or errors (e.g., due to equipment failure). Data gaps shall be filled using the most conservative approach:

a. For parameters contributing to emission reductions (e.g., $EG_{RES,y}$): A value of zero shall be assumed for the period the data is missing.

b. For parameters contributing to activity emissions: The highest plausible value based on historical data or equipment capacity shall be used.

14.5 | Sampling Requirements

14.5.1 | **Applicability of Sampling:** Sampling may be used for monitoring and verification when it is impractical to monitor 100% of the population, specifically for:

a. Verification of decommissioning (Decommissioning Status (Distributed)) for large numbers of Baseline Generation Systems.

b. Monitoring of Service Level or operational status across distributed RES if remote monitoring is not utilized.

c. Determination of baseline parameters through surveys (e.g., establishing load factors for Tier 2 defaults).

14.5.2 | **Sampling Standards:** All sampling shall be conducted in accordance with the latest version of the *CDM Standard: Sampling and surveys for CDM project activities and programme of activities* (or equivalent A6.4 standard).

14.5.3 | **Sampling Plan:** A detailed Sampling Plan shall be included in the PDD, specifying the objective, target population, sampling frame, sampling method (e.g., simple random sampling, stratified sampling), required confidence/precision level, and the calculated sample size.

14.5.4 | **Confidence and Precision Requirements**:

a. **Ex-Ante Surveys (Baseline):** A 90/10 confidence/precision level (90% confidence interval, 10% margin of error) is the minimum requirement.

b. **Ex-Post Monitoring and Verification:**

i. For determining mean values: A 90/10 confidence/precision level is required for annual monitoring.

ii. For determining proportions (e.g., decommissioning status): A 95/5 confidence/precision level is required.

14.5.5 | **Conservativeness and Evaluation:** The implementation of the sampling plan and the analysis of the results shall be subject to verification. If the required confidence/precision level is not achieved, the results must be adjusted conservatively (using the lower or upper bound of the confidence interval, as appropriate) or the sample size shall be increased.

14.5.6 | **Specific Requirements for Decommissioning Verification:** If sampling is used to verify decommissioning, and non-compliance is identified in the sample, corrective actions must be implemented, or the corresponding emission reductions for the non-compliant proportion (using the upper bound of the confidence interval for the failure rate) shall be excluded.

15| MONITORING REQUIREMENTS FOR ACTIVITIES WITH REVERSAL RISKS

15.1.1 | As detailed in Section 12, the primary reversal risk for this methodology is the failure of the Renewable Energy System (RES), leading to a potential reversion to fossil-fuel-based generation by consumers.

15.1.2 | The methodology requires continuous monitoring of the RES performance to detect any reversal event. A reversal event is characterized by a cessation of operation or a decline in the Service Level that results in the electricity generation ($EG_{RES,y}$) falling below the baseline level (EG_{BAS}).

15.1.3 | **Key Monitoring Parameters:** No additional monitoring requirements beyond those specified in Section 14 are necessary to manage reversal risks. The continuous monitoring of the following parameters is required:

a. $EG_{RES,y}$ **(Net electricity delivered by the RES):** Direct measurement of the mitigation outcome.

b. **Service Level (Hours of availability and power capacity):** Ensures the RES is meeting the required demand and reliability standards (Section 3.2.3) and confirms the effectiveness of the mitigation measures defined in Section 12.2.

15.1.4 | **Detection and Reporting**:

a. The monitoring system (e.g., DMRV systems) should be designed to rapidly detect system failures or significant performance degradation.

b. Any significant downtime or failure to meet the required Service Level shall be documented in the Monitoring Report, including the cause, duration, and corrective actions taken.

c. The implementation and effectiveness of the Operation and Maintenance (O&M) Plan and Component Replacement Strategy shall be monitored and reported.

15.1.5 | **Quantification and Compensation:** Emission reductions are calculated ex-post based on the monitored $EG_{RES,y}$. Therefore, any reduction in generation due to a reversal event automatically reduces the calculated ER_y for that period, ensuring that reversals are fully accounted for.

16| APPLICATION TO PROGRAMME OF ACTIVITIES (POA)

16.1 |General Requirements

16.1.1 | The Coordinating/Managing Entity (CME) is responsible for ensuring that all VPAs comply with the requirements of this methodology and the GS4GG PoA Standard.

16.1.2 | **Eligibility Criteria for VPA Inclusion:** The CME shall define clear eligibility criteria for the inclusion of VPAs in the PoA Design Document (PoA-DD). These criteria shall ensure that each VPA meets all the Applicability Criteria defined in Section 3.2 of this methodology.

16.1.3 | **Heterogeneity:** The PoA may include heterogeneous VPAs (e.g., different technologies, different scales, different baseline contexts such as Off-Grid and Unreliable Grid), provided the specific methodological procedures applicable to each context are followed for each VPA.

16.2 |Baseline and Additionality Demonstration

16.2.1 | **Baseline Determination:** The baseline scenario shall be determined at the VPA level, following the procedures in Section 7. The tiered approach (Tier 1 or Tier 2) shall be applied based on the data availability for the specific assets within the VPA. The CME shall ensure the consistent and correct application of the selected Tier.

16.2.2 | **Remaining Lifetime (RLT):** The RLT shall be assessed for each Baseline Generation System (or homogenous group) within a VPA, using the methods in Section 7.4. The crediting period of the VPA shall be limited by the RLT of

the assets included within it (unless baseline continuation beyond RLT is validated).

16.3 | Monitoring and Quantification

16.3.1 | **Monitoring Plan:** The CME shall establish a comprehensive monitoring system for the PoA, detailing how data will be collected, managed, and verified across all VPAs.

16.3.2 | Sampling may be applied for monitoring and verification across the PoA (cross-VPA sampling), particularly for the verification of decommissioning of distributed assets and monitoring of operational status.

a. Sampling shall comply with the requirements of Section 14.5.

b. The sampling plan shall be detailed in the PoA-DD and relevant VPA-DDs, ensuring the required confidence/precision levels are met for the specific parameters being sampled.

c. The CME is responsible for implementing the sampling plan, analyzing the results, and applying conservative adjustments if the required precision is not met.

16.3.3 | **Digital Monitoring and Verification (DMRV):** The use of DMRV systems (Section 14.1.4) is strongly encouraged for PoAs to manage data from distributed assets efficiently and enhance monitoring integrity.

17| RENEWAL OF CREDITING PERIOD

17.1 | Crediting Period Renewal Requirements

17.1.1 | The activity developer shall comply with the latest GS4GG requirements for the renewal of the crediting period. The crediting period is five years, renewable twice (maximum total 15 years), subject to the limitations defined in Section 1 (e.g., RLT).

17.2 | Reassessment of the Baseline Scenario

17.2.1 | **Validity of the Baseline Scenario:** The activity developer shall reassess the validity of the baseline scenario (continued operation of the Baseline Generation System or its replacement with a similar fossil fuel system) in light of the current regulatory, economic, and technological context at the time of renewal.

17.2.2 | **Regulatory Context Update:** The Regulatory Analysis (Section 6.2) shall be updated to confirm that the activity remains regulatory surplus. If new mandates have come into force that require the activity, the crediting period cannot be renewed.

17.2.3 | **Baseline Fuel Mix Evolution:** The activity developer shall assess if the baseline fuel in the region remain applicable or has shifted towards lower-carbon alternatives (e.g., biodiesel blends like B20, green hydrogen, or small-scale LNG). If the market standard has shifted, the Baseline Emission Factor

(EF_{BL}) shall be updated to reflect the lower carbon intensity of the dominant fuel mix.

17.2.4 | **Impact of Remaining Lifetime (RLT):**

a. If the ex-ante determined RLT extends beyond the end of the subsequent crediting period, the baseline scenario remains valid.

b. If the RLT ends during the subsequent crediting period, baseline emissions associated with that system can only be claimed up to the end of the RLT, unless the conditions for Baseline Continuation Beyond RLT (Section 7.4.22) were validated ex-ante.

17.3 | Update of Baseline Parameters

17.3.1 | **Dynamic Parameters:** The following parameters shall be reassessed and updated for the subsequent crediting period:

a. **Grid Emission Factor (EF_{Grid}):** If applicable (Unreliable Grid context), the EF_{Grid} shall be updated using the latest available data and the version of the relevant tools.

b. **Baseline Emission Factor (EF_{BL}):** Updated based on the latest conservative defaults (Tier 2) or fuel mix analysis available at the time of renewal.

17.4 | Reassessment of Additionality

17.4.1 | **Ongoing Financial Need (OFN):** The activity developer shall conduct an Ongoing Financial Need assessment to demonstrate that the activity continues to require carbon revenues to remain financially viable or to overcome persisting barriers, considering updated costs (including O&M, component replacement, and JT plan implementation).

17.4.2 | **Positive List Activities:** Activities initially deemed additional via the Positive List shall conduct a full Investment or Barrier analysis at renewal if the host country/region no longer meets the eligibility criteria for the Positive List at the time of renewal (Section 6.7.2).

17.4.3 | **Common Practice Analysis:** The Common Practice Analysis (Section 6.6) shall be updated in subsequent methodology updates to reflect the current market penetration of similar activities and shall be applied as per the methodology in force at the time of renewal.

ANNEX.1|DEFAULT FACTORS FOR BASELINE AND RLT ASSESSMENT

This annex provides default factors and standardized criteria required for the assessment of the RLT and the calculation of Baseline Emissions (Tier 2).

A.1.1 |Parameters for Simplified Remaining Lifetime (RLT) Assessment

A.1.1.1 |This section supports the simplified assessment of RLT as described in Section 7.4.4 (Option B), applicable only to Baseline Generation Systems with a capacity < 1MW.

A. Default Total Technical Lifetime ($TL_{Default}$)

A.1.1.2 |The following default total technical lifetimes ($TL_{Default}$) shall be used[3]. The selection depends on the fuel type, capacity rating, and the primary usage pattern (Continuous/Prime Power vs. Standby/Intermittent Use).

A.1.1.3 |Activity developers shall select the limiting factor (Years or Operating Hours) that results in the shortest RLT.

Table A.1.1. Default Total Technical Lifetimes ($TL_{Default}$)

Fuel Type	Capacity Rating (kVA)	Usage Pattern	$TL_{Default}$ (Years)	$TL_{Default}$ (Operating Hours)
Petrol/ Gasoline	< 5 kVA	Standby/Intermittent	8	2,000
	< 5 kVA	Continuous/Prime	5	3,000
Diesel	< 15 kVA	Standby/Intermittent	12	5,000
	< 15 kVA	Continuous/Prime	10	10,000
	15 – 500 kVA	Standby/Intermittent	20	10,000
	15 – 500 kVA	Continuous/Prime	15	20,000
	>500 kVA – 1MW	Standby/Intermittent	25	15,000
	>500 kVA – 1MW	Continuous/Prime	20	30,000
LPG/ Natural Gas	All sizes < 1MW	Standby/Intermittent	15	10,000
	All sizes < 1MW	Continuous/Prime	12	20,000

[3] EPA. (2018). Catalog of CHP technologies. Section 3. Technology description and performance – reciprocating internal combustion engines. U.S. environmental protection agency, combined heat and power partnership.

B. Standardized Criteria for Condition Factor (CF)

A.1.1.4 | The following criteria shall be used to determine the Condition Factor (CF) as required in Section 7.4.4. The determination shall be documented with verifiable evidence and is subject to validation.

Table A.1.2. Criteria for Determining Condition Factor (CF)

Condition	CF	Quantitative Indicator (Derating)	Operational Status	Physical Integrity
Good	1	< 5% Power Derating	Fully operational; meets expected performance. No history of major failures.	Excellent condition; no significant wear, corrosion, or damage to major components.
Average	0.75	5-15% Power Derating	Operational, but may exhibit reduced efficiency, minor issues, or occasional downtime.	Moderate wear and tear; minor corrosion or superficial damage. No immediate major repairs required.
Poor	0.5	> 15% Power Derating	Operational, but exhibits frequent breakdowns, significantly reduced performance, or requires immediate repairs.	Significant wear, corrosion, or damage. Major overhaul required soon.

A.1.2 | Default Baseline Emission Factors ($EF_{Default}$) (Tier 2 Approach)

A.1.2.1 | This section provides the Default Emission Factors ($EF_{Default}$) for the Tier 2 baseline assessment.

A.1.2.2 | Default Selection: The >25% Load Factor values (representing higher efficiency) shall be applied by default.

Table A.1.3. Default Emission Factor by Fuel Type (tCO_2e/MWh)

Fuel Type	User Type	Power Rating	Load Factor Scenario	Efficiency (η)	Baseline Emission Factors(tCO2e/MWh)
Diesel	Type 1	< 5 kVA	≤25% (default)	22.0%	1.22
Diesel	Type 1	5-10 kVA	>25%	25.0%	1.07

Diesel	Type 1	10-25 kVA	≤25%	22.6%	1.19
Diesel	Type 1	10-25 kVA	>25%	29.1%	0.92
Diesel	Type 1	25-50 kVA	≤25%	30.1%	0.89
Diesel	Type 1	25-50 kVA	>25%	30.1%	0.89
Diesel	Type 2	75-375 kVA	≤25%	22.9%	1.17
Diesel	Type 2	75-375 kVA	>25%	28.0%	0.96
Petrol	Type 1	< 10 kVA	≤25%	15.0%	1.72
Petrol	Type 1	< 10 kVA	>25%	19.3%	1.33

A.1.2.3 | For other fuel types, the $EF_{Default}$ shall be determined selecting the most conservative applicable value.

ANNEX.2| Default Emission Factors for Activity Emissions

This annex provides the conservative default factors required for the calculation of Activity Emissions (AE_y), specifically Embodied Emissions and Decommissioning Emissions.

A.2.1 |Default Factors for Embodied Emissions ($EF_{LCA,k}$)

A.2.1.1 |The activity developer shall determine the lifecycle emission factors for RES and BESS components using the following hierarchy of options:

a. Option 1 (Supplier-Specific - Preferred): Environmental Product Declarations (EPDs) (Type III) provided by the equipment supplier, verified in accordance with ISO 14025 or EN 15804.

b. Option 2 (Verified LCA): A project-specific Life Cycle Assessment (LCA) report conducted in accordance with ISO 14067 or ISO 14040/44, verified by an independent third party.

c. Option 3 (Conservative Defaults): The standardized conservative default factors provided in Table A.2.1 below. These factors represent 'cradle-to-gate' emissions (manufacturing and transport) based on median values from harmonized international literature..

Table A.2.1. Default Embodied Emission Factors by Technology (kgCO2e/kW)

Technology	Sub-Type / Scale	Default Embodied Emission Factor ($kgCO_2e/kW$)	Notes on Application and Limitations
Solar Photovoltaic (PV)	Monocrystalline Silicon (mono-Si), Polycrystalline Silicon (poly-Si)	1490	Based on median harmonized LCA data (40 g/kWh), a 25-year lifetime, and 17% capacity factor. Includes inverter and balance of system. Excludes emissions from Land Use Change (LUC).
	Cadmium Telluride (CdTe)	1120	Based on representative LCA data (30 g/kWh), a 25-year lifetime, and 17% capacity factor. Includes inverter and balance of system. Excludes emissions from LUC.
	Copper Indium Gallium Selenide (CIS/CIGS)	1300	Based on representative LCA data (35 g/kWh), a 25-year lifetime, and 17% capacity factor. Includes inverter and balance of system. Excludes emissions from LUC.
Wind	Onshore Wind Turbine	725	Based on median harmonized LCA data (11 g/kWh), a 25-year lifetime, and 30% capacity factor. Includes foundation and balance of system. Excludes emissions from LUC.

Hydropower	Small-Scale Run-of-River (< 15 MW)	4205	Based on IPCC median LCA data (24 g/kWh), a 40-year lifetime, and 50% capacity factor. Includes all civil works and electromechanical equipment. Excludes LUC and biogenic emissions.
Biomass	Residue Feedstock (e.g., Forestry/Agri.)	7884	Based on median LCA data for residue feedstock (45 g/kWh), a 25-year plant lifetime, and 80% capacity factor. Includes feedstock collection and transport. Excludes emissions from LUC.
Battery Energy Storage (BESS)	Lithium-Ion (LFP Chemistry)	360	Factor is for a standard 4-hour duration system (E/P ratio = 4). For systems with a different duration (D, in hours), this factor shall be multiplied by (D/4). Based on IEA global average data.

A.2.1.2 | **General Application Conditions:** The application of the factors in this annex is subject to the following conditions:

a. The factors represent 'cradle-to-grave' embodied emissions, based on median values from harmonized, globally representative Life Cycle Assessment (LCA) literature.

b. The factors are expressed per kilowatt (kW) of installed DC capacity for PV and AC capacity for all other technologies.

c. These factors are used to calculate the total embodied emissions, which is then amortized over the project's crediting period.

A.2.1.3 | Emissions from Land Use Change (LUC) are excluded from these factors and shall be assessed separately under the Leakage section of this methodology, if applicable.

A.2.2 | Default Emission Factor for Decommissioning (EF_{Decom})

A.2.2.1 | **Methodology for Factor Derivation:** The default emission factors are derived using a bottom-up methodology, which calculates the total estimated emissions from each key decommissioning activity and normalizes them per unit of genset capacity (kW or kVA). This approach ensures transparency and allows for the integration of specific emission factors for materials and processes.

A.2.2.2 | The derivation follows these steps:

a. **Genset Weight Estimation**: The total mass of the genset to be decommissioned is determined by utilizing the average weight per kW/kVA for various genset sizes.

b. **Material Breakdown**: The total genset weight is multiplied by typical material composition percentages to estimate the mass or volume of each material type (e.g., steel, aluminum, copper, plastics, waste oil, coolant).

c. **Pathway Assignment**: An end-of-life pathway is assigned to each material type based on the relevant country context (e.g., High-Income, Middle-Income, or Least Developed/Lower-Middle Income) or a globally conservative assumption. This assignment reflects the prevailing waste management practices, such as formal recycling in High-Income Countries versus a higher proportion of landfilling or informal practices in Least Developed Countries.

d. **Emission Calculation per Pathway**: The relevant GHG emission factors are applied to the mass or volume of each material for its assigned end-of-life pathway. This calculation includes emissions from:

   i. Energy consumption for mechanical dismantling, shredding, and smelting, converted to CO_2e using an appropriate grid emission factor.

   ii. Management of waste oil and coolant, accounting for emissions from re-refining, combustion, or improper disposal.

   iii. Transportation of materials, based on estimated weight and conservative transport distance assumptions.

e. **Summation and Normalization**: All calculated emissions are summed and then normalized by the genset's capacity (kW or kVA) to yield the final default emission factor in tCO_2e/kW or tCO_2e/kVA.

A.2.2.3 | The following table presents the derived default emission factors. The values are categorized by genset capacity and country income level to reflect significant variations in waste management infrastructure and practices. These factors are applicable to both diesel and petrol (gasoline) gensets, as the physical components and decommissioning processes are substantially similar.

Table A.2.2. Default Decommissioning Emission Factors per Genset Capacity (tCO_2e/kW or tCO_2e/kVA)

Genset Capacity Range (kW/kVA)	Category A: Globally Applicable (Highly Conservative) (tCO_2e/kW or kVA)	Category B1: High-Income Countries (HICs) (tCO_2e/kW or kVA)	Category B2: Middle-Income Countries (MICs) (tCO_2e/kW or kVA)	Category B3: LDCs & Lower-Middle Income Countries (LMICs) (tCO_2e/kW or kVA)
<10 kW	0.0080	0.0018	0.0045	0.0080
10-25 kW	0.0075	0.0016	0.0042	0.0075
25-50 kW	0.0070	0.0015	0.0040	0.0070
50-200 kW	0.0045	0.0010	0.0025	0.0045

>200 kW	0.0025	0.0006	0.0015	0.0025

Note: Numerical values are derived through detailed calculations using the methodology outlined in Section above and the emission factors in Table above, combined with specific assumptions for each category. These factors are designed to be conservative and practical, reflecting typical end-of-life pathways in different contexts.

A.2.2.4 | Key Assumptions for Derivation: The derivation of the factors in Table A2.2 is based on the following key assumptions, designed to ensure conservativeness and practicality across different contexts.

a. **Category A (Globally Applicable)**: Assumes a conservative, blended scenario reflecting a mix of formal and informal practices. This includes baseline formal recycling for metals (accounting for process emissions) and a component for landfilling. For hazardous fluids, it assumes a higher proportion of combustion for waste oil and less formal disposal for coolant, reflecting a conservative global average.

b. **Category B1 (High-Income Countries)**: Assumes high rates of formal metal recycling (accounting for energy consumption for shredding and smelting) and established infrastructure for the re-refining of waste oil and treatment of coolant.

c. **Category B2 (Middle-Income Countries)**: Assumes a transitional scenario with a mix of formal and less efficient informal recycling processes. Waste oil management includes a blend of re-refining and combustion.

d. **Category B3 (LDCs & Lower-Middle Income Countries)**: Assumes a higher prevalence of informal practices, including open burning to recover valuable materials and direct dumping of non-recoverable components and hazardous fluids. This category's factors are the most conservative to account for the higher GHG releases associated with these disposal methods.

A.2.3 | Standardized Decommissioning Verification Protocol

A.2.3.1 | This section provides guidance and a template for verifying the permanent decommissioning of the BGS. This is essential for preventing leakage (Section 9.1.2).

A.2.3.2 | To ensure that the BGS is rendered permanently inoperative and that major components (engine, alternator) are not reused or sold for use in other fossil fuel combustion activities.

A.2.3.3 | Verification Requirements by Scale

a. **Large Systems (≥ 100 kVA, Mini-grids):** 100% verification is mandatory.

b. **Distributed Systems (< 100 kVA):** 100% documentation is required. Verification may utilize sampling (Section 14.5) if the population is large.

A.2.3.4 | **Documentation and Evidence Protocol:** For each decommissioned asset, the following documentation shall be compiled.

Genset Decommissioning Certificate (Template)

- **Project Name:** _____
- **Project ID:** _____
- **Consumer Name:** _____
- **Consumer ID / Household ID:** _____
- **Genset Details:**
  - Make/Model (if known): _____
  - Serial Number (if available): _____
  - Capacity (kW/kVA): _____
  - Fuel Type: _____
  - Geotagged Location (Coordinates): _____
- **Decommissioning Details:**
  - Date of Collection: _____
  - Collected by (Name/Organization): _____
  - Method of Decommissioning (e.g., key components destroyed, sent for recycling): _____
- **Signatures:**
  - Consumer Signature/Thumbprint: _____
  - Project Representative Signature: _____
  - Date: _____

Annex 2.2: Baseline Evidence Checklist (Template)

- **Project Name:** _____
- **Project ID:** _____
- **Consumer Name:** _____
- **Consumer ID / Household ID:** _____
- **Checklist of Evidence Provided (to be ticked by project staff):**
  - [ ] Dated photograph/video of the genset in operation.
  - [ ] Photograph of the genset's serial number plate (if available).
  - [ ] Fuel purchase receipts (attach copies).
  - [ ] Fuel consumption logbook (attach copies/photo).
  - [ ] Maintenance records (for commercial gensets, attach copies).
  - [ ] Signed Genset Decommissioning Certificate (attach copy).
- **Verification:**
  - Verified by (Name of Project Staff): _____
  - Signature: _____
  - Date: _____

ANNEX.3| Methodology-Level Lock-in Risk Analysis

A.3.1 |Exemption from Activity-Level Lock-in Risk Assessment

A.3.1.1 |A comprehensive, methodology-level lock-in risk analysis has been conducted in accordance with the GS4GG Additionality Requirements. The full analysis, which demonstrates that project activities under this methodology do not present a material lock-in risk, is available as supplementary information to this methodology.

A.3.1.2 |Based on this analysis, project activities that are fully compliant with this methodology are exempt from the requirement to conduct a separate, project-specific lock-in risk analysis.

A.3.2 |Requirements for Applying the Exemption

A.3.2.1 |To qualify for the exemption from a project-level lock-in analysis, the project developer shall demonstrate compliance with the following key methodological safeguards, which are designed to systematically mitigate all relevant lock-in risks.

Table A.3.1. Summary of Lock-in Risks and Required Methodological Safeguards

Risk Vector	Lock-in Risk Description	Required Mitigation Safeguard
Fossil Fuel Technology	Continued use or resale of displaced fossil-fuel generators.	**Mandatory Genset Decommissioning**: The project shall ensure the verifiable collection, decommissioning, and disposal of all baseline gensets, preventing their continued use.
Technology (Lifecycle)	Long asset lifespans lead to unmanaged End-of-Life (EoL) waste for all major components, creating environmental liabilities.	**End-of-Life Management Best Practice**: The project is strongly encouraged to provide a signed commitment for the EoL handling of all major components (e.g., panels, turbines, batteries) in line with best practices.
Land Use	Competition between ground-mounted solar and agriculture on arable land, leading to inefficient land use.	**Agrivoltaics Best Practice**: For large-scale solar projects on arable land, it is recommended as a best practice that the project completes a checklist confirming the review of agrivoltaics best practices and provides justification if not implemented.

ANNEX.4| Methodology level Barrier Analysis for Activities in LDCs, SIDS, and Vulnerable Regions of Lower-Middle-Income Countries

A.4.1 |Exemption from Activity-Level Additionality Demonstration

A.4.1.1 |A comprehensive, methodology-level barrier analysis has been conducted, demonstrating that for specific project types in high-barrier contexts, implementation is not a credible business-as-usual scenario. The full analysis, which justifies the use of a positive list for deemed additionality, is available as supplementary information to this methodology.

A.4.1.2 |Based on this analysis, project activities that meet all the criteria are deemed additional. Such projects are exempt from the requirement to conduct a separate, project-specific investment or barrier analysis.

A.4.2 |Criteria for Deemed Additionality

A.4.2.1 |An activity is deemed additional if it simultaneously meets all three of the criteria specified in the table below.

Table A.4.1. Positive List Criteria for Deemed Additionality

Criterion	Requirement
Geographic Location	The project activity shall be physically located in a country that, at the time of the project's first submission for Gold Standard listing, meets one of the following conditions: a. Is Classified as a Least Developed Country (LDC) or a Small Island Developing State (SIDS). b. Is classified as a Lower-Middle-Income Country (as per the most recent World Bank classification) AND the project is implemented within a Special Underdeveloped Zone (SUZ). An SUZ is a sub-national region officially recognized by the national government or characterized by an electrification rate of less than 20%.
Project Scale	The project activity shall be classified as 'Microscale' or 'Small-scale'.

A.4.3 |Validity Period

A.4.3.1 |This positive list for deemed additionality shall have a validity period of five years from the date of its approval by the Gold Standard Technical Advisory Committee. Following this period, the criteria and their underlying justifications will be subject to review to ensure their continued relevance and integrity.

ANNEX.5| Guidance: Proportionate Just Transition (JT) Implementation for Decentralized Energy Transitions

A.5.1 |INTRODUCTION

A.5.1.1 |This Annex provides practical guidance for Activity Developers applying the methodology. The methodology mandates compliance with the *GS4GG Just Transition Requirements* (hereafter referred to as the JT Requirements).

A.5.1.2 |The transition from decentralized fossil fuel systems (e.g., gensets, mini-grids) to Renewable Energy Systems (RES) involves diverse scales and socio-economic contexts, ranging from individual households to critical industrial infrastructure.

A.5.2 |IMPLEMENTATION FRAMEWORK

A.5.2.1 |The implementation of the JT Requirements follows a structured, four-step approach designed to determine and deliver a proportionate response.

Step 1: Scoping and Socio-Economic Impact Assessment (SEIA)

A.5.2.2 |The first step is to understand the scale and nature of the impacts (JT Requirements, Section 6.2).

A.5.2.3 |**Defining the Area of Influence (AoI):** Define the geographical and economic boundaries for the assessment (JT Requirements, Section 2.2).

Guidance:

a. ***Centralized Assets (Mini-grids, Captive Plants):*** *The AoI includes the operational staff, the community served, and direct supply chain dependencies.*

b. ***Distributed Assets (Household/SME Gensets):*** *The AoI is typically localized to the end-users and immediate local service providers (e.g., local mechanic, fuel vendor).*

A.5.2.4 |**Identifying Affected Stakeholders and Workers:** Identify individuals or groups negatively impacted by the decommissioning. Crucially, the definition of "Worker" (JT Requirements, Section 4) includes full-time employees, long-term contractors, and *informal workers whose primary livelihood depends on the baseline scenario*.

A.5.2.5 |**Assessing Impact Severity:** Analyze the baseline socio-economic dependencies. The primary metric for determining the scale of impact is the potential disruption to livelihoods, quantified as Full-Time Equivalent (FTE) job losses or equivalent livelihood disruptions (e.g., loss of primary income source for informal workers).

Guidance for Data Collection: In decentralized and informal contexts where formal records are often unavailable, use practical assessment methods such as surveys, interviews with community leaders and business associations, and local market analysis.

Step 2: Determining the Just Transition Tier

A.5.2.6 | Based on the SEIA, categorize the activity (or a homogenous group of assets within a Programme of Activities) into one of the following Tiers. This Tier determines the required scope and complexity of the Just Transition Plan (JT Plan).

Table A.5.1. Just Transition Tiers based on Socio-Economic Impact

Tier	Impact Profile	Impact Threshold (Livelihood Disruption)	Typical Activity Context
Tier 1: Minimal Impact	Negligible employment impact. Primary impact is on energy access, cost, and reliability for the consumer.	< 1 FTE equivalent	Distributed household or small enterprise gensets; highly automated systems.
Tier 2: Moderate Impact	Localized job losses or significant impact on specific local businesses/supply chains.	1 – 10 FTE equivalent	Small-to-medium mini-grids; commercial captive power; activities significantly impacting dedicated local maintenance contractors or fuel distributors.
Tier 3: Significant Impact	Substantial localized employment losses and broader community economic disruption.	> 10 FTE equivalent	Large mini-grids; major industrial captive plants with significant workforce and community dependencies.

Step 3: Developing the Proportionate JT Plan

A.5.2.7 | The Activity Developer shall develop a JT Plan (JT Requirements, Section 6.3) addressing all five core principles and the implementation framework, tailored to the determined Tier.

Table A.5.2. Proportionate Implementation of JT Framework Components (Governance, Planning, MRV)

Requirement (Section 6 of JT Requirements)	Tier 1: Minimal Impact	Tier 2: Moderate Impact	Tier 3: Significant Impact
Governance and Coordination (6.1)	Integrated into existing project management structure. A designated focal point for	Dedicated team or individual responsible for JT implementation. Formal coordination	Formal governance structure (e.g., JT Committee) with representation from management,

	stakeholder engagement.	mechanism with local representatives if appropriate.	workers, and community stakeholders. Clear mandates and resources.
Just Transition Plan (6.3)	Simplified JT Plan focusing on consumer protection (ensuring improved Service Level), fair access to the RES, and environmental management (decommissioning).	Focused JT Plan addressing specific impacts identified: worker transition support, supply chain engagement, and community benefits.	Comprehensive JT Plan detailing strategies for all 5 principles, including social dialogue mechanisms, workforce transition, economic diversification, and social protection measures.
Monitoring, Reporting, and Verification (MRV) (6.4)	Monitored via standard project indicators (e.g., Service Level, decommissioning compliance). Reported in the standard Monitoring Report.	Tracking of specific JT KPIs (e.g., retraining outcomes, jobs created). Dedicated section in the Monitoring Report.	Robust MRV system with participatory monitoring involving stakeholders. Public disclosure of JT performance reports (in line with Annex 02 of the Requirements).

Table A.5.2. Proportionate Implementation of the Five Core JT Principles

JT Principle (Section 5 of JT Requirements)	Tier 1: Minimal Impact	Tier 2: Moderate Impact	Tier 3: Significant Impact
P1: Stakeholder Consultation & Continuous Input	Focus on the Consumers. Clear communication regarding the transition and new service levels. Establish an accessible grievance mechanism (e.g., customer service line).	Engage Consumers, affected Workers, and community representatives. Conduct focused consultations on the transition plan and opportunities. Establish formal continuous input channels.	Comprehensive engagement (as per GS4GG Stakeholder Requirements). Establish formal Social Dialogue mechanisms involving workers/unions, community

			leaders, and local government.
P2: Retaining & Retraining Workers	SEIA shall verify the absence of dependent workers. If informal workers are identified, assess opportunities for inclusion (e.g., basic RES maintenance training).	Develop a transition plan for affected workers. Prioritize direct retention/redeployment within the RES activity. Provide targeted retraining (e.g., solar O&M certification).	Comprehensive workforce transition strategy. Includes skills mapping, extensive retraining programs, early retirement options (if applicable), and collaboration with vocational institutions.
P3: Sustainable Job Creation & Economic Diversification	Focus on indirect benefits through improved energy reliability (Service Level). Prioritize local sourcing for RES installation where feasible. Ensure Decent Work standards.	Actively maximize local employment in RES construction and O&M (Decent Work). Support local businesses impacted by the supply chain shift (e.g., former fuel suppliers transitioning).	Develop a local economic diversification strategy. Includes investment in new economic activities, SME support programs, and maximizing local content and Decent Work in the RES supply chain.
P4: Social Protection & Benefit Sharing	Ensure the transition does not negatively impact energy affordability for vulnerable consumers. Benefits are shared through improved Service Level and reduced pollution.	Ensure compliance with national labour laws regarding severance (if retention is not possible). Implement benefit-sharing mechanisms (e.g., community funds, preferential tariffs).	Implement robust social protection measures, potentially beyond legal requirements (e.g., enhanced severance, transitional support). Establish significant, long-term benefit-sharing mechanisms.
P5: Environmental Protection	Mandatory: Compliance with safe decommissioning	Implement environmental remediation of the baseline site (if required). Ensure sustainable	Comprehensive environmental remediation plan for the baseline

	and waste management protocols (Methodology Sec 3.3.5), especially for hazardous materials (fuel, lubricants, batteries) and RES end-of-life (e.g., BESS).	management of the RES lifecycle.	site and associated areas. Implementation of best practices for environmental management of the RES.

Step 4: Implementation and Monitoring

A.5.2.8 | Implementation: The Activity Developer is responsible for executing the JT Plan according to the established governance structure.

A.5.2.9 | Duration: Monitoring shall continue throughout the crediting period or until the objectives defined in the JT Plan are verified as achieved, whichever is later (JT Requirements, Section 2.2.2).

ANNEX.6| Quantification of Avoided Black Carbon and PM2.5 Emissions

A.6.1 |Introduction and Scope

A.6.1.1 |**Background:** Fossil fuel generators, particularly those running on diesel and petrol without emission controls, are significant sources of Black Carbon (BC) and Fine Particulate Matter (PM2.5). BC is a potent Short-Lived Climate Pollutant (SLCP) with a significant near-term warming effect (Bond et al., 2013; IPCC, 2021). PM2.5 (which includes BC) is a major air pollutant with severe adverse health impacts (WHO, 2021). The displacement of these generators provides substantial climate and health co-benefits.

A.6.1.2 |**Scope and Applicability:** This Annex provides a methodology for the quantification of avoided BC and PM2.5 emissions resulting from the decommissioning of the Baseline Generation Systems. The application of this Annex is voluntary.

A.6.1.3 |**Reporting:** The results from this Annex (avoided mass of PM2.5, and the CO_2 equivalent (CO_2e) impact of BC) shall be reported separately from the net GHG emission reductions (ERy) calculated in Section 10 of the main methodology.

A.6.2 |Metrics and Global Warming Potentials (GWP) for Black Carbon

A.6.2.1 |Metrics:

a. **Health Impacts (PM2.5 and BC):** Quantified based on the avoided mass (tonnes) of PM2.5 and BC emissions.

b. **Climate Impacts (BC):** Quantified based on the avoided mass of BC emissions, converted to CO_2 equivalents (tCO_2e) using Global Warming Potentials (GWP).

A.6.3 |Definitions

A.6.3.1 |In addition to the definitions provided in the core methodology, the following definitions apply to this annex:

a. **Black Carbon (BC)**: The most strongly light-absorbing component of particulate matter (PM), formed by the incomplete combustion of fossil fuels, biofuels, and biomass.

b. **Particulate Matter 2.5 (**PM2.5**)**: Fine inhalable particles with diameters that are generally 2.5 micrometers and smaller.

c. **Global Warming Potential (GWP)**: An index, based on radiative properties of greenhouse gases, measuring the radiative forcing following a pulse emission of a unit mass of a given substance, accumulated over a chosen time horizon, relative to that of the reference substance, carbon dioxide.

A.6.4 |Quantification of Emissions Avoided

A.6.4.1 | The annual avoided emissions are equal to the baseline emissions from the displaced generator(s), as project emissions of BC and PM2.5 from the installed renewable energy system are zero. The calculation shall be performed annually for each year y of the crediting period.

Step 1: Calculate Baseline BC Emissions in CO_2 Equivalent $(BE_{BC,CO2e,y})$

$$BE_{BC,CO2e,y}=\sum_i(EG_{RES,y} \times EF_{BC,CO2e,i}) \quad \text{(Equation 6.1)}$$

Where:

- $BE_{BC,CO2e,y}$ = Baseline emissions of Black Carbon in year y, expressed as tonnes of CO_2 equivalent (tCO_2e).
- $EG_{RES,y}$ = Net quantity of electricity supplied by the project RES to consumers in stratum i in year y (MWh).
- $EF_{BC,CO2e,i}$ = Unified Black Carbon Emission Factor for the baseline scenario corresponding to stratum i (tCO_2e /MWh)

Step 2: Calculate Baseline PM2.5 **Emissions** $\left(BE_{PM2.5,y}\right)$

$$FC_{BL,i,y} = \frac{EG_{RES,y}}{\eta_{BL,i} \times NCV_i} \text{ (Equation 6.2)}$$

$$BE_{PM2.5,y} = \sum_i \left(FC_{BL,i,y} \times EF_{PM2.5,i} \times \frac{1}{1000}\right) \text{ (Equation 6.3)}$$

Where:

- $BE_{PM2.5,y}$ = Baseline emissions of PM2.5 in year y (tonnes of PM2.5).
- $FC_{BL,i,y}$ = Total baseline fuel consumption for stratum i in year y (kg of fuel).
- $\eta_{BL,i}$ = Efficiency of the baseline genset technology for stratum i (%).
- NCV_i = Net Calorific Value of the baseline fuel for stratum i (MWh/kg_{fuel})
- $EF_{PM2.5,i}$ = Emission factor for PM2.5 for the baseline genset in stratum i (g PM2.5 / kg of fuel)
- 1/1000 = Conversion factor from kg to tonnes.

Step 3: Calculate Baseline BC Emissions $(BE_{BC,y})$

$$BE_{BC,y} = \sum_i \left(BE_{PM2.5,i,y} \times Frac_{BC,i}\right) \text{ (Equation 6.4)}$$

Where:

- $BE_{BC,y}$ = Baseline emissions of Black Carbon in year y (tonnes of BC).
- $BE_{PM2.5,i,y}$ = Baseline emissions of PM2.5 for stratum i in year y (tonnes of PM2.5).
- $Frac_{BC,i}$= The fraction of PM2.5 that is Black Carbon for the baseline fuel in stratum i (tonne BC/tonne PM2.5).

A.6.5 |Data and Parameters

A.6.5.1 |Data and Parameters Not Monitored (Default Values)

Table A.6.1. Default Unified Black Carbon Emission Factors ($EF_{BC,CO2e,i}$)

Fuel Type	User Type	Power Rating	Load Factor Scenario	Unified BC Emission Factor (tCO_2e/MWh)
Diesel	Type 1	< 5 kVA	≤25%	0.610
Diesel	Type 1	< 5 kVA	>25%	0.419
Diesel	Type 1	5-10 kVA	≤25%	0.509
Diesel	Type 1	5-10 kVA	>25%	0.369
Diesel	Type 1	10-25 kVA	≤25%	0.408
Diesel	Type 1	10-25 kVA	>25%	0.317
Diesel	Type 1	25-50 kVA	≤25%	0.306
Diesel	Type 1	25-50 kVA	>25%	0.306
Diesel	Type 2	75-375 kVA	≤25%	0.241
Diesel	Type 2	75-375 kVA	>25%	0.197
Petrol	Type 1	< 10 kVA	≤25%	0.201
Petrol	Type 1	< 10 kVA	>25%	0.157

A.6.5.2 | **Component Parameters for Derivation and Informational Purposes**

The tables below provide the component parameters used to derive the unified emission factors.

Table A.6.2. Default Baseline Genset Efficiencies ($\eta_{BL,i}$)

Fuel Type	User Type	Power Rating	Load Factor Scenario	Default Baseline Efficiency (ηBL)
Diesel	Type 1	< 5 kVA	≤25%	15.1%
Diesel	Type 1	< 5 kVA	>25%	22.0%
Diesel	Type 1	5-10 kVA	≤25%	18.1%
Diesel	Type 1	5-10 kVA	>25%	25.0%
Diesel	Type 1	10-25 kVA	≤25%	22.6%
Diesel	Type 1	10-25 kVA	>25%	29.1%
Diesel	Type 1	25-50 kVA	≤25%	30.1%

Diesel	Type 1	25-50 kVA	>25%	30.1%
Diesel	Type 2	75-375 kVA	≤25%	22.9%
Diesel	Type 2	75-375 kVA	>25%	28.0%
Petrol	Type 1	< 10 kVA	≤25%	15.0%
Petrol	Type 1	< 10 kVA	>25%	19.3%

Table A.6.3. Default Net Calorific Values (NCV)

Parameter	Fuel Type	Default Value	Unit	Source & Justification
NCV	Diesel	0.01172	MWh/kgfuel	Derived from NCV of 9.96 kWh/L and density of 0.85 kg/L.[1]
NCV	Petrol	0.01192	MWh/kgfuel	Derived from NCV of 8.94 kWh/L and density of 0.75 kg/L.[1]

Table A.6.4. Default PM2.5 **Emission Factors (**EFPM2.5**)**

Parameter	Genset Type	Default Value	Unit	Source & Justification
EFPM2.5	Diesel Type 1 (< 75 kVA)	2.0	g PM2.5 / kg fuel	Conservative value derived from literature on small, non-road diesel engines, which often have higher emission rates.
EFPM2.5	Diesel Type 2 (75-375 kVA)	1.2	g PM2.5 / kg fuel	Represents the common range for medium commercial generators, synthesized from data on in-use generators.
EFPM2.5	Petrol Type 1 (< 10 kVA)	2.0	g PM2.5 / kg fuel	Based on U.S. EPA AP-42 data for uncontrolled gasoline engines, which assumes all particulate is PM2.5.

Table A.6.5. Default Black Carbon to PM2.5 **Speciation Factor (**FracBC**)**

Parameter	Fuel Type	Default Value	Unit	Source & Justification
FracBC	Diesel	0.60	tonne BC / tonne PM2.5	Conservative lower bound of the 60-80% range identified for diesel engines without DPFs.
FracBC	Petrol	0.20	tonne BC / tonne PM2.5	Conservative estimate based on literature suggesting a lower BC fraction in gasoline exhaust compared to diesel.

Table A.6.6. Global Warming Potential for Black Carbon ($GWP_{BC,20yr}$)

Parameter	Default Value	Unit	Source & Justification
GWPBC,20yr	900	tCO_2e / tonne BC	Adopted as a conservative estimate in the absence of an official IPCC AR6 value. Based on a review of available literature to prioritize environmental integrity. See Part I, Section 2 for a full discussion.

A.6.6 |Data and Parameters Monitored

A.6.6.1 |No new parameters require monitoring for the application of this voluntary annex. The calculations rely entirely on data and parameters that are already required to be monitored or determined under the core methodology.

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