Gold Standard for the Global Goals

METHODOLOGY TOOL
GS4GG PAA MT400-09

ANALYSIS OF LOCK-IN RISK

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Summary

Analysis of Lock-in Risk (PAA MT400-09) establishes a mandatory, sector-agnostic framework for activity developers to objectively prove that the project activity avoids "lock-in." It ensures that carbon finance under the Gold Standard for the Global Goals (GS4GG) does not inadvertently prolong the use of emissions-intensive technologies, lock host countries into sub-optimal greenhouse gas (GHG) performance, or monopolize critical natural resources needed for broader sustainable development.

To balance stringent environmental integrity with the practical realities of project validation (reducing prohibitive transaction costs), the tool bifurcates projects into two distinct assessment pathways:

- **Track A (Fast-Track):** Designed for inherently low-risk activities, such as those on the "Lock-in Safe Positive List" or microscale decentralized projects (e.g., household clean cooking, point-of-use WASH). These projects only complete Step 1 (Lifetime Assessment) and Step 2 (Policy Alignment).
- **Track B (Project-level assessment):** Designed for large-scale infrastructure, commercial land-use (AFOLU), and engineered carbon removals. These projects shall complete the full 4-step framework, which incorporates rigorously contextualized GHG intensity benchmarking (Step 3) and critical resource efficiency limits (Step 4).

The tool operates on a four-step framework: (1) Lifetime Assessment, (2) Policy Alignment, (3) GHG Intensity, and (4) Resource Efficiency. The tool embeds six comprehensive annexes (Annexes 1–6) containing normative default lifespans, Best Available Technology (BAT) benchmarks, and Safe-Scale thresholds.

ANALYSIS OF LOCK-IN RISK — AT A GLANCE

GS4GG PAA MT400-09

METHODOLOGY TOOL · VERSION 1.0

PURPOSE

This mandatory, sector-agnostic framework demonstrates that an activity avoids carbon lock-in under the Gold Standard for the Global Goals (GS4GG). It prevents:

- i **Prolonged use of emissions-intensive technologies**
- ii **Sub-optimal national GHG performance**
- iii **Monopolisation of critical resources needed for sustainable development**

ASSESSMENT PATHWAYS

Track A — Fast-Track — TIER 1

FOR Activities on the "Lock-in Safe" Positive List (Annex B) **or** microscale / decentralised activities below the Annex C thresholds.

REQUIRED **Step 1** (Lifetime) + **Step 2** (Policy & LT-LEDS alignment)

EXEMPT Steps 3–4

Track B — Activity-Level — TIER 2

FOR Activities not qualifying for Track A — large-scale infrastructure and industry, commercial AFOLU, engineered removals.

REQUIRED **Steps 1–4**

> **Step 3 rule:** required when lifetime > 10 years, and for any activity submitted for Preliminary Review after 31 Dec 2030 (sunset clause). If lifetime ≤ 10 years **and** submitted on/before that date, Step 3 may be exempt.

STEP-WISE FRAMEWORK

1 Technical / Operational Lifetime
All activities · Annex A defaults

2 Policy & LT-LEDS Alignment
All activities · NDC and LT-LEDS check

3 Contextualised GHG Intensity / Net Removal Efficiency
Track B, conditional · Annexes D–E

4 Critical Resource Efficiency & Scale
Track B · Annex F safe-scale thresholds

KEY ANNEXES

- **A** Default Technical and Operational Lifetimes (Step 1)
- **B** "Lock-in Safe" Positive List (Track A)
- **C** Standardised Microscale Capacity Thresholds (Track A)
- **D** Pre-Verified Path Dependency Macro-Indicators (Step 3)
- **E** Regional Best Available Technology (BAT) Benchmarks (Step 3)
- **F** Default Safe-Scale Thresholds for Critical Resources (Step 4)

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1| INTRODUCTION

1.1 | Purpose

1.1.1 | The purpose of this methodological tool is to provide a practical, step-by-step procedure for activity developers to assess and demonstrate that a proposed activity avoids lock-in risk.

1.1.2 | Under the Gold Standard for the Global Goals (GS4GG), avoiding lock-in risk is a mandatory requirement for demonstrating additionality. This ensures that carbon finance does not inadvertently support the adoption or prolonged use of emissions-intensive technologies, practices, or resource allocations that hinder a host country's long-term climate goals and transition to net-zero.

1.2 | Scope

1.2.1 | This tool is designed to be sector-agnostic. It applies to a wide range of mitigation activities, including energy generation, industrial infrastructure, waste management, Agriculture, Forestry and Other Land Use (AFOLU), Blue Carbon and Freshwater Wetlands, and engineered carbon removals. It explicitly incorporates qualitative safeguards and pre-verified macroeconomic parameters to account for different national circumstances, path dependencies, and socio-economic contexts, ensuring an equitable assessment for projects in developing regions.

1.2.2 | For applying PACM methodologies approved under GS4GG, the assessment of locking-in risk may be conducted using either the PACM approach or using this tool.

2| DEFINITIONS

2.1.1 | In addition to the terms defined in the GS4GG Glossary, the following definitions shall apply for the application of this tool:

Table 1. Terms and definitions

TERM	DEFINITION
Lock-in Risk	The risk that implementing an activity results in the adoption, or prolonged use, of technologies, practices, or resource allocations that are incompatible with the long-term goals of the Paris Agreement and the host country's Long-Term Low-Emission Development Strategy (LT-LEDS).
Technical Lifetime	The expected period during which a physical technology, infrastructure, equipment, can remain functional and deliver the intended output if maintained according to the standard industrial practices.
Operational Lifetime	The expected period during which a technology, equipment, or specific management practice will be actively operated or

	economically viable. *Note: Operational lifetime is typically shorter than technical lifetime due to economic considerations, regulatory shifts, or contract length.* **Sector Note for Practice-Based Activities (e.g., Agriculture, AFOLU, Removals):** For mitigation activities relying on management practices rather than fixed infrastructure, the operational lifetime is defined strictly by the continuous duration of the committed activity, physical intervention, or active management contract. The lifetime of the practice takes strict precedence over the physical lifespan of any underlying machinery or tools used to implement it. This shall also not be confused with the biological permanence period of the sequestered carbon. Where long-term management contracts (>10 years) do not strictly specify technological parameters regarding GHG emissions, the contract should include provisions for the periodic review and adoption of Best Available Practices.
Path Dependency	Existing local constraints—such as a lack of national grid infrastructure, missing supply chains, or strict socio-economic conditions—that realistically limit the types of alternative technologies or practices an activity developer can implement in a given region.
Lowest GHG Intensity / Optimal Net Removal Efficiency	The primary metric for evaluating the climate performance of an activity. To account for different sectors, this is defined as: • *For Emission Reductions:* The lowest amount of greenhouse gas emitted per unit of output or service provided over a specific period (e.g., tCO_2e per MWh, or passenger-km). • *For Nature-Based Net Removals (AFOLU/BCFW):* The highest rate of net greenhouse gas sequestered per unit of limiting resource per year (e.g., tCO_2e per hectare per year), strictly bounded by ecosystem resilience and biodiversity safeguards. • *For Engineered Net Removals:* The highest rate of net greenhouse gas sequestered per unit of limiting energy or resource consumed (e.g., net tCO_2e per MWh of input energy).
Critical Resources	Natural or structural resources essential for achieving broader climate mitigation and sustainable development goals. Depending on the sector, these shall include, but are not limited to arable land for food security, local freshwater availability, sustainable biomass supply, and renewable energy grid capacity.

3| Applicability

3.1 | General Applicability

3.1.1 | This tool shall be applied by activity developers when the chosen GS4GG methodology or the *GS4GG Additionality Standard* explicitly requires a project-level lock-in risk analysis.

3.1.2 | In the event of any conflict or divergence between the requirements of this tool and the applied GS4GG methodology, the provisions of the specific methodology shall take precedence. Where an applicable methodology mandates the use of this tool, it may prescribe alternative approaches, adapt specific steps and parameters (e.g., custom baseline benchmarks or sector-specific resource thresholds), or establish bespoke exemptions to reflect sector-specific contexts. In such cases, the activity developer shall apply this tool in accordance with those specific methodological provisions.

3.2 | Assessment Pathways:

3.2.1 | This tool classifies activities into two tiers. The activity developer shall determine the applicable tier based on the criteria below:

Track A: Fast-Track / Simplified Assessment (Tier 1)

3.2.1.1. Activities that meet the criteria for Track A pose a fundamentally low risk of systemic or macroeconomic lock-in. Track A activities shall only complete Step 1 and Step 2.

3.2.1.2. An activity qualifies for Track A if it meets any of the following conditions:

a|. **Lock-in Safe Positive List:** The primary technology or practice is explicitly included on the active GS4GG Lock-in Safe Positive List (e.g., point-of-use WASH, decentralized household clean cooking). Refer to Annex -B.

b|. **Microscale or Distributed Activities:** The activity consists of highly decentralised, microscale units at the household or smallholder-farmer level (e.g., decentralised WASH, smallholder agroforestry) where the scale poses no risk of infrastructural lock-in, provided the aggregate size of the activity falls strictly below the quantitative capacity thresholds defined in Annex C.

3.2.1.3. Activities applying Track A shall only be required to complete Step 1 (Technical or Operational Lifetime Assessment) and Step 2 (Policy and LT-LEDS Alignment Assessment) of this tool. They are exempt from alternative-scenario and resource modelling (Steps 3 and 4).

3.2.2 | **Track B: Project-Level Assessment (Tier 2)**

3.2.2.1. Activities that represent large-scale investments, utilise transitional fuels, consume vast amounts of critical resources, or otherwise do not qualify for Track A shall apply the comprehensive project-level assessment. Common Track B activities include:

a|. **Centralised Infrastructure & Industry:** Large-scale power generation, industrial energy efficiency, waste-to-energy plants, and eligible industrial fuel switch measures (e.g., strictly limited as per GS4GG principle and requirements).

b|. **Engineered Removals:** Highly capital and resource-intensive technologies, such as Direct Air Capture (DACCS) or Bioenergy with Carbon Capture and Storage (BECCS), where the lock-in risk pertains to the massive consumption and monopolisation of renewable energy or freshwater.

c|. **Large Commercial AFOLU:** Large-scale commercial timber plantations or sovereign-scale land-use conversions.

3.2.2.2. Activities applying Track B shall conduct a full assessment using all steps outlined in this tool, including the contextualised GHG Intensity check and the Critical Resource Efficiency check.

3.3 | Sunset Clause for Short-Lived Technologies

3.3.1 | If an activity employs technologies or practices with a technical or operational lifetime of 10 years or less, it may be deemed to have no long-term lock-in risk, provided it meets the resource efficiency safeguards of this tool.

3.3.2 | Limitation: In accordance with GS4GG rules to ensure continuous ambition, this specific exemption shall only be valid for activities submitted for Preliminary Review to Gold Standard on or before **31 December 2030**. Any project seeking validation or crediting period renewal after this date shall undergo a full reassessment for lock-in risk without relying on this automatic exemption. Furthermore, retrofits or life-extensions of existing fossil-fuel or highly emissive industrial assets are strictly ineligible for the ≤ 10-year exemption and shall undergo full assessment regardless of their remaining lifespan.

4| NORMATIVE REFERENCES

4.1.1 | When applying this tool, the activity developer shall use the most recent, valid versions of the following documents available at the time of validation or crediting period renewal:

a|. **GS4GG Methodology Standard:** Requirements for Additionality Demonstration

b|. **GS4GG Methodology Standard:** Requirements for Baseline Determination in Methodologies

4.1.2 | In addition to the GS4GG standards, the activity developer shall refer to the host country's active **Nationally Determined Contribution (NDC)** and **Long-Term Low-Emission Development Strategy (LT-LEDS)**, where available, as the primary benchmarks for national climate alignment.

5| GENERAL REQUIREMENTS

5.1 | Guiding Principles

5.1.1 | When conducting the lock-in risk assessment, the activity developer shall adhere to the principles of Technology and Source Neutrality (evaluating the actual risk profile without bias), Conservativeness (using assumptions that do not underestimate lock-in risk), Contextual Awareness (actively considering local path dependencies), and Transparency.

5.2 | Overview of the Stepwise Framework

5.2.1 | The activity developer shall follow a structured, four-step procedure:

a|. Step 1: Technical or Operational Lifetime Assessment.

b|. Step 2: Policy and LT-LEDS Alignment Assessment.

c|. Step 3: Contextualised GHG Intensity / Optimal Net Removal Efficiency Assessment.

d|. Step 4: Critical Resource Efficiency and Scale Assessment.

5.3 | Application of Steps by Track (Default vs. Project-Level)

5.3.1 | **Track A (Fast-Track/Simplified Assessment):** Complete Step 1 and Step 2 only.

5.3.2 | **Track B (Activity-level Assessment):** Complete Step 1, Step 2, Step 3 (if lifetime > 10 years or submitted post-2030), and Step 4.

5.4 | Data and Evidence Quality

5.4.1 | The activity developer shall prioritise official host country policies, national statistics, manufacturer specifications, and peer-reviewed literature. Anecdotal evidence or unsupported internal company projections shall not be accepted. The uncertainty margins provided by the manufacturer shall be incorporated where applicable to ensure conservativeness.

5.4.2 | Default Values: Where GS4GG, IPCC, or host country provides recognised default values or benchmarks for specific sectors or regions (e.g., default equipment lifetimes, standardized regional grid baselines), the developer shall prioritise their use over project-specific modelling to simplify the assessment.

5.5 | Timing and Frequency of Assessment

5.5.1 | The analysis shall be conducted ex-ante and documented in the Project Design Document (PDD) during initial validation. It shall be updated and re-validated at each renewal of the crediting period to account for evolving NDCs, LT-LEDS, and technological advancements against the latest active *Annex*.

5.5.2 | *Change of Operational Status:* If an activity originally exempted from market scale limits under Step 4 as a '100% captive facility' later alters its operational profile to export output to public markets (e.g., connecting a behind-the-meter power plant to the national grid to sell surplus electricity), the exemption is immediately voided. The activity shall undergo a full Step 4 Scale Assessment against public market thresholds prior to the next issuance or crediting period renewal.

6| METHODOLOGY

6.1 | Step 1: Technical or Operational Lifetime Assessment

6.1.1 | The objective of this step is to determine how long the proposed technology, equipment, or management practice will be in active operation.

6.1.1.1. **Determining the Lifetime:** The activity developer shall determine the technical or operational lifetime by applying one of the following options, strictly prioritised in this order:

a|. **Option 1: Default Values (Preferred):** The developer shall use the standard default lifespans listed in the *Default Technical and Operational Lifetimes* table within Annex A.

b|. **Option 2: Manufacturer Specifications / Expert Assessment:** Only where a technology is entirely unlisted in the Annex, or where project-specific engineering documentation conclusively proves physical degradation will occur faster than the default, the developer may use verifiable Original Equipment Manufacturer (OEM) design lifetimes or independent expert assessments.

6.1.2 | **Sector-Specific Application for Practice-Based Activities (e.g., Agriculture, AFOLU, and Management Changes):** Where the proposed mitigation activity is based on the implementation of a continuous management practice, behavioural change, or land-use intervention (e.g., regenerative agriculture, alternate wetting and drying in rice cultivation) rather than the installation of major physical infrastructure, the lifetime assessment shall be based on the committed duration of the activity or practice, not the technical lifespan of the incidental equipment or machinery used to facilitate it. The operational lifetime shall be determined by the length of the programmatic commitment period, the legally binding active management contract, or the crediting period, whichever is longest. For AFOLU, this operational duration shall also not be confused with the biological permanence period of the sequestered carbon.

6.1.3 | **Application for Retrofit and Life-Extension Activities:** For retrofit, life-extension, or refurbishment activities, the Operational Lifetime shall be calculated as the total remaining physical or economic life of the underlying baseline asset following the intervention.

6.1.3.1. **Mandatory Phase-Out Cap:** This extended Operational Lifetime (and corresponding crediting period) shall be strictly capped by, and shall not

violate, any sectoral phase-out dates mandated by the host country's NDC, LT-LEDS, or national law. To accurately reflect industrial realities, retrofits shall not be assessed as greenfield installations under Step 3, but rather compared against alternative retrofit options and the feasibility of early asset replacement.

6.1.4 | **Outcome of Step 1:**

6.1.4.1. **For Track A Activities:** The lifetime is recorded, and the developer proceeds directly to Step 2.

6.1.4.2. **For Track B Activities:**

a|. If the determined lifetime is ≤10 years, the activity is exempt from Step 3 *(exemption valid for activities submitted for Preliminary Review on or before 31 December 2030)*. The developer proceeds to Step 2 and then skips to Step 4.

b|. If the determined lifetime is > 10 years, the developer proceeds sequentially through Step 2, Step 3, and Step 4.

6.2 | Step 2: Policy and LT-LEDS Alignment Assessment

6.2.1 | The objective of this step is to demonstrate that the proposed activity actively aligns with, and does not contradict, the host country's official long-term climate transition pathways.

6.2.2 | **Assessment Procedure:** The activity developer shall demonstrate alignment using one of the following options:

6.2.2.1. **Option 1: Pre-approved Alignment** The activity is deemed to satisfy the requirements of this step if the developer provides evidence that the proposed activity type is included on the **GS4GG Lock-in Safe Positive List** (Annex B), is included on an official host country positive list for Article 6, or is explicitly supported by a formal Letter of Authorization (LoA) from the host country confirming LT-LEDS consistency.

6.2.2.2. **Option 2: Qualitative Narrative Assessment:** If Option 1 is not applicable, the developer shall provide a qualitative narrative in the PDD identifying how the activity supports the general goals of the NDC and LT-LEDS. Where national policies are silent on the specific technology, the developer shall demonstrate that the activity's operational lifetime does not extend past, or violate, any broader sectoral phase-out dates specified in national law.

6.2.3 | **Outcome of Step 2**

6.2.3.1. **Pass:** If the activity demonstrably aligns with the NDC and LT-LEDS and does not contradict stated phase-out targets, it satisfies Step 2.

a|. For Track A activities, the Lock-in Risk Assessment is now complete. The activity is deemed to have no lock-in risk.

b|. For Track B activities, the developer shall proceed to Step 3 or Step 4 (as determined in Step 1)

6.2.3.2. **Fail:** If the activity contradicts stated national phase-out targets, it poses a policy lock-in risk and is ineligible for GS4GG certification.

FIGURE 1. LOCK-IN RISK ANALYSIS — DECISION FLOW TREE

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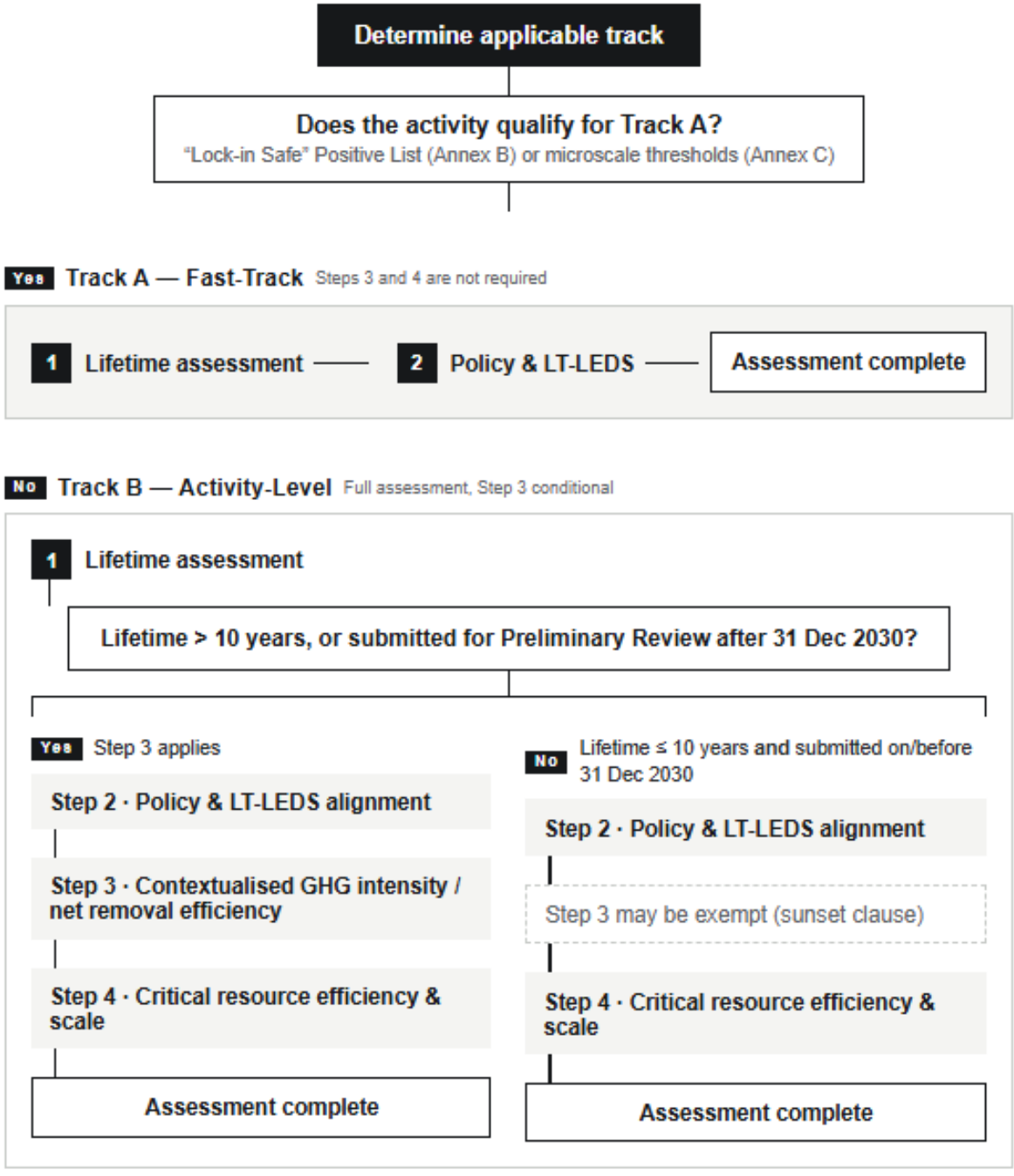

6.3 | Step 3: Contextualized GHG Intensity and Optimal Net Removal Efficiency Assessment

6.3.1 | This step ensures activities with long operational lifetimes do not lock the host country into sub-optimal climate performance. It incorporates a "Path

Dependency Filter" to ensure developers in developing nations are not penalised for failing to adopt theoretical global best practices that are physically or socio-economically impossible locally.

6.3.2 | This step shall apply only to Track B activities with a determined technical or operational lifetime of greater than 10 years (or all Track B activities submitted for preliminary review post-2030).

6.3.3 | **Assessment Procedure** The activity developer shall demonstrate compliance using one of the following two options:

6.3.3.1. **Option 1 - Default BAT/ Methodological benchmark:** The developer may use the officially recognised contextual thresholds established within the applicable GS4GG methodology (See section 7 Guidance Note) or the default benchmarks listed in Annex E. The activity is deemed to satisfy Step 3 if its GHG intensity is equal to or lower than these thresholds.

6.3.3.2. **Option 2 - Context-Filtered Alternatives Assessment:** If Option 1 is not applicable, the developer shall conduct a three-phase assessment:

a|. **Phase A: Identify Theoretical Alternatives:** Identify commercially available technologies/practices providing the same output or service.

b|. **Phase B: Apply Path Dependency Filters.** Eliminate theoretically cleaner alternatives that are physically, structurally, or socio-economically impossible to implement locally. The developer *shall* utilize the Pre-Verified Path Dependency Macro-Indicators (Annex D) to exclude inapplicable advanced alternatives without requiring bespoke feasibility studies. *(Note: High financial cost alone is not a valid path dependency filter. For projects spanning large areas, developers may rationally break up administrative or legally homogeneous areas to define "locally").*

c|. **Phase C: Performance Comparison** Compare the proposed activity against the remaining *feasible* alternatives. The proposed activity shall have a GHG intensity equal to or lower than (or a net removal efficiency equal to or better than) the best remaining feasible alternative. If the proposed activity is a retrofit or refurbishment, the alternatives analysis shall not compare the project to building brand-new greenfield infrastructure. Instead, the proposed activity should be compared against: (1) continuing the existing baseline operation, (2) alternative retrofit technologies available for that specific asset, and (3) early retirement of the asset in favour of cleaner greenfield alternatives. If the financial/barrier analysis demonstrates that early greenfield replacement is financially feasible and structurally viable (with or without carbon credits), the retrofit poses a lock-in risk and fails Step 3.

6.3.4 | **Outcome of Step 3**

6.3.4.1. **Pass:** If the proposed activity is equal to or better than the best feasible alternative identified in Phase C (or satisfies Option 1), it passes Step 3. The developer shall proceed to Step 4.

6.3.4.2. **Fail:** If a cleaner, feasible alternative exists that is not blocked by legitimate path dependencies, the proposed activity poses a technological lock-in risk, is not additional, and is ineligible for GS4GG certification.

6.4 | Step 4: Critical Resource Efficiency and Scale Assessment

6.4.1 | This step ensures that large-scale mitigation activities do not monopolise natural or structural resources, thereby "crowding out" local sustainable development. Monopolising a finite resource (e.g., arable land, freshwater, or grid capacity) [1] physically prevents the host country from using that resource for alternative LT-LEDS pathways, constituting a structural lock-in risk.

6.4.2 | This step shall apply only to Track B activities.

6.4.3 | **Identification of Critical Resources**: The developer shall assess the activity's consumption of Arable Land, Freshwater, Sustainable Biomass, and Renewable Energy Grid Capacity where applicable. Note:
Applicability for Scale: *Scale assessments related to output market share—specifically Renewable Energy Grid Capacity—are only applicable if the project's output is delivered to public networks (e.g., grid-connected power plants or green hydrogen injected into public pipelines). If the project provides energy or services exclusively for its own internal operations (100% captive / behind-the-meter facilities), the developer is exempt from assessing the Grid Capacity threshold. However, all projects remain fully subject to the scale assessments for physical input resources (Arable Land, Freshwater, and Sustainable Biomass).*

6.4.3.1. **Assessment Procedure**: The developer shall apply one of the following two options:

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[1] **Arable Land:** Relevant for large-scale Land Use and Forestry (LUF), commercial agriculture, or purpose-grown bioenergy crop production, to ensure the activity does not displace local food production.

Freshwater: Relevant for agricultural practices, large-scale afforestation, or water-cooled industrial and engineered removals (e.g., DACCS), to ensure the activity does not deplete local watersheds or aquifers.

Sustainable Biomass: Relevant for biochar, biomass energy, or Bioenergy with Carbon Capture and Storage (BECCS) feedstocks, to ensure feedstock demand does not drive indirect land-use change (ILUC) or deforestation.

Renewable Energy Grid Capacity: Relevant for highly energy-intensive engineered removals or green hydrogen production, to ensure the activity does not consume clean energy needed to decarbonize the host country's primary public power grid.

6.4.3.2. **Option 1: Default Exemption**: The activity is deemed to satisfy Step 4 if it meets specific qualitative limits (e.g., generates 100% off-grid power, utilizes 100% waste biomass, operates on 100% officially degraded land) **OR** if its cumulative resource consumption falls strictly below the quantitative limits defined in the *Default Safe-Scale Thresholds for Critical Resources* table within the **Annex F** (e.g., < 1% of catchment water, < 500 ha of land control or acquisition).

6.4.3.3. **Option 2: Project-Level Resource and Scale Assessment**: If thresholds are exceeded, the developer shall calculate the resource use intensity of the proposed activity against identified alternative scenarios. If a feasible alternative exists that utilizes resources more efficiently than the proposed activity, it does not result in an automatic failure. Instead, the developer shall subject both the proposed activity and the efficient alternative to an Investment or Barrier Analysis (in accordance with the GS4GG Additionality Standard) to evaluate economic lock-in risk.

Note: Baseline ecological depletion and absolute resource availability (i.e., Resource Abundance) are rigorously assessed under the mandatory GS4GG Safeguarding Principles (e.g., Water and Land Use Safeguards) and applicable Leakage standards. To avoid regulatory duplication and subjectivity during validation, developers are not required to provide a separate demonstration of abundance within this Lock-in Risk Tool.

6.4.4 | **Outcome of Step 4**

6.4.4.1. **Pass:** The activity satisfies Step 4 if it demonstrates the highest resource efficiency among all alternatives, OR if a more efficient alternative exists but the Investment/Barrier Analysis demonstrates that the more efficient alternative remains financially unviable or faces prohibitive barriers even when accounting for carbon finance revenues. In this scenario, carbon finance is not locking the host country into a sub-optimal pathway; the optimal pathway is simply un-fundable.

6.4.4.2. **Fail:** The proposed activity poses a resource lock-in risk, is not additional, and is ineligible for GS4GG certification if the Investment/Barrier Analysis demonstrates:

a|. The more resource-efficient alternative is financially viable without carbon revenues; OR

b|. The more resource-efficient alternative becomes financially viable (or its barriers are overcome) when evaluated with the incentives from carbon finance.

6.4.4.3. When conducting this comparative financial analysis, the Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) inputs for the theoretical "more efficient alternative" must be sourced from independent, third-party benchmarks (e.g., IEA, IRENA, World Bank, NREL) or verified independent vendor quotes. VVBs shall reject subjective, internally generated cost estimates designed to artificially inflate the cost of the cleaner alternative."

7| ESTABLISHING TOP-DOWN GHG BENCHMARKS:

7.1.1 | While Step 3 of this tool provides a robust framework for project developers to conduct a bottom-up alternatives analysis, Gold Standard recognises that pre-verified, top-down benchmarks provide greater objectivity and significantly reduce transaction costs. Therefore, when developing or revising GS4GG Methodologies, methodology developers are strongly encouraged to define sector-specific, contextualised GHG intensity thresholds (e.g., maximum permissible tCO2e/MWh for grid power in specific regional tiers) directly within the methodology.

7.1.2 | Where a methodology establishes such a threshold, the activity developer shall use that methodological benchmark to automatically satisfy Step 3 (Option 1) of this tool, bypassing the requirement to conduct a project-level alternatives assessment and subjective path-dependency justification.

1| ANNEX A: DEFAULT TECHNICAL AND OPERATIONAL LIFETIMES (STEP 1)

Application: Activity developers shall use these normative default values to complete Step 1 of the Lock-in Risk Tool. Track B Technologies with a lifespan ≤ 10 years qualify for an exemption from the GHG intensity assessment (Step 3), valid for activities submitted for Preliminary Review on or before 31 December 2030.

Sector / Category	Specific Technology / Practice	Default Lifetime (Years)	Step 3 Assessment (Pre-2030)	Scientific Basis
Renewable Energy	Solar PV (Utility-Scale)	30	Required (>10 Yrs)	NREL (2023a)
	Solar PV (Commercial/Residential)	25	Required (>10 Yrs)	NREL (2024)
	Wind (Onshore and Offshore)	25	Required (>10 Yrs)	IEA (2020); NREL (2023b)
	Hydropower (Electro-mechanical)	40	Required (>10 Yrs)	UNFCCC (2023)
Household / WASH	Basic Improved Cookstoves (Clay/Metal)	4	Exempt (≤10 Yrs)	Beyene et al. (2015), Schilmann et al. (2019)
	Advanced Biomass/Pellet Cookstoves	7	Exempt (≤10 Yrs)	Clean Cooking Alliance (2022)
	LED Lighting & Solar Lanterns	10	Exempt (≤10 Yrs)	IEA (2020)
	Fixed-Dome/Masonry Biodigesters	20	Required (>10 Yrs)	Wang et al. (2014)
Agriculture*	Irrigation Water Pumps (Solar/Electric/Diesel)	10 (up to 15 depending on usage)*	Exempt or Required	UNFCCC (2023) / Expert assessment
Industrial / Thermal	Industrial Boilers (Biomass or Fossil)	25	Required (>10 Yrs)	UNFCCC (2023)
	Commercial HVAC / Chillers	15	Required (>10 Yrs)	UNFCCC (2023)

	Fossil Fuel Generators (Diesel/Gas)	20	Required (>10 Yrs)	UNFCCC (2023)
Engineered Removals	Direct Air Capture (DACCS) Facilities	25	Required (>10 Yrs)	U.S. DOE (2022)
	Bioenergy with CCS (BECCS) Plants	25	Required (>10 Yrs)	IPCC (2022)
AFOLU, Blue Carbon and Freshwater Wetlands**	Regenerative Ag / Soil Interventions	N/A - Project Specific	Assessed per contract	GS4GG Activity Requirements
	Commercial Timber / Afforestation	N/A - Project Specific	Assessed per contract	GS4GG Activity Requirements

** For irrigation water pumps used intermittently (e.g., alternate wetting and drying in rice cultivation), the lifespan may extend due to lesser wear and tear. Developers shall assess specific usage to determine if the 10-year threshold is exceeded.*

*** For land-use and agricultural practices, there is no single default physical lifetime. The operational lifetime shall be assessed based on the length of the legally binding active land management contract or the crediting period, whichever is longer.*

2| ANNEX B: "LOCK-IN SAFE" POSITIVE LIST (TRACK A APPLICABILITY)

Application: Activities exclusively employing the specific technologies or practices listed below pose zero macroeconomic or systemic lock-in risk due to their highly decentralised scale, absence of fossil-fuel dependence, and inherent alignment with sustainable development goals

If a proposed activity exclusively employs technologies from this list, it automatically qualifies for Track A (Fast-Track / Simplified Assessment). Consequently, per Section 6.2.1 (Option 1), the activity is deemed to automatically satisfy Step 2 (Policy Alignment) and is strictly exempt from Steps 3 and 4. Developers are only required to complete Step 1 to document the physical lifetime of the intervention.

(Note: To ensure long-term environmental integrity, this Positive List shall be subject to periodic review by the Gold Standard Secretariat to ensure these technologies remain aligned with evolving global net-zero baselines).

Sector	Eligible "Lock-in Safe" Technologies / Practices
Household Energy	• Advanced Biomass/Pellet Cookstoves (ISO Tier 3+) • Household Biogas Digesters (≤ 15m³ volumetric capacity) • Solar Cookers and Solar Water Heaters • Electric Cooking Appliances (e.g., highly efficient induction stoves) • Distributed household energy efficiency measures (e.g., LED lighting distributions)
WASH	• Point-of-use water purification systems (e.g., ceramic/gravity filters) • Manual, non-motorized boreholes and community handpumps • Decentralised renewable energy-powered (e.g., solar PV) water pumps dedicated to community drinking water supply • Safe Sanitation Containment/Treatment (e.g., manually collected Container-Based Sanitation, non-mechanized aerobic composting toilets)
Agriculture, Forestry and Other Land Use (AFOLU)	• Agroforestry, regenerative soil interventions, and small-scale plantings implemented exclusively by farmers meeting the official GS4GG Glossary definition of a "Smallholder." • Decentralised renewable energy-powered (e.g., solar PV) irrigation pumps for smallholder agriculture. • Solar dryers for agricultural produce and food processing.
Distributed Power	• Pico/Nano-Solar Home Systems (SHS) and standalone off-grid Solar Lanterns ≤100W capacity per system).

	• Isolated, off-grid mini-grids or micro-grids powered 100% by renewable energy (e.g., solar, micro-hydro, wind) providing first-time energy access.
Utility scale Renewable Energy	• Activities powered by solar, wind, run-of-river hydropower, marine, geothermal
Waste Management	• Decentralised, community-based or household-level aerobic composting/vermicomposting of municipal solid waste or agricultural residues.
Mobility / Transport	• Active, non-motorised transport interventions (e.g., distribution of bicycles, pedestrian infrastructure). • Decentralised light electric vehicles (e.g., e-bikes, e-rickshaws, electric two/three-wheelers) replacing internal combustion engines.

3| ANNEX C: STANDARDIZED MICROSCALE CAPACITY THRESHOLDS (TRACK A APPLICABILITY)

Application: Irrespective of technology (excluding fossil-fuel additions), activities falling strictly below these quantitative caps are designated as microscale. They automatically qualify for **Track A** and are exempt from Steps 3 and 4 of the tool.

Normative Precedence: Where a specific GS4GG Activity Requirement (e.g., Renewable Energy, Community Services, or Land Use & Forestry) defines a distinct threshold for "microscale" activities, the threshold defined in the applicable Activity Requirement shall strictly supersede the default limits provided in this Annex.

Parameter Metric	Maximum Permissible Threshold for Track A Exclusion	Regulatory Alignment
Renewable Generation	**≤5 MW** installed capacity per independent, grid-connected unit (or **≤ 15 MW** for isolated off-grid/mini-grid systems).	UNFCCC (2021)
Energy Efficiency	**≤ 20 GWh** of equivalent energy savings per year.	UNFCCC (2021)
Emission Reductions	**≤ 10,000 tonnes of CO_2e** emission reductions or net removals achieved per year.	GS4GG Microscale

4| ANNEX D: PRE-VERIFIED PATH DEPENDENCY MACRO-INDICATORS (STEP 3)

Application: When evaluating alternative scenarios in Step 3 (Phase B), developers may use these macro-indicators to automatically filter out theoretical, globally advanced technologies that are impossible to implement locally. If the host region meets the trigger condition, the developer is exempt from providing activity-specific feasibility studies for the excluded alternatives.

Macro-Indicator (Data Source)	Trigger Condition	Resulting Automatic Exclusions from Alternative Scenario
1. World Bank Income Classification *(Source: World Bank Open Data)*	Host country is currently classified as a Low-Income Economy (LIC), Least Developed Country (LDC) or Small Island Developing State (SIDS).	Excludes all pre-commercial, highly capital-intensive, or proprietary technologies requiring advanced maintenance supply chains (e.g., liquid solvents DACCS, Green Hydrogen, large-scale BECCS).
2. Rural Electrification Rate *(Source: World Bank Open Data)*	Project is located in a sub-national region where the rural electrification rate is **< 50%**.	Excludes all continuous, grid-dependent alternatives (e.g., grid-tied electric industrial boilers, full-scale residential induction cooking).
3. Water Stress Index *(Source: WRI Aqueduct Atlas)*	Project is located in a catchment area classified as "High" or "Extremely High" baseline water stress.	Excludes all highly water-consumptive alternatives (e.g., liquid-solvent DACCS, wet-cooled thermal power generation, massive irrigated monoculture, commercial plantation).

5| ANNEX E: REGIONAL BEST AVAILABLE TECHNOLOGY (BAT) BENCHMARKS (STEP 3)

Application: Track B activities with a lifespan >10 years shall demonstrate they employ the lowest GHG intensity technology feasible. Developers meeting or outperforming the absolute benchmarks below automatically pass Step 3 (Option 1) without requiring multi-scenario mathematical modelling. (Note: Where an applicable GS4GG Methodology defines a stricter contextual benchmark, the methodology shall supersede this table).

Sector	Global / Regional Context	Default BAT Benchmark to Pass Step 3
1. Grid Power Generation	Global	Lifecycle emission intensity of **< 100g CO_2e / kWh** (e.g., Wind, Solar, Run-of-River Hydro) (IEA, 2023).
2. Waste Management	Non-Annex I Countries (Developing)	**> 70% active capture and flaring/utilization** of Landfill Gas (LFG), or controlled aerobic composting (Evrard et al., 2016).
3. Industrial Heat	Global	Emission intensity equivalent to a **high-efficiency boiler (>85% thermal efficiency)** utilising 100% sustainable waste or biomass residues; **OR** the use of 100% renewable electricity for heat generation.

6| ANNEX F: DEFAULT SAFE-SCALE THRESHOLDS FOR CRITICAL RESOURCES (STEP 4)

Application: Track B activities shall demonstrate they do not monopolize natural resources needed for the host country's broader climate transition. Under Step 4 (Option 1), if the activity's *cumulative* resource consumption falls strictly below either the Relative Threshold or the Absolute threshold, it is deemed to have a *de minimis* macroeconomic impact and automatically passes Step 4. Projects generating 100% of required energy/water through dedicated, newly constructed, off-grid infrastructure—e.g., behind-the-meter solar, closed-loop desalination—inherently consume 0% of the public resource and automatically pass the threshold requirement.

Safeguard: To prevent misuse of Annex F, these thresholds apply to the cumulative resource draw of all carbon projects operated by the same developer (or its affiliates) within the same geographic district over a rolling 5-year period.

Critical Resource	Relevant Mitigation Sectors	Relative Threshold (Contextual)	Absolute Safe Harbor Cap (Default)	Authoritative Justification
1. Arable Land	Large-scale Commercial Timber / Commercial ARR, Bioenergy Crops	**< 5%** of the district's available, unallocated non-forested arable land.	**< 500 hectares** of contiguous land acquisition.	Prevents displacement of food production and ILUC (Searchinger et al., 2015; FAO, 2012).
2. Freshwater	Engineered Removals (DACCS), Large-Scale Commercial Irrigation / ARR	**< 1%** of the available renewable freshwater yield of the local catchment/aquifer.	**< 100,000 m³ / year** total net consumptive withdrawal.	Ensures no exacerbation of local basin water stress (Hoekstra et al., 2011; WRI, 2026).
3. Sustainable Biomass	Biochar, Biomass Power, BECCS	**< 5%** of the safely extractable, surplus waste biomass in the project's sourcing radius.	**< 10,000 tonnes / year** of dry biomass consumption.	Protects soil organic carbon retention and local feedstock markets (IRENA, 2022).
4. Renewable	Green Hydrogen, DACCS, High-	**< 1%** of the host region's installed grid-connected	**< 5 MW** of continuous grid-connected power demand.	Prevents cannibalization of public green energy

Grid Capacity	Heat Electrification	renewable energy capacity.	*(Note: 100% captive/off-grid generation inherently consumes 0 MW of public grid capacity and automatically passes this threshold).*	transition (IEA, 2023).

7| REFERENCES

Clean Cooking Alliance. (2022). Clean cooking industry snapshot: A comprehensive look at the state of the clean cooking sector. Clean Cooking Alliance, Washington, D.C.

Evrard, D., Laforest, V., Villot, J., & Gaucher, R. (2016). Best Available Technique assessment methods: A literature review from sector to installation level. Journal of Cleaner Production, 121, 72-83. https://doi.org/10.1016/j.jclepro.2016.01.096

Hoekstra, A. Y., Chapagain, A. K., Aldaya, M. M., & Mekonnen, M. M. (2011). The water footprint assessment manual: Setting the global standard. Earthscan, London. Daugherty Water for Food Global Institute: Faculty Publications. 77. https://digitalcommons.unl.edu/wffdocs/77

Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. https://doi.org/10.1017/9781009157926

International Energy Agency (IEA). (2020). Projected costs of generating electricity 2020. IEA Publications, Paris. https://www.iea.org/reports/projected-costs-of-generating-electricity-2020

International Energy Agency (IEA). (2023). Net Zero Roadmap: A global pathway to keep the 1.5°C goal in reach - 2023 Update. IEA Publications, Paris. https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-c-goal-in-reach

International Renewable Energy Agency (IRENA). (2022). Bioenergy for the energy transition: Ensuring sustainability and overcoming barriers. IRENA, Abu Dhabi. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Aug/IRENA_Bioenergy_for_the_transition_2022.pdf

Kuzma, S., Bierkens, M.F.P., Lakshman, S., Luo, T., Saccoccia, L., Sutanudjaja, E.H., & Van Beek, R. (2023). Aqueduct 4.0: Updated decision-relevant global water risk indicators. Technical Note. World Resources Institute, Washington, DC. https://doi.org/10.46830/writn.23.00061

National Renewable Energy Laboratory (NREL). (2023a). Utility-scale PV. 2023 Annual technology baseline. U.S. Department of Energy. https://atb.nrel.gov/electricity/2024/technologies

National Renewable Energy Laboratory (NREL). (2023b). Land-based wind. 2023 Annual technology baseline. U.S. Department of Energy. https://atb.nrel.gov/electricity/2023/index

National Renewable Energy Laboratory (NREL). (2024). Residential and commercial PV. 2024 Annual technology baseline. U.S. Department of Energy. https://atb.nrel.gov/electricity/2024/technologies

Schilmann, A., Riojas-Rodríguez, H., Catalán-Vázquez, M., Estevez-García, J. A., Masera, O., Berrueta-Soriano, V., Armendariz-Arnez, C., Pérez-Padilla, R., Cortez-Lugo, M., Rodríguez-Dozal, S., & Romieu, I. (2019). A follow-up study after an

improved cookstove intervention in rural Mexico: Estimation of household energy use and chronic PM2.5 exposure. Environment International, 131, 105013. https://doi.org/10.1016/j.envint.2019.105013

Searchinger, T., Estes, L., Thornton, P. *et al.* High carbon and biodiversity costs from converting Africa's wet savannahs to cropland. *Nature Clim Change* **5**, 481–486 (2015). https://doi.org/10.1038/nclimate2584 .

United Nations Framework Convention on Climate Change (UNFCCC). (2021). Methodological tool 19: Demonstration of additionality of microscale project activities (Version 09.0). CDM Executive Board. https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v10.0.pdf

United Nations Framework Convention on Climate Change (UNFCCC). (2023). Methodological tool: Determination of the technical lifetime of equipment (Version 01.0). Article 6.4 Mechanism. A6.4-SBM020-A06. https://unfccc.int/node/655890

U.S. Department of Energy (DOE). (2022). Best practices for life cycle assessment (LCA) of direct air capture with storage (DACS). Office of Fossil Energy and Carbon Management. https://www.energy.gov/hgeo/best-practices-life-cycle-assessment-direct-air-capture-storage-dacs

World Bank. (2024). World Bank Country and Lending Groups: Historical classification by income. World Bank Open Data. https://blogs.worldbank.org/en/opendata/world-bank-country-classifications-by-income-level-for-2024-2025

World Bank. (2024). World Development Indicators: Access to electricity, rural (% of rural population). World Bank Open Data. https://databank.worldbank.org/metadataglossary/world-development-indicators/series/EG.ELC.ACCS.RU.ZS

Zhang, L., & Wang, C. (2014). Energy and GHG Analysis of Rural Household Biogas Systems in China. Energies, 7(2), 767-784. https://doi.org/10.3390/en7020767

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