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# SIX Projects Three Continents One Pattern

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A Structural Benchmark Using **ToC:f(x)<sup>TM</sup>**

**Analysis of the Lowest-Scoring Entries in the GGGI SII**

*In climate systems, structure determines outcome. Everything else is noise.*

ENHANCE Institute

April 2026



# ENHANCE

Enhancing the Systems that sustain our world

## Quantifying Structural Determinism in Climate Project Design

This report utilises artificial intelligence–assisted information extraction and deterministic computational evaluation to analyse the structural integrity of publicly available climate project documentation. Artificial intelligence systems were employed solely to assist in the structured extraction of textual information from project documents.

All structural assessments were conducted using a **deterministic Python-based implementation of the ToC:f(x)<sup>TM</sup>** framework, which evaluates the causal architecture of project design based on predefined structural criteria.

The evaluation process combines:

- **Multi-AI structured information extraction**
- **Protocol-constrained structural inference**
- **Deterministic Python-based scoring**

This hybrid analytical architecture ensures that project scores are generated through rule-based computational procedures rather than probabilistic AI judgement.

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## About ENHANCE

ENHANCE is an independent analytical entity that designs sustainable policies, projects, and systems based on deterministic architectural principles.

It develops integrated architectures that ensure climate interventions are structurally viable, financially aligned, and capable of delivering real-world outcomes.

To support this, ENHANCE operates proprietary evaluation frameworks—including **ToC:f(x)<sup>TM</sup>**, **C-FAIR<sup>TM</sup>**, and **VORTA<sup>TM</sup>**—which verify the structural integrity, risk allocation, and value formation of designed systems.

ENHANCE also develops quantitative methodologies and analytical tools to improve the transparency, reliability, and design quality of climate and sustainability projects.

ENHANCEInstitute is the research division of ENHANCE Co., Ltd.

# Why This Note Exists

## Six projects scored below 0.30.

The ENHANCE Structural Integrity Index 2026 evaluated 101 publicly disclosed GGGI climate project documents using the ToC:f(x)<sup>™</sup> framework — 20 binary structural conditions, no discretionary weighting, no probabilistic inference.

Six projects scored below 0.30. Combined, they satisfied fewer than 5 of 20 structural conditions on average.

This note examines those six cases — not to judge their implementation outcomes, which we did not assess, but to make visible the structural patterns that produced the lowest scores in the benchmark. The purpose is diagnostic, not adversarial.

These six projects span **three continents, four countries, and four distinct thematic areas.**

They were funded by different resource partners and implemented across different institutional contexts.

**Yet they share a single structural failure.**

*The pattern is not a matter of Don't.  
It is a matter of Can't.*

# The Lowest Six Cases: KH34

## KH34 – Capacity Building and Accreditation Support, Cambodia

Score: **0.15** | USD 550,000 | GCF-funded

**Project Code:** KH34

**Period:** Mar 2024 – Mar 2026

**Funding:** USD 550,000

**Status:** Active

**Resource Partner:** Green Climate Fund (GCF)

**Theme:** Green Investment

### Project Summary

Cambodia's NDC (2020) targets 27% emission reduction by 2030. Estimated financing requirement: USD 5.8B (mitigation) + USD 2B (adaptation). The Ministry of Environment and GGGI launched a 24-month capacity building project to support three private banks – FTB, ACLEDA, ABA – and NCS D in preparing a GCF Direct Access Entity (DAE) accreditation application.

### Objective

Support at least one nominated Direct Access Entity in the preparation and submission of a GCF accreditation application.

### Stated Outcomes

Enhance capacity, policies, and tools for climate finance mobilization. Submit one accreditation application from one of the three candidate banks during the project implementation phase.

### INPUT

USD 550,000 GCF readiness grant. GGGI technical expertise. Three candidate banks (FTB, ACLEDA, ABA) + NCS D. Cambodia climate finance gap: USD 7.8B.

### ACTIVITY

Capacity building workshops for candidate institutions. Document preparation for accreditation assessment. Development of policies and tools for climate finance mobilization. Stakeholder coordination across financial institutions and government bodies.

**OUTPUT** ← Terminal output as documented

One GCF DAE accreditation application submitted by one of the three candidate banks.

### ⚠ CAUSAL BREAK: OUTPUT → OUTCOME

The application submission does not produce DAE approval. GCF's accreditation decision is made by an external body operating on its own criteria and timeline. The project architecture contains no mechanism that influences, compels, or guarantees that decision. The causal pathway from submission to approval is not within the project's documented structure – it is assumed.

Furthermore, even if DAE approval is granted, it does not mobilize capital. Approval creates eligibility. Actual climate finance access requires a subsequent project pipeline and capital deployment – both of which are additional dependencies entirely outside this architecture.

**OUTCOME** ← Assumed, not structured

DAE status granted → climate finance access for Cambodia.

**IMPACT** ← Structurally unreachable from this architecture

Contribution toward Cambodia's USD 7.8B climate finance gap.

### Structural Classification

Framework substitution. The accreditation application is treated as equivalent to the climate finance access it is intended to enable. The output lies outside the inverse image of the claimed outcome:  $O^* \neq g^{-1}(R^*)$ . The core constraint — absence of a national accredited entity — is addressed to a process that may or may not remove it.

*Cambodia faces a documented gap in climate finance access, estimated at USD 7.8 billion.*

#### **This project's response:**

support three banks in preparing a GCF Direct Access Entity accreditation application.

The project's **terminal output is one submitted accreditation document.**

Between that document and any climate outcome lie at least three external dependencies — GCF approval decision, subsequent project pipeline development, and capital deployment.

None of these are within the project's causal architecture.

**The core constraint** (absence of climate finance) **is not removed by the output.**

It is addressed to a process that may or may not remove it.

#### **Note:**

As of April 9, 2026, the project documents analysed in this benchmark are no longer publicly accessible via the GGGI project database.

# The Lowest Six Cases: GGPI11

## GGPI11 – Sovereign Green Bond Framework, Sri Lanka

Score: **0.20** | USD 123,805 | Luxembourg-funded

**Project Code:** GGPI11

**Period:** Aug 2023 – Dec 2024

**Funding:** USD 123,805

**Status:** Completed

**Resource Partner:** Government of the Grand Duchy of Luxembourg

**Theme:** Green Investment

### ⚠ Data Integrity Note

The original project document recorded on GGGI's database lists the Project Code as GGPI12. GGPI12 is the designated code for a separate project: Accelerating the Corporate Thematic Bond Issuance in Lao PDR (Mar 2024 – Aug 2025, USD 145,000). The Sri Lanka project is correctly identified as GGPI11 based on sequential coding and project content. This internal code duplication in GGGI's own documentation represents a basic data management failure in a publicly disclosed project registry.

### Project Summary

Sri Lanka's 2022 economic crisis – compounded by COVID-19 and fiscal constraints – created a significant climate financing gap. Despite launching a Green Finance Taxonomy in 2022, the absence of a sovereign framework and limited private sector readiness restricted access to international green capital. This project responded by developing a Sovereign Green Bond Framework for the Government of Sri Lanka and two Sustainable Bond Frameworks for private financial institutions – Commercial Bank of Ceylon and National Development Bank PLC.

### Objective

Strengthen Sri Lanka's sustainable finance ecosystem. Attract international climate finance via a sovereign framework. Enhance capacity of private institutions to issue thematic bonds aligned with global standards.

### Stated Outcomes

Sovereign Green Bond Framework established – enabling access to "over USD 400 million in green investments." Two private institutions anticipated to issue thematic bonds of USD 50 million each, targeting green and social projects including renewable energy and sustainable infrastructure.

### INPUT

USD 123,805 Luxembourg grant. GGGI technical expertise. Sri Lanka post-crisis fiscal context: limited market access, elevated sovereign risk, constrained investor confidence. Green Finance Taxonomy (2022) as existing baseline.

### ACTIVITY

Development of Sovereign Green Bond Framework aligned with global best practices. Technical assistance to Commercial Bank of Ceylon and National Development Bank PLC for Sustainable Bond Framework development. Capacity building on green taxonomy and bond issuance standards. External review and validation of frameworks.

### OUTPUT ← Terminal output as documented

Three framework documents: one Sovereign Green Bond Framework + two institutional Sustainable Bond Frameworks.

### ⚠ CAUSAL BREAK: OUTPUT → OUTCOME

A framework document does not issue bonds. It does not move capital.

Bond issuance requires investor appetite, sovereign creditworthiness, favorable market timing, regulatory execution, and issuer readiness – none of which are within this project's architecture. Sri Lanka's economic crisis context – the same context the project acknowledges – directly undermines the conditions the outcome assumes.

The stated outcome uses explicitly conditional language: institutions are "anticipated to issue" bonds worth USD 50 million each. This anticipation is not a structural output. It is an external market event that the project creates conditions for but cannot produce.

The claimed USD 400 million access figure is similarly conditional: it presupposes functioning capital markets, investor demand at scale, and sovereign credit recovery – all variables operating entirely outside the documented project architecture.

### OUTCOME ← Assumed, not structured

Bond issuances executed. USD 400M in green investments accessed. Sri Lanka climate finance gap partially addressed.

**IMPACT** ← Structurally unreachable from this architecture

NDC support. Low-carbon development. Economic recovery aligned with sustainability goals.

### Structural Classification

Framework substitution. The framework document is treated as equivalent to the capital mobilization it is intended to enable. The output lies outside the inverse image of the claimed outcome:  $O^* \neq g^{-1}(R^*)$ . The core constraint — absence of climate finance — is not removed by producing a framework. It is addressed to a market that may or may not respond.

Sri Lanka's climate finance gap is real.

The project's response:  
develop a Sovereign Green Bond Framework and two institutional Sustainable Bond Frameworks.

The document promises access to "over USD 400 million in green investments" and anticipates bond issuances of USD 50 million each from two private institutions. These are **conditional projections, not structural outputs**.

A framework document does not move capital. Investor appetite, sovereign credit conditions, and market timing sit entirely outside the project architecture.

**The output is a document.**

The claimed outcome requires **a functioning market**.

### Note:

*As of April 9, 2026, the project documents analysed in this benchmark are no longer publicly accessible via the GGGI project database.*

# The Lowest Six Cases: KH26

## KH26 – Provincial Water Supply and Sanitation, Cambodia

Score: **0.20** | USD 250,000 | Unspecified

**Project Code:** KH26

**Period:** Jun 2023 – Jan 2025

**Funding:** USD 250,000

**Status:** Completed

**Resource Partner:** Unspecified

**Theme:** Green Investment, Climate Action

### Project Summary

Cambodia's urban sewer coverage stands at 12% outside Phnom Penh. Ten cities are in the process of installing wastewater management infrastructure through parallel investment programs funded by ADB, AFD, and JICA. This project supports the Ministry of Public Works and Transport in establishing the policy framework and regulatory mechanisms to ensure sustainability of those investments, and to enhance the capacity of provincial authorities in operating the infrastructure.

### Objectives

Diagnose and consolidate country-wide sanitation activities into a centralized National Action Plan with supporting guidelines and policies.

Develop a customizable Performance Improvement Plan (PIP) for wastewater utilities, including city-specific PIPs for Battambang and Siem Reap.

Develop and implement a national sanitation communication strategy with campaigns for Battambang and Siem Reap.

### Stated Outcomes

On 9 May 2024, the "Guidelines for Operation and Maintenance of Sewerage Networks" – a joint publication between MPWT and GGGI – was handed over to the Director General of the General Department of Sewerage and Wastewater Management at a ministerial ceremony. The guideline aims to ensure sustainable use of sewerage networks.

### INPUT

USD 250,000. GGGI technical expertise. MPWT partnership. Parallel infrastructure investments by ADB, AFD, JICA across 10 cities. Baseline: 12% urban sewer coverage outside Phnom Penh.

### ACTIVITY

Diagnostic assessment of national sanitation activities. Development of National Action Plan. Drafting of Performance Improvement Plans for Battambang and Siem Reap. Development of national sanitation communication strategy. Capacity training for provincial authorities.

### OUTPUT ← Terminal output as documented

"Guidelines for Operation and Maintenance of Sewerage Networks" – delivered at ministerial handover ceremony. One document.

### ⚠ CAUSAL BREAK: OUTPUT → OUTCOME

The guideline governs the operation of infrastructure that this project did not build and does not control.

The physical infrastructure – the sewer networks across 10 cities – is being constructed through entirely separate programs (ADB, AFD, JICA). KH26's architecture contains no mechanism for ensuring that infrastructure is built, operational, or governed according to its guidelines.

Three external conditions must hold for the outcome to be reachable: the parallel infrastructure programs must complete construction, the infrastructure must become operational, and provincial authorities must adopt and implement the guidelines. All three are outside KH26's causal architecture.

The terminal output is a document that describes how to operate a solution that another project must first build.

### OUTCOME ← Assumed, not structured

Sustainable operation of sewerage networks across Cambodia's urban areas. Improved sewer coverage beyond 12%.

**IMPACT** ← Structurally unreachable from this architecture

Urban sanitation improvement. Climate resilience in Cambodian cities.

### Structural Classification

Advisory displacement. The project positions a regulatory and operational guideline as its output where the physical infrastructure itself is the required intervention. The output documents the environment around the solution. It does not constitute the solution.  $O^* \neq g^{-1}(R^*)$ .

Cambodia's urban sewer coverage stands at 12% outside Phnom Penh.

Ten cities are in the process of installing wastewater infrastructure through parallel investment programs.

This project supports the policy and regulatory environment around those investments.

**The terminal output is an "Operation and Maintenance Guidelines" document**, handed over in a ministerial ceremony.

The infrastructure itself – the physical intervention that would address the 12% coverage gap – is external to this project.

**The project documents the environment around the solution.**

It does not constitute the solution.

### Note:

*As of April 9, 2026, the project documents analysed in this benchmark are no longer publicly accessible via the GGGI project database.*

# The Lowest Six Cases: KH33

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## **KH33 – Air Quality Improvement Program, Cambodia**

Score: **0.20** | USD 800,000 | AFD-funded

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**Project Code:** KH33

**Period:** May 2023 – May 2025

**Funding:** EUR 800,000

**Status:** Active

**Resource Partner:** Agence Française de Développement (AFD)

**Theme:** Sustainable Mobility

### **Project Summary**

Cambodia's transport sector is the primary driver of urban air pollution. AFD established the Air Quality Improvement Program (AQIP) for Southeast Asia with Cambodia as a beneficiary. Implemented by GGGI in partnership with the Ministry of Environment (MOE) and Ministry of Public Works and Transport (MPWT), the project supports air quality monitoring, transport emissions inventory, and an enabling environment for electric bus deployment in Siem Reap.

### **Objectives**

Raise awareness of air quality issues. Enhance knowledge and capacity to monitor air quality. Strengthen institutional capacity across MOE and MPWT. Prepare projects, programs, financial instruments, and public policies leading to reduction of air pollution from the transport sector.

### **Stated Outcomes**

**Outcome 1:** Sustainable air quality management practices mainstreamed within MOE and MPWT through SOP for calibration of air monitoring equipment and emissions inventory tool. 38 provincial officials from 24 provinces trained.

**Outcome 2:** Investment mobilization for deployment of electric buses in Siem Reap resulting from the institutional framework for public bus operation and low carbon transport strategy.

### **INPUT**

EUR 800,000 AFD grant. GGGI + MOE + MPWT partnership. Cambodia transport sector as primary emission source. 38 provincial officials (24 provinces) + 28 MPWT officials as capacity recipients.

### **ACTIVITY**

Development of SOP for quality assurance and quality control of air monitoring stations. Transport sector emissions inventory tool development. Training of 38 MOE provincial officials on air quality data monitoring and calibration. Training of 28 MPWT officials on emissions inventory. Governance framework for public electric bus operation in Siem Reap. Support to CDIA for PPP feasibility study for e-bus deployment.

### **OUTPUT** ← Terminal output as documented

SOP document. Emissions inventory tool. Training completion records. Governance framework document. CDIA feasibility study for e-bus PPP model.

### **⚠ CAUSAL BREAK: OUTPUT → OUTCOME** (two independent pathways)

#### **Pathway 1** – Monitoring to Emissions Reduction:

Air quality monitoring makes deterioration visible. It does not reduce emissions. The causal path from a calibrated monitoring SOP to reduced air pollution requires regulatory enforcement, vehicle fleet turnover, fuel standards reform, and behavioral change — none of which are within this project's architecture. Outcome 1 establishes the capacity to observe the problem. It provides no mechanism for removing it.

#### **Pathway 2** – Governance Framework to E-Bus Deployment:

The governance framework and feasibility study create enabling conditions. E-bus deployment requires a private investment decision, PPP agreement execution, vehicle procurement, charging infrastructure development, and operational financing — all external to this architecture. Outcome 2's own language reveals the structural problem: it states investment mobilization will occur

"resulting from" the institutional framework. This is a causal claim the project cannot substantiate. The framework does not produce investment. It creates conditions that external actors may or may not respond to.

**OUTCOME** ← Assumed, not structured

Reduced air pollution from Cambodia's transport sector. Electric bus fleet operational in Siem Reap.

**IMPACT** ← Structurally unreachable from this architecture

Improved public health. Reduced GHG emissions. Sustainable urban transport.

**Structural Classification**

Advisory displacement. Monitoring and governance outputs are positioned as interventions where physical emissions reduction is the required outcome. Two independent causal breaks exist within a single project architecture — each sufficient alone to sever the documented output from the claimed impact.  $O^* \neq g^{-1}(R^*)$ .

Cambodia's air pollution is driven primarily by transport sector emissions.

This project responds by developing air quality monitoring guidelines, training 38 provincial officials, and supporting a feasibility study for electric buses in Siem Reap.

The causal path from these activities to reduced air pollution passes through multiple unspecified transmission mechanisms — regulatory adoption, vehicle fleet turnover, private investment in electric buses.

**The project's outputs operate at the monitoring and governance layer, not the emissions layer.**

**Air quality monitoring does not improve air quality.**

It makes deterioration visible.

**Note:**

*As of April 9, 2026, the project documents analysed in this benchmark are no longer publicly accessible via the GGGI project database.*

# The Lowest Six Cases: IN34

## IN34 — Electrification of Industries, India

Score: **0.25** | USD 131,699 | GGGI/CII

### Project Code: IN34

**Period:** Apr 2024 – May 2025

**Funding:** USD 131,699

**Status:** Active

**Resource Partners:** Global Green Growth Institute (GGGI) + Confederation of Indian Industry (CII)

**Theme:** Climate Action, Green Industries

### Project Summary

India is the third-largest carbon emitter globally. Under its NDC, India targets 50% cumulative power from non-fossil fuel sources and a 45% reduction in emissions intensity by 2030 from 2005 levels. This project — conducted by a GGGI-CII consortium under the guidance of the Bureau of Energy Efficiency (BEE) — assesses electrification potential across industrial, commercial, residential, and transport sectors, with primary focus on the first two. Objectives

**Phase 1 (Apr – Sep 2024):** Assessment of current electrification state and opportunities across industrial, commercial, residential, and transport sectors. Includes electricity demand projections, technology feasibility analysis, and emissions reduction potential.

**Phase 2 (Oct 2024 – Apr 2025):** Development of a comprehensive roadmap outlining specific policy measures, investment requirements, and alternative energy options (renewable energy, green hydrogen, bio-CNG) for the Bureau of Energy Efficiency. Stated Outcomes

Policymakers benefit from informed decision-making support for India's broader energy transition goals. Significant impact anticipated on carbon emissions reduction, renewable energy adoption, and job creation.

### INPUT

USD 131,699. GGGI-CII consortium. BEE guidance and institutional mandate. India's NDC commitments. Documented baseline challenges: insufficient generation capacity, grid infrastructure gaps, high upfront technology costs, critical mineral demand.

### ACTIVITY

**Phase 1:** Sectoral electrification potential assessment. Electricity demand projections. Technology feasibility mapping. Emissions reduction potential quantification across industrial, commercial, residential, and transport sectors.

**Phase 2:** Comprehensive roadmap development. Policy measure identification. Investment requirement analysis. Alternative energy option assessment including green hydrogen and bio-CNG. Blueprint preparation for BEE.

### OUTPUT ← Terminal output as documented

Phase 1 assessment report + Phase 2 strategic roadmap delivered to the Bureau of Energy Efficiency. Two documents.

### ⚠ CAUSAL BREAK: OUTPUT → OUTCOME

The roadmap describes the path. It does not walk it.

The project's own documentation is explicit about the core constraints: additional electricity generation capacity is required, transmission and distribution networks need strengthening, industrial heating requirements present technical barriers, and high upfront costs restrict adoption. These are not peripheral risks — they are the structural obstacles that define why India has not electrified at scale.

The output is an analysis of those constraints. It is not a mechanism for removing them.

BEE receiving the roadmap does not compel: legislative action, industry capital allocation, grid infrastructure investment, technology cost reduction, or private sector adoption decisions. Each of these is an independent external variable. The roadmap's translation into outcomes depends on a chain of discretionary decisions by actors entirely outside this project's architecture.

Furthermore, the stated outcomes acknowledge only that "policymakers will benefit from informed decision-making" — which is an input-level effect, not an outcome. Informing a decision is not the same as the decision being made, implemented, or producing results.

**OUTCOME** ← Assumed, not structured

India's industrial and commercial sectors begin electrification transition. Emissions intensity reduction trajectory altered.

**IMPACT** ← Structurally unreachable from this architecture

Contribution to India's NDC targets. Reduced fossil fuel dependence in the world's third-largest emitter.

### Structural Classification

Advisory displacement. A two-phase assessment and roadmap is positioned as the output where physical electrification infrastructure, policy enactment, and capital deployment are the required interventions. The project documents the constraints rather than removing them.  $O^* \neq g^{-1}(R^*)$ . The gap between what the project produces and what the project claims is the largest among the six cases in proportional terms — USD 131,699 against India's NDC commitments.

India is the third-largest carbon emitter globally.

This project assesses the electrification potential across industrial, commercial, residential, and transport sectors, and develops a strategic roadmap for the Bureau of Energy Efficiency.

**The output is a two-phase assessment report and roadmap.**

The project explicitly acknowledges the challenges — additional generation capacity requirements, grid infrastructure gaps, high upfront costs.

These are the core constraints.

The output is an analysis of those constraints, not a mechanism for removing them.

**The roadmap describes the path.**

It does not walk it.

### Note:

*As of April 9, 2026, the project documents analysed in this benchmark are no longer publicly accessible via the GGGI project database.*

# The Lowest Six Cases: ROC02

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## ROC02 – Solar Grandmothers, Burkina Faso

Score: **0.25** | USD 439,000 | Ministry of Environment

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### Project Code: ROC02

**Period:** Jan – Jan  
(year unspecified in original documentation)

**Funding:** USD 439,000

**Status:** Completed

**Resource Partner:** Ministry of Environment, Water and Sanitation (Burkina Faso)

**Theme:** Solar Energy, Green Jobs

### Project Summary

In 2022, 31 senior rural women were selected from seven regions of Burkina Faso – Centre, Centre-West, Centre-East, Sahel, North, Hauts-Bassins, and Cascades – to participate in a training program on solar systems management. Delivered through a partnership with Barefoot College Institute, established via a 2019 India-Burkina Faso government agreement, the program trained participants in the installation, operation, and maintenance of solar kits. The project aimed to empower women to contribute to reduction of negative environmental impacts from fossil fuel use through promotion of clean technologies.

**Objectives**

Bring positive change in the status of older rural women, making them genuine actors in local development.

Raise awareness of the need to combat climate change and protect the environment.

Reduce urban/rural inequalities and improve living conditions of beneficiary households.

Reduce gender inequalities through involvement of women as key actors and beneficiaries.

Accelerate local development through increased income-generating activities in villages.

### Stated Outcomes

No formal outcomes section in original project documentation. Project goals serve as proxy outcomes. No household coverage targets specified. No installation volume documented.  
⚠ Temporal Integrity Failure

Implementation period recorded as "Jan – Jan" with no year specified in either field. Independent temporal reconstruction of project activities is not possible from the public record.

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### INPUT

USD 439,000. Ministry of Environment partnership. Barefoot College methodology. 31 rural women from 7 regions. Burkina Faso context: widespread fossil fuel dependency for household lighting, limited solar knowledge, high rural energy poverty.

### ACTIVITY

Selection of 31 women from seven regions. Training program on solar kit installation, operation, and maintenance. Knowledge transfer on solar systems management. Awareness raising on climate change and clean technology.

### OUTPUT ← Terminal output as documented

31 women trained in solar systems management. Training completion. No installation records, no deployment targets, no household coverage figures in public documentation.

△ CAUSAL BREAK 1: OUTPUT → OUTCOME

Training is not deployment. The causal mechanism between trained personnel and actual solar kit installation in rural households is entirely absent from the project architecture. No deployment target is documented. No household coverage figure is specified. No procurement or distribution mechanism for solar kits is referenced. The project produces skilled individuals. Whether those individuals install anything, for how many households, at what scale, and under what resource conditions — none of this is within the documented architecture.

△ CAUSAL BREAK 2: OUTCOME → IMPACT

Even if deployment occurred at undocumented scale, the pathway from household solar adoption to measurable emissions reduction is not established. Emissions reduction requires fuel substitution at quantifiable scale with a documented baseline — neither of which appears in this project record. The project's own stated outcomes do not claim a climate result: they reference "positive change in the status of older rural women" and "accelerating local development through increased income-generating activities." Neither constitutes a measurable climate outcome attributable to this intervention.

ROC02 is the only case among the six with a double causal break — the gap exists simultaneously at both the Output→Outcome and Outcome→Impact layers.

**OUTCOME** ← Assumed, not structured

Solar kits deployed in rural Burkina Faso households. Fossil fuel substitution at household level.

**IMPACT** ← Structurally unreachable from this architecture

Reduced environmental impact from fossil fuel use. Improved rural living conditions. Gender equity in clean energy access.

**Structural Classification**

Training as terminal output. Capacity building is treated as a self-completing intervention rather than an enabling condition requiring a subsequent deployment mechanism. This is the most physically grounded of the six cases — there is a real intervention embedded in the design — yet the public documentation does not establish the causal chain from training to deployment to emissions reduction. The double causal break, combined with the temporal integrity failure, renders independent verification structurally impossible.  $O^* \neq g^1(R^*)$  at two independent layers.

Thirty-one rural women from seven regions of Burkina Faso were selected and trained in the installation, operation, and maintenance of solar kits.

The project is the most physically grounded of the six cases.

However, the public documentation does not establish the causal chain from training to deployment to emissions reduction.

**No household coverage targets are specified. No installation volume is documented.**

The implementation period is recorded as "Jan – Jan" with no year indicated — a basic disclosure gap that prevents temporal reconstruction.

The project's stated outcomes include "positive change in the status of older rural women" and "accelerating local development through increased income-generating activities" — neither of which constitutes a measurable climate outcome attributable to this intervention.

**Note:**

*As of April 9, 2026, the project documents analysed in this benchmark are no longer publicly accessible via the GGGI project database.*

# The Shared Structural Failure

These six projects are diverse in geography, sector, funding source, and institutional design. What they share is a single structural pattern, observable at the Output layer of the **ToC:f(x)**<sup>™</sup> framework.

In each case, **the project's terminal output does not directly remove the core constraint** it was designed to address.

The causal break occurs at the same point across all six cases — between *what the project produces and what the project claims*.

This gap is not filled by the project architecture.

It is filled by an implicit assumption: that producing the output will trigger a downstream process that eventually addresses the constraint.

## In structural terms:

The output lies outside the inverse image of the claimed outcome.

$$O^* = g^{-1}(R^*)$$

When this condition holds, no amount of implementation effort, additional funding, or favorable context can structurally close the gap.

The causal pathway does not exist in the documented architecture.

We observe three recurring forms of this failure across the six cases:

**Framework substitution** — a policy or financial framework document is treated as equivalent to the intervention it enables. **(KH34, GGPI11)**

**Advisory displacement** — a roadmap, assessment, or guideline is positioned as the output where a physical or institutional change is the required output. **(KH26, KH33, IN34)**

**Training as terminal output** — capacity building is treated as a self-completing output rather than an enabling condition requiring a subsequent deployment mechanism. **(ROC02)**

## A Structural Distinction: Can't and Don't

These three failure modes share a common linguistic feature. In each case, the project documentation frames a structural impossibility as a matter of incomplete action. The framework has not yet mobilised capital. The roadmap has not yet been walked. The trained personnel have not yet deployed. The implicit logic is that the constraint will be removed once the enabling condition is in place — that the gap is a matter of don't, not can't.

This distinction matters. A project that doesn't remove a constraint may be redesigned, extended, or followed by a successor intervention. A project that can't remove a constraint — because the output lies outside the causal pathway to the claimed outcome — is not a question of effort or timing. It is a question of architecture.

The six cases examined here are not instances of insufficient implementation. They are instances of structural misclassification: the documented output is treated as capable of closing a gap it is not positioned to close. Recognising this distinction is not a criticism of intent. It is a precondition for design that works.

# What This Does and Does Not Mean

This analysis evaluates the publicly documented project architecture.

It does not assess what happened during implementation.

Some of these projects may have produced real-world changes that the public documentation does not capture. That possibility is acknowledged.

**What it does establish is this:**

the publicly observable causal architecture of **these six projects does not contain the structural conditions required for independent verification of the outcomes they claim.**

The gap between *narrative ambition and documented causal logic* is not unique to any one country or sector.

It appears in Cambodia, Sri Lanka, India, and Burkina Faso.

It appears in finance, transport, sanitation, and energy.

**That consistency is the finding.**

# The Design Implication

The structural pattern identified here is not a consequence of insufficient commitment or inadequate implementation.

It reflects a design convention in which the preparation of enabling conditions — frameworks, assessments, guidelines, trained personnel — is treated as structurally equivalent to the interventions those conditions are intended to enable.

This convention is widespread in climate project design. It is not confined to GGGI, and it is not confined to the six cases examined here.

The structural question it raises is direct:

***If the output does not remove the core constraint, what does?***

Where that question cannot be answered from the documented project architecture, the causal chain is incomplete — regardless of what occurs during implementation.

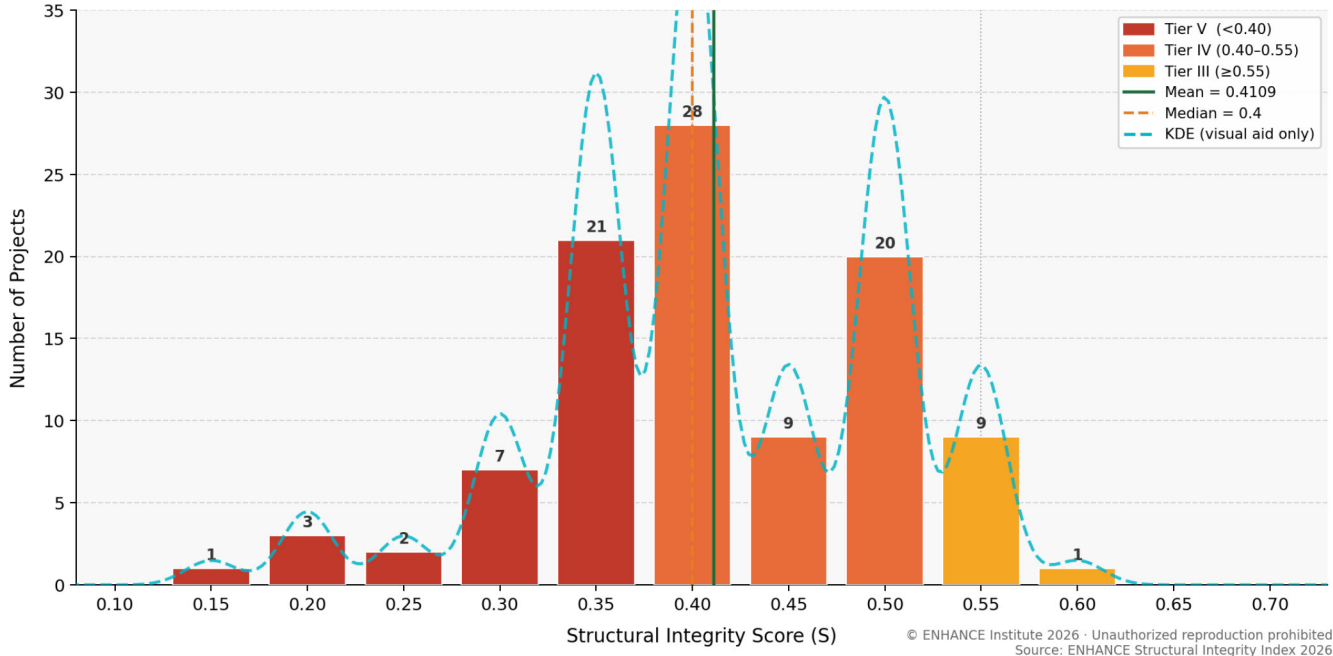
Structural integrity requires the answer be visible before implementation begins.

# Appendix A. Structural Integrity Distribution

## SI Score Distribution and Tier Thresholds

This figure presents the distribution of Structural Integrity (SI) scores across the analysed GGGI project portfolio.

Figure 1. Score Distribution — GGGI Project Portfolio (n = 101)  
 Scores are discrete multiples of 0.05, derived from a 20-condition binary kernel.  
 KDE curve is shown for visual reference only and does not represent a continuous distribution.



[Figure] Distribution of Structural Integrity Index and ToC:f(x)<sup>TM</sup> Tier Thresholds

The **SII (Structural Integrity Index)** measures the degree to which project information specifies a deterministic causal architecture linking resources, activities, outputs and outcomes, as defined by the ToC:f(x)<sup>TM</sup> framework.

The dashed vertical lines represent the official tier thresholds used to classify structural integrity levels.

Projects are assigned to tiers based on their SII relative to these thresholds.

Because the score is derived from 20 binary conditions, the distribution appears as **discrete score** clusters.

### Structural Integrity Tier Classification

The ToC:f(x)<sup>TM</sup> framework classifies project architectures into structural integrity tiers according to the proportion of project actions that remain within the valid climate outcome domain.

Tier	SII Threshold	Interpretation
Tier I	≥ 0.85	Fully deterministic causal architecture
Tier II	≥ 0.70	Strong structural integrity
Tier III	≥ 0.55	Moderately specified causal structure
Tier IV	≥ 0.40	Partial causal specification
Tier V	< 0.40	Limited Structural Specification

The most structurally deficient cases in the tail-risk category record scores at or below 0.25, as identified in Section 1.7.

### Observed Portfolio Distribution

Across the analysed portfolio:

No projects reach Tier I or Tier II structural integrity levels.

The highest observed scores correspond to Tier III (ET23, Score=0.60).

The majority of projects fall within Tier IV or Tier V. The distribution is strongly concentrated between 0.40 and 0.50 SII, indicating limited causal specification in most project information.

This pattern suggests that, while many projects articulate intended impacts, the intermediate causal architecture linking activities to outcomes is often only partially specified in the available information.

## Appendix B. SII Ranking of Analysed GGGI Projects

### Structural Integrity Ranking

Rank	Project ID	Country	SII	Category
1	ET23	Ethiopia	0.60	<b>TIER III</b>
2	ET017	Ethiopia	0.55	
3	LA041	Lao PDR	0.55	
4	LA043	Lao PDR	0.55	
5	LK02	Sri Lanka	0.55	
6	LK05-LK14	Sri Lanka	0.55	
7	ROA035	Multiple	0.55	
8	ORC051	Multiple	0.55	
9	ROC09	Multiple	0.55	
10	ROC15	Multiple	0.55	
11	ET032	Ethiopia	0.50	<b>TIER IV</b>
12	ET034	Ethiopia	0.50	
13	ID24	Indonesia	0.50	
14	ID37	Indonesia	0.50	
15	LA09	Lao PDR	0.50	
16	LA14	Lao PDR	0.50	
17	LA17	Lao PDR	0.50	
18	LA18	Lao PDR	0.50	
19	LA23	Lao PDR	0.50	
20	LA29	Lao PDR	0.50	
21	LA30	Lao PDR	0.50	
22	LA31	Lao PDR	0.50	
23	LA35	Lao PDR	0.50	
24	LK013	Sri Lanka	0.50	
25	PE48	Peru	0.50	
26	PY003	Paraguay	0.50	
27	ROA016	Multiple	0.50	
28	ROA026	Sri Lanka	0.50	
29	ROA014	Central Asia	0.50	
30	ROC030	N/W Africa	0.50	
31	BF014	Burkina Faso	0.50	
32	CAR023	Saint Lucia	0.50	
33	CAR024	Saint Lucia	0.50	
34	CAR025	Saint Lucia	0.50	
35	ET030	Ethiopia	0.50	
36	ID11	Indonesia	0.50	
37	ID40	Indonesia	0.50	
38	MN22	Ulaanbaatar	0.50	
39	ROC035	Benin	0.50	
40	CAR027	Saint Lucia	0.40	
41	ET015	Ethiopia	0.40	
42	ET26	Ethiopia	0.40	
43	ET27	Ethiopia	0.40	
44	ET029	Ethiopia	0.40	
45	ET031	Ethiopia	0.40	
46	ET033	Ethiopia	0.40	
47	GY017	Guyana	0.40	
48	GY05	Guyana	0.40	
49	GY10	Guyana	0.40	
50	GY12	Guyana	0.40	

Rank	Project ID	Country	SII	Category
51	ID26	Indonesia	0.40	<b>TIER IV</b>
52	IN12	India	0.40	
53	LA38	Lao PDR	0.40	
54	MN26	Ulaanbaatar	0.40	
55	MN27	Ulaanbaatar	0.40	
56	MX034	Mexico	0.40	
57	QA06	Qatar	0.40	
58	QA07	Qatar	0.40	
59	RA024	Multiple	0.40	
60	ROA012	Multiple	0.40	
61	ROA02	Karakalpakstan	0.40	<b>TIER V</b>
62	ROA05	ASEAN-Korea	0.40	
63	ROC038	West Africa	0.40	
64	TG02	Togo	0.40	
65	TG03	Togo	0.40	
66	UG81	Uganda	0.40	
67	UG15	Uganda	0.40	
68	BF005	Burkina Faso	0.35	
69	BF019	Burkina Faso	0.35	
70	CTFR006	Paraguay	0.35	
71	DO004	Dominican Rep.	0.35	
72	GIS04	MATS	0.35	
73	GY016	Guyana	0.35	
74	ID56	Indonesia	0.35	
75	IN31	India	0.35	
76	KH08	Cambodia	0.35	
77	LA36	Lao PDR	0.35	
78	MN34	Ulaanbaatar	0.35	
79	QA05	Qatar	0.35	
80	QA07-E1-5	Qatar	0.35	
81	QA09	Qatar	0.35	
82	ROB04	Dominican Rep.	0.35	
83	RW058	Rwanda	0.35	
84	TG05	Togo	0.35	
85	UG17	Uganda	0.35	
86	UG56	Uganda	0.35	
87	VN07	Viet Nam	0.35	
88	VN10	Viet Nam	0.35	
89	DO002	Dominican Rep.	0.30	
90	GGPI12	Lao PDR	0.30	
91	KH27	Cambodia	0.30	
92	PE37	Peru	0.30	
93	QA09-E3	Qatar	0.30	
94	UG64	Uganda	0.30	
95	UZ03	Uzbekistan	0.30	
96	IN34	India	0.25	
97	ROC02	Burkina Faso	0.25	
98	GGPI11	Sri Lanka	0.20	
99	KH26	Cambodia	0.20	
100	KH33	Cambodia	0.20	
101	KH34	Cambodia	0.15	

## Appendix C. On the Methodology: Two Questions We Anticipate

### Q1. Are 20 binary conditions too simple a basis for structural evaluation?

The **ToC:f(x)**<sup>™</sup> framework evaluates **structural integrity** across two distinct architectural layers.

**The first layer** concerns the construction of a solution: the causal pathway from

$$f(\text{Input, Activity}) \rightarrow \text{Output}.$$

The Output is the project's proposed solution — the mechanism by which mitigation or adaptation is directly achieved.

It is the structural kernel on which the project's success or failure turns.

**The second layer** concerns what that solution produces: the pathway from

$$\text{Output} \rightarrow \text{Outcome} \rightarrow \text{Impact}.$$

This layer evaluates whether the solution generates durable results, and whether those results are capable of scaling and replication sufficient to produce systemic change.

Critically, this layer is only meaningful if it originates from a structurally sound solution. A well-described impact pathway built on a structurally deficient output is not a partial success. It is an unreachable destination.

The evaluative questions that follow from this architecture are precise:

*Did the inputs and activities efficiently produce the solution?*

*Does the solution achieve the intended outcome?*

*Do results persist over time without structural decay?*

*Can results scale and replicate to produce impact?*

Each of these questions requires a determination of whether a causal condition holds.

That determination is expressed as a *binary* not because the underlying logic is simple — but because causality is not a matter of degree.

A causal condition either holds or it does not. It cannot partially hold. The binary expression is not a simplification of complexity.

It is the correct representation of a logical state.

When the 20 conditions are decomposed into their constituent causal sub-questions, the equivalent set in conventional evaluation language would number no fewer than 40 to 60 discrete items.

The 20-condition structure represents an *optimised formulation* — each condition encoding a causal inference that eliminates redundancy without sacrificing coverage.

If a superior set of conditions can be constructed, we welcome the proposal. We will decompose it, test it against the same cases, and demonstrate whether it produces more or less structural discrimination than the current framework.

## Q2. Does the framework fail to reflect field context?

The distinction is accurate, and it is one we draw deliberately. Structural integrity and operational execution are different dimensions of project performance.

ToC:f(x)<sup>™</sup> is a design evaluation instrument. Field context belongs to the domain of implementation. We evaluated the documented design architecture — asking whether, under the assumption of full execution, the structure is capable of reaching the claimed outcome.

**Implementation failures** are classified under Operational Risk, which takes three forms.

**System failure** encompasses the integrity of the design and execution architecture as a whole. As we are evaluating projects under the assumption of design coherence, system-level failure is not the relevant category here.

**Process failure** refers to the accuracy with which a design is translated into operational reality — whether the implementation sequence performs as intended when executed.

This is a function of *the competence of responsible parties* and *the quality of process governance*.

**People failure** takes two forms.

*Intentional failure* occurs when an actor knowingly neglects a responsibility or deliberately acts contrary to project objectives — whether through negligence or misdeed. This is managed through monitoring, accountability structures, and governance oversight.

*Unintentional failure* occurs when an actor causes harm through ignorance or insufficient competence.

This is managed through *selection, training, and ongoing supervision*.

What is commonly described as "*field context*" reduces, upon examination, to the question of whether responsible parties possess sufficient risk management capacity to prevent these failure modes.

It is *not an irreducible environmental variable*.

It is a *governance and capacity question* — one that falls outside the scope of design evaluation and inside the scope of implementation oversight.

We exclude from this analysis force majeure events — *extreme weather, natural disasters, and other conditions* beyond human control. These are not design failures, and *they are not operational failures*.

They are exogenous shocks that no evaluation framework is designed to anticipate.

If additional contextual variables exist that are neither design-structural nor operational in nature, we welcome their identification.

We will assess whether they constitute a category of risk that the current framework does not account for — and if so, we will say so.



*The Gravity of Truth*

FOR INQUIRIES

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## ENHANCE

ENHANCE is an independent analytical initiative dedicated to advancing structural integrity in climate and sustainability projects.

ENHANCE develops computational and causal analytical frameworks designed to evaluate the structural architecture of climate interventions. Its research focuses on identifying the causal robustness, evidentiary sufficiency, and systemic alignment of project designs before large-scale capital deployment.

Through methodologies such as the ToC:f(x)<sup>™</sup> framework and the Structural Integrity Index (SII), ENHANCE provides analytical tools for assessing the structural feasibility of climate projects and improving the reliability of climate finance decisions.

ENHANCE operates as an independent research initiative and collaborates with researchers, institutions, and financial actors seeking more rigorous evaluation of climate project architectures.