METHODOLOGIES AND VIABILITY FOR ARTICLE 6 PROJECTS IN THE BUILDINGS SECTOR

Unlocking opportunities and overcoming barriers across the building lifecycle

WHITE PAPER

PEEB
PARTNERSHIP FOR ENERGY EFFICIENCY IN BUILDINGS

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PEEB Climate Finance Incubator (CFI) is a programme under the umbrella of the Partnership for Energy Efficiency in Buildings (PEEB) that lays the foundation for climate finance through support for a clear data baseline on greenhouse gas emissions from buildings, pioneering work on Article 6 mechanisms for buildings, and innovative incentive mechanisms that mobilise private investments.

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EXECUTIVE SUMMARY

The buildings sector has had nearly no engagement with carbon markets, even before the introduction of Article 6 of the Paris Agreement. Why? Its emission reductions are mostly small-scale and energy efficiency upgrades are typically cost-effective, making them appear non-additional to carbon finance.

Despite these challenges, there are pathways for building projects to unlock Article 6 financing. Across the four lifecycle stages of a building – production, construction, use, and end-of-life – many project types with high emission-saving potential exist. To assess whether these projects could qualify for Article 6 crediting and are likely to work in practice, this White Paper introduces four "viability" criteria: (1) Economic viability; (2) Additionality; (3) MRV feasibility; and (4) Scalability. These criteria are linked to methodologies, established under the Clean Development Mechanism and voluntary carbon market standards, which are needed to demonstrate real emission reductions and obtain credits.

FINDINGS

Building projects may currently be easier to implement under Article 6.2 than Article 6.4. Article 6.4 methodologies are still under development and could involve higher transaction costs. This may limit project proposals, particularly in the buildings sector where split incentives – owners pay but tenants benefit – can slow climate action. Article 6.2 potentially offers more flexibility, with the possibility of simpler MRV and additionality approaches.

Methodologies for the use phase of buildings are well established – but significant gaps remain for the production, construction, and end-of-life stages. In the use phase, MRV is particularly reliable for projects addressing the carbon footprint of cement, energy-efficient appliances, and renewable energy solutions such as rooftop solar. Yet: Production-stage methodologies focus mainly on industrial processes, construction coverage is limited to replacing conventional vehicles, and aside from generic solid waste approaches, no specific methodologies exist for the end-of-life stage.

The best (most viable) building projects for Article 6 include:

1. Retrofits of commercial and public buildings
2. New low-carbon buildings and materials
3. Heat pump installations
4. Building-integrated systems (boilers, HVAC)

These interventions offer strong potential for scale, robust MRV, and demonstrable additionality, even if upfront costs can be substantial. Combining methodologies, such as efficiency upgrades with fuel switching or renewables, can further scale emission reductions and increase returns on the carbon market. In contrast, smaller-scale projects and individual consumer appliance measures are less viable, facing higher transaction costs, lower impact, and greater challenges in demonstrating additionality.

Going forward, for buildings to play a meaningful role under Article 6, the methodological toolbox must be improved. This White Paper recommends expanding coverage to production, construction, and end-of-life stages; integrating financing tools like shared savings or on-bill financing; providing guidance on baselines for new buildings, especially where codes are unevenly enforced; and including digital solutions such as remote sensing to cut costs and increase transparency.

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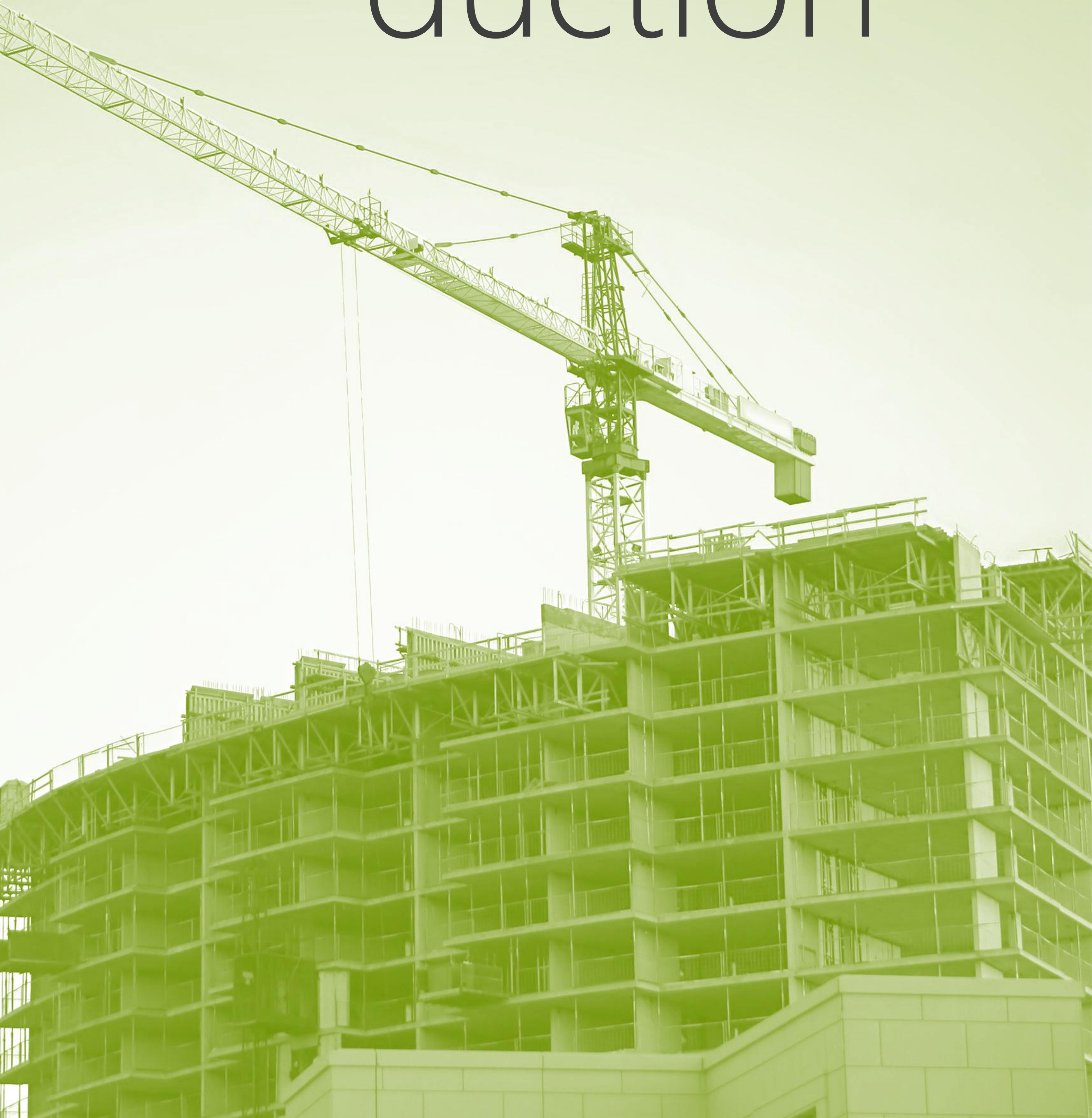
GLOSSARY

A6.4 Ers	Article 6.4 Emission Reductions
ACM	Approved Consolidated Methodology
AM	Approved Methodology
AMS	Approved Methodology for Small-scale projects
BAU	Business-as-Usual
CA	Corresponding Adjustment
CCU	Carbon Capture and Utilisation
CDM	Clean Development Mechanism
CFI	Climate Finance Incubator
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DNA	Designated National Authority
DSM	Demand-Side Management
EDGE	Excellence in Design for Greater Efficiencies
EPC	Energy Performance Contract
ESCO	Energy Service Company
ESG	Environmental, social, and governance
GCF	Green Climate Fund
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GS	Gold Standard
GWP	Global Warming Potential
HVAC	Heating, Ventilation, and Air Conditioning
ICAO	International Civil Aviation Organisation
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
ITMO	Internationally Transferred Mitigation Outcomes
JCM	Joint Crediting Mechanism
LCA	Life Cycle Assessment
LED	Light-Emitting Diode
LEED	Leadership in Energy and Environmental Design
MRV	Monitoring, Reporting and Verification
MTECT	French Ministry of Ecological Transition and Territorial Cohesion
NDC	Nationally Determined Contribution
NPV	Net Present Value
ODP	Ozone Depletion Potential
PBAs	Policy-Based Activities
PBP	Policy-Based Programme
PEEB	Partnership for Energy Efficiency in Buildings
PoA	Programme of Activities
RAC	Refrigeration and Air Conditioning
REDD+	Reducing Emissions from Deforestation and Forest Degradation
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
VCS	Verified Carbon Standard (by Verra)

1 | Intro-duction



1. INTRODUCTION

1.1. Objective and scope of this White Paper

Carbon markets can unlock new sources of climate finance for buildings – a sector with enormous but underused potential to cut emissions. This White Paper offers practical guidance to stakeholders in the buildings sector to scale up greenhouse gas (GHG) emission reductions using the carbon market framework under the Paris Agreement. It analyses viable project types, relevant methodologies, and potential implementation challenges.

In 2023, buildings accounted for around 34% of global energy-related CO_2 emissions[1]. Yet they remain one of the largest untapped areas for emission reductions. Many countries still lack robust, mandatory standards for energy performance in buildings or the carbon footprint of building materials.

Finance for buildings is insufficient. Global climate finance reached USD 1.4 trillion in 2022, but only 22% went to buildings and infrastructure – most of that was concentrated in advanced economies and China[2]. Very little of this funding flowed through carbon markets. Under the Clean Development Mechanism (CDM), building-related projects generated less than 1% of all issued credits, while voluntary market activity has also remained small and scattered[3].

Article 6 of the Paris Agreement offers a chance to help close this gap. It creates new carbon market mechanisms that allow countries and authorised entities to generate and trade emission reductions in support of their Nationally Determined Contributions (NDCs) through three approaches:

1. Article 6.2 – bilateral agreements between parties
2. Article 6.4 – a centralised crediting mechanism under UNFCCC governance
3. Article 6.8 – non-market-based approaches

While these mechanisms offer new opportunities, their design and implementation are governed by complex UNFCCC rules, as was the case under the CDM. For the buildings sector in particular, these rules, next to other sector specific barriers and complex monitoring, have made it difficult to fully participate in the carbon market.

This White Paper aims to equip public and private stakeholders with practical insights to engage in Article 6 carbon markets for long-term decarbonisation of the buildings sector. It will:

- Assess if existing methodologies for buildings can reliably verify reductions and enable participation in carbon markets
- Evaluate which building projects may be viable under Article 6
- Provide examples for inspiration on the potential application of Article 6 to building projects

[1] UNEP | Global Status Report for Buildings and Construction 2024/2025. Accessed via: https://globalabc.org/sites/default/files/2025-03/Global-Status-Report-2024_2025.pdf

[2] CPI | Global Landscape of Climate Finance 2024: Insights for COP29. Accessed via: https://www.climatepolicyinitiative.org/wp-content/uploads/2024/10/Global-Landscape-of-Climate-Finance-2024.pdf

[3] IFC | Building Green: Sustainable Construction in Emerging Markets, October 2023. Accessed via: https://www.ifc.org/content/dam/ifc/doc/2023/building-green-sustainable-construction-in-emerging-markets.pdf

1.2. Reader’s guide

This White Paper is designed as a comprehensive knowledge resource for anyone working, or seeking to work, at the intersection of buildings and carbon markets.

How to use this White Paper

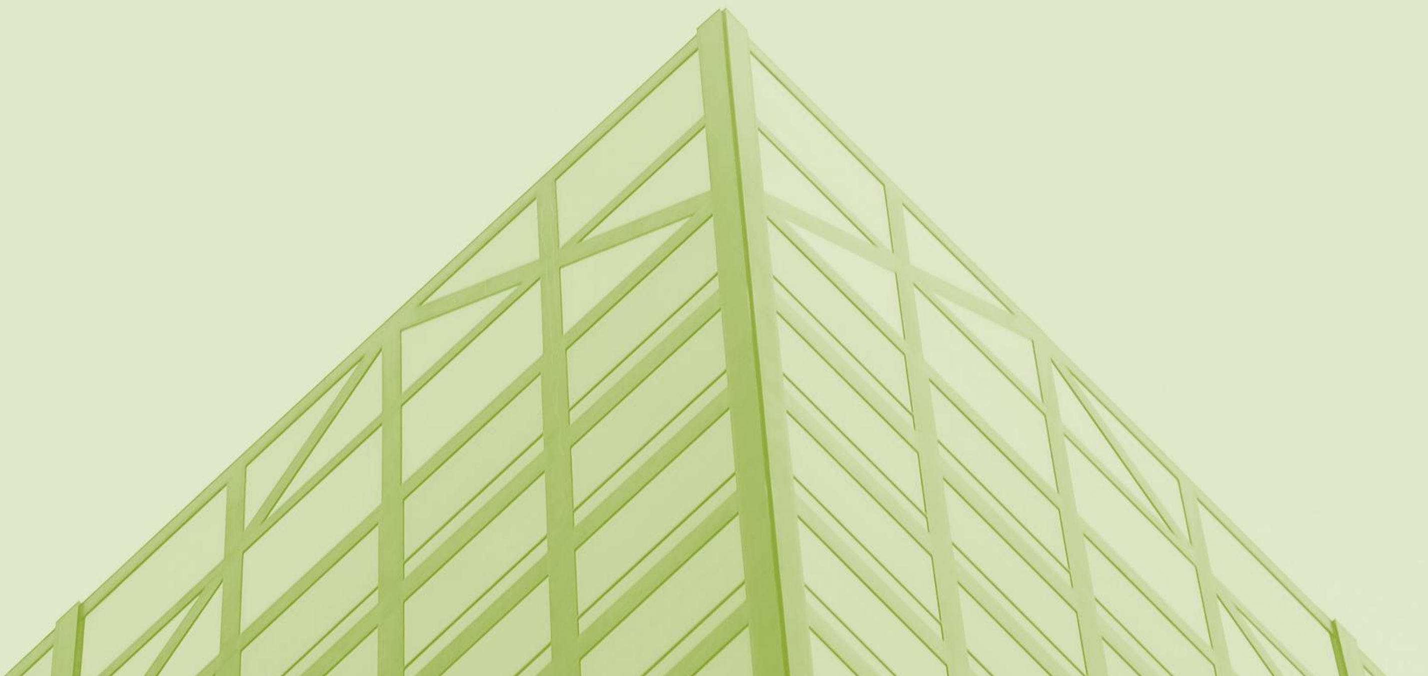
- **If you are new to Article 6, start with Chapter 2**. It is a plain-language introduction to Article 6 of the Paris Agreement and explains its mechanisms, opportunities, and challenges for engagement in the buildings sector.
- **If you want to find out where building projects can cut the most emissions and achieve the highest impact, turn to Chapter 3**. It maps promising building projects and shows the mitigation potential across the four stages of the building lifecycle.
- **If you (aim to) design or assess Article 6 projects for buildings, focus on Chapter 4**. It reviews existing methodologies from the CDM, JCM, and voluntary carbon markets, and helps you understand where current tools work for buildings, and where new ones are needed.
- **If you want to know what building projects are viable under Article 6, go straight to Chapters 5 and 6.** The latter includes a “viability matrix,” evaluating projects across the four criteria of economic viability, additionality, MRV feasibility, and scalability.
- **For practical illustrations of how Article 6 can be applied to building projects, jump to Chapter 7.** It presents six case studies that demonstrate how such projects can be designed and carried out to qualify for Article 6 financing.

Who this White Paper is for

- **If you are a government official or policymaker,**
  use this paper to design national frameworks, assess project eligibility, and ensure alignment with NDCs, Article 6, and broader UNFCCC requirements. This is particularly relevant for staff in ministries and institutions responsible for the building sector, including Designated National Authorities (DNAs) and Article 6 focal points.
- **If you are a building practitioner,**
  this paper will help you understand how your projects, whether in design, construction, or operation, can benefit from Article 6 mechanisms. It is intended for engineers, architects, project developers, and consultants involved in building projects.
- **If you are a carbon market or MRV specialist,**
  use this paper to identify where existing CDM and voluntary market tools can be helpful, and where new approaches are needed. It is aimed at methodology developers, verifiers, and consultants working on carbon markets.
- **If you are a public or private sector actor,**
  this paper will help you explore opportunities to mobilise finance for building decarbonisation. It is relevant for real estate companies, financial institutions, and technology providers.

2|

Article 6 and Buildings



2. ARTICLE 6 AND BUILDINGS

2.1. Article 6: How does it work and where do we stand?

Article 6 of the Paris Agreement sets out three approaches for international cooperation on climate action. Its market-based mechanisms (Article 6.2 and 6.4) are designed to help countries achieve their mitigation targets more cost-effectively by trading emission reductions among each other. Article 6.2 is largely organised on a bilateral basis, while Article 6.4 is governed centrally by the UNFCCC.

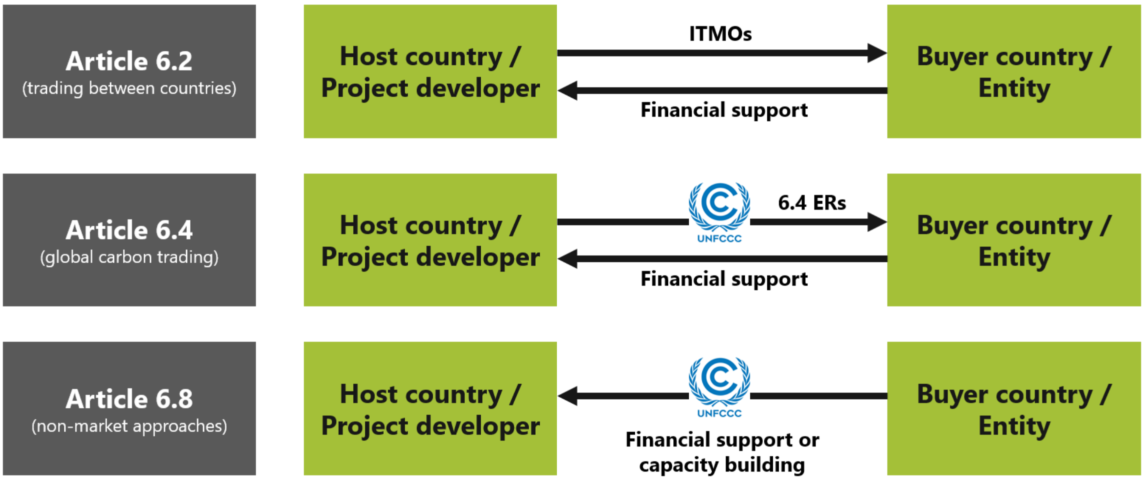


Figure 1: Article 6 cooperation mechanisms – Unit and finance flows

Source: Own creation, based on graphic by Zero Carbon Analytics

Article 6.2 allows countries to engage in bilateral or multilateral cooperative approaches, through which they can generate and transfer Internationally Transferred Mitigation Outcomes (ITMOs). These ITMOs can be applied towards the NDC target of the acquiring country. The emission reductions can in that case not be used to meet the host country's NDC target as well. Article 6.2 offers flexibility in terms of governance and methodologies within the overall UNFCCC framework, as long as transparency, environmental integrity, and the avoidance of double counting are ensured.

Status: Article 6.2 has been operational since 2021, and over 80 bilateral agreements have been signed between countries. However, there remains a gap between political agreements and actual credit transfers. While many countries are still developing the institutional systems needed for authorisation, reporting, and corresponding adjustments (see Box 2), only two projects have so far completed ITMO issuance under Article 6.2: an electric bus project in Thailand and a smart agriculture project in Ghana, both authorised for transfer to Switzerland and recorded in the UNEP-CCC Article 6 pipeline as of September 2025[4]. Other initiatives have reported contracted volumes and prices (see Box 1) but are still in the early stages of delivery.

Article 6.4 establishes a centralised mechanism overseen by a Supervisory Body under the UNFCCC. It aims to support mitigation activities through the generation of Article 6.4 Emission Reductions

[4] https://unepccc.org/article-6-pipeline/

(A6.4ERs) that can be sold for NDC compliance or other purposes (e.g. CORSIA[5]). Article 6.4 builds on and replaces the CDM, with stronger safeguards and updated methodologies, aligned with the objectives of the Paris Agreement.

Status: Article 6.4 is still under development. The first authorisations and methodology approvals by the Supervisory Body are expected between mid-2025 and early 2026, including the transition of selected CDM methodologies (e.g. renewable energy and efficient cookstoves).

Article 6.8 covers non-market-based approaches such as technology transfer, policy cooperation, capacity building and results-based finance. While it offers a complementary pathway for climate collaboration, Article 6.8 is outside the scope of this White Paper, which focuses specifically on market-based mechanisms and their applicability to the buildings sector.

Status: Article 6.8 has been formally launched, but concrete modalities and funding mechanisms remain under development.

Box 1: Financial Outlook for ITMOs under Article 6

Only limited information on contracted ITMO prices has been publicly disclosed, and to date very few ITMOs have been traded. Some credit prices from other crediting mechanisms are available, though these cannot be generalised as market benchmarks for future ITMO prices. Reported prices for 2023 are:

- **Japan's Joint Crediting Mechanism (JCM):** Contracted 0.127 million credits at an average price of **USD 36/tCO_2e.** These are primarily small-scale demonstration projects with relatively high transaction costs, contributing to the higher unit price.
- **Switzerland's KliK Foundation:** Reported contracting 8.7 million credits at an average price of **USD 23.5/tCO_2e.** The larger scale and streamlined contracting processes contributed to a lower unit cost compared to JCM.

For comparison, prices in the voluntary carbon market (VCM) are typically much lower, averaging USD 8–9/tCO_2e for REDD+ credits in 2023. However, VCM projects often involve higher volumes and less stringent MRV requirements.

Though project and context-specific, the first two cases illustrate a premium for compliance market credits over most VCM credits. This may occur also for Article 6.4 credits with centralised rules over Article 6.2 credits with more flexible rules. However, prices under Article 6 will ultimately depend on broader supply–demand dynamics, host country readiness, and methodology availability. If supply of Article 6.4 credits is limited due to delays or complexities, buyers may prefer Article 6.2 transactions, which could push prices upward for the latter mechanism.

Source: Perspectives Climate Group (2023)

[5] The Carbon Offsetting and Reduction Scheme for International Aviation, established by ICAO (the International Civil Aviation Organisation), to help the sector meet its emission reduction targets (covering emissions not included in national emission inventories and NDCs). Accessed via: https://www.icao.int/environmental-protection/CORSIA/pages/default.aspx

Box 2: Corresponding Adjustment (CA)

To avoid double counting of emission reductions, Article 6 requires corresponding adjustments in national emissions reporting. When a host country transfers emission reductions abroad (e.g. as ITMOs under Article 6.2 or A6.4ERs under Article 6.4), it must add them back into its own inventory. The receiving country then subtracts the same amount. This ensures only one country counts the reduction towards its NDC target.

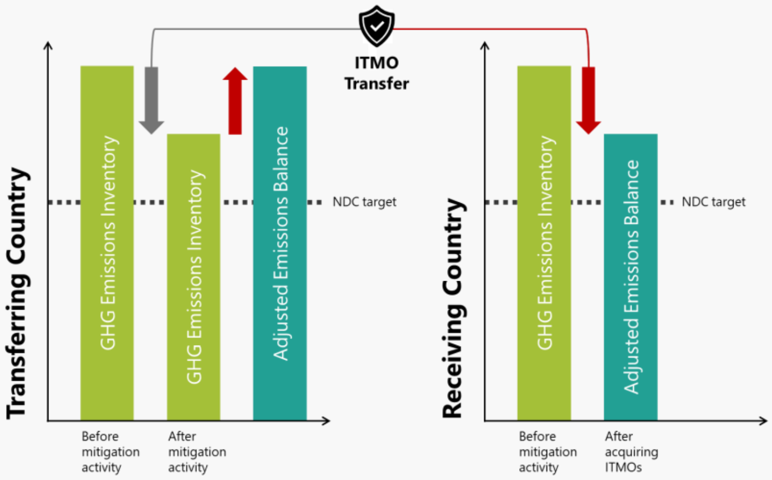


Figure 2: Corresponding adjustments in Article 6.2 to avoid double accounting

Source: Own creation based on UNFCCC graphic presented in training on Article 6 (16 October 2024)

For project developers, this means that approval and authorisation by the host government is an essential step in the project cycle. Without a host country authorisation (confirming that a corresponding adjustment will be made), no credits can be transferred internationally.

2.2. Potential to use Article 6 mechanisms for the buildings sector today

The evolving Article 6 landscape creates opportunities for actors seeking to engage in the mechanisms, but uncertainties remain. The buildings sector has shown limited engagement to date, compared to other sectors where early progress has already been made. Two early Article 6.2 projects were on transport and cookstoves. Under Article 6.2, Switzerland became the first country to complete an ITMO transfer. It acquired 1,916 tonnes of CO_2 reductions from Thailand's Bangkok E-Bus Programme, marking a landmark move in January 2024[6]. This was followed by another transfer from Ghana's transformative cookstove project, resulting in 11,733 ITMOs being issued to the KliK Foundation's account in the Swiss Emissions Trading registry in July 2025[7].

The relatively minimal engagement from the buildings sector stems from structural hurdles. Emission reductions here typically come from dispersed and small-scale interventions, such as appliance upgrades, or capital-intensive measures like energy-efficient retrofits, which are challenging to aggregate and track. Sector-specific methodologies remain limited. Furthermore, energy efficiency improvements in buildings are often considered business-as-usual due to their cost-saving nature, making it difficult to demonstrate additionality, a core requirement for crediting.

[6] S&P Global Commodity Insights (2024). Switzerland, Thailand conclude first Article 6.2 deal in landmark move for carbon markets. Accessed via: https://www.spglobal.com/commodity-insights/en/news-research/latest-news/energy-transition/010824-switzerland-thailand-conclude-first-article-62-deal-in-landmark-move-for-carbon-markets

[7] KliK Foundation (2025). Ghana and Swizerland Pioneer Africa's First ITMO Issurance Under Paris Agreement's Article 6.2 for NDC Use. Accessed via: https://www.klik.ch/en/news/news-article/first-itmo-transfer-switzerland-ghana

The scenario parallels challenges previously encountered under the CDM, where buildings-related activities formed only a tiny fraction of overall credits issued. However, with the increasing maturity of both Article 6.2 and 6.4, and the growing availability of guidance and tools, there is untapped potential to position building projects within the Article 6 landscape. Drawing on lessons learned from the CDM and voluntary markets, new projects can take advantage of the evolving Article 6 framework to accelerate decarbonisation, attract finance, and scale innovation.

2.3. National strategies for integrating buildings into carbon markets

The role of national strategies is decisive in shaping whether building-sector activities are integrated into carbon markets. National strategies determine which sectors are targeted for Article 6 activities, how eligibility criteria are applied, and how carbon finance is aligned with national climate objectives.

Priority-setting across sectors
Governments must decide where to focus their Article 6 efforts. Large-scale energy or industrial projects are often favoured because they are easier to aggregate and monitor. By contrast, building-sector measures can appear fragmented and administratively costly. Unless explicitly recognised in national strategies, building activities may therefore remain underrepresented.

Baseline and additionality definitions
Host-country strategies also influence how baselines are set and how additionality is demonstrated. In countries with ambitious building codes or efficiency standards, it can be difficult for projects to demonstrate that Article 6 support is decisive. Conversely, where such regulations are absent, national strategies can create space for building-sector projects, for example by validating voluntary certification schemes as acceptable baselines.

Alignment with NDCs and national policies
Article 6 projects must contribute to a country’s NDC and avoid double counting. Whether building-sector activities are included in national carbon market strategies determines if they are recognised as contributing to NDC targets. Long-term clarity in national decarbonisation plans is essential to give investors confidence that building-sector projects will be supported.

Incentives and enabling frameworks
Governments can support building-sector projects through complementary incentives, such as subsidies for efficiency retrofits, low-carbon materials, or green building certification. However, if provided outside Article 6 mechanisms, such subsidies could undermine additionality. Careful alignment of project design with policy frameworks can result in overcoming barriers (Section 2.3) in a way that standalone policies or project cannot, jointly resulting in additional emission reductions.

National strategies act as the bridge between technical project viability and real-world implementation. They determine whether building-sector activities are prioritised, how baselines and additionality are interpreted, and whether enabling incentives are provided. National strategies also interact with broader Article 6 design choices such as the application of corresponding adjustments, the treatment of conditional NDC targets, and the distinction between Article 6.2 and 6.4 mechanisms. These issues are further explored in Section 4 in the context of methodological requirements and accounting rules.

3| Projects

3. PROJECTS: WHICH PROJECT TYPES ARE RELEVANT FOR CLIMATE MITIGATION

Emissions from buildings occur throughout the building lifecycle – from production of materials to construction to operation and end-of-life. To understand how the buildings sector can engage with Article 6, this chapter shows how GHG emissions are categorised, examining barriers that hinder investment and presenting relevant project types.

3.1. Where do the biggest emissions occur?

The buildings sector is one of the largest contributors to total global GHG emissions, and hence climate change. In 2023, the sector was responsible for 34% of global CO2 emissions. Of this, 15% came from residential buildings; 10% from non-residential buildings; and the remaining 7% came from the building construction industry (particularly from concrete, aluminium and steel) and materials (bricks and glass).[8]

Mitigation opportunities in the buildings sector can be grouped according to their place within the **building lifecycle**: production, construction, use, and end-of-life. This perspective links emissions directly with (GHG mitigation project) intervention points and helps to identify where carbon finance can have the greatest impact.

Globally, the **use stage** dominates, being responsible for about 72% of total building energy and process-related CO_2 emissions, mainly from heating, cooling, and electricity use. The **production stage** contributes about 26% of emissions through the manufacture of materials such as cement, steel, and glass. The **construction** and **end-of-life stages** account for the remaining 2%, largely from transport, demolition, and waste processing.[9]

Because buildings have long lifespans, decisions taken today on design, materials, and construction methods **lock in emission trajectories for decades to come**. Early, ambitious interventions in the buildings sector are therefore particularly critical, with the potential to deliver substantial emission reductions and multiple co-benefits such as improved health, resilience, and affordability.

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[8] UNEP | Global Status Report for Buildings and Construction 2024/2025. Accessed via: https://globalabc.org/sites/default/files/2025-03/Global-Status-Report-2024_2025.pdf

[9] UNFCCC, GIZ, PEEB, and BPIE, 2021. Compendium on greenhouse gas baselines and monitoring. Building and construction sector. Accessed via: https://unfccc.int/sites/default/files/resource/UNFCCC%20Compendium%20GhG%20Building%20Sector.pdf

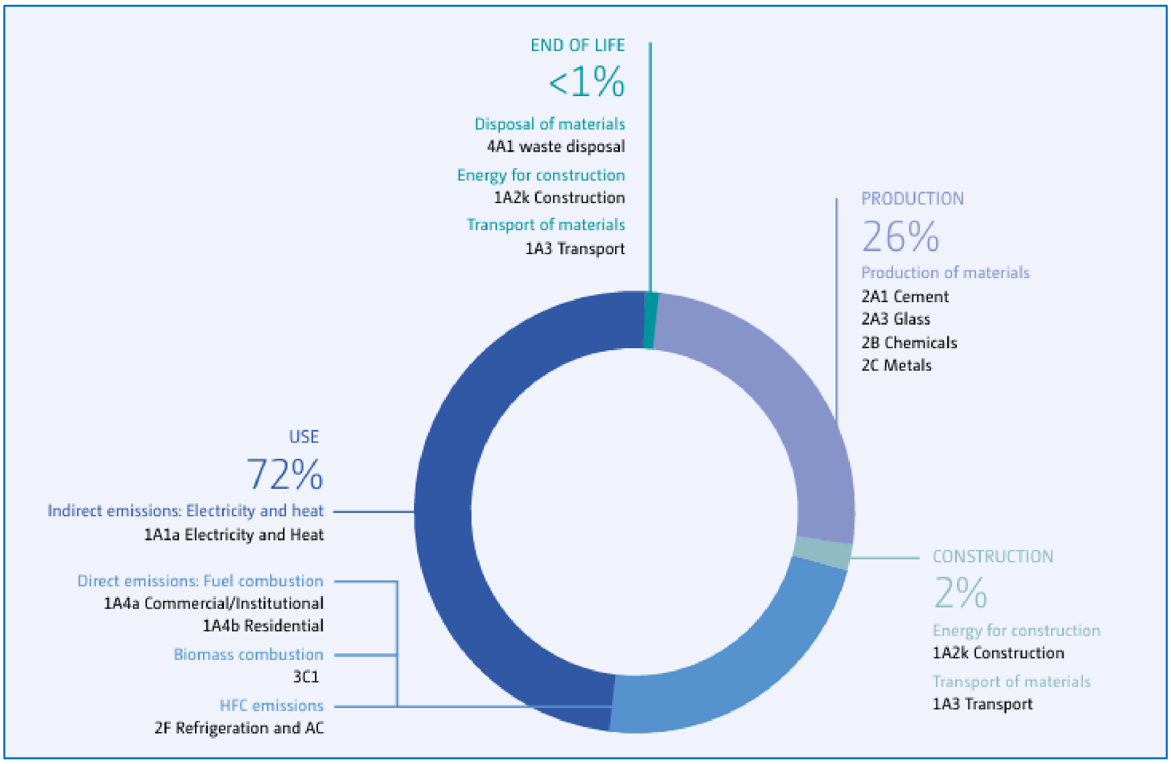

Figure 3: Overview of emissions from the buildings and construction sector (based on national GHG inventories)

Source: UNFCCC (2021)[10]

Box 3: Cause accounting

In order to determine the full range of GHG emissions generated by the buildings sector, the principle of **cause accounting** needs to be applied. Cause accounting attributes emissions to the activity that drives them (e.g. energy demand in buildings), rather than to the sector where they physically occur (e.g. power generation under source accounting). This approach is preferred for the buildings sector because much of its impact is indirect, realised through energy and material use. Cause accounting therefore provides a more accurate picture of mitigation potential and avoids underestimating the sector's role.

This means that mitigation measures are categorised under the stage where the emissions actually occur, rather than the stage where the decision is made. For example, measures such as improved building design, passive cooling, or the contruction of new net-zero buildings are grouped under the **use stage**, since their impact is realised through lower operational energy demand over the building's lifetime. This approach ensures methodological consistency and avoids double counting across lifecycle stages.

It must be noted though that for activities affecting the emission impact of new buildings, the project intervention needs to take place in the design and construction phase of the building. This in contrast to retrofit measures which are applied in the use phase. Similarly, the use of low-carbon construction materials will require those materials to be available (potentially requiring intervention in the production phase) and to be used (in the construction phase for new build or the use phase for retrofits). This means a wider range of stakeholders across the building's value chain may need to be involved in project design and implementation.

Source: UNFCCC (2021)

[10] The key energy use categories are shown in bold. All GHG emissions are indirect, except for 1A4a Commercial/Institutional and 1A4b Residential. All GHG emissions from maintenance, repair and renovation during the life of the building should be considered within the product and construction stages.

Box 4: GHG emission categories in the buildings sector for accounting purposes

While the building lifecycle approach is a practical way of categorising different GHG mitigation project opportunities, it is important to be aware of the specific emissions accounting framework used to quantify and manage emissions across a building's lifecycle. The following is a short overview of the accounting framework.

Under the Greenhouse Gas Protocol[11], emissions are classified into Scope 1–3.

Scope 1 covers direct emissions from the building itself. These include on-site fuel combustion, such as natural gas or diesel used for heating, boilers, generators, or cooking. They also cover refrigerant leakage from HVAC systems, which may be small in volume but comprise gases that can have a high global warming potential (GWP).

Scope 2 refers to indirect emissions from purchased energy. These arise from the generation of purchased/imported electricity, steam, heating, or cooling that is consumed in the building. Although such emissions occur offsite at the energy producer's facility, they are attributed to the building through its energy use – for example, lighting, HVAC, elevators, appliances, and plug loads, or district heating and cooling purchased from external providers.

Scope 3 captures other indirect emissions across the value chain. These extend beyond the building itself and include upstream emissions from the production of construction materials (embodied carbon in cement, steel, glass, insulation), emissions from construction activities and their transport, and end-of-life emissions such as demolition and waste processing.[12] It also extends to supply chain emissions from purchased goods and services used in building operations, as well as employee commuting and business travel associated with building management staff.

Measuring Scope 3 emissions is complex but crucial, especially for new developments, retrofits, and long-term sustainability targets. Tools such as life cycle assessment (LCA)[13] and embodied carbon calculators are often used for this purpose. Robust carbon accounting across Scopes 1, 2, and 3 provides a comprehensive picture of a building's climate impact. By identifying emission hotspots, building stakeholders can prioritise interventions, align with environmental, social and governance (ESG) goals, and contribute to climate targets such as net zero. As regulatory frameworks and investor expectations evolve, transparent and accurate carbon accounting is becoming a cornerstone of responsible building management and development.

The extent to which emissions are distributed between Scopes 1, 2 and 3 varies significantly by country and regional context.

3.2. Barriers to low-carbon investment in the buildings sector

Although the buildings sector offers significant potential for mitigation, a range of structural barriers continues to hinder the implementation of low-carbon measures. These barriers affect both conventional mitigation projects and the ability to structure them as viable Article 6 activities.

[11] Greenhouse gas protocol. Accessed via: https://ghgprotocol.org/

[12] United Nations Environment Programme (2023). Building Materials and the Climate: Constructing a New Future. Accessed via: https://wedocs.unep.org/handle/20.500.11822/43293.

[13] Considering EN15978 life cycle stages.

Barriers to implementing mitigation measures[14]:

- **Lack of regulation and enforcement**: In many countries, building codes and energy performance standards exists but are poorly enforced. Limited capacity among local authorities and weak compliance monitoring reduce their effectiveness. Moreover, introducing more or stricter rules does not automatically yield better compliance; in lower-income and emerging contexts, it can unintentially push construction activity into informality, reinforcing the need for incentive-based frameworks and accessible finance under Article 6.
- **High upfront costs and split incentives**: Efficiency retrofits and low-carbon construction often require large initial investments. The split-incentive problem – where the party paying for the upgrade (e.g. a landlord) is not the one who benefits from reduced utility bills (e.g. a tenant) – further depresses investment appetite. Practical responses such as Energy Service Company (ESCO) shared-savings models, on-bill financing, and energy-performance contracting can mitigate this barrier by aligning repayments with realised savings and shifting performance risk[15], but these solutions are not yet widespread in many markets.
- **Limited technical knowledge and access to technology**: Developers, architects and facility managers may lack practical experience in designing and implementing measures, especially for deeper retrofits and embodied-carbon choices. In addition, low-carbon technologies and materials are not always accessible or affordable, particularly in developing country contexts.
- **No financial benefit in using low-carbon materials**: Even where alternatives exist, low-carbon construction materials such as green cement or recycled steel are often more expensive. Without regulatory requirements, incentives, or recognition in the market, there is little financial motivation for developers to choose them.

It is due to these barriers that, despite the significant potential for emissions mitigation, the buildings sector has been somewhat underrepresented to date in terms of decarbonisation. In Section 0 of this White Paper, the main challenges and barriers to the buildings sector's engagement with international carbon markets are discussed.

[14] Not necessarily related to whether the mitigation project is seeking climate finance funding support (e.g. via carbon markets).

[15] Several mechanisms have emerged and been successfully applied to address split incentives in investments in building energy efficiency interventions. The three main mechanisms include: **(1) Shared Savings:** In this model, an ESCO covers the upfront cost of energy efficiency improvements. The resulting energy cost savings are shared between the building owner and the ESCO over a set period, allowing the owner to benefit without initial investment. **(2) On-Bill Financing:** This mechanism allows building owners to repay the cost of energy efficiency upgrades through their utility bills. The loan is typically provided by a utility or a third party, and the repayments are structured to be offset by the energy savings, making it budget neutral. **(3) Energy Performance Contracts (EPCs):** Under EPCs, an ESCO implements energy-saving measures and guarantees a certain level of energy savings. The cost of the project is paid back over time from the guaranteed savings, transferring performance risk from the building owner to the ESCO.

3.3. Building-sector project types under Article 6

This chapter presents the key emission mitigation projects within each stage of the building lifecycle as well as the emission reduction potential and scalability, overall feasibility for MRV, and general economic viability of each respective project type. These assessments are based on experience in the VCM and the current status of approved Article 6 methodologies as of July 2025. Some uncertainty remains, as some project methodologies are not yet officially approved.

3.3.1. Production Stage

In the production stage, the transition to more sustainable and low-carbon buildings includes sourcing materials locally, the use of materials with lower carbon contents,[16] increasing the longevity of buildings, and the use of recycled and waste materials as inputs.

The main opportunities for the decarbonisation of building production processes focus on building material production and target their industrial production. These include the following:

- **Brick production systems**. This can be achieved through a combination of fuel switching (substituting fossil fuels with renewable alternatives, e.g. biomass, hydrogen from renewable electricity), the use of more energy efficient brick kilns, and substituting key raw materials.[17]
- **Cement and concrete factories**. Emission reductions can be achieved through reducing the clinker content in cement production (by replacement with fly ash, slag, and limestone), using alternative cements (e.g. geopolymer cements or magnesium-based binders), and using pre-calcinator kilns, process optimisation and waste heat recovery. In the medium-term horizon, Carbon Capture (Utilisation) and Storage (CCUS) projects are also anticipated to play a significant role in the decarbonisation of cement and concrete production.
- **Metal production factories (e.g., steel, aluminium and copper**). Technologies to produce low-carbon or zero-emission metals already exist, but are more expensive than conventional processes (e.g. Direct Reduction of Iron within Electric Arc Furnaces (DRI-EAF) powered by renewable energy or green hydrogen).
- **Glass production factories.** Switching to electric melting (using renewable-sourced electricity), hydrogen combustion, or the use of biofuels and synthetic fuels as replacement of fossil fuels; and batch preheating of raw materials using recovered waste heat from exhaust gases can also yield significant energy efficiency improvements.
- **Production of biodegradable bioplastics**, along with standardising their compositions to improve recyclability, helps reinforce circularity in the sector.
- **Production of bio-based materials for buildings** – such as bamboo, cork, straw bale, sugarcane, and cellulose insulation – as substitutes for traditional emissions-intensive materials can also be appropriate under certain circumstances.

Nevertheless, mitigation projects might also focus on the large-scale integration of low-carbon building materials into existing or planned buildings which essentially take the building as a starting

[16] UNEP, 2023. Building Materials and the Climate: Constructing a New Future | UNEP - UN Environment Programme Accessed via: https://wedocs.unep.org/handle/20.500.11822/43293

[17] This includes using alternative binders or additives – for example, replacing some clay with fly ash, construction waste, and rice husk ash.

point. Such projects generally tend to **focus on best practices**, and **architectural design with prefabricated or reusable elements**, together with the **circular management of materials**. Together these projects can consolidate a comprehensive approach to reducing emissions in the production of building materials.

Table 1: Overview of project types in the production stage

Project	GHG Reduction Potential / Scalability	MRV Feasibility	General Economic Viability of the Project (without carbon finance support)[18]
Building materials			
Steel and aluminium: DRI and EAF in steel production; use of EAF in aluminium production	High	Available industry protocols and clear traceability	Low
Incorporation of Carbon Capture (Utilisation) and Storage (CCUS) technologies in energy-intensive materials production processes (including cement and concrete production)	High	Monitoring through both energy consumption / metering, and CO2 flue gas measurements	Low
Improvement in the energy and material efficiency of production processes for building materials	High	Monitoring through energy datasets and material mapping	Medium
Low-Carbon Building Materials in a construction programme			
Decarbonisation of cement production. Reduction of the proportion of clinker in cement by using fly ash or sewage sludge[19]	High	Well documented in industrial processes	Medium
Switching to bio-based materials and low-carbon alternatives in plastics, wood, and masonry	Medium	Monitoring through LCA and certification	Medium
Local manufacture of earthen masonry and other materials as an alternative to carbon-intensive building blocks	Medium	Verifiable through local audits and certifications	Medium

[18] This refers to the indicative average cost of the project / measure per unit GHG mitigated (often considered in units € / tCO2 or equivalent). It is important to note that the scorings (high / medium / low) presented in the following tables are indicative and for general guidance purposes only. The specific scoring of respective GHG mitigation projects – including on their relative attractiveness and ranking of economic competitiveness – can vary significantly between different geographical locations and climatic conditions.

[19] In some countries and regions, the use of fly ash and other replacement materials are increasingly being used within cement production as a standard practice. This means that projects based on reducing the proportion of clinker in cement find it increasingly difficult (and sometimes impossible) to prove the additionality (i.e. additional GHG mitigation) of such projects.

Optimisation of the dimensions and design of materials such as steel, aluminium and concrete blocks. This involves switching to the use of modular and reusable materials, that help avoid off-cuts and material wastage	High	Measuring material input reduction and process efficiency	High
Renewable energy in material production processes			
Transport of building construction materials and products using vehicles running on electricity or second-generation biofuels[20]	High	Measurable by direct substitution of fossil fuels and energy monitoring	Medium

3.3.2. Construction Stage

This stage includes the physical construction of buildings. Minimising the carbon impact of construction involves ensuring efficient processes at all sub-stages. In the transportation of building materials, it is a priority to switch to the use of technologies and vehicles that reduce the use of fossil fuels (e.g. through the uptake of electric, hybrid, or biofuel-powered vehicles and machinery). Equipment such as excavators, cranes, and electric dump trucks, currently available on the market, offers additional benefits such as noise reduction and greater compatibility with sensitive urban areas. Hybrid machinery combines internal combustion engines with electric motor systems, optimises energy efficiency, and significantly reduces GHG emissions. The renewal of the machinery fleet with units using second-generation biofuels can also lead to reduced GHG emissions.

Table 2: Overview of project types in the construction stage

Project	GHG Reduction Potential / Scalability	MRV Feasibility	General Economic Viability of the Project (without carbon finance support)
Renewable energy within building construction activities			
Replacement of conventional construction vehicles and heavy machinery with renewable electricity powered or hybrid vehicles; and implementation of second-generation biofuels	Medium	Tracking through energy consumption records and fleet monitoring	Low

3.3.3. Use Stage

The use stage of the building lifecycle has by far the longest duration of the four phases mentioned, typically spanning multiple decades. As a result, significant GHGs are emitted from the operation of

[20] There is some uncertainty at the current time (July 2025) on the specific methodologies for renewable energy projects that may (or may not) be supported under Article 6, with final approvals pending confirmation.

heating, ventilation, air conditioning (HVAC), and refrigeration and other electrical systems, as well as non-electrical hot water and cooking systems (e.g. biomass, coal or natural gas-fired systems).

The highest energy efficiency gains (and emissions savings) can be made when a building is constructed to be energy-efficient from the outset of its use. Undertaking renovations on existing buildings can deliver significant energy savings but this approach can be very capital-intensive and hence may not be viable for many building owners.

Modernising the technical systems used within existing buildings will reduce GHG emissions; and can be achieved, for example, through replacing conventional lighting systems with high-efficiency LED solutions, implementing automatic lighting and energy controls, and integrating energy-efficient appliances such as electric or induction cookers. In addition, using advanced technologies such as Smart Grids and the Internet of Things (IoT) applications allows for more efficient and real-time management of energy consumption (and storage). Adopting low or zero GWP refrigerants in systems is also key to reducing indirect emissions from refrigerators, air conditioners, or chillers.

The existing built environment may be addressed by refurbishing buildings. Emissions at this stage can be reduced by applying passive heating and cooling strategies. These include sun-shading systems to limit direct sunlight, high-performance glass façades, and thermal insulation in roofs, basements, exterior walls, and heating pipes.

In addition, interventions such as the installation of solar photovoltaic (PV) panels, solar collectors for domestic hot water (DHW), energy storage systems, and charging stations for electric vehicles allow a substantial part of the energy demand to be met from low- or zero-GHG emission sources. The actions shown in Table 3 have potential to markedly reduce GHG emissions in both newly built and existing buildings, whilst also enhancing their long-term sustainability.

Table 3: Overview of project types in the use stage

Project	GHG Reduction Potential / Scalability	MRV Feasibility	General Economic Viability of the Project (without carbon finance support)
Lighting and appliances			
Replacement of electrical appliances with significantly more energy efficient appliances	High	Energy labels and audits	Medium
Replacement of obsolete lighting systems with significantly more energy efficient systems	Medium	Measurable by reduction of electricity consumption	High
Installation of automatic lighting control systems	Medium	Sensor monitoring and usage data	Medium
Heating, ventilation and air conditioning (HVAC) and refrigeration			
Use of foaming agents in Ozone Depletion Potential (ODP)-free systems	High	Technical product certification and traceability	Medium

Installation of energy-efficient Refrigeration and Air Conditioning (RAC) equipment with energy performance significantly above the current baseline	High	Consumption data and technical specifications	High
Installation of waste heat recovery systems to recover heat from central chillers	High	Measurable by heat balance and avoided consumption	High
Replacement of electric geysers with energy efficient heat pumps (powered by low-carbon electricity)	High	MRV for energy consumed vs. energy delivered	High
Replacement or rehabilitation of steam and condensate systems	Medium	Thermal audits and system efficiency	Medium
Renewable and low-carbon energy consumption			
Installation of solar collectors for domestic hot water, solar PV, and storage systems and as a direct replacement of existing energy sources that are based on fossil fuels or inefficient systems	High	Measurable heat output and energy monitoring tools	Medium
"Smart buildings", demand side management (DSM) and load-shifting			
Installation and use of Smart Metering systems, smart grids and IoT integration in buildings that currently do not use such optimisation systems	High	Real-time data and energy optimisation	Low
Introduction of energy management processes for automated demand side management and load shifting	Medium	ISO 50001 type certifications and operational monitoring	Medium
Old buildings			
Renovation/rehabilitation of existing buildings to improve the energy use efficiency of the building	High	Energy audits before and after intervention	Medium
Implementation of measures to improve the thermal insulation of roofs and external walls which have significant inefficiencies in the insulation of heat energy	High	Verifiable by physical inspections and changes in energy consumption	High
Implementation of high-technology glass façades that minimise heat absorption and reflection, as a replacement to standard glass material, and which contribute to substantially better energy use and reduction of unwanted insolation	Medium	Measurable through thermal simulations and building energy performance	Low
New low- and zero-emission buildings			
Development of best practice new and zero-emission buildings, that have very low energy demand and emissions, in jurisdictions where such energy performance goes far beyond what is required by regulatory and policy frameworks	High	Measureable via building energy performance, meters and audits	Medium

Uptake and formal implementation of Green Certification systems, which directly lead to energy savings	High	Verifiable according to the applied standard	High
Engagement with Nature-based Solutions			
Adoption of energy efficient building envelope (green) infrastructure, such as green (vegetation) roofs which offer improved shading and thermal performance and promote local biodiversity	Medium	Methodologies are in a nascent stage; but typically include baseline comparisons and/or energy simulation models	Medium

3.3.4. End-of-Life Stage

For buildings at their end-of-life stage (decommissioning, demolition, dismantling), mitigation opportunities focus on circular approaches that retain or recover material value and thereby avoiding emissions from producing new primary materials. In this sense, updates to building codes should be oriented towards facilitating the separation and reuse of materials during the dismantling or rehabilitation phases, as well as integrating recycling practices (see Table 4).

Direct reuse of prefabricated and structurally sound components (e.g. steel beams, aluminium elements) preserves their embedded emissions of materials with minimal further processing. Because structural integrity is maintained, GHG benefits are high and can be realised relatively quickly once materials re-enter the contruction cycle. Recycling construction and demolition materials – such as crushing concrete into aggregates or recovering metals – also displaces primary materials but typically delivers lower emission reductions due to the additional processing required. For this reason, reuse and recycling are treated separately: both contribute to circularity, but they differ in technical requirements, costs, and mitigation potential.

Waste-to-energy pathways and e-waste recovery are not included here, as both have limited relevance to the buildings sector under Article 6 and low attributable mitigation potential.

Table 4: Overview of project types in the end-of-life stage

Project	GHG Reduction Potential / Scalability	MRV Feasibility	General Economic Viability of the Project (without carbon finance support)
Circular approaches to building materials			
Reuse of prefabricated and structurally-sound components during demolition for direct reuse in new buildings, reducing the demand for new materials.	High	Design, inventory, and component lifecycle control	High
Recycling of construction materials and demolition waste into secondary materials to substitute primary materials in new construction.	Medium	Measurement of recovered volumes and certified recycling rates	Medium

4 | Metho-dologies

4. METHODOLOGIES: ARE THEY FIT FOR PURPOSE?

Are there sufficient methodologies to implement Article 6 projects on buildings? This section reviews selected methodologies from the CDM and voluntary carbon market standards that are relevant. The aim is not to provide an exhaustive list, but to highlight potential approaches that illustrate how emission reductions can be credited, their applicability across the building lifecycle, with a view to their potential use under Article 6 mechanisms.

4.1. Methodological foundations: from CDM and voluntary markets to new approaches

Determining baselines, monitoring project emissions, and quantifying additional and creditable emission reductions is required for mitigation projects. These approaches have been developed in earlier carbon market mechanisms, especially the CDM and voluntary carbon market standards such as Verra's VCS and the Gold Standard. Their application under Article 6 may require adaptation to new rules on host-country authorisation, corresponding adjustments, and alignment with NDCs.

In terms of robustness, most existing methodologies – particularly those developed under the CDM, and to a lesser extent those from other standards – have already been extensively scrutinised and refined by stakeholders and experts. This means there is limited room for further strengthening in terms of methodological accuracy or integrity. At least for Article 6.4 projects, new methodologies are likely to lean heavily on this CDM foundation and apply a similar level of stringency.

4.1.1. CDM as the primary reference

The CDM framework remains the most established source of applicable methodologies. Figure 4 from the UNFCCC CDM Methodology Booklet[21] lists methodologies related to energy efficiency interventions in households and the buildings sector, with the most frequently used ones circled in red, representing the most tested methodologies. Methodologies that are applicable to interventions that address emissions deriving from industrial processes related to production and manufacturing building materials are however not included in this table.

Box 5: CDM methodology types and numbers

The CDM categorises methodologies as AM, ACM, and AMS, indicated by their numbering:

- **AM = Approved Methodologies (large scale CDM)**: Developed and applicable to single project or a Programme of Activities (PoA) - project activities that involve multiple, geographically dispersed actions, such as renewable energy projects or energy efficiency improvements in buildings across different locations.
- **ACM = Approved Consolidated Methodologies**: Developed by consolidating and streamlining existing methodologies, aiming to simplify the process for project developers.
- **AMS = Approved Small-Scale Methodologies**: Developed specifically for project activities resulting in relatively small emission reductions, often with simplified procedures and less stringent requirements.

[21] UNFCCC (2022). CDM Methodology Booklet. https://cdm.unfccc.int/methodologies/documentation/meth_booklet.pdf

Figure 4: Methodologies for household and building energy efficiency (Source: CDM Methodology Booklet)

4.1.2. Voluntary carbon market standards

Aside from the CDM, several VCM initiatives have developed their own standards and methodologies. Some of these standards are less robust than CDM and may not qualify for Article 6.4. These could, however, still be relevant for Article 6.2.

On the high-quality end of the voluntary carbon market, initiatives include:

- Gold Standard (GS)
- Verra's Verified Carbon Standard (VCS) programme
- American Carbon Registry (ACR)
- Joint Crediting Mechanism (JCM)

The first three initiatives are independent, international initiatives, while the JCM is a mechanism set-up by the government of Japan to work with other countries on a bilateral basis. It is used as an Article 6.2 pilot programme and will be aligned with Article 6.2 in the future.

4.1.3. Status of methodologies under Article 6

Article 6.2: Requirements and methodologies are agreed bilaterally between countries and can vary. In practice, many are expected to align with Article 6.4-approved methodologies or draw from CDM and voluntary market experience. Regardless of the source, eventually any methodology must be approved under Article 6.4 in order to be applicable.

Article 6.4: No project-specific methodologies have yet been approved, but generic standards to determine baseline emissions and additionality have been adopted. New methodologies are expected to build on and be adapted based on existing CDM methodologies.

While Article 6.2 projects can use different methodologies than Article 6.4 projects, it is likely that Article 6.4 approved methodologies can also be used for Article 6.2.

4.1.4. Boundaries and leakage

A core requirement of any Article 6 methodology is to establish a **clear project boundary** for the activity and its source of emissions. This ensures that emission reductions are calculated against a consistent and transparent baseline.

In the buildings sector, boundaries are not limited to the physical site of a building but extend across **Scopes 1–3 categories described in Box 4 under Section 3.1**. For example, replacing a gas boiler with a heat pump reduces on-site emissions (Scope 1) but may increase emissions from the power sector (Scope 2) if the electricity generation is fully or partly fossil fuel based. Similarly, the embodied carbon of materials (Scope 3) must be considered when assessing mitigation potential.

Article 6 methodologies therefore require:

- **Baseline definition** – establishing expected emissions without the intervention.
- **System boundaries** – clarifying which emissions sources are included (onsite and upstream/downstream).
- **Leakage assessment** – identifying potential displacement of emissions outside the system boundary due to the intervention.

Comprehensive accounting across all relevant scopes ensures that credited reductions are real, additional, and not undermined by hidden increases elsewhere.

4.1.5. Combining methodologies within one project

While some methodologies have a narrow applicability (such as those for cookstoves, HFCs from refrigerators, or energy-efficient elevators), others cover a broader range of measures or can be applied in combination. For example, methodologies such as AMS-II.E or AMS-II.Q combine building efficiency improvements with fuel switching or renewable energy measures, thereby increasing the potential scale of emission reductions. The overall scope can also be expanded by combining different methodologies for projects that implement multiple measures – such as district heating together with the construction of buildings that do not use fossil fuels.

However, combining methodologies also increases complexity. Separate baselines must be developed for each activity, additional data must be monitored, and different additionality tests may apply. [22] Despite these challenges, experience shows that this approach is feasible: of around 8,200 currently registered CDM projects, more than 580 have successfully used more than one methodology (2-4), including at least 34 projects related to buildings.[23]

4.1.6. Policy crediting

Emission reduction measures can also, in principle, be credited when they are introduced through new policies – provided they are not already mandatory under existing legislation[24]. If a measure is legally required and effectively enforced, then the resulting emission reductions would generally not be considered additional. To address this, the Gold Standard has developed a *policy crediting approach* under which emission reductions can be credited if it can be demonstrated that carbon finance is necessary for the new policy to be adopted and implemented.[25] Eligible emission reductions must be directly attributable to the policy and meet the standard requirements for activity eligibility and use of approved methodologies. If credits are authorised for use under Article 6, they must also comply with the Gold Standard's requirements for such credits.

Under this approach, credits are generated through a registered *Policy-based Programme (PBP)* that provides the framework for design, certification, and monitoring. Within the PBP, a variety of measures or technologies can be credited as *Policy-based Activities (PBAs)*.[26] For both the overall programme and each individual activity, financial additionality must be demonstrated to show that implementation would not have occurred without carbon finance.[27] The developed 'Policy Requirements and Procedures'[28] and 'Tool for Determining the Additionality of a Policy' address additionality testing, baseline setting and the relationship with NDCs for policies to be credited. The approach is currently being piloted in selected countries[29].

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[22] For example, under the CDM guidelines were developed for a PoA for urban areas, that would potentially combine a dozen methodologies to address emissions related to urban transport, energy generation and energy efficiency in buildings and waste management and wastewater. This was, however, ultimately not taken forward any further (see: https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20190520161053696/MP79_EA05_Guideline_Urban_CDM.pdf).

[23] Energy efficiency in buildings, efficient appliances, solar lamps, solar water heaters, district heating, cookstoves. Including 'domestic manure' projects increases the number to ~70.

[24] Or other jurisdictions that can impose such requirements (sub-national regions, such as states, provinces, or cities).

[25] GoldStandard: https://globalgoals.goldstandard.org/standards/Policy-Requirements-and-Procedures-Summary-and-Guidance.pdf; https://globalgoals.goldstandard.org/pilot-policy-requirements-and-procedures/

[26] For example, a renewable energy subsidy programme (the policy) can register different PBAs for run-of-river electricity generation and one for wind-battery energy. Once one type of PBA is registered, additional projects in the same category (implementing the same technology) can be added, as the policy incentivises additional implementation over time.

[27] This involves both financial and investment analysis or a barrier analysis, and a common practice assessment in line with the additionality tool. Standardised approaches such as positive lists can be used to demonstrate additionality.

[28] The Policy Requirements and Procedures, developed as part of the initiative 'Development of Paris Agreement Compliant Carbon Standard for Policy Approaches', supported by the Global Green Growth Institute (GGGI).

[29] A joint initiative between GGGI and Gold Standard has identified Indonesia, Morocco, Senegal, and Vietnam as pilot countries for advancing policy crediting approaches under Article 6. See Perspectives Climate Group (2024). Methodological challenges of policy crediting under Article 6 of the Paris Agreement – Discussion Paper. Available at: https://perspectives.cc/wp-content/uploads/2025/03/CMM-WG_Art6-Policy-Crediting-Paper_2024-1.pdf.

4.2. Selected methodologies by lifecycle stage

There is a wide range of potential project types in the buildings sector. Each will involve different types of methodologies to be deployed for calculating emission reductions. The following presents a review of existing methodologies from CDM and selected high-quality voluntary crediting programmes that can serve as examples of applicable standards for Article 6 projects.

With adaptations specific to Article 6 – such as authorisation of ITMO transfer and corresponding adjustments – these methodologies can help ensure credible emissions reductions while fostering effective international cooperation under the Paris Agreement.

4.2.1. Production stage

As described in Section 3.3.1, this typically refers to the production of building materials, either by using alternative raw materials in the manufacturing process or by addressing the energy sources used during production. Especially relevant for the buildings sector are the **large-scale methodologies addressing cement production** and potential substitutes as presented in Table 5.

Annex II provides an overview of the available and most relevant CDM methodologies for energy efficiency, fuel switch (including renewable energy) and process emission interventions in the industry. This includes both sector-specific methodologies and cross-cutting methodologies that are applicable to the industry. For the latter, sectors in which the methodologies have been applied are also listed.

Table 5: Overview of project types and available methodologies in the production stage

Project type	Available methodology
Reducing process emissions (e.g. in clinker/lime/cement production or aluminium production)	
Fossil fuel substitution in cement, lime, and aluminium/steel production	**ACM003 (CDM):** Substitution of fossil fuels in cement or quicklime manufacturing. Applicable to other energy-intensive processes like steel/aluminium where similar baselines exist.
Clinker substitution / blended cement production	**ACM0005 (CDM):** Large-scale energy efficiency in cement through blending, MRV based on measured energy savings and emissions reductions. Additionality stems from demonstrating financial barriers.
	AM0121 (CDM): Emission reduction from partial raw material switching and increased additives in blended cement, reducing use of raw materials containing calcium and/or magnesium carbonates (e.g. limestone) to produce clinker.
	ACM0015 (CDM): Partial or full switch to alternative raw materials that do not contain carbonates in the production of clinker in cement kilns in existing and Greenfield cement plants, with or without additional energy efficiency measures.
Carbon capture and utilisation in concrete production	**VM0043 (Verra):** CO_2 Utilisation in Concrete Production methodology. Reduces emissions by capturing waste CO_2 and mineralising it into concrete products, thereby lowering cement use and permanently sequestering CO_2. Such projects may face obstacles such as delays in regulatory approvals, high costs associated with CO_2 capture technologies, time-consuming quality control procedures, and market fragmentation.

Industrial energy efficiency and fuel switching (cross-cutting for cement, metals, other building materials)	**AMS-II.D (CDM):** Methodology for energy efficiency and fuel-switching in industrial facilities. It applies to single or multiple sites in sectors such as cement, steel, or mining. Eligible activities include: • **Process improvements** at specific production steps (e.g. kilns, furnaces) or across multiple processes (e.g. integrated production lines). • **Upgrades to energy conversion equipment** (e.g. boilers, motors) that supply heat, electricity, or mechanical energy within a facility.

4.2.2. Construction stage

The construction stage covers interventions that directly reduce emissions during the building process. The methodological review shows that applicable methodologies are limited. Only measures related to the replacement of conventional construction vehicles and machinery with renewable electricity, hybrid, or biofuel-powered alternatives are covered by methodologies that allow monitoring through fleet and energy consumption records. For other project types identified in Section 3.3.2, such as nature-based solutions (e.g. green roofs), no directly relevant methodologies were found.

Table 6: Overview of project types and available methodologies in the construction stage

Project type	Available methodology
Transport of building materials (e.g. ready-mix concrete delivery, use of local materials to reduce transport demand)	No directly applicable CDM/Article 6 methodologies identified. There are examples of concrete suppliers who are introducing and testing electrical trucks that transport ready concrete from mixing site / factory to construction sites. The use of locally produced materials is also one way to reduce these emissions. These options are however not reflected in specific CDM methodologies.
Fugitive emissions from refrigerants or sealants	Existing methodologies for refrigerants (e.g. CDM HFC recovery) apply to use stage, not construction.

4.2.3. Use stage

The use stage refers to the emissions that occur as a result of the use and operation of a building. These are typically interventions that address the quality of the building envelope and the energy efficiency of measures and appliances such as cooling or heating systems, lighting systems and any electricity-consuming equipment. In special cases, GHGs with a high GWP such as refrigerants (HFC gases) can also be included in the use stage.

Table 7: Overview of project types and available methodologies in the use stage

Project type	Available methodology
Whole building energy efficiency & fuel switching	
Energy efficiency & fuel switching in new/existing buildings (HVAC, renewables)	**AM0091 (CDM):** Supports energy efficiency and fuel switching in new buildings through interventions like efficient HVAC and renewable energy systems. MRV relies on baseline comparisons and energy audits, while additionality is demonstrated via barrier analysis like cost.

Project type	Available methodology
Small-scale energy efficiency & fuel switching in buildings	**AMS-II.E (CDM):** Small-scale methodology for energy efficiency and fuel-switching measures in buildings. MRV includes fuel consumption tracking and emissions factor application. Additionality linked to going beyond local norms.
Energy efficiency and/or energy supply projects in commercial buildings	**AMS-II.Q:** Combines energy efficiency with renewable energy in commercial buildings. MRV based on metered energy savings and renewable outputs. Additionality depends on exceeding regulatory baselines or overcoming technological barriers.
Weatherisation of residential buildings (insulation, appliances)	**VM0008 (Verra):** Improves insulation, air sealing, and the replacement of inefficient appliances, including heating and cooling systems, in single- and multi-family buildings. MRV options include performance or project method, with monitoring via adjusted baselines or consumption data. Barriers include high upfront costs, limited contractor capacity, and resident resistance.
Commercial building retrofits (efficient boilders, heat pumps, LEDs)	**VN_AM003 Ver1.1 (JCM)**: Improves the energy efficiency of commercial buildings by installing high-efficiency boilers, heat recovery heat pumps, and LED lighting. Barriers include high equipment costs, technical complexity in retrofitting existing buildings, limited availability of suitable equipment, and lack of regulation. MRV based on energy savings.
Double-bundled modular heat pumps for new buildings	**ID_AM010 Ver2.0 (JCM):** Introduces double-bundle modular electric heat pumps for simultaneous heating and cooling in new buildings. Comprehensive MRV covers heating/cooling outputs, electricity, and supplementary fuel. Data is collected through meters, equipment logs, and temperature sensors to accurately calculate emission reductions. Barriers include high capital cost, refrigerant availability, and integration challenges.
New residential buildings (holistic EE + RE)	**Energy Efficiency and Renewable Energy Measures in New Residential Buildings (Verra):** Emphasises holistic performance improvements in new residential projects. MRV tracks design innovations and energy system performance. Additionality is ensured barrier analysis.
Appliance & equipment efficiency	
Energy efficiency and HFC-134a recovery in residential refrigerators	**AMS-III.X (CDM):** Targets residential refrigerators. Replacement of existing, functional domestic refrigerators by more-efficient units and recovery/destruction of HFCs from the refrigerant and the foam.
Elevator energy recovery systems	**Energy-Saving through Elevator Regenerative Power System Implementation methodology (Gold Standard):** Captures and reuses energy lost during elevator braking. Barriers include high capital costs of equipment, technical difficulties in integrating the systems into existing buildings, a lack of regulatory incentives, and limited market awareness.
Improved cookstoves	**Simplified Methodology for Clean and Efficient Cookstoves (Gold Standard)**: Replaces traditional, inefficient cooking stoves with modern, cleaner-burning alternatives that meet specified thermal efficiency and emission standards. Barriers include high upfront stove/fuel costs, user reluctance, rural supply chain gaps, and stove maintenance challenges.

4.2.4. End-of-life stage

The end-of-life stage refers to emissions that arise from the demolition of existing buildings and the treatment of building materials that are either disposed of or reused and recycled in new construction projects. Emissions from production and manufacturing of new building materials can be fully or partially avoided if materials from existing buildings are recycled or reused. In some cases, the main structures of "old" buildings can be retained and integrated into new projects on the same site.

Table 8: Overview of project types and available methodologies in the end-of-life stage

Project type	Available methodology
Reuse and recycling of construction materials	**Gold Standard – Recovery and Recycling of Materials from Solid Wastes methodology:** Supports diversion of materials such as metals, plastics, and minerals from landfills or incineration, for recycling and reuse in new building projects. Reduces demand for new raw materials and the associated GHG footprint of construction. Projects must show additionality via financial or barrier analysis, proof of low market uptake (<20%), and compliance beyond legal requirements. Barriers include high system costs, integration issues with existing infrastructure, lack of regulatory mandates, and limited market awareness.

4.3. Gaps and challenges in the existing methodologies

While a range of methodologies from the CDM and voluntary carbon markets are available for building-sector mitigation, their coverage and applicability under Article 6 remains limited. The table below provides an overview of selected methodologies, mapped against the building lifecycle stages they address. To avoid confusion with project-level considerations (to be discussed in Section 5), the table focuses only on methodology, lifecycle stage, and key comments. The comments highlight gaps, limitations, or special considerations that affect the usability of the methodology for Article 6 projects.

Table 9: Summary of key building-sector methodologies and identified gaps

Methodology	Lifecycle stage	Scope	Key limitations
ACM0005 – Increasing Blend in Cement Production[30] (CDM, version 5)	Production	Promotes blended cement to reduce clinker-related emissions	Few active projects; benchmarking limits comparability; lacks linkage to downstream building use
CO2 Utilisation in Concrete Production (Verra)	Production	Enables CO_2 capture and mineralisation in concrete curing	Limited to specific processes (e.g., carbonation curing); high data intensity; narrow applicability
Carbon Sequestration Through Cultivating Hemp (Verra, draft)	Production	Captures CO_2 via hemp biomass for material use	Methodology incomplete; uncertain permanence and lifecycle accounting
AMS.II.C - Demand-side energy efficiency activities for specific technologies (CDM, version 1)	Use	Covers retrofit and replacement of energy-efficient equipment	Not building-specific; capped at 60 GWh/year; outdated scope.
AMS-II.E - Energy efficiency and fuel switching measures	Use	Efficiency and fuel-switching measures in	60 GWh/year cap; excludes renewable energy integration

[30] https://cdm.unfccc.int/methodologies/DB/0QRWHIPKB7OKC5QBO6DBQPG6NUFIIK/view.html

for buildings (CDM, version 16)		residential and commercial buildings	
AM0091 - Energy efficiency technologies and fuel switching in buildings (CDM, version 4)	Use	Focuses on insulation and passive design	Excludes biomass fuels; outdated technical scope
AMS II.J - Demand-side activities for efficient lighting technologies (CDM, Version 4)	Use	Promotes efficient lighting replacements	Narrow focus; requires proof of additionality; subject to 60 GWh/year cap
AMS-III.AE – EE & renewables in residential buildings (CDM, version 2.0)	Use	Integrates EE and renewable energy in new housing	Complex baselines; limited to residential sector
GS Clean and Efficient Cookstoves (Gold Standard)	Use	Improves stove efficiency and reduces emissions	Requires on-site verification; limited scalability and relevance to buildings
GS Elevator Regenerative Power System (Gold Standard)	Use	Captures regenerative energy from elevator motion	Niche application; minimal whole-building impact
VM0008 – Building Weatherisation (Verra)	Use	Reduces thermal losses through envelope improvements	Data-heavy baseline requirements; limited multi-measure integration
Energy Efficiency in Commercial Buildings (JCM, VN_AM003 v1.1)	Use	Improves efficiency of commercial equipment and systems	Narrow equipment scope; limited transparency and regional applicability
Introducing Double-Bundle Modular Electric Heat Pumps (JCM, ID_AM010 v2.0)	Use	Promotes efficient electric heat pumps in new buildings	Applies only to new builds; excludes retrofits and hybrids
GS Recycling of Materials from Solid Wastes (Gold Standard)	End-of-life	Supports recovery and recycling of waste materials	Not specific to construction waste; limited lifecycle integration

A common challenge across all phases is the demonstration of additionality. This remains a barrier for many building-sector projects. Under CDM and Article 6.4, strict rules apply, typically requiring investment analysis, while Article 6.2 allows greater flexibility, enabling approaches such as barrier analysis or positive lists (see Chapter 2). This flexibility could increase the viability of building-sector projects under Article 6.

In summary, the review shows that while methodologies for direct emissions (Scope 1) and purchased energy (Scope 2) are relatively mature, major gaps remain in addressing indirect emissions (Scope 3). Key findings include:

- **Use stage – relatively mature:** Methodologies are well established for energy efficiency and electrification measures (HVAC, lighting, appliances, and efficient building envelopes), covering the largest share of building emissions. These are relatively cost-effective and applicable to both new and existing buildings.
- **Production stage – partially covered:** Some methodologies exist for cement, steel, and lime, with growing pilots for low-carbon and bio-based materials (e.g. timber, hempcrete, bamboo). However, most apply at the industry level, not specifically to buildings, and coverage of innovative materials (e.g. CCU, advanced composites) remain limited.

- **Construction stage – major gaps:** Very few methodologies address emissions during construction. Options such as electrification of machinery or low-carbon vehicles lack direct methodologies, and attribution of reductions to buildings is complex.
- **End-of-life stage – major gaps:** Only generic waste-sector methodologies exist (e.g. for recycling or recovery of materials), with limited applicability to building demolition or reuse of materials. MRV is costly and long time horizons weaken viability.

4.4. Recommendations for improving the methodology toolbox

The review in the previous sections has shown that while a number of methodologies from the CDM and voluntary carbon markets are available for buildings sector mitigation, their coverage is uneven, their applicability can be narrow, and important gaps remain. The following recommendations can contribute to a meaningful role of the buildings sector under Article 6.

Simplifying CDM/Article 6.4 methodologies for Article 6.2 projects

Countries participating in Article 6.2 can agree to accept simplified MRV methodologies and additionality tests. This could entail specifying for which types of projects the simpler additionality and/or MRV options outlined in the existing methodologies would be eligible. This could be complemented by the development of positive (and/or negative) lists to determine additionality. It should be kept in mind that all Article 6.2 methodologies need to be approved by both participating countries, so also by the country buying the ITMOs. To this end, a host country would be best placed if it has a range of eligible methodologies to match with corresponding requirements of different buying countries.

Expanding methodological coverage across the building lifecycle

As stressed in Section 4.4, most existing methodologies focus on the use stage of buildings, particularly on energy efficiency and fuel switching measures. By contrast, methodologies for the production stage (e.g. low-carbon materials), the construction stage, and the end-of-life stage are far less developed. Expanding methodological coverage would make it possible to capture the full mitigation potential of the sector.

Developing methodologies to overcome typical building sector challenges, including split incentives

As highlighted in Section 3.2, the landlord–tenant divide remains a major barrier for energy efficiency investments, since the party paying for upgrades is often not the one benefiting from reduced energy costs. Methodologies should therefore explore the integration of contractual and financing approaches such as shared savings, on-bill financing, energy performance contracts, or energy savings insurance. Embedding these mechanisms in Programmes of Activities would allow wider replication and reduce transaction costs.

Developing methodologies for the quantification of additional emission reductions in new buildings

Challenges exist in establishing credible baselines for new buildings, i.e. determining the most likely development of new buildings' energy performance and carbon footprint. This is especially the case where building codes or efficiency standards exist but are unevenly enforced. Methodologies should provide guidance on how to define baselines in different legislative contexts and determine when project activities genuinely exceed business-as-usual practice. This would ensure that Article 6 activities in new construction deliver measurable and credible mitigation outcomes.

Exploring opportunities for digital MRV and innovation

Looking forward, methodologies could also incorporate digital solutions – such as smart meters, remote sensing, and blockchain-based registries – to reduce costs and improve transparency. These innovations, though not yet widely applied, would help address barriers related to high monitoring costs and the challenges of monitoring-dispersed activities.

5| Viability

5. VIABILITY: WHICH BUILDING-SECTOR PROJECTS MIGHT QUALIFY FOR ARTICLE 6

5.1. Key viability considerations under Article 6

The barriers outlined in Section 3.2 explain why many building-sector mitigation measures remain difficult to implement. Article 6 brings an opportunity to enhance the viability of some of these projects. At the same time the mechanism comes with additional requirements that influence their viability under Article 6. Still, some activities are more suitable than others, provided they can demonstrate that carbon finance is essential, that emissions are verifiable, and that emission reductions are replicable and scalable. Viability in this context refers to the likelihood that a project type can deliver credible, cost-effective emission reductions at scale that qualify under Article 6.

To provide a structured assessment, **four key dimensions** of viability are proposed:

1) **Economic viability: *Is the project financially attractive enough to invest in?*** Any project must be able to cover its costs and meet certain minimum criteria for the economic returns on the investment made. This can be shown by a positive net present value (NPV) or acceptable internal rate of return (IRR). Projects that do not meet these investor requirements are not considered economically viable. However, under Article 6, revenue from carbon credits may be sufficient to improve the project's NPV or IRR and enhance its viability. In this case, the transaction costs of participating in Article 6 should also be included in the investment analysis (developing required documentation, obtaining approval, additional monitoring and verification costs).

2) **Additionality**: ***Does the project create environmental impact that would otherwise not be achieved?*** For a project to be considered additional, it must result in GHG emissions reductions that would not have occurred without Article 6 support. This means emissions after project implementation need to be below the emissions in the most likely baseline, the situation that is most likely to occur in absence of the project. The project must ensure real, measurable, and long-term benefits while avoiding leakage of emissions outside the project's system boundaries. Additionality can be demonstrated by means of an investment analysis showing the credit revenues tipping the balance of the project's economic viability. Alternatively, for projects that meet the minimum economic viability criteria, additionality can be demonstrated by showing other barriers that prevent the project from being implemented in absence of the project. This can be legal constraints (e.g. limitations to using certain low-carbon materials under waste or safety regulations), technical barriers (e.g. lack of district heating infrastructure), lack of capacity (e.g. for installing heat pumps) or a lack of access to capital. Here the project would need to show how its design can overcome such barriers.

3) **MRV feasibility**: ***Can emissions be monitored accurately and transparently?*** The credibility of carbon market projects depends on showing that emission reductions are real, measurable, and verifiable. This requires the use of a methodology to monitor all relevant GHG emissions with sufficient accuracy and implementing the required processes and equipment to monitor and report them after project implementation on a regular basis. These monitoring reports

must be independently verified before credits can be generated. Together with a validated baseline (established in the project design phase), this demonstrates that interventions deliver additional and creditable emission reductions. Carbon market standards provide rules for setting baselines, monitoring project emissions, and verifying the results.

4) **Scalability and replication potential**: ***Can the project deliver emission reductions at sufficient scale?*** Projects are generally more viable under Article 6 when they achieve a significant scale of impact (i.e. the total size of emission reductions). This can be supported by selecting project types that either are large-scale by themselves (low-carbon manufacturing of building materials, large new construction projects) or that can be replicated and scaled up over time. This can be done by bundling multiple smaller interventions into larger scale project activities. The Programme of Activities (PoA) approach used under the CDM allows for this, facilitating also additional smaller interventions (e.g. additional building sites) to the PoA over time, increasing its scale.

The viability factors above also play a role in the host country's government determination of which project types are eligible for submission under Article 6. Most host countries are likely to want to use the more low-hanging fruits (projects that face fewer barriers) for their own NDC targets, leaving more complicated interventions to Article 6 projects (see also Section 5.3). Examples include using new low-carbon buildings for domestic action while allowing only low-carbon retrofits under Article 6, or limiting eligible renewable energy projects under Article 6 to those that include energy storage.

Table 10 summarises the key considerations for each **viability dimension**, along with the main implications for successful project design.

Table 10: Key viability dimensions and their implications for building-sector Article 6 projects

Viability dimension	Key Considerations	Implications for project design
Economic viability	• The higher the economic viability, the lower the chance the project is considered additional and/or eligible • Interventions in the building material production phase are often economically viable investments, but implementation (and additionality) will depend on local context (regulations, market acceptance) • High transaction costs can inhibit feasibility, especially for small-scale interventions • Programme-based approaches (e.g. bundling projects) reduce cost per unit of emissions reduction and allow for scaling up and replication	**Design the project in such a way that it overcomes (also) non-economic barriers** • Include innovative finance options to address access to capital and/or potential split incentives • Include measures that increase confidence in new technologies or materials, creating a market **Bundle distributed measures through programmatic approaches to reduce transaction costs** • Consolidate small projects where feasible to reduce costs • Use modular or phased approaches that allow for low-risk initial investments and scaling over time
Additionality	• The higher the economic viability, the lower the chance the project is considered additional and/or eligible • Overall, additionality tends to be easier to demonstrate in projects where interventions replace existing technologies or materials (replacing appliances, building retrofit) than for hypothetical new developments (new buildings) • A legal requirement (ban or mandate) does not necessarily mean a project is not additional if it can be shown that compliance with the requirement does not happen in practice • Demonstrating additionality through investment analysis is challenging, given the usually relatively small share in overall costs	**Design the project in such a way that it overcomes (also) non-economic barriers** • Include innovative finance options to address access to capital and/or potential split incentives • Include measures that increase confidence in new technologies or materials, creating a market **Ensure clear attribution of mitigation impact beyond BAU** • Focus on interventions where mitigation impact can be clearly attributed to the project • Demonstrate additionality, where needed by other means than investment analysis • Avoid relying solely on business-as-usual trajectories that may fail to capture significant jumps in the learning curve (technology improvements, reduced costs)

MRV feasibility	• Emissions of some gases and sources are inherently more difficult and/or expensive to monitor accurately, e.g. the release of F-gas emissions from insulation or cooling equipment • Monitoring energy consumption or emissions from distributed technologies (lights, appliances) can be burdensome • Depending on the baseline methodology, also data on technology implementation rates or energy use before implementation is needed • Project types with discrete energy impacts are better suited (e.g., equipment upgrades) as the impact (number of equipment replaced) is relatively easy to quantify • Whole-building projects can present challenges, as variables not controlled by the project (e.g. behaviour, levels of occupancy) can significantly affect total energy demand of a building, potentially leading to difficulties in determining the specific impact of a given project • Potential leakage of emissions to outside the project's system boundaries must be monitored as well	**Prioritise projects with measurable energy impacts** • Select technologies and interventions that allow for consistent, affordable monitoring • Avoid projects with MRV risks that are difficult to assess (e.g. for emissions outside core business, such as leakage, biological storage in wood products) • Go for projects that support affordable, verifiable monitoring methodologies • Select projects whose impact monitoring draws on reputable and official data, where possible **Address MRV challenges in project design and methodology selection** • Define system boundaries that include all relevant sources, including potential leakage • Do not claim emission reductions that add complexity and risks from an MRV perspective • Select methodologies that are standardised (simplified methodologies, default approaches) or allow flexibility
Scalability and replication potential	• Projects with higher total mitigation potential are more attractive economically and environmentally • Replicability and upscaling options enhance project attractiveness • Scalability and replicability depend on project design and methodology selection • Programmatic approaches allow for interventions to be replicated and added over time	**Maximise viability through scale** • Choose project types with large-scale or scalable emission reductions • Select approaches and methodologies that allow flexibility so that they can apply to different types of interventions as well as interventions that are spaced out over time

5.2. Viability: from economics and additionality to scalability and MRV

To be fit for purpose under Article 6, methodologies for building-sector activities must meet certain minimum requirements. These reflect the four viability dimensions described in the previous section. Here we outline the methodological implications and potential trade-offs between the different viability dimensions (see also Table 10).

5.2.1. Economic viability and cost-effectiveness: Designing proportionate methodologies

Transaction costs are a critical barrier for building sector activities, where individual interventions are often small in scale and widely dispersed. Methodologies must therefore be designed so that the effort of data collection, monitoring, and verification does not outweigh the expected carbon revenues. This requires proportionate requirements that are simple enough to be implemented in practice, while still ensuring environmental integrity.

To achieve this balance, methodologies should allow for streamlined monitoring approaches, such as using conservative default factors or standardised baselines, particularly for small projects. Aggregation mechanisms, including PoAs or other bundling approaches, are essential to spread transaction costs across many small interventions. Digital MRV tools can also help reduce costs while maintaining transparency.

5.2.2. Additionality: Balancing robustness and flexibility

Methodologies must provide clear and transparent procedures for demonstrating that emission reductions are additional to business-as-usual. The Article 6.4 additionality tool and many other approaches build on the CDM's Additionality Tool, which offers different options for proving additionality, such as investment analysis, regulatory analysis, or barrier analysis. Under Article 6.4, strict rules determine which options may be applied in which circumstances. Investment analysis is the default additionality test, unless it can be shown to be infeasible or inappropriate.

Article 6.2 leaves more flexibility for countries to select approaches that fit their context (see also Section 5.3). Alternative approaches – such as first-in-kind assessments, regulatory analysis, barrier analysis, or the use of positive/negative lists – may provide more appropiate additionality tests, providing practical and still robust options for certain project types. Whatever approach is used, it must be applied against the backdrop of national circumstances and the feasibility of achieving the host country's NDC targets as raised in Section 2.3.

5.2.3. MRV feasibility: Ensuring credible but practical monitoring

Robust MRV is central to the credibility of Article 6, but methodologies must reflect the realities of the buildings sector to be applied successfully. The more accurate the monitoring approach, the higher the transaction costs involved. This is especially true for projects in the use phase, where emission reductions often result from numerous small-scale measures – such as efficient light bulbs, boilers, or appliances – making it economically and practically unfeasible to meter each device individually.

To address this, methodologies must strike a balance between accuracy and practicality. Some existing approaches use actual energy consumption data to calculate emissions and reductions, while others allow the use of historical data, surveys, or default factors. Each option entails different levels of cost and accuracy. Simplified approaches, including the use of conservative default values, can therefore be important tools, particularly in the context of Article 6.2 projects where countries may have more flexibility to tailor MRV requirements to their national circumstances.

5.2.4. Scalability and replication potential: Moving from projects to systemic change

Methodologies should not only enable individual projects but also support replication and broader transformation of the buildings sector. This requires standardised approaches that can be applied across a wide range of building types and contexts, reducing the need for project-by-project customisation.

Aggregation mechanisms, such as PoAs or policy crediting approaches as described under Section 4.1.6, play a critical role in enabling scalability by allowing many small measures to be bundled together. Over time, methodologies should also evolve to accommodate systemic interventions – for example, promoting deep retrofits at scale or supporting the use of low-carbon construction materials. By doing so, they can move beyond isolated projects and help drive the structural changes needed for long-term decarbonisation of the sector.

5.3. Project eligibility under host government NDC and Article 6 strategy

Beyond methodological requirements, building-sector activities under Article 6 are also shaped by broader accounting rules and design choices. These rules determine how emission reductions are authorised, transferred, and accounted for in relation to national climate targets, and they strongly influence whether building-sector projects are considered viable under host-country strategies.

Corresponding adjustments

A central feature of Article 6 is the requirement for host countries to apply corresponding adjustments when emission reductions are transferred internationally. This ensures that the same reduction is not counted towards both the host country's NDC and an international buyer's target. For building projects, this implies that host countries must have the capacity to track and report reductions accurately, and that they are willing to adjust their NDC accounting to authorise such transfers.

Host country authorisation and strategies

For project developers, host country approval and authorisation are a prerequisite for transferring credits internationally, as it confirms that a corresponding adjustment will be made. This makes early engagement with the DNA or Article 6 focal point essential. At the same time, host countries face the challenge of developing strategies that balance NDC achievement with Article 6 participation. Selling large amounts of relatively cheap units could undermine their ability to meet their own climate targets, while overly restrictive strategies risk sidelining building-sector opportunities altogether.

Conditional NDC targets

Several countries have submitted conditional NDC targets that depend on the availability of international support, including carbon finance. In these cases, building-sector activities could play a role if they are explicitly recognised within national strategies. However, if Article 6 activities are authorised to meet conditional targets, care must be taken to avoid undermining the credibility of those targets or creating risks of double counting.

Article 6.2 versus Article 6.4 mechanisms

Article 6.2 allows for bilateral or multilateral cooperation between countries, using their own methodologies subject to international guidance, while Article 6.4 establishes a centralised UNFCCC mechanism with standardised procedures. For the buildings sector, the choice between these tracks has direct implications for methodological development and project design. Article 6.2 may provide greater flexibility and allow countries to adopt simplified additionality tests or MRV requirements, such as positive lists of eligible project types. Article 6.4, by contrast, offers stronger standardisation and oversight, but can be slower to adapt to the particularities of the buildings sector.

Flexibility and risks for project proponents

While greater flexibility under Article 6.2 can make building sector projects more feasible, it also creates risks. Because corresponding adjustments must be agreed by both host and buyer countries, the methodologies and approaches accepted in practice may vary across transactions. This can generate uncertainty for project developers and limit the ability to sell credits freely on a broad market. Transparent communication from host countries on eligible project types and clear buyer-country expectations are therefore essential to reduce these risks.

Taken together, these accounting and design considerations underscore that the viability of building-sector activities under Article 6 depends not only on technical methodologies but also on host-country policy choices and the evolving international rules framework.

6| Promising Article 6 Projects

6. CONCLUSION: PROMISING BUILDING SECTOR PROJECTS UNDER ARTICLE 6

Viability can vary widely across project types – depending on factors such as building materials, building use, building type (existing, residential, commercial, or public), location (urban or rural), and ownership (owner-occupied or rented).

Table 11 summarises the most promising projects, assessed against the four viability dimensions introduced in Section 5.1. Nevertheless, in practice every project needs to be assessed in its specific local context, for factors such as energy cost or CO2 intensity of local energy sources. The eligibility of activities also depends on how they interact with host country NDC targets and policy frameworks.

Based on the comparative viability assessment, four project types stand out as particularly promising candidates for Article 6 activities. These use-stage projects offer high mitigation potential, robust methodological coverage, and scalability, while addressing barriers that make carbon finance relevant. While material production projects have great potential scale and systemic impact, additionality and MRV for newer materials are slightly more challenging.

1. **Retrofits of commercial and public buildings:** Efficiency upgrades in lighting, insulation, and equipment offer strong potential for emission reductions. Moderate costs can be offset by the aggregation of projects through PoAs, while metered energy data ensures reliable MRV. In many contexts, these interventions go beyond existing standards, providing clear additionality.
2. **New low-carbon buildings and materials:** Designing new buildings with passive principles, optimised orientation, and high-efficiency building envelopes, using low-carbon construction materials, results in substantial energy savings and emission reductions across the supply chain. Integrated MRV at the design stage, combined with high scalability, supports large-scale carbon reductions. These projects are particularly additional where codes are limited, offering systemic impact across new construction and strong potential for Article 6 crediting.
3. **Heat pump installations:** Installing heat pumps to replace fossil-fuel heating or cooling delivers measurable energy savings and clear additionality in regions without widespread mandates. Though costs are medium and climate-dependent, programmatic approaches enable broad scalability. MRV is straightforward through metered energy or fuel displacement, making these projects particularly suitable for Article 6.
4. **Building-integrated systems:** Upgrading boilers, HVAC, and other building appliances enhances efficiency while providing measurable energy reductions. Costs are moderate at first, but aggregating projects at building or district scale maximises impact. Where regulations do not require such upgrades, additionality is high, and MRV via energy metering ensures reliable tracking of emission reductions.

Legend for the traffic-light system

🟢 High viability – strong methodological basis, clear additionality, manageable MRV and transaction costs, and potential for scale-up.

🟡 Medium viability – potential exists, but barriers remain (e.g. context-specific additionality, high MRV costs, or limited scalability). Success depends on national context and project design.

🔴 Low viability – major structural or methodological barriers (e.g. difficulty proving additionality, high transaction costs, or low overall mitigation potential). Unlikely to generate a significant amount of ITMOs under current conditions.

Table 11: Viability Matrix – Overview of building-sector project types and their viability under Article 6, mapped across the building lifecycle

Project type	Available methodologies[31]	Article 6 Viability Assessment				
		Economic viability & cost-effectiveness	Additionality	MRV feasibility	Scalability	Overall viability
Production Stage						
Reducing emissions from energy use in material production (efficiency, fuel switch, electrification)	CDM ACM0005 (cement fuel switch), AM0034 (power plants, applicable cross-sector), Verra VM0033 (cement & lime); methodologies exist for steel, aluminium, bricks	Medium (depends on fuel/technology costs)	Medium (varies by material; financial additionality issues)	High (well-established MRV)	High (large-scale in cement[32]/steel[33])	**High**
Production of new low-carbon materials (e.g. alternative binders, advanced composites, bio-based materials such as timber, hempcrete, bamboo)	Limited methodologies under CDM/Verra; some pilots for alternative binders, hemp, biochar and composites, but no consolidated approach yet	Medium (costly today, but improving)	Likely (not mandated, market confidence issues)	Medium (depends on material type and data availability)	High (large potential if markets grow)	**High[34]**
Reduction of process emissions[35] (clinker substitution, lime production, aluminium PFCs)	CDM methodologies for clinker substitution (ACM0005), lime production efficiency; Verra methodologies under development for process emissions	Medium (high costs for some technologies)	Medium (depends on tech maturity and context)	Medium (cement relatively robust, others weak)	Medium (large potential for cement, small for others)	**Medium**

[31] More methodologies may exist, especially for domestic of bilateral crediting programmes. Here the more commonly accepted ones are listed.
[32] Host countries may consider this to be a relatively easy measure to use for meeting national (unconditional) NDC targets.
[33] Experience with electrification and hydrogen-based steel production is still relatively limited.
[34] While methodologies and market acceptance are still developing, these materials offer significant long-term mitigation potential at scale. The overall viability rating therefore reflects their strategic importance under Article 6, even though near-term barriers remain (e.g. standards, durability, and certification).
[35] Process emissions refer to chemical reactions in material production (e.g. clinker calcination, lime production, aluminium electrolysis), not emissions from the combustion of fuels.

Project type	Available methodologies	Article 6 Viability Assessment				
		Economic viability & cost-effectiveness	Additionality	MRV feasibility	Scalability	Overall viability
Construction Stage						
More efficient vehicles / construction equipment	No dedicated methodologies; closest analogues CDM AMS-III.C (*low-GHG vehicles*) or AMS-III.AA (*transport energy efficiency*)	🔴 Low (small scale, marginal savings)	🟢 Likely (not usually covered by policies, small share of costs)	🟢 High (easy to monitor fuel consumption in captive fleets)	🔴 Low (few projects, limited sector impact)	🔴 **Low**
Fuel switch / electrification of construction equipment	No dedicated methodology; could draw from CDM AMS-III.AA (transport) or stationary fuel-switch methodologies	🔴 Low (electrification costly; small scale)	🟡 Medium (high for electrification; fuel switch context-specific)	🟢 High (captive fleet MRV feasible)	🔴 Low (few projects, context dependent)	🔴 **Low**
Use[36] Stage						
Commercial / public building retrofits	CDM AMS-II.Q (EE + RE in commercial), CDM AM0091 (design / EE measures in non-residential), JCM VN_AM003 (efficient commercial equipment)	🟡 Medium (high upfront cost)	🟢 Likely	🟢 High (metered data)	🟢 High (larger-scale, fewer stakeholders)	🟢 **High[37]**
Heat pump installation (new/existing)	JCM ID_AM010 (heat pumps in new buildings), CDM AM0091	🟡 Medium (costly, climate-dependent)	🟢 Likely	🟢 High (metered fuel displacement)	🟢 High (scalable via PoAs)	🟢 **High**
Building-integrated appliances (e.g. boilers, HVAC)	CDM AMS-II.C (EE equipment), JCM EE methodologies	🟡 Medium (depends on retrofit/new build; higher upfront costs)	🟢 Likely (higher investment barriers)	🟢 High (metered energy savings possible)	🟢 High (aggregation feasible at building level)	🟢 **High**
New low-carbon building (passive design, insulation, orientation)	CDM AM0091 (building efficiency); JCM ID_AM009 (efficient building envelopes)	🟡 Medium (costs vary by context)	🟢 Likely (codes limited in many countries)	🟢 High (MRV system can be integrated in design)	🟢 High (scalable across new builds)	🟢 **High[38]**

[36] Ownership barrier: In leased/rented buildings, split incentives between landlords (who pay for upgrades) and tenants (who benefit from lower bills) remain a major viability constraint across all use-stage activities.
[37] Commercial and public buildings are more viable than residential – larger scale, fewer stakeholders, easier MRV.
[38] Establishing robust baselines can be challenging where building codes exist, yet the scalability and long-term mitigation potential of such measures are very high. The overall viability rating reflects their strategic relevance under Article 6, even though short-term methodological and cost barriers persist.

Project type	Available methodologies	Article 6 Viability Assessment				
		Economic viability & cost-effectiveness	Additionality	MRV feasibility	Scalability	Overall viability
Efficient lighting replacement	CDM AMS-II.J (lighting in existing buildings)	🟢 High (quick payback)	🟡 Medium (challenging if standards exist; often assumed to happen anyway)	🟢 High (but depends heavily on project design and MRV aggregation)	🟡 Medium (distributed and small-scale, market saturation risk)	🟡 **Medium**
Residential whole-building retrofits (insulation, HVAC, appliances, weatherisation)	CDM AMS-II.E (EE in buildings), CDM AM0091 (building design efficiency), Verra VM0008 (weatherisation)	🟡 Medium (PoAs reduce costs)	🟢 Likely	🟡 Medium (dispersed measures)[39]	🟢 High (large-scale if aggregated)	🟡 **Medium**
Consumer appliances (e.g. refrigerators, washers)	CDM AMS-III.X (HFC-134a recovery from fridges), JCM EE methodologies	🟢 High (quick payback, but varies with age of equipment)	🟡 Medium (weaker if MEPS/regulations exist; often faces additionality concerns)	🟢 High (possible with robust MRV, but costly to aggregate)	🟡 Medium (scale limited per appliance, high transaction costs)	🟡 **Medium**
Improved cookstoves (urban/peri-urban)[40]	GS cookstove methodology	🟡 Medium (transaction costs, small units)	🟢 Likely (clear additionality)	🟡 Medium (survey-based MRV, costly)	🟢 High (PoAs aggregation possible)	🟡 **Medium**
District heating/cooling	CDM AM0070, JCM methodologies	🟡 Medium (high upfront cost)	🟡 Medium (context-specific)	🟢 High (metered supply)	🟡 Medium (dense urban only)	🟡 **Medium**
Niche EE opportunities (elevators, etc.)[41]	Gold Standard – Energy-Saving through Elevator Regenerative Power System Implementation (V1.0)	🟢 High (low transaction cost)	🟢 Likely (small-scale, clear additionality)	🟢 High (simple MRV)	🔴 Low (niche, limited scope)	🟡 **Medium**

[39] New vs. existing buildings: Retrofits in *new* buildings can integrate MRV systems during construction; in *existing* buildings projects are smaller/dispersed and MRV is costlier unless default factors are used.
[40] Cookstoves are most viable in urban/peri-urban settings (better infrastructure, easier MRV). Rural cookstove projects face smaller scale and survey-based MRV, raising costs.
[41] Small-scale EE opportunities (e.g. elevator energy recovery) are typically additional but have limited overall sector impact.

Project type	Available methodologies	Article 6 Viability Assessment				
		Economic viability & cost-effectiveness	Additionality	MRV feasibility	Scalability	Overall viability
Low-carbon urban planning	Combination of methodologies from buildings, other construction (infrastructure), energy and transport sectors	🟡 Medium (cost-effective at system level, but with high transaction costs)	🟢 High (complexity, MRV challenges, and split incentives)	🟡 Medium (complex, many different interventions, but can be integrated in design)	🟢 High (large-scale, systemic potential if frameworks are in place)	🟡 **Medium**[42]
End-of-Life Stage						
Reuse of prefabricated and structurally sound components[43]	No dedicated methodology; impact assessment challenging	🟡 Medium (small scale, requires planning and selective demolition, cost-effective where reuse markets exist)	🟡 Medium (not common practice, but legislation may require in some countries)	🔴 Low (requires detailed inventory and traceability of components, no methodologies)	🟡 Medium (larger potential for new builds designed for deconstruction; limited for existing stock)	🟡 **Medium**
Recycling of construction and demolition materials into secondary raw materials	Possibly covered/derived from waste treatment or industrial material recycling methodologies[44]	🔴 Low (process costs vary, only certain materials, transaction costs high)	🟡 Medium (depends on policy and market standards)	🟢 High (measurement of recovered volumes and certified recycling rates feasible)	🟡 Medium (sector potential depends on construction market demand and material types)	🔴 **Low**

[42] While system-level economic viability and additionality are strong, implementation under Article 6 faces significant challenges. These include high transaction costs, complex governance involving multiple stakeholders, and difficulties in attributing emission reductions to specific interventions for MRV purposes.

[43] Examples of reusable construction materials include steel, aluminium, timber, and bricks, as well as some secondary components such as doors, windows, and fixtures. When these components can be recovered intact and directly reused, most of the embedded emissions are preserved with minimal re-processing. When materials are instead processed into secondary raw materials (e.g. crushed concrete aggregates or recovered metals), emissions from primary material production are avoided, though additional processing reduces overall net benefit. In both cases, most of the associated GHG emission reductions actually occur in the production stage, even though the recovery activity takes place at end-of-life. The overall viability is limited for existing buildings (due to mixed or contaminated waste streams) but could become more significant for new buildings designed for selective demolition and material traceability.

[44] While CDM and Gold Standard have methodologies for recycling of solid waste (e.g. CDM AMS-III.AJ "Recovery and recycling of materials from solid wastes", AMS-III.BA "Recovery and recycling of materials from end-of-life products"), these were designed primarily for municipal waste streams rather than construction and demolition waste. Verra has methodologies for plastics recycling (e.g. VM0043, VM0047) but none directly applicable to construction materials. Adaptation would be required to assess building material reuse.

7| Illustrative Examples

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7. ILLUSTRATIVE EXAMPLES OF BUILDING-SECTOR PROJECTS

Building on the analysis of project types (Chapter 3), methodologies (Chapter 4) and viability considerations (Chapters 5 and 6), this chapter illustrates what Article 6-compatible activities in the buildings sector could look like in practice. The six examples presented are illustrative and do not represent “best” projects or a ranked list of priorities. Rather, they are meant to provide a diverse sample of how building-related mitigation can be structured under Article 6, highlighting both opportunities and remaining challenges. Some are real projects already implemented under existing carbon market frameworks, while others are illustrative scenarios designed to demonstrate untapped potential.

These examples showcase the diversity of opportunities for applying Article 6 in the buildings sector. They span different lifecycle stages, geographies, and implementation models, each offering a distinct lesson – from aggregation at scale to niche but replicable measures, from linking finance with building standards to addressing embodied emissions. Together, they provide concrete entry points for Article 6 and highlight where further methodological and policy development is needed.

Overview of illustrative examples and their relevance for Article 6:

- **Vietnam – Low-Carbon Hotel (JCM):** Bilateral crediting for commercial building retrofits with robust MRV, showing Article 6.2 transferability. Viable as a blended-finance pilot for scaling similar retrofits despite modest carbon revenues.
- **India – ACC Blended Cement (CDM):** Industrial-scale clinker substitution tackles embodied emissions using a proven methodology (ACM0005).
- **Nigeria – CFL Retrofit Programme (CDM):** Nationwide aggregation of distributed energy efficiency with clear MRV – a candidate for transition/replication under Article 6.
- **Canada – Quebec’s Sustainable Community (Verra):** Grouped, ICT-enabled MRV across thousands of small actors – a blueprint for cooperative approaches.
- **Mexico – EcoCasa Low-Carbon Housing (NAMA):** Finance-linked housing standards at scale; strong Article 6 relevance for programmatic housing.
- **Global – Low-Carbon Building Materials PoA (Illustrative):** Programmatic scaling of emerging materials (biochar, hempcrete, recycled aggregates) under Article 6.

Taken together, the six examples demonstrate how Article 6 can mobilise finance for buildings-sector mitigation in ways that are both technically robust and context-sensitive. They highlight the importance of aggregation and programmatic approaches to overcome transaction costs, of tailored MRV systems to ensure credibility, and of clear additionality tests to safeguard environmental integrity. They also show that while some solutions are already cost-effective, Article 6 can play a catalytic role in de-risking investment, unlocking replication, and accelerating market transformation.

By situating these cases against the viability dimensions developed in this paper, the examples provide practical insights for policymakers, DNAs, project developers, and financiers. They illustrate that Article 6 is not only a mechanism for transferring emission reductions, but also a lever to shape sustainable and resilient building practices worldwide.

Example 1: Vietnam – Low-Carbon Hotel under JCM

Project Snapshot	
Project Type	Energy efficiency retrofit (use phase, commercial buildings)
Timeline	April 2016 – 10 years
Target measures	Building Energy Management System (V-BEMS), high-efficiency boilers, heat pumps, and LED lighting
Methodology	JCM methodology: VN_AM003 Ver1.1 – *Improving the energy efficiency of commercial buildings by utilisation of high efficiency equipment*
Owner / Operator	Renaissance Riverside Hotel Saigon; Hotel Nikko Hanoi, Vietnam
Implementing Partners	**CME:** Ho Chi Minh City University of Natural Resources and Environment (Vietnam) **Technology/Service Provider:** Hibiya Engineering Ltd. (Japan) **Financial / Trading Partner:** Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (Japan) **Funding / Support Entity:** NEDO (Japan)
Financing / Credit Flow	Blended finance of NEDO subsidy[45], hotel energy cost savings, and JCM credits transferred to Japanese government

Project Description & Viability Assessment

Two major hotels in Ho Chi Minh City and Hanoi installed high-efficiency boilers, heat pumps, LED lighting, and a building energy management system under the Japan–Vietnam JCM. These measures targeted core energy consumption drivers such as air-conditioning, hot water, and lighting, which represent the largest share of hotel energy use. Credits were transferred to Japan, while hotels benefitted from energy cost savings. Though the project is small-scale, it demonstrates how bilateral cooperation and structured MRV can support efficient building retrofits in the hospitality sector.

Economic viability & cost-effectiveness	Medium	Upfront investment is substantial, but carbon revenues + energy savings ensure payback.
Additionality	High	Advanced EE measures not mandated in Vietnam's building codes; external support decisive.
MRV Feasibility	High	Energy data tracked through V-BEMS and metered equipment.
Scalability	High	Hotel retrofits can be replicated and scaled via aggregated certification schemes (e.g. net-zero hospitality).

Article 6 Relevance

- Demonstrates how JCM bilateral crediting frameworks can evolve into Article 6.2-aligned programmes.
- Serves as a model for scaling through green building certifications (e.g., EDGE, LEED).
- Demonstrates aggregation potential across hospitality chains or sector-wide initiatives.

Impact Snapshot	
GHG Reduction	~289 tCO_2/year (2016–20)
Carbon Revenues	Approx. USD 1,500–3,000/year (assuming USD 5–10/tCO_2).
Co-benefits	Significant energy cost savings for hotel operators; technology transfer from Japanese partners; reduced dependency on fossil fuels.

Key Insights

- Shared-savings and ESCO-type models can help overcome high upfront costs.
- JCM's robust MRV infrastructure ensures credibility and potential Article 6 transferability.
- Sector-wide strategies (e.g. for hotels and public buildings) hold promise for aggregated scaling.

[45] NEDO (New Energy and Industrial Technology Development Organisation) is a Japanese government agency under the Ministry of Economy, Trade and Industry (METI). It provides subsidies and technical support for innovation and international cooperation projects, including JCM demonstration activities.

Example 2: India – ACC Blended Cement Project

Project Snapshot	
Project Type	Industrial process optimisation (production stage, cement sector)
Timeline	Registered 2010 under CDM, first crediting period 2010-2016
Target measures	Reduction of clinker content in cement by blending with fly ash
Methodology	CDM ACM0005 ver.2 – *Consolidated Methodology for Increasing the blend in cement production*
Owner / Operator	ACC Limited (major Indian cement producer)
Implementing Partners	**CME:** ACC Limited **DOE:** TÜV SÜD Industrie Service GmbH **Financial Partner:** CER buyers (European utilities for Kyoto compliance)
Financing / Credit Flow	Capital investment by ACC; CER revenues from sales to international buyers, primarily European utilities under the EU ETS.

Project Description & Viability Assessment

ACC Limited implemented a package of clinker substitution measures at its New Wadi and Tikaria plants, replacing a portion of energy- and carbon-intensive clinker with fly ash in cement production. This project was one of the pioneering large-scale applications of clinker substitution registered under the CDM, demonstrating the role of carbon finance in accelerating industrial decarbonisation in emerging economies. The activity reduced both process emissions from clinker calcination and fuel-related emissions from clinker manufacture. The project achieved an expected 1.45 million tCO_2 reductions during its first crediting period (2010–2016). It was selected for this case study because it provides a clear example of how robust methodologies and carbon revenues can drive industrial emission reductions at scale.

Economic viability & cost-effectiveness	High	Large, low-cost reductions per tonne CO_2; carbon finance accelerates adoption.
Additionality	Medium	At the time of registration, blending was not mandated; under Article 6, risk increases as blending becomes industry norm or regulation.
MRV Feasibility	High	Production data and blending ratios are straightforward to monitor.
Scalability	High	PoA or sectoral crediting could scale across India; globally replicable where SCMs are available.

Article 6 Relevance

- Demonstrates how robust industrial methodologies from the CDM can inform Article 6 activities
- Shows the potential for large-scale, cost-effective emission reductions in hard-to-abate sectors
- Highlights additionality challenges once clinker substitution becomes widespread or mandated
- Provide a blueprint for scaling through PoAs in multiple cement plants and regions

Impact Snapshot	
GHG Reduction	Estimated 1.45 million tCO_2 over first crediting period (2010–2016), ~240,000 tCO_2/year.
Carbon Revenues	CER revenues estimated at EUR 5–10/tCO_2 under Kyoto markets, providing EUR 1.2–2.4 million annually.
Co-benefits	Lower production costs, reduced clinker imports, improved industrial efficiency, enhanced use of fly ash (a waste product).

Key Insights

- Cement blending delivers large, low-cost emission reductions with proven methodologies.
- MRV is straightforward, supporting carbon market application.
- Additionality risk emerges when blending becomes mandated or industry norm.
- A PoA approach could scale up to multiple cement plants and regions.
- High replication potential globally where suitable supplementary cementitious materials (SCMs) are available, especially in Africa and Asia.

Example 3: Nigeria - CFL Retrofit Programme (PoA 9441)

Project Snapshot	
Project Type	Efficient lighting retrofit (use phase, residential sector).
Timeline	2012–2023 under CDM; planned extension to LED phase under Article 6
Target measures	Distribution and free installation of up to 40 million compact fluorescent lamps (CFLs) to replace incandescent bulbs in grid-connected households nationwide.
Methodology	AMS-II.J (v4) – *Demand-side activities for efficient lighting technologies*
Owner / Operator	Icimi Ltd. (CME)
Implementing Partners	**DOE:** Carbon Check (India) Pvt. Ltd. **Institutional Stakeholders :** Nigerian Rural Electrification Agency, Distribution Companies (DISCOs)
Financing / Credit Flow	Funded through a combination of bulk public procurement and post hoc carbon revenues; CERs issued under CDM and potentially sold to compliance buyers or transitioned under Article 6.4 mechanisms.

Project Description & Viability Assessment

This nationwide PoA distributed up to 40 million CFLs to replace incandescent bulbs, implemented through DISCOs and trained community agents. Robust MRV (serial tracking, spot checks) ensured credibility, while behavioural support was provided via SMS and workshops. The programme informed Nigeria's 2024 MEPS standards (NIS 1209:2024, which phases out inefficient lamps from 2025[46]) and fed into the Carbon Market Activation Plan[47] and draft carbon market policy (April 2025), that proposes a 5-year roadmap and legal basis for authorizing transfers and applying corresponding adjustments[48].

Economic viability & cost-effectiveness	🟡 Medium	Low abatement costs; Article 6 adds transaction overheads.
Additionality	🟡 Medium	MEPS from 2025 reduces additionality, but accelerated or deeper LED uptake can qualify.
MRV Feasibility	🟢 High	Serial tracking and sampling easily align with Article 6 MRV.
Scalability	🟢 High	PoA model enables nationwide roll-out and replication across West Africa.

Article 6 Relevance

- Strong candidate for transition to Article 6.4, offering continuity for future crediting once Nigeria issues Letters of Authorisation.
- Demonstrates how dispersed EE measures can be aggregated under Artcile 6.
- Provides lessons for structuring future LED programmes aligned with NDCs.

Impact Snapshot		**Key Insights**
GHG Reduction	First CPA: ~28,900 tCO_2e/year; Full roll-out: projected at >13 million CERs over 10 years	• Scalable approach via PoA architecture
Carbon Revenues	Estimated $20–55 million at $3/CER[49]	• Reinforced regulatory reform (MEPS)
Co-benefits	Energy cost savings (reduced 65–80% per bulb), reduced grid load (~200 MW), improved indoor lighting, catalysed CFL/LED recycling initiatives.	• MRV good practice for distributed EE projects • Strong replication potential for distributed lighting and appliance retrofits across West Africa.

[46] CLASP
[47] In 2024, Nigeria launched a Carbon Market Activation Plan and hosted Article 6 implementation training to prepare for ITMO transactions, Extractive 360
[48] ossapcfse.org
[49] These are indicative prices and can vary depending on the buyer, timing, and trackability of the CERs. Sources: Ecosystem Marketplace, *State of the Voluntary Carbon Markets 2025* – average price for Energy Efficiency / Fuel Switching credits in 2024: US $ 3.05 /t.

Example 4: Canada - Quebec's Sustainable Community Project (Verra)

Project Snapshot	
Project Type	Aggregated energy efficiency (use stage, residential/commercial/industrial) and waste diversion (end-of-life stage, grouped project)
Timeline	Registered 2013 under VCS, crediting period from 1 Jan 2010 to 31 Dec 2029
Target measures	Construction, retrofits, and process changes that improve energy efficiency across diverse activities such as HVAC, lighting, industrial processes, building envelopes, heat recovery, and solid waste handling
Methodology	VM0018 (VCS): *Energy Efficiency and Solid Waste Diversion Activities within a Sustainable Community (v1.0)*
Owner / Operator	Will Solutions Inc. – Sustainable Community Service Promoter (SCSP), retains emission reduction rights
Implementing Partners	**CME:** Will Solutions Inc. (coordinates >10,000 client facilities) **Client Facilities:** SMEs, municipalities, institutions, and community actors implementing individual measures
Financing / Credit Flow	Participants benefit from energy savings and incentives; Will Solutions aggregates ERs, registers them under VCS, and manages credit sales.

Project Description & Viability Assessment

The Sustainable Community project demonstrates how thousands of small emitters can be mobilised into one grouped programme. Will Solutions coordinates energy efficiency and waste diversion measures across 10,000+ client facilities in Quebec. Activities range from HVAC retrofits and efficient lighting to industrial process improvements and recycling. An ICT-enabled platform ensures real-time data collection and transparent MRV, while alignment with Quebec's regulatory framework adds credibility. Registered in 2013 under VCS (crediting period 2010–2029), the project has delivered millions of verified emission reductions and serves as a blueprint for grouped approaches.

Economic viability & cost-effectiveness	🟡 Medium	Aggregation cuts costs, though A6 authorisation and adjustments add overhead.
Additionality	🟡 Medium	Activities exceeded requirements at start, but policy overlap could weaken future additionality.
MRV Feasibility	🟢 High	ICT-driven MRV provides robust, standardised data.
Scalability	🟢 High	Grouped model can expand nationally and be replicated internationally.

Article 6 Relevance

- Provides a blueprint for Article 6.2 cooperative approaches, showing how small actors can be aggregated nationally.
- Demonstrates aggregation of SMEs and municipalities in climate action.
- Shows how voluntary market experience can inform NDC-aligned Article 6 methodologies.

Impact Snapshot

GHG Reduction	~2.37 million tCO_2e/year; ~26 million tCO_2e estimated over 2010–2029
Carbon Revenues	Up to ~$600,000/year at ~US$3.05/tCO_2e (depending on market prices and issuance)
Co-benefits	Energy cost savings, infrastructure upgrades, better waste management, capacity-building for SMEs and municipalities

Key Insights

- Aggregation unlocks participation for small emitters who would otherwise be excluded from carbon markets.
- ICT-enabled MRV ensures credibility, lowers transaction costs, and facilitates replication.
- Grouped design offers a practical model for cooperative Article 6 approaches.
- Demonstrates how voluntary market projects can transition towards NDC-aligned strategies.

Example 5: Mexico – EcoCasa Low-Carbon Housing (NAMA)

Project Snapshot

Project Type	New housing – low-carbon residential housing (use stage)
Timeline	Launched 2013, ongoing (EcoCasa I–III phases)
Target measures	Energy-efficient housing construction using bioclimatic design, efficient appliances, improved insulation, solar water heating, and reduced reliance on fossil fuels.
Methodology	Not linked to a UNFCCC CDM/Article 6 methodology; developed as a Nationally Appropriate Mitigation Action (NAMA) supported by international climate finance.
Owner / Operator	Sociedad Hipotecaria Federal (SHF, federal development bank)
Implementing Partners	Government of Mexico (Ministry of Environment SEMARNAT, CONAVI), German Development Bank (KfW), Inter-American Development Bank (IDB), and Clean Technology Fund (CTF)
Financing / Credit Flow	USD 151 million provided by international partners (KfW, IDB, CTF), blended with domestic finance through SHF mortgage loans. No carbon credit revenues reported.

Project Description & Viability Assessment

EcoCasa is a flagship housing programme launched to reduce emissions in Mexico's fast-growing residential sector. It provides concessional loans to developers who construct homes that meet defined low-carbon performance standards (20–80% below baseline). It enabled Mexican developers to construct 27,600 energy-efficient homes that achieve 20–40% lower emissions compared to conventional homes. The programme's MRV system relies on simulation-based energy performance models, with lifecycle GHG accounting aligned to NAMA standards. The benchmarks were based on Mexican standards plus additional low-carbon criteria co-developed with GIZ and KfW. The initiative also aligns with Mexico's Sustainable Housing NAMA and national policy, providing a framework that could transition into Article 6-compatible activities.

Economic viability & cost-effectiveness	High	Incremental costs of efficient housing covered by concessional loans and green mortgages; long-term energy savings for households.
Additionality	High	Mainstream housing in Mexico would not typically integrate efficiency and renewable features without financial incentives. The NAMA approach demonstrates policy and financial additionality.
MRV Feasibility	Medium	Emissions reductions estimated through energy simulation tools and compliance checks; household-level metering less common. Transparent but less rigorous than Article 6 methodologies.
Scalability	High	Embedded in national housing finance system; transferable to other countries with large-scale social housing demand.

Article 6 Relevance

- Demonstrates how programmatic, finance-linked interventions in housing can deliver measurable GHG reductions.
- Offers a model for scaling Article 6.2 or 6.4 projects through PoA-like approaches combining design, appliances, and financing instruments.
- Shows potential pathways for NDC alignment: mitigation in housing is significant in Mexico's sectoral emissions profile.
- Illustrates barriers that could justify additionality (upfront cost, developer/consumer split incentives, lack of strong enforcement of building codes).

Impact Snapshot

GHG Reduction	Estimated 1.8 $MtCO_2$ over programme lifetime (EcoCasa I & II, according to SHF and IDB reporting)
Carbon Revenues	n/a
Co-benefits	Affordable housing access, improved thermal comfort, reduced energy bills, capacity building for developers, support for Mexico's climate commitments

Key Insights

- Financing innovation is essential to unlock large-scale housing mitigation.
- Aggregated approaches can overcome small-unit barriers common in residential energy efficiency.
- MRV remains challenging but feasible with standardised baselines and programme-level monitoring.
- Provides a replicable model for linking national policy instruments (NAMAs, green mortgages) with international carbon finance under Article 6.

Example 6: Low-Carbon Building Materials PoA in Affordable Housing (Fictitious Case)

Project Snapshot	
Project Type	Low-carbon building materials in affordable housing (production + use stage)
Timeline	Illustrative – potential PoA concept for replication under Article 6
Target measures	Substitution of conventional cement and bricks with biochar bricks, hempcrete insulation, and recycled aggregates
Methodology	Verra VM0044 (biochar), draft hemp methodology, CDM AMS-III.AJ – *recycling of materials from solid waste*
Owner / Operator	Public housing authority in partnership with private developers
Implementing Partners	**CME:** National housing agency (as PoA coordinator) **Technology Providers**: Local producers of biochar, hempcrete, and recycled aggregates **DOE:** Independent validator/verifier (e.g. TÜV, DNV)
Financing / Credit Flow	Blended financing model – public housing funds, concessional climate finance, and carbon revenues through Article 6 ITMOs

Project Description & Viability Assessment

This illustrative PoA concept envisions the integration of low-carbon building materials into a large-scale affordable housing programme. Conventional cement and bricks would be partially substituted with biochar-based bricks, hempcrete insulation, and recycled concrete aggregates. These measures target reductions in embodied emissions during the production stage, while also improving the thermal performance of buildings and reducing operational energy demand. By using a PoA structure, the housing authority could register a national umbrella programme under Article 6, with each housing development or material supplier added as a Component Project Activity (CPA). This reduces transaction costs, creates economies of scale, and allows for consistent MRV across multiple projects.

Economic viability & cost-effectiveness	🟡 Medium	Production costs higher than conventional materials; carbon revenues and concessional finance improve competitiveness.
Additionality	🟡 Medium - 🟢 High	Most low-carbon materials are not yet mandated or mainstream, but financial additionality may depend on market conditions and subsidies.
MRV Feasibility	🟡 Medium - 🟢 High	Biochar methodology and CDM recycling methodologies provide robust MRV approaches; hempcrete methodologies still under development.
Scalability	🟢 High	PoA structure allows multiple housing projects and suppliers to join, enabling large-scale replication in national housing programmes.

Article 6 Relevance

- Demonstrates how emerging low-carbon material methodologies (biochar, hemp, recycling) can be operationalised under Article 6.
- PoA structure enables scaling across multiple housing developments, lowering transaction costs and standardising MRV.
- Carbon revenues can complement public housing budgets and international climate finance, creating a viable financing model.

Impact Snapshot		**Key Insights**
GHG Reduction	Indicative lifecycle analysis suggests 30–40% reduction in embodied emissions compared to conventional cement and bricks.	• Low-carbon materials can cut embodied emissions at scale when embedded in housing programmes. • PoA design enables scalability and reduces transaction costs. • MRV approaches exist for biochar and recycling, though hempcrete methodologies are still emerging. • Strong co-benefits strengthen project attractiveness under Article 6.
Carbon Revenues	Dependent on issuance under Article 6; revenues could offset incremental material costs	
Co-benefits	Reduced construction waste, productive use of biomass, better building performance, and green job creation.	

Annex I: Table of reviewed building sector methodologies

Methodology name / reference no.	Demand-side energy efficiency activities for specific technologies / CDM - AMS.II.C (version 16)
Project type	Energy efficiency improvement projects
Requirements Technologies Size Boundaries	*Technologies:* This methodology comprises activities that encourage the adoption of energy-efficient equipment, lamps, ballasts, refrigerators, motors, fans, air conditioners, appliances, etc. at many sites. These technologies may replace existing equipment or be installed at new sites. In the case of new facilities, the determination of the baseline scenario shall be in accordance with UNFCCC general guidance on small scale methodologies under the section 'Type II and III Greenfield projects (new facilities)'. *Size:* The aggregate energy savings by a single project may not exceed the equivalent of 60 GWh per year for electrical end use energy efficiency technologies. For fossil fuel end use energy-efficient technologies, the limit is 180 GWh thermal per year in fuel input. *Boundaries:* The project boundary is the physical, geographical location of each measure (each piece of equipment) installed.
Additionality assessment	*Additionality assessment* is depending on the context of the proposed project activity(ies). The CDM standard stepwise determination of additionally test is recommended. Demonstration whether the proposed project activity is the first-of-its-kind Identification of alternatives to the project activity Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible Barrier analysis; and Common practice analysis
Emissions Baseline Project Leakage	*Baseline emissions:* If the energy displaced is fossil fuel based, the energy baseline is the existing level of fuel consumption or the amount of fuel that would be used by the technology that would have been implemented otherwise. The emissions baseline is the energy baseline multiplied by an emission factor for the fossil fuel displaced. If the energy displaced is electricity, the emission baseline is determined as the product of the baseline energy consumption of equipment/appliances and the emission factor for the electricity displaced *Project emission:* is defined by the annual energy consumption in the project activity multiplied by an emission factor for the electricity or thermal baseline energy. *Leakage:* Project emissions from physical leakage of refrigerants are accounted for. If the energy efficiency technology is equipment transferred from another activity, leakage is to be considered.
Monitoring plan	Monitoring: The emission reduction achieved by the project activity shall be determined as the difference between the baseline emissions and the project emissions and leakage. The specific monitoring plan is depending on the implemented technology and the baseline. 3 different options are devised.

Methodology name / reference no.	Energy efficiency and fuel switching measures for buildings / CDM - AMS-II.E. (version 16)
Project type	Scope 3 – Energy efficiency improvement projects
Requirements Technologies Size Boundaries	*Technologies:* Includes project activities that implement energy efficiency measures (including savings of electricity and fuel) and/or fuel switching in new or existing residential, commercial or institutional building units or group of building units. The methodology covers project activities aimed primarily at energy efficiency. Examples include technical energy efficiency measures (such as efficient appliances, better insulation and optimal arrangement of equipment, BEMS – Building Energy Management Systems) and fuel switching measures (such as switching from oil to gas). *Size:* The aggregate energy savings of a single project may not exceed the equivalent of 60 GWh per year. *Boundaries:* The project boundary is the physical, geographical site of the building(s)
Additionality assessment	*Additionality assessment* depends on the context of the proposed project activity(ies). Methodological tool - Demonstration of additionality of small-scale project activities (Tool 21). Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers: Investment barrier Technological barrier Barrier due to prevailing practice Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.
Emissions Baseline Project Leakage	*Baseline & Project emissions see under Monitoring plan.* The methodology is applicable to both retrofitting of existing building units and new buildings. *Leakage:* If the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.
Monitoring plan	The methodology provides three options to determine emission reductions: based on expost monitoring of fuel and electricity consumed, based on a standardised tCO2 emission factor per m2, and based on a standardised value of tCO2 emissions per occupant of building. Sampling shall follow the latest version of the “Standard: Sampling and surveys for CDM project activities and programme of activities” and the “Guideline: Sampling and surveys for CDM project activities and programmes of activities”

Methodology name / reference no.	Energy efficiency technologies and fuel switching in new and existing buildings / CDM - AM0091 (version 4)
Project type	Energy efficiency- measures and/or fuel switching in new or existing building units (residential, commercial, and/or institutional building units). Examples of the measures include efficient appliances, efficient thermal envelope, efficient lighting systems, efficient heating, ventilation and air conditioning (HVAC) systems, passive solar design, optimal shading, building energy management systems (BEMS), intelligent energy metering and switch to less carbon intensive fuel
Requirements Technologies Size Boundaries	*Technologies:* The methodology applies to project activities that implement energy efficiency measures and/or fuel switching in new or existing building units. Examples of the measures include efficient appliances, efficient thermal envelope, efficient lighting systems, efficient heating, ventilation and air conditioning (HVAC) systems, passive solar design, optimal shading, building energy management systems (BEMS), intelligent energy metering, and fuel switching, excluding switching to biomass. Building units eligible for applying the methodology should belong to residential, commercial and institutional categories (education and public assembly, an annex to the methodology exists listing various kind of building types). *Boundaries:* The spatial extent of the project boundary encompasses the area covering all the project and baseline building units. In addition, the spatial extent of the energy supply systems that supply energy to the project and baseline building units is included in the project boundary.
Additionality assessment	*Additionality assessment* is depending on the context of the proposed project activity(ies). The CDM standard stepwise determination of additionally test is recommended (Tool for the demonstration and assessment of additionality"): • Demonstration whether the proposed project activity is the first-of-its-kind; • Identification of alternatives to the project activity; • Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible; • Barriers analysis; and • Common practice analysis
Emissions Baseline Project Leakage	*Baseline:* The project participants may either choose to identify the baseline building units from all the building units in the project boundary or use a randomly selected sample of the building units in the project boundary. The baseline building units are identified as building units in circumstances similar to the building units constructed in the project activity (project building units). The baseline includes emissions from the following sources: Electricity consumption in buildings Fuel consumption in buildings Chilled/hot water consumption in buildings Leakage of refrigerants in buildings

	Project: Project emissions include the following sources: Electricity consumption in buildings Fuel consumption in buildings Chilled/hot water consumption in buildings Leakage of refrigerants in buildings For new construction, project emissions can be estimated: Calculation of project emissions based on monitoring of energy consumption Modelling project emissions (For retrofits, the only option available is modelling) *Leakage:* Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.
Monitoring plan	Comprehensive monitoring plan involving recording (electronically) 70 different parameters.

Methodology name / reference no.	**Demand-side activities for efficient lighting technologies / CDM - AMS II.J (Version 4)**
Project type	Scope 3 – Energy efficiency improvement projects
Requirements Technologies Size Boundaries	*Technology:* This category comprises activities that lead to efficient use of electricity through the adoption of energy efficient light bulbs (project lamps) to replace less energy efficient light bulbs (baseline lamps) in residential applications. The project lamps adopted to replace existing equipment shall be new equipment and not transferred from another activity. The performance of project lamps shall exceed applicable Minimum Energy Performance Standards (MEPS) in the host Party. *Size:* The aggregate electricity savings by a single project activity may not exceed the equivalent of 60 GWh per year. *Boundaries:* The spatial extent of the project boundary encompasses the physical, geographical location of each project lamp installed in the project area and the spatial extent of the electricity system(s) that the households are connected to
Additionality assessment	The following options are applicable for assessing additionality: The proposed technology is on the positive list Additionality should be demonstrated through barrier analysis using the latest version of the methodological tool . If "Investment barrier" is chosen to demonstrate additionality, the investment analysis should be applied from the perspective of the project coordinator undertaking the project activity. For "Technological barrier", it shall be assessed from the perspective of the users of the project lamps. Demonstration of additionality of microscale project activities: Is the emission reduction of the project activity <=20 ktCO2e per year?
Emissions Baseline Project	The emission reductions are calculated as the difference in power consumption (kWh) between old and new lightbulbs multiplied by a grid emission factor.

Leakage	
Monitoring plan	Number of pieces of new equipment distributed under the project activity, identified by the type of equipment and the date of supply The number and power of the replaced devices Data to unambiguously identify the recipient of the new equipment distributed under the project activity

The following tables list **Gold Standard methodologies** focus on energy efficiency in buildings:

Methodology name	Simplified Methodology for Clean and Efficient Cookstoves[1]
Project type	Energy efficiency improvement projects in households
Requirements	*Technologies:* Interventions in households involving biomass, biogas, ethanol, or other clean-burning fuels, and improved stove designs that meet minimum performance standards for thermal efficiency and emissions. *Size:* New or retrofitted stoves must have a minimum efficiency of 20% for wood-fired stoves and 22.5% for charcoal-fired stoves. *Boundaries:* The project boundary covers the location of the baseline and project stoves and areas where biomass is sourced or processed. The target area is defined by similar baseline conditions at the outer boundary within which the project's target population is located and may encompass neighbouring cities, regions, or countries.
Additionality assessment	The developer demonstrates that the project would not occur without carbon finance. Justification may include high upfront investment or unaffordable ongoing costs such as marketing, distribution, manufacturing, or maintenance. Additionality must be demonstrated using one of the following options: GS4GG Community Services Requirements, CDM Tool 01, CDM Tool 21, or an approved Gold Standard VER additionality tool.
Emissions	The baseline scenario is defined as the existing cooking technologies and fuel consumption patterns used by the target population before the project technology was adopted. Quantity of fuel consumed is estimated using default values, historical data, sample surveys, or standardised baselines. The baseline and project stove efficiency are measured under SMEC 11 and SMEC 15, respectively. *Project emissions:* The technology is used by end-users to meet household cooking energy needs within the target area. Emission reductions are calculated by comparing the fuel consumption in the project scenario to that in the defined baseline scenario. *Leakage:* If non-renewable biomass is saved, leakage emissions are not considered, setting the value to zero. For PoAs, a 0.95 adjustment factor is applied to emission reductions. Leakage risks deemed very low may be excluded if supported by appropriate justification.
Monitoring plan	The following key data must be monitored and recorded throughout the crediting period:

	This includes total sales or dissemination records detailing installation date, location, stove model, quantity, and user information, backed electronically. A project database must be maintained, tracking only those stoves within their technical life. Annual monitoring surveys must estimate stove usage and assess physical condition, including continued use of baseline stoves.

Methodology name	Energy-saving through elevator regenerative power system implementation[2]
Project type	Energy efficiency improvement projects in buildings
Requirements Technologies Size Boundaries	*Technologies:* Implement elevator regenerative power systems to recover and reuse energy typically lost during elevator operation. Eligible technologies must be commercially available, energy-efficient, and capable of capturing braking energy and converting it into usable electricity within the building's power system. *Size:* Not explicitly limited. *Boundaries:* The physical and geographical area where the elevator and relevant devices are located.
Additionality assessment	The project must prove additionality by showing that the activity depends on carbon finance, using financial analysis, investment barrier justification, or market penetration below 20%. Includes project activities that are not legally mandated and must demonstrate regulatory surplus.
Emissions	*Baseline emissions:* Calculated by deducting the project equipment's electricity consumption from the total elevator operation electricity consumption and multiplying the result by the applicable electricity carbon emission factor. *Project emissions* are the incremental energy stored and dispatched by the Energy Storage System (ESS). If upstream emissions from the manufacture of ESS/BSS exceed 5% of annual emission reductions, they must be included as project emissions, using credible literature or manufacturer data. Consumption is determined through electricity meter readings, EMS data, or standardised calculations, based on monthly consumption multiplied by the number of operating elevators. *Leakage:* This does not have to be taken into account.
Monitoring plan	The monitoring plan requires accurate measurement equipment, with calibration details included in the PDD/VPA DD. Electricity data may be rounded appropriately based on device type. Monitored data includes monthly and annual elevator energy use, units, and regenerative electricity. EMS or equivalent systems must be used for data collection and management.

Methodology name	Recovery and Recycling of Materials from Solid Wastes[3]
Project type	Energy efficiency improvement process
Requirements Technologies Size Boundaries	*Technologies:* The methodology covers project activities that divert waste from landfills or incineration by sorting, cleaning, and reprocessing recyclable materials (e.g., metals, alloys, and minerals). Eligible technologies include mechanical recycling systems, manual or automated separation lines, and material recovery facilities. *Size:* Not explicitly limited. *Boundaries:* cover GHG emissions from virgin material production in the baseline and from solid waste collection to material recovery or recycling in the project scenario. Transportation to direct downstream customers is included unless it is insignificant. Recycling stages within the project boundary must be clearly defined at the project level.
Additionality assessment	An additional assessment shall be demonstrated that the proposed activity is not mandated or driven by existing regulations. Only the portion of material recovery or recycling exceeding legal requirements is eligible for crediting. Regulatory surplus must be demonstrated through credible evidence. Additional analyses include investment analysis—highlighting financial constraints mitigated by carbon revenue—and optional barrier analysis, demonstrating institutional, technical, or economic obstacles. Other programmes should not be used to incentivise the activity. Common practice analysis is required to confirm the activity is not standard in the project region or industry.
Emissions	*Baseline emissions:* Mitigation activity shall establish a baseline below BAU levels and quantify emission reductions as the difference between baseline and BAU emissions, calculated annually and over the crediting period, including emissions from virgin material production and existing recycling activities. *Project emissions:* Calculated as the sum of total GHG emissions from project activity facility operations, GHG emissions associated with the transportation of waste type w, and GHG emissions from the transportation of recyclate type i. *Leakage:* Calculated as the sum of emissions from two sources: (1) the use of chemical products in the recovery facility and (2) additional downstream processing of recyclates. No upstream leakage is expected if materials are proven to have reached end-of-life. Emissions from chemical use must be assessed unless proven de minimis. Downstream processing emissions are included only if they differ from baseline conditions.
Monitoring plan	Monitoring the types and quantities of waste introduced, material recovery and recycling outputs, and associated energy consumption. Data must be collected through reliable methods such as direct measurements, weighbridges, and validated records. Recyclate traceability, chemical usage, and downstream processing emissions must also be monitored. Annual monitoring reports are required, ensuring transparency, consistency, and verification of emission reductions following the methodology's prescribed parameters and data quality standards.

The following tables list **Verra** methodologies focused on energy efficiency in buildings:

Methodology name	Weatherization of Single-Family and Multi-Family Buildings[4] VM0008
Project type	Sectoral Scope 3. Energy efficiency improvement projects
Requirements	*Technologies:* These measures include, but are not limited to, enhancing insulation, improving air sealing, and replacing appliances and central heating/cooling systems. Additionally, upgrades to heating and cooling systems, such as heat pumps and heat pump water heaters, are incorporated. *Size:* Not explicitly limited; applicable to single-family homes and multi-family buildings. *Boundaries:* The building envelope of the dwelling(s) and its heating/cooling equipment.
Additionality assessment	For categories A, B, and C, additionality is demonstrated through the Performance Method by achieving energy savings or efficiency levels exceeding benchmarks unlikely to occur without the project. The Project Method applies to category D, using the CDM Tool for Additionality, where investment, technological, or institutional barriers may be cited.
Emissions	*Emissions reductions:* The methodology does not calculate a baseline and project emissions separately. Instead, they are determined by subtracting the project consumption from the adjusted baseline and applying the relevant emission factors. *Leakage* is calculated as the sum of the continuous operation of appliances and improper disposal of refrigerators or air conditioners.
Monitoring plan	Monitoring includes: For Categories A and B, the average weather-normalised energy savings and their standard deviation within comparable dwellings. Category C monitors average and standard deviation of electricity consumption by appliance type. Across all calculation approaches, parameters are the grid emission factor, fuel calorific value, and baseline fuel CO_2 emission factor. For appliance replacements, only the grid emission factor is required.

Methodology name	CO_2 Utilization in Concrete Production[5]
Project type	Industrial process improvement; Carbon capture and utilization (CCU) in ready-mix and precast concrete manufacturing
Requirements	*Technologies:* Technologies that utilise waste CO_2 as a feedstock in ready-mix or pre-cast concrete production, incorporating CO2 into concrete (e.g., via mineralisation) and reducing cement content compared to traditional processes. *Size:* No specific size limit; applicable to concrete production facilities globally. *Boundaries:* The physical and geographical location of the concrete production facility, including CO_2 capture, transport, and concrete mixing processes.
Additionality assessment	Additionality is demonstrated by showing that the project is not common practice, faces financial or technical barriers (e.g., high costs of CO_2 utilization technology), or is not mandated by regulations. The VCS stepwise approach is applied, including the identification of alternatives, barrier analysis, and common practice analysis, to ensure emission reductions and removals exceed business-as-usual scenarios.

Emissions	*Baseline Emissions:* Calculated based on CO_2 emissions from traditional concrete production, including emissions from cement production (energy-intensive) and waste CO_2 that would have been emitted without capture. Baseline cement quantity is determined through updated testing procedures. *Project Emissions:* Include emissions from CO_2 capture, transport, and integration into concrete, plus any additional process emissions. Emissions are net of reductions from lower cement use and CO_2 sequestration. *Leakage:* Assessed with displacement of virgin material production, with a discount factor applied to account for uncertainty. No significant leakage from CO_2 release is assumed due to permanent sequestration in concrete.
Monitoring plan	Key parameters monitored include: Quantity of cement used in the project, quantity of cement for baseline and project test specimens, amount of CO_2 injected (metered) and its source, carbon content of baseline and project concrete samples (if testing option is used), quantity of concrete produced, electricity used by CO_2 injection equipment, electricity for CO_2 capture/processing, grid emission factor, fossil fuel for CO_2 injection, fossil fuel for CO_2 capture/processing, CO_2 supplied by transport mode and distance, and total CO_2 processed by the supplier.

The following tables list **Joint Crediting Mechanism (JMC)** methodologies focused on energy efficiency in buildings:

Methodology name	Improving the energy efficiency of commercial buildings by utilization of high efficiency equipment[6] VN_AM003 Ver1.1 (JCM)
Project type	Energy efficiency improvement projects in commercial buildings
Requirements	*Technologies:* High-efficiency boilers (≥93% efficiency, with automatic control and performance test report), heat recovery heat pumps (electric, generating cooling/heating ≥80°C, non-HFC refrigerants), LED lighting (coupled with another measure). *Size:* Not explicitly limited; applicable to commercial building retrofits. *Boundaries:* Physical, geographical location of the commercial building where high-efficiency equipment is installed.
Additionality assessment	*Additionality assessment*: Additionality is demonstrated by showing the project is not a common practice in Vietnam, using high-efficiency equipment beyond regulatory requirements. A simplified JCM approach is applied, considering first-of-its-kind measures or barriers to adoption (e.g., cost, technical complexity).
Emissions	*Baseline Emissions:* Calculated by multiplying project electricity and fossil fuel consumption by the efficiency ratio of the reference to the project equipment, and emission factors. For LED lighting, based on rated electricity consumption of reference equipment and operating hours. For each measure type, different calculation methods are applied: High efficiency boiler: Baseline fossil fuel consumption = Project fossil fuel consumption × (Efficiency of project equipment / Efficiency of reference equipment) Heat recovery heat pump: Baseline fossil fuel consumption = Function of electricity consumption of project equipment, rated electricity consumption, heating capacity, and unit fuel consumption rate Baseline electricity consumption = Function of electricity consumption of project equipment, rated cooling capacity, and COP of reference equipment High efficiency lighting: Baseline electricity consumption = Rated electricity consumption of reference equipment multiplied by operation hours *Project Emissions:* Project emissions are calculated as the sum of emissions from electricity and fossil fuel consumption in the project: Emission from electricity consumption = Electricity consumed × CO_2 emission factor of electricity Emission from fuel consumption = Fuel consumed × Emission factor of the fuel *Leakage:* The methodology does not explicitly account for leakage emissions. However, for projects involving existing equipment that contains chiller systems with CFCs, HFCs, or HCFCs, a plan to prevent the release of refrigerant into the atmosphere is required, and its execution must be verified.
Monitoring plan	Monitoring includes:

	Monitor the electricity and fossil fuel consumption of high-efficiency equipment. Monitor operation hours for high efficiency and auxiliary equipment. Emission reductions are calculated as the difference between the reference and project emissions. Key parameters include the electricity and fossil fuel consumption of the high-efficiency equipment, as well as the operating hours of this equipment and any applicable auxiliary equipment.

Methodology name	Introducing double-bundle modular electric heat pumps to a new building[7] ID_AM010 Ver2.0
Project type	Energy efficiency improvement and renewable energy use in new buildings
Requirements	*Technologies* Double-bundle modular electric heat pumps (modular HPs): Water-to-water type systems that generate both heating and cooling simultaneously. Must produce hot water ≥70°C Equipped with power optimization devices (e.g., inverters) Oil-fired hot water generating equipment: Optional supplementary system (capacity ≤50% of modular HP heating capacity) Electric-run chilled water generating equipment: Optional supplementary system (capacity ≤50% of modular HP cooling capacity) *Size* Total cooling capacity of modular HP(s) must be less than 176 kW or 600,000 BTU/hr Supplementary equipment capacities are limited to 50% of respective modular HP capacities *Boundaries* The project boundary includes: Modular HPs and their auxiliary equipment (e.g., air handling units, fan coil units, pumps) Supplementary oil-fired hot water generators and/or electric chillers All equipment used for heating and cooling within the new building Refrigerant handling systems if applicable
Additionality assessment	*Additionality assessment*: The methodology ensures net emission reductions through: Using conservative default efficiency values for the reference equipment: 90% for oil-fired boilers (derived from CDM methodological tool) COP of 3.70 for packaged air conditioners (derived from Indonesian National Standard SNI 6390:2011) The project must demonstrate that the modular HP technology provides superior combined heating and cooling efficiency compared to conventional separate systems.

Emissions	*Baseline emissions:* Calculated using monitored hot and chilled water demand multiplied by reference equipment efficiencies and emission factors Efficiencies from CDM tools and the Indonesia National Standards (SNI) *Project emissions:* Based on monitored electricity use of modular HPs, auxiliary equipment, other chilled water generating equipment, and oil consumption *Leakage:* Addressed through a mandatory refrigerant control plan where applicable
Monitoring plan	Monitoring: The emission reduction is calculated as the difference between the reference emissions and the project emissions. Key monitoring parameters include: Quantity of heating energy utilised by the building (GJ/p) Quantity of cooling energy utilised by the building (GJ/p) Oil consumed by the project (kL/p) Electricity consumed by modular HPs (MWh/p) Electricity consumed by auxiliary equipment of modular HPs (MWh/p) Electricity consumed by other chilled water generating equipment (MWh/p) Electricity consumed by auxiliary equipment of other chilled water equipment (MWh/p) Data sources: Energy meters Equipment logs Temperature and flow sensors Emission reduction calculated as: $ERp = REp - PEp$

Annex II: Available CDM methodologies for interventions in industry[50]

Meth #	Used in sector	
Sector-specific energy efficiency interventions (methodologies used in registered projects only)		
AM009	Petrochemicals	Recovery and utilization of gas from oil fields that would otherwise be flared or vented --- Version 7.0
AM0038	Non-ferrous metals	Methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of silicon and ferro alloys --- Version 3.0.0
AM0059	Iron & steel, Non-ferrous metals	Reduction in GHGs emission from primary aluminium smelters --- Version 2.0
AM0066	Iron & steel	GHG emission reductions through waste heat utilisation for pre-heating of raw materials in sponge iron manufacturing process --- Version 2.0
AM0068	Ferrous metals	Methodology for improved energy efficiency by modifying ferroalloy production facility --- Version 1.0
AM0106	Building materials	Energy efficiency improvements of a lime production facility through installation of new kilns --- Version 2.0.0
AM0109	Iron & steel	Introduction of hot supply of Direct Reduced Iron in Electric Arc Furnaces --- Version 1.0.0
AM0114	Chemicals	Shift from electrolytic to catalytic process for recycling of chlorine from hydrogen chloride gas in isocyanate plants --- Version 1.0
AM0115	Iron & steel	Recovery and utilization of coke oven gas from coke plants for LNG production --- Version 1.0
AMS-I.C	Paper	Thermal energy production with or without electricity --- Version 22.0
AMS-III.B	Chemicals	Switching fossil fuels --- Version 18.0
AMS-III.BA	Electronics	Recovery and recycling of materials from E-waste --- Version 4.0
AMS-III.M	Recycling, Paper	Reduction in consumption of electricity by recovering soda from paper manufacturing process --- Version 2.0
AMS-III.V	Iron & steel	Decrease of coke consumption in blast furnace by installing dust/sludge recycling system in steel works --- Version 1.0
AMS-III.Q	Chemicals, Paper	Waste energy recovery --- Version 6.1
AMS-III.Z	Building materials	Fuel Switch, process improvement and energy efficiency in brick manufacture --- Version 6.0
Crosscutting interventions (also) used in industry		
AM0017	Cross-cutting	Steam system efficiency improvements by replacing steam traps and returning condensate --- Version 2.0
AM0018	Cross-cutting Projects in Chemicals, Petrochemicals, Paper, Food	Baseline methodology for steam optimization systems --- Version 4.0
AM0044	Cross-cutting	Energy efficiency improvement projects - boiler rehabilitation or replacement in industrial and district heating sectors --- Version 2.0.0

[50] Sources: UNFCCC CDM methodology website: https://cdm.unfccc.int/methodologies/index.html, and the UNEP CDM pipeline: https://unepccc.org/cdm-ji-pipeline/

AM0048	Cross-cutting	New cogeneration project activities supplying electricity and heat to multiple customers --- Version 5.0
AM0049	Cross-cutting	Methodology for gas-based energy generation in an industrial facility --- Version 3.0
AM0055	Cross-cutting	Efficiency improvement by boiler replacement or rehabilitation and optional fuel switch in fossil fuel-fired steam boiler systems --- Version 1.0
AM0060	Cross-cutting	Power saving through replacement by energy efficient chillers --- Version 2.0
AM0063	Cross-cutting	Recovery of CO2 from tail gas in industrial facilities to substitute the use of fossil fuels for production of CO2 --- Version 1.2.0
AM0076	Cross-cutting	Implementation of fossil fuel trigeneration systems in existing industrial facilities --- Version 2.0
AMS-I.C/IID	Cross-cutting Projects in Iron & Steel, non-ferrous metals, Petrochemicals, Chemicals, Cement, Building materials, Glass, Paper, Machinery, Electronics, Food, Textiles, Construction	Energy efficiency and fuel switching measures for industrial facilities --- Version 13.0
AMS-II.C	Mining, Chemicals, Machinery, Textiles, Electronics	Demand-side energy efficiency activities for specific technologies --- Version 16.0
Fuel switch interventions in industry, including to renewable energy[51]		
AM0082	Iron & steel	Use of charcoal from planted renewable biomass in a new iron ore reduction system --- Version 2.0
ACM003	Building materials	Partial substitution of fossil fuels in cement or quicklime manufacture --- Version 9.0
Interventions to reduce industrial process emissions		
ACM005	Cement	Increasing the blend in cement production --- Version 7.1.0
AM0021	Chemicals	Baseline Methodology for decomposition of N2O from existing adipic acid production plants --- Version 3.0
AM0027	Chemicals	Substitution of CO2 from fossil or mineral origin by CO2 from biogenic residual sources in the production of inorganic compounds --- Version 3.0
AM0028	Chemicals	N2O destruction in the tail gas of Caprolactam production plants --- Version 6.0
AM0030	Non-ferrous metals	PFC emission reductions from anode effect mitigation at primary aluminium smelting facilities --- Version 4.0.0
AM0065	Non-ferrous metals	Replacement of SF6 with alternate cover gas in the magnesium industry --- Version 2.1
AM0078	Electronics	Point of Use Abatement Device to Reduce SF6 emissions in LCD Manufacturing Operations --- Version 2.0.0
AM0081	Iron & Steel	Flare or vent reduction at coke plants through the conversion of their waste gas into dimethyl ether for use as a fuel --- Version 1.0

[51] Note that for renewable energy interventions only industry-specific methodologies are included. There are many more generic renewable energy methodologies.

AM0096	Electronics	CF4 emission reduction from installation of an abatement system in a semiconductor manufacturing facility --- Version 1.0.0
AM0111	Electronics	Abatement of fluorinated greenhouse gases in semiconductor manufacturing --- Version 1.0.0
ACM0019	Chemicals	N2O abatement from nitric acid production --- Version 4.0
AMS-III.N	Building materials	Avoidance of HFC emissions in rigid Poly Urethane Foam (PUF) manufacturing --- Version 3.0
Construction		
AMS-III.BH.		Displacement of production of brick and cement by manufacture and installation of gypsum concrete wall panels --- Version 1.0

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