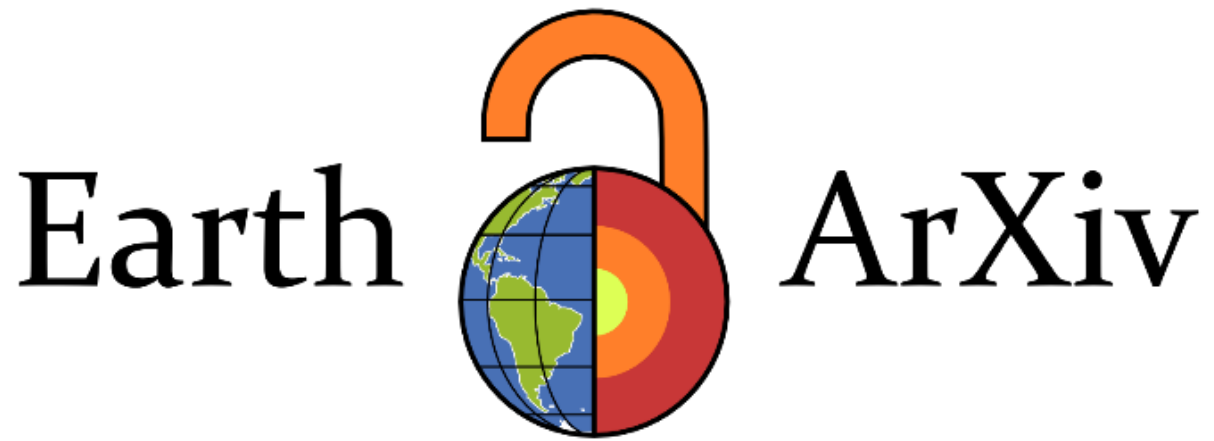




Peer review status:

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Executive Summary

- **Storage ≠ Removal:** Timber buildings store carbon that was already sequestered by forests; they do not actively remove CO₂ from the atmosphere.
- **Net climate benefit depends on counterfactuals:** Climate impacts should be assessed against credible baselines to ensure additionality and attribution.
- **Carbon Storage Units (CSUs):** CSUs can be introduced as a separate category, but only constitute a climate benefit if net gains can be demonstrated.
- **Carbon Storage Units ≠ Net Climate Benefit:** Only a harvested wood product (HWP) baseline can quantify net climate benefit from carbon storage. A zero-storage baseline (e.g. a concrete building) shows how much carbon is stored, but not whether this storage offers greater benefit than alternative uses of the wood.
- **Environmental trade-offs:** Increased demand for timber may lead to biodiversity loss, land-use change, or leakage, undermining broader climate and sustainability goals.

Recommendations

- **Timber should be integrated, not isolated:** Timber use should be part of project-level, integrated emission reduction strategies - be it for claiming climate benefits from carbon storage, from emission reduction from material substitution or from mixed component approaches.
- **Ensure policy and market alignment:** Incentive mechanisms should align with robust decarbonization goals, inter-sectoral policy coherence, and integrity standards.
- **Safeguard against potential land-use and biodiversity trade-offs:** Mechanism design should include safeguards to address potential land-use and biodiversity trade-offs. Social and wellbeing co-benefits should be promoted.
- **Make No Net Loss a condition for eligibility:** Crediting of timber-related climate benefits should be conditional on demonstrable No Net Loss of biodiversity, with avoidance prioritized in line with the mitigation hierarchy. Nature-positive targets should be encouraged as co-benefits to ensure alignment of climate and biodiversity goals.
- **Science-based mechanism design:** Policy and mechanism design should incorporate scientific evidence and support ecological and policy coherence.

White Paper

Classifying Climate Benefits and Addressing Trade-offs of Timber Use in Buildings for Voluntary Carbon Markets and the EU Carbon Removal Certification Framework

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Abstract: Timber use in construction is increasingly promoted as a climate mitigation option due to its potential for carbon storage and material substitution. Current classifications often conflate storage with carbon removal, risking misalignment with voluntary carbon market integrity frameworks and the EU Carbon Removal Certification Framework. This paper evaluates the scientific and methodological basis for classifying timber-related climate benefits and advocates for integrating scientific evidence into future market and policy mechanisms. It outlines technical requirements for attribution, baseline setting, and carbon pool consistency, and assesses four classification options. The paper recommends treating timber as part of an integrated building-level mitigation strategy rather than a standalone component - be it for climate benefits from carbon storage, from emission reduction through material substitution, or from mixed component approaches. Further emphasis is placed on the need to safeguard against biodiversity and land-use trade-offs associated with timber demand as an integral part of any incentive mechanism.

1 Introduction

1.1 Scientific perspectives

According to the IPCC climate mitigation report 2023, buildings have been responsible for a share of 21 % of global Greenhouse Gas (GHG) emissions, and a share of 32% of global CO₂ emissions in 2019 alone. Decarbonization of the built environment is therefore a significant lever for transforming and reducing anthropogenic drivers of global warming and climate change. While the reduction of energy consumption by buildings and supply of renewable energy are a primary focus in the built environment, the sector has engaged in promoting mitigation strategies to further reduce GHG emissions from building materials in recent years. One strategy focuses on increasing the use of wood in buildings as a low-impact material. Use of timber in buildings has been promoted as a climate-beneficial construction material (Dzhurko et al., 2024; Himes & Busby, 2020; Mishra et al., 2022), underlining its potential to act as a “global carbon sink” (Churkina et al., 2020) by storing biogenic carbon retained in the wood for a long term and to avoid emissions from more emission-intensive materials such as concrete or steel. More recently, several studies have provided a more detailed picture of the mitigation potential of timber as a building material. Research using life cycle assessment in the built environment across different building types highlights mixed results regarding climate benefits from transitioning to timber-based buildings on the building and building stock level (Andersen et al., 2024; Hansen et al., 2024; Kumar et al., 2024; Zhong et al., 2021): Climate benefits from timber

were found to depend not only on the building type but also on features of the building design such as combinations of different materials. Furthermore, increased use of timber was shown to correlate with negative impacts on biodiversity (Hansen et al., 2024), leading to further research on how to compensate land use impact from harvested wood products with other biobased building materials such as straw (Hansen et al., 2025). While climate benefits from timber-based construction remain an important component of decarbonization strategy in the built environment, research suggests that use of timber should be integrated within a balanced mitigation portfolio, safeguarding against potential land use and biodiversity tradeoffs.

1.2 Recent policy developments

Despite mixed scientific evidence of climate benefits from using timber in buildings, and evidence of its negative land use impacts, policy in various countries promotes its use as a construction material within the decarbonization strategy of the built environment. Most recently, as a market lever for potential climate benefits from biogenic carbon storage, certification of the use of long-lived wood products in buildings has been included in the European Carbon Removal Certification Framework (CRCF). Established under EU Regulation 2024/3012, the CRCF seeks to provide standardized methodologies to certify carbon removal and carbon storage interventions for voluntary markets, covering practices like afforestation, direct air capture, and carbon storage in products like biochar and timber use in buildings. It mandates proof of additionality, environmental and financial, based on standardized or activity-specific regional baselines, requires adjustments of net benefits for direct and indirect emissions caused by the intervention, and recommends uncertainty assessments and discounting. Under the CRCF, all activities have to follow a common methodology called Q.U.A.L.I.T.Y, which is based on four core principles:

1. Q.U.A.N.T.I.F.I.C.A.T.I.O.N – calculating net carbon removals (Article 4).
2. A.D.D.I.T.I.O.N.A.L.I.T.Y – proving the activity goes beyond the baseline or status quo (Article 5).
3. L.I.A.B.I.L.I.T.Y – ensuring long-term permanence or accountability for stored/removed carbon (Article 6).
4. S.U.S.T.A.I.N.A.B.I.L.I.T.Y – showing the activity causes no significant harm (DNSH) to other sustainability areas in alignment with activities outlined in the EU Taxonomy (Article 7).

The framework currently includes use of long-lived wood products in buildings as a carbon storage method, while a detailed methodology remains still under development. A working group commissioned by the European Commission has published two reports examining existing methodologies on the market for assessing the climate benefits of timber use in construction (CRETA 2023, 2024) with the aim to provide a standardized methodology for using timber in buildings as a carbon storage medium within the scope of the European Carbon Removal Certification Framework.

1.3 VCM Integrity Requirements

Existing methodologies certifying climate benefits from timber buildings have been drafted for certification within the Voluntary Carbon Market which has increasingly formalized its integrity requirements for high quality and high integrity carbon credits during past years. Among these integrity efforts count the establishment of market oversight bodies including the Integrity Council for the Voluntary Carbon Market (ICVCM) and the Voluntary Carbon Market Integrity

Initiative (VCMi), both of which focus on ensuring the quality and integrity of carbon credit issuance, their use and the integrity of associated mitigation claims. Integrity frameworks for carbon accounting have been introduced and updated, including the GHG Protocol to provide globally recognized standards for measuring and managing greenhouse gas emissions, the Oxford Principles for Net Zero Aligned Offsetting to guide credible use of carbon offsets in net-zero strategies and ensure they contribute to long-term decarbonization (Allen et al., 2020; Axelsson et al., 2024), the SBTi guidelines for Net-Zero Target Setting in the Corporate Sector and their various standards (2021, 2023), and the Core Carbon Principles guiding integrity of credits within the Voluntary Carbon Market. In contrast to the EU CRCF, which focuses only on carbon removals, and potentially aims to include carbon storage, the Voluntary Carbon Market allows for claims related to emission removal, reduction, and avoidance.

The Core Carbon Principles define integrity requirements for the VCM, establishing criteria that carbon credits have to meet to qualify as high-integrity, high-quality tradable units measured in CO₂ equivalent (ICVCM, 2023). Emission reduction, removal, or avoidance benefits from interventions must be transparent, traceable, verifiable, effective, and measurable. They must result in permanent climate benefits, be additional relative to a credible baseline, and contribute to a net-zero transition. Moreover, all carbon accounting approaches must avoid the risk of double counting climate benefits.

While carbon market policy, both regionally and globally, clearly aims to establish binding principles for market integrity, standardized methodologies, and the formalization of climate effects, climate benefits of timber use in construction remain debated. For one, recent studies using consequential LCA on the building and building stock level demonstrate that the classification of timber as a building material with unconditionally low climate impact is not defensible (Andersen et al., 2024; Dzhurko et al., 2024; Hansen et al., 2024, 2025; Hoxha et al., 2025; Zhong et al., 2021). Assuming that climate benefits from using timber in construction exist compared to emission-intensive material and from storing biogenic carbon, its negative impact on biodiversity still indicates that it can have direct and indirect negative effects on the climate by negatively impacting biodiversity and ecosystems. Furthermore, current market approaches sometimes conflate fundamentally different mechanisms of quantifying net climate benefits from timber under a single category of “carbon removal”. The blurring of boundaries can risk overstating the mitigation value of timber construction and may challenge the alignment with integrity requirements established by frameworks such as the CRCF, GHG Protocol, and the Core Carbon Principles. Without clear analytical distinction between the mechanisms that support emission avoidance, carbon storage and removal, and without consistent treatment of baselines, permanence, and attribution, the credibility of timber-based credits and their eligibility within high-integrity carbon markets remains uncertain. The following sections therefore outline the methodological requirements and technical challenges for classifying climate benefits from timber use in construction, followed by a discussion of classification options and their compatibility with VCM integrity requirements. Timber construction remains an important tool in decarbonization strategy. Recognizing its benefits while applying accounting safeguards will help maximize climate gains while ensuring ecological and policy integrity.

2 Toward enhanced carbon accounting and integrity in classifying climate benefits from timber-based buildings

2.1 Mitigation actions and Attribution Logic

Avoided, reduced or removed emissions are distinct effects from mitigation actions that correspond to different steps in the mitigation hierarchy (see for instance SBTi Net-Zero Standard, 2021, 2024). Climate mitigation interventions rely on different mechanisms, produce different effects, and often vary regarding the time frames of these effects. The effect size of interventions to avoid, reduce or remove emissions is measured or approximated in tons of CO₂ equivalent, based on an equivalence principle that allows emissions from different sources to be compared. Adjustments to the effect size are made to account for direct and indirect emissions caused by the intervention, as well as for limitations of durability, and the additionality of effects from the intervention are assessed. This ultimately quantifies or estimates the net climate benefit (Δ) attributable to the intervention. This is often expressed in a simplified equation:

$$\Delta = (\text{Observed outcome under project}) - (\text{Associated emissions}) - (\text{Counterfactual outcome or baseline})$$

A net climate benefit means that there is net less greenhouse gas in the atmosphere than there would be without the project, whether because the project avoids or reduces the release of net emissions, or removes additional emissions from the atmosphere. Hence, proving additionality of the net climate benefits of mitigation interventions requires showing that these benefits would not have occurred in the absence of the intervention under a counterfactual scenario. This counterfactual analysis does not only serve to quantify net climate benefits but also to determine whether those benefits can be attributed to the intervention as their cause. It serves not only as a means to compare the mitigation mechanism against a scenario in which it is absent but to solidify the causal relation in the first place. Both aspects - quantitative and qualitative - are part of establishing internal validity of making inferences based on observations. Attributing net climate benefits to a specific intervention as their cause is specifically crucial to avoid double counting of emission avoidance, reduction or removal. Further, attribution is important in carbon markets where companies or countries make use of these claims in their net zero transitions.

2.2 Methodological and Technical Considerations

2.2.1 Mixed-Method Approach

Classifying climate benefits from using timber as a construction material is challenging due to the mixed-method complexity involved. While the statistics of impact evaluation have evolved through experimental work collecting observational data, evaluating benefits from use of timber in construction requires a combination of different methods. A challenge arises because Life Cycle Assessment, carbon accounting, and attribution logic are methodologically different and rely on different assumptions:

- **Life Cycle Assessment models** project material flows based on modeled system behavior at the product or building level (Andersen et al., 2024; Hansen et al., 2024; Kumar et al., 2024). LCA considers the entire lifespan of a building or a construction product, including emissions associated with different life cycle phases, both positive and negative (see Figure 1: Life Cycle Stages).

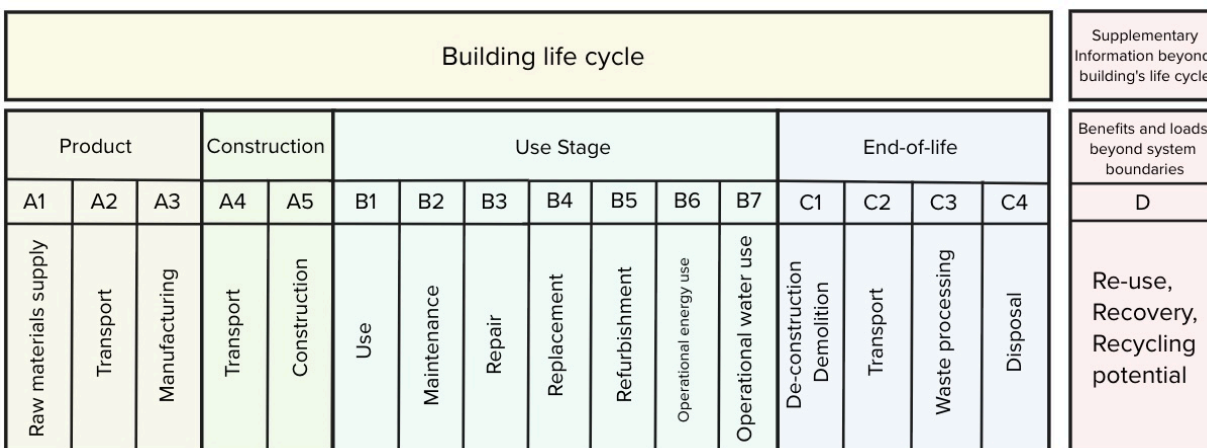


Figure 1: Building life cycle stages according to EN 15978.

- LCA results for construction products are reported in **Environmental Product Declarations (EPDs)**. In accordance with norm EN 15804+A2, Global Warming Potential (GWP) outcomes are disaggregated by emission source into GWP-fossil, GWP-biogenic, and GWP-land use and land use change (GWP-LULUC) (see Figure 2, taken from the EU Level(s) Framework Indicator GWP 1.2, Dodd et al., 2021). While most LCA software allows for uncertainty and sensitivity analysis (with MC simulation being the most frequently used method according to Marsh et al., 2023), EPDs do not disclose methodological choices or uncertainty measures. Hence, serving as a data base for building material emissions requires using methods that can work around the information as disclosed in EPDs (e.g. Hoxha et al., 2025).

Indicator	Unit	Product (A1-3)	Construction process (A4-5)	Use stage (B1-7)	End of life (C1-4)	Benefits and loads beyond the system boundary (D)
(1) GWP - fossil	kg CO ₂ eq					
(2) GWP - biogenic	kg CO ₂ eq					
GWP – GHGs (1+2)	kg CO ₂ eq					
(3) GWP – land use and land use change	kg CO ₂ eq					
GWP – overall (1+2+3)	kg CO ₂ eq					
Notes:						

Figure 2: Disaggregated Global Warming Potential across life cycle stages and emission sources, following EN 15804+A2.

- **Carbon accounting** in land-use sectors is typically mass-based.
- **Additionality assessments** use quasi-experimental statistical methods applied to observational data to estimate net benefits relative to a counterfactual (for examples from forestry see Swinfield et al., 2024; Swinfield & Balmford, 2023; West et al., 2020).

- **Validity of attribution:** These methods are designed not only to quantify net climate benefits of an intervention but also to ensure attribution of these net benefits to the intervention itself (as part of internal validity of the inference), rather than to potential confounding causes.

While mixed-method approaches are not inherently problematic, they require careful integration and transparency regarding assumptions, boundaries, interoperability, and interpretability to avoid conflating distinct forms of evidence.

2.2.2 System Boundaries, Carbon Pools and Flows

Methods may also differ in how they define system boundaries and the system-level assumptions they imply.

- **The IPCC Guidelines** for National Greenhouse Gas Inventories treat forests and harvested wood products as separate carbon pools (IPCC, 2006; Rüter et al., 2019). This distinction is designed to prevent double counting in national inventories.
- **Carbon Flows:** While carbon may flow between pools, any methodological framework applied to voluntary carbon markets should respect such distinctions between pools to credit net climate benefits to the appropriate carbon pool only once.
- **System boundaries** of LCA may carry different assumptions than additionality assessments based on counterfactual scenarios. While evaluating impact against baseline scenarios always implies assumptions that extend beyond the individual project level, building life cycle assessment and its norms and standards impose strict boundaries on the building level.

To ensure consistency across different levels of carbon accounting and the data used in these methodologies, project-level assessments should aim to harmonize methodological approaches or assess and evaluate their potential alignment and conflicting assumptions and respect the logic of distinct carbon pools.

3 Key Classification Issues

3.1 Classification of timber as a CDR technology

Methodologies to certify climate benefits from use of timber in buildings show a variety of approaches, some classifying climate benefits from timber as a carbon removal technology, others as carbon storage or emission reduction. The classification of timber use in buildings as a CDR technique may stem from an earlier IPCC taxonomy of carbon removal methods, presented in a table in the Sixth Assessment Report, Climate Change 2022: Mitigation of Climate Change (Figure 3 from Shukla et al., 2022). The report refers to an earlier categorization adapted from Minx et al. (2018) which lists negative emissions technologies but does itself not include timber or long-lived wood products as a carbon removal activity (see Figure 4 from Minx et al., 2018). While the 2022 IPCC report on climate mitigation discusses emission reduction strategies for buildings in detail (Chapter 9), it does not provide the reasons for the classification of using timber in buildings as a carbon removal method in either of the chapters that include discussions related to climate mitigation in buildings (Chapters 9 and 12). As a result, the basis for the inclusion of timber as a CDR option in the report remains unclear.

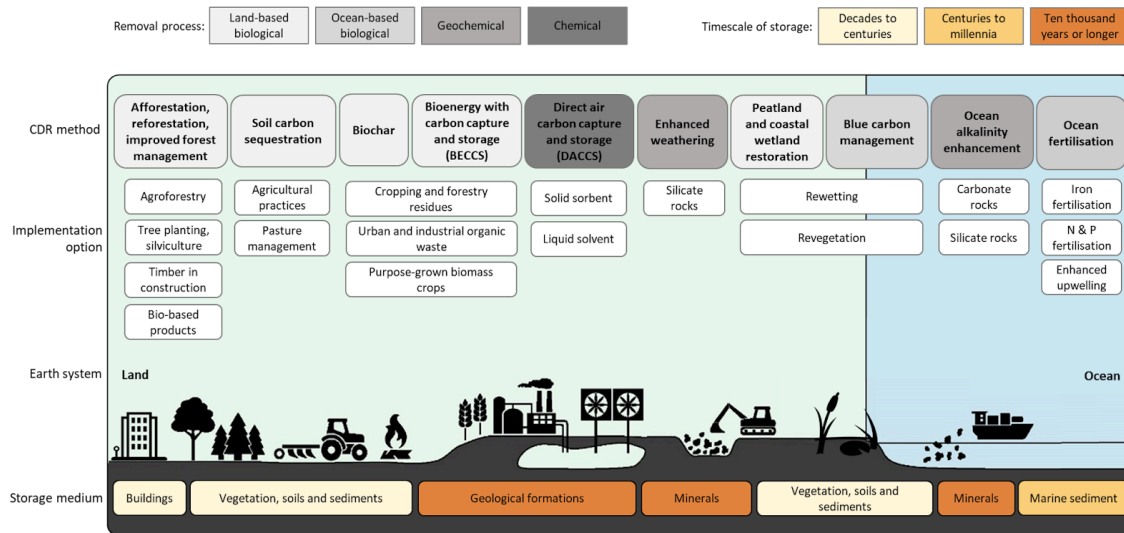


Figure 3: Overview taken from IPCC 6th Assessment report CDR Carbon dioxide removal taxonomy (Shukra et al., 2022).

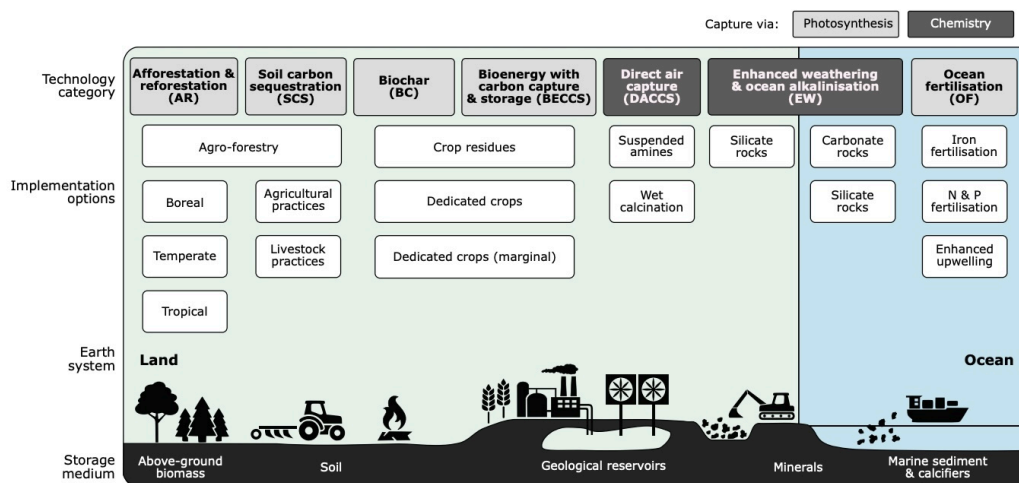


Figure 4: Overview of negative emissions technologies as included in Minx et al. (2018) not listing timber as a CDR method.

3.2 Clarifying the mechanism: Storage is not removal

The use of terminology might have caused confusion about the correct classification of climate benefits from using wood in buildings, risking conflating removal with storage. An intervention can claim to have removed net emissions permanently only if the intervention and its mechanism capture CO₂ from the atmosphere and store it in a durable carbon sink and only if this can be attributed to that intervention. Hence, carbon storage is a necessary condition for making a removal claim but it is alone not sufficient.

To qualify as net carbon removal two further conditions must be met:

- A. **Removal mechanism:** There must be an intervention that actively removes CO₂ from the atmosphere such as tree planting or direct air capture.

- B. **Attribution and effect:** The carbon removed must be additional and attributable to the intervention, meaning it would not have been stored without the project intervention.

Timber in construction violates the first condition: it does not remove carbon from the atmosphere but only extends storage duration of already-sequestered carbon. There is no removal mechanism in using timber in construction, hence, there can also be no removal effect attributable to the intervention. The removal mechanism is forest growth and must be credited to the forest sink (Figure 5).

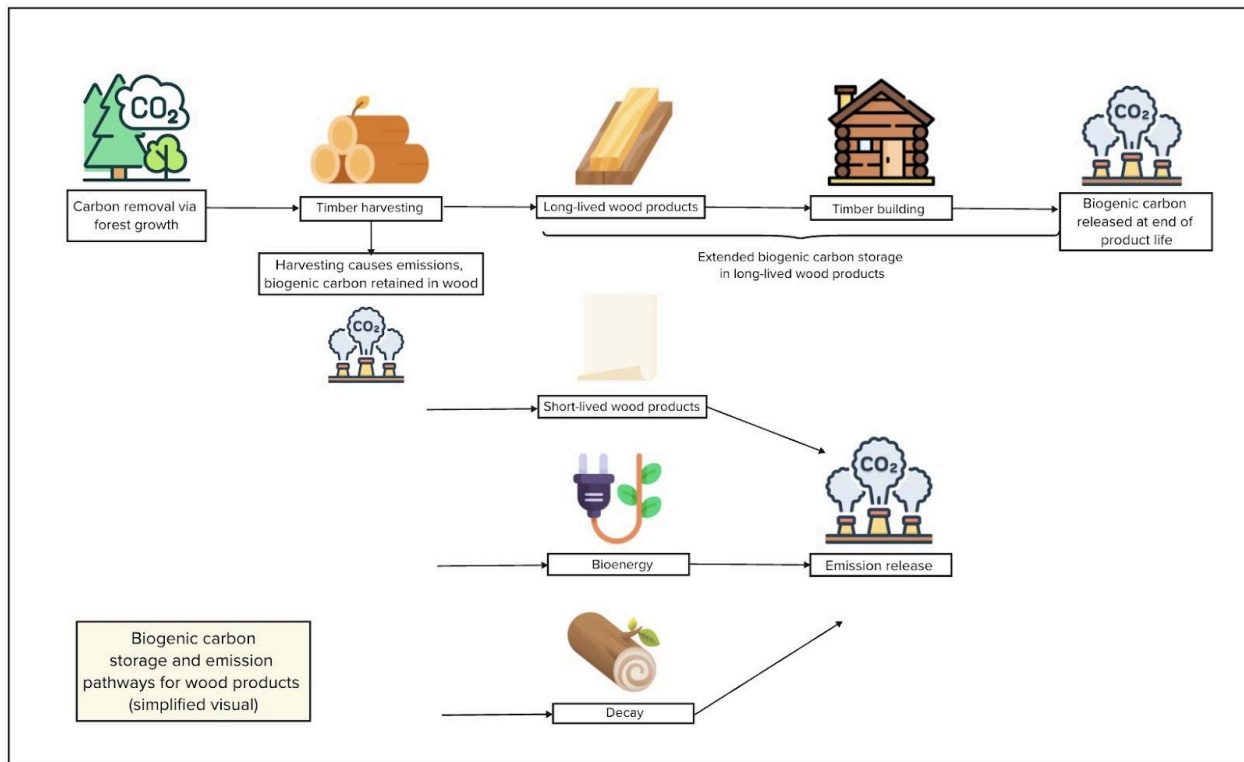


Figure 5: Biogenic carbon storage and emission pathways for wood products (simplified visual). Carbon is removed from the atmosphere through forest growth and stored in biomass. Timber harvesting generates emissions, but the biogenic carbon remains stored in wood. Long-lived wood products, such as timber buildings, extend storage duration before eventual release at the end of product life. Short-lived wood products, by contrast, result in earlier emissions through decay or conversion to bioenergy. Only forest growth constitutes a carbon removal mechanism; wood product use affects the timing of emissions, not the net atmospheric drawdown.

3.2 Can Timber Support an Emission Avoidance or Reduction Claim?

Storage is a necessary condition of a carbon removal mechanism, but it is not sufficient. Carbon storage can also be an implication of certain avoidance or reduction mechanisms, for instance in cases where deforestation and the associated emission release is prevented or delayed. Although the prevention of deforestation preserves an active natural carbon sink and therefore differs in mechanism as well as in effect from the use of timber which only prolongs carbon storage of already harvested “dead” wood, both options have in common that prolonging

storage for the prevention or delay of emission release can under favorable baseline conditions count as a climate benefit.

For emission avoidance or reduction through the use of timber in construction there are two pathways:

A. Substitution Effect:

Timber can avoid or reduce emissions by replacing emission-intensive materials such as steel or concrete in construction.

B. Storage Effect:

Timber delays biogenic emission release relative to alternative harvested wood product pathways, such as short-lived uses, combustion, or natural decay.

In both cases, additionality depends on counterfactual (baseline) scenarios:

Avoidance or reduction can only be credited if it can be demonstrated that the emissions would have occurred or would have occurred earlier in the absence of the intervention. This requires a credible baseline and robust counterfactual analysis.

3.3 Carbon Storage Units as a new classification option

To uphold accounting integrity while acknowledging the climate value of long-lived wood products, methodologies could introduce a separate category for “carbon storage” and account for carbon storage units. This would allow recognition of the extended retention of biogenic carbon without conflating it with atmospheric removal or baseline-substituting avoidance. However, biogenic carbon storage in wood products alone - without differentiating against a credible baseline - does not represent net avoided or net reduced emissions.

3.4 The amount of carbon storage units in a timber building does not equal its net climate benefit

A central question arises around how to quantify net climate benefits from carbon storage units. Net climate benefits must be assessed relative to a credible baseline, demonstrating that there is less CO₂ in the atmosphere than would be without the project intervention. Currently, broadly two methodological approaches exist for assessing carbon storage in timber buildings:

1. Quantification against a zero-storage baseline, i.e. a conventional non-timber building, and
2. Quantification against a baseline of alternative harvested wood product storage pathways.

To understand what the net climate benefits of storing wood products in buildings consist of, it is important to remember that a potential climate benefit originates from delaying the release of emissions from already harvested wood by extending the storage duration through their use in buildings. While the first approach, using a zero-storage baseline, may quantify the amount of carbon stored in timber buildings, it does not reflect the net climate benefit of that storage. This is because the net benefit stems from extending the lifespan of existing biogenic carbon stocks. Therefore, to assess net climate benefits at the system level, carbon storage in buildings should be quantified against alternative wood product storage pathways, as suggested by the second approach.

While incentive mechanisms for both approaches to carbon storage are conceivable, methodological choices should be transparent about whether net climate benefits are quantified

or not. Only net climate benefits meet additionality requirements set out in VCM integrity principles. However, crediting carbon storage units on the building level without claiming net climate benefits could still be used for corporate disclosure or insetting of emissions along the timber value chain.

4 Harmonizing Market Incentives with Climate and Environmental Integrity

Given mixed evidence of climate benefits from timber use in buildings, and potential trade-offs between timber demand, land use, and biodiversity protection: how can incentive mechanisms be designed to deliver climate and environmental benefits and safeguard against potential adverse effects and ensure alignment of global climate and biodiversity targets?

4.1 Learning from trade-offs in forest-based carbon projects and forest management

Nature-based climate solutions and carbon crediting for removal, reduction, or avoidance have long been discussed regarding potential inherent trade-offs between carbon-focused incentives and other environmental or social goals (e.g. Díaz et al., 2009; Isbell et al., 2015; Liang et al., 2016; Liu et al., 2018; Mori et al., 2021; Weiskopf et al., 2024 on carbon-biodiversity relations in forest-based carbon credits or forest management). A lesson is that monetized carbon should not stand alone; incentive mechanisms can and should be complemented by eligibility requirements, safeguards, co-benefits, and disclosure requirements that promote balanced management for carbon, biodiversity, and social outcomes (e.g. see Springer et al., 2024 on managing stand properties for carbon and biodiversity in German forests) and ensure alignment of global climate and KMGBF biodiversity targets (see e.g. Burgos Cuevas et al., 2025 on nature-positive pathways for forestry).

Translating these learnings to carbon storage or emission reduction through use of timber in buildings implies that certification should not only go beyond carbon metrics for timber to consider other building features relevant for GHG emissions and benefits but also comprise DNSH criteria as listed in the EU Taxonomy, environmental and social safeguards and co-benefits, and transparent disclosure across the building lifecycle as the EU CRCF QUALITY criteria suggest.

Trade-offs may arise both at the building project level between different components and along the timber value chain. Mechanism or incentive design should include safeguards against both types of conflict. Eligibility requirements should therefore include deforestation-free supply chains, thresholds for carbon intensity of buildings, sustainable forest sourcing, conducting whole life cycle and life cycle impact assessments, and compliance with energy efficiency standards. Given the importance of forests for the global climate and the critical role of biodiversity in maintaining ecosystem health and service provision, No Net Loss of biodiversity, with avoidance prioritized (Maron et al., 2023), should be treated as both a minimum safeguard and an eligibility criterion for the classification of timber-related climate benefits in voluntary carbon markets and policy frameworks. This further helps ensure policy alignment of climate and biodiversity and nature-positive goals. While environmental and social safeguards can address potential land use tradeoffs, circular material use, biodiversity-enhancing building design (e.g. Weisser and Hauck, 2017), nature-positive targets, water stewardship, health and social well-being can be encouraged as co-benefits. Disclosing ratios such as GHG stored/GHG

emitted across lifecycle phases could provide a more integrated view of climate benefits from timber use in buildings (Dzhurko et al., 2024).

Addressing potential land use trade-offs in the mechanism design is particularly important, where incentives such as for timber use can increase deforestation risk. If forest harvesting increases to supply timber demand, there is a risk of deforestation elsewhere (leakage) or pressure on natural forests, reducing overall net benefit. To avoid unintended effects such as increased deforestation, environmental safeguards, such as caps on amounts of timber used in the building stock and requirements for material reuse, next to deforestation-free supply and no net loss requirements, could be considered.

By implementing adequate safeguards and eligibility requirements, adding co-benefits and disclosure mechanisms, carbon storage or emission reduction certification of timber use can help incentivize holistic sustainable building practices, avoid mitigation deterrence, and address potential trade-offs on the building level and in the value chain. In addition, forestry actors may benefit from complementary incentive mechanisms such as biodiversity crediting, for example through conservation set-asides or improved forest management (Wunder et al., 2025). These mechanisms can reward ecological stewardship beyond carbon and should be considered in parallel with carbon-focused incentives.

4.2 Ensuring intra- and inter-sectoral policy alignment

Use of timber or biobased material in general is only one lever for decarbonization in the built environment and incentive mechanisms can be structured accordingly. Policy should therefore align timber use with other high-priority measures for decarbonization in the built environment and align with policy in other adjacent sectors such as forestry and the energy sector. The design of incentive mechanisms should be informed by scientific findings that identify the conditions under which timber use delivers favorable climate and nature outcomes. These conditions may include, for example, integration with lightweight building design, application in specific building types, circular building design, biodiversity-enhancing building design or the combination with other bio-based materials (Andersen et al., 2024; Dzhurko et al., 2024; Hansen et al., 2024, 2025; Hoxha et al., 2025; Kumar et al., 2024; Kupilas et al., 2025; Weisser and Hauck, 2017; Zhong et al., 2021).

5 Classification Options

Provided that eligibility requirements comprising DNSH criteria and No Net Loss, sustainable building features, and environmental and social safeguards are in place, and that nature-positive targets and other co-benefits are encouraged, there are several options for classifying and quantifying the potential climate benefits from using timber in buildings within the VCM - through carbon storage as well as emission avoidance or reduction through substitution. Since the CRCF covers only carbon removal and storage, the evaluation of options in this paper focuses on compliance with Voluntary Carbon Market standards, which also allow for claims related to carbon avoidance, reduction, and removal.

Option 1: Avoidance or reduction of emissions through material substitution

Use of timber can contribute to avoid and reduce emissions through substitution of more emission-intensive materials such as steel or aluminium. This net emission reduction benefit is

quantified against use of conventional material and associated GHG emissions in a comparable building project as a baseline. Emission avoidance or reduction refers to mitigation across all GHG emission categories - fossil, LULUC and biogenic (see table above in Figure 2).

VCM Compliance: Yes. Avoidance and reduction credits are still considered valid mechanisms in many voluntary carbon market frameworks, especially when coupled with rigorous methodologies and conservative assumptions.

Option 2: Removal through additional afforestation or reforestation upstream the value chain

Looking forward, methodologies could evolve to assess the entire timber value chain, from forest management to end-of-life treatment, to evaluate cumulative climate and environmental impacts and benefits. Incentivizing timber construction could, in some cases, stimulate additional forest regrowth; however, the carbon sequestered and stored would be credited to the forest sink, while the use of timber would merely prolong biogenic carbon storage.

By accounting for the full forest–timber system, certification of carbon removal, for example, through afforestation or reforestation, could become applicable again. However, such removal should be tied to net sequestration in forests, and the credit would belong in land-use carbon accounting, not in product-level or building certification claims.

VCM Compliance: Yes. VCM-compatible for land-use removals, not for timber use itself.

Option 3: Integrative Project-Level Emission Reduction Credit

Rather than crediting timber use in isolation, this option proposes to monetize the net emission reductions of an entire building project as an integrated carbon credit. Timber use would be treated as one component within a broader mitigation strategy that includes energy efficiency measures, material reuse, circular design, renewable energy systems, and low-carbon construction practices. The climate benefit would be credited based on net lifecycle emission reductions relative to a robust counterfactual scenario (e.g. a conventional design baseline without these interventions). The focus shifts from individual materials or actions to the combined decarbonization effect of the building project as a whole.

This option requires a composite methodology that aggregates mitigation outcomes across multiple levers including avoided emissions, reduced operational energy use, retained biogenic carbon, and material circularity and translates them into a single quantified emission reduction claim. This could form the basis for issuing project-level carbon credits under a dedicated methodology tailored to the built environment.

By accounting for interactions of building components and trade-offs between mitigation actions, this integrated approach promotes climate-effective design and aligns carbon crediting with whole-system performance.

VCM Compliance: Yes, in principle compatible but requires careful methodological development.

Option 4: Introduce a Separate Category for Carbon Storage Units

A distinct category for carbon storage or retention can acknowledge the temporal climate value of prolonged carbon storage in wood products. This benefit refers to the emission category of biogenic GHG emissions only (see table in Figure 2). However, as mentioned, carbon storage

alone does not provide a net benefit to the climate system unless net climate benefits are calculated from comparisons with alternative storage scenarios. Otherwise carbon storage units do not represent a change to the system-level carbon balance. Furthermore, it should be disclosed clearly that climate benefit from using timber does not represent a claim to emission removal.

VCM Compliance:

- **No** - if not calculated against a credible baseline.
- **Yes** - if net storage benefit can be demonstrated in assessment against credible alternative storage pathways.

Policy Recommendation:

Timber use for climate benefits, whether from carbon storage or material substitution or mixed component approaches, should be integrated into a broader mitigation strategy at the building level, aligned with the best available scientific evidence and recommendations (e.g. Andersen et al., 2024; Dzhurko et al., 2024; Hansen et al., 2024, 2025; Hoxha et al., 2025; Kumar et al., 2024; Kupilas et al., 2025; Weisser and Hauck, 2017; Zhong et al., 2021).

Whichever of the four policy options is considered, timber use should not be treated in isolation. Any mechanism design should ensure that credited benefits, whether from storage, substitution, or mixed component approaches, are embedded within systemic decarbonization pathways and subject to appropriate environmental safeguards. This broader project context includes:

- Demand reduction through material reuse and circular design,
- Energy efficiency across the building lifecycle,
- Use of renewable energy,
- Combination with other low-emission materials,
- Sustainable forestry and upstream value chain improvements, and
- DNSH compliance, deforestation-free supply chains, and safeguards for biodiversity, land use and communities.
- Biodiversity-enhancing building design on site such as through Animal-Aided Design.
- No net loss as a minimum eligibility requirement for crediting climate benefits from timber to safeguard against potential adverse effects on climate and biodiversity and ensure alignment of global climate and biodiversity targets.
- Promote co-benefits to reach nature-positive goals and building health and well-being targets.

Mechanism design should preserve methodological integrity and ensure transparency about what is being claimed and whether the credit quantifies net climate benefits. Where additional gains cannot be demonstrated, the use of stored or reduced emissions may still inform corporate disclosure or transition planning, but does not meet VCM integrity requirements. This enables timber to play a constructive, context-sensitive role within scientifically grounded and ecologically responsible mitigation strategies.

To ensure methodological rigour across all VCM-compatible options, the following aspects should be taken into consideration:

1. Require counterfactual baseline to ensure additionality: Avoidance, reduction or removal credits should only be granted if a credible baseline demonstrates additionality.
2. Maintain methodological clarity across LCA, carbon accounting, IPCC guidelines and attribution logic: Clearly differentiate and integrate LCA model-based projections, data uncertainties from EPDs, mass-based accounting, and counterfactual statistical analysis to avoid misleading conclusions.
3. Respect carbon pool boundaries in line with IPCC guidelines: Align methodologies with the IPCC's separation of carbon pools, ensuring consistency between project-level and system-level accounting.
4. Avoid conflation of storage and removal in certification logic: Emphasize that storage without atmospheric drawdown is not removal. This distinction is critical for maintaining market credibility and policy integrity.
5. Account for temporal dynamics and credit validity in line with SBTi and Oxford Offsetting Principles: Crediting should reflect the duration and reversibility of climate benefits.
6. Ensure policy coherence and maintenance of priorities within climate transition pathways
7. Proactively address potential adverse and system-level effects of promoting use of timber in construction on other environmental aspects such as biodiversity, water, forest ecosystem degradation and environmental policy in mechanism design.
8. Promote intra- and intersectoral policy and disclosure coherence.
9. Implement eligibility criteria such as deforestation-free supply chains, DNSH criteria and E&S safeguards such as No Net Loss, and promote nature-positive targets as co-benefits, holistic building sustainability and co-benefits.

Conclusion

Timber buildings can contribute to lower embodied emissions through emission reduction from substitution and carbon storage effects, but they don't remove GHG emissions from the atmosphere. The carbon stored in the timber was sequestered by the forest before harvest. Putting that timber into a building extends storage duration, it does not actively remove new carbon from the atmosphere. Storage benefits depend on baselines and end-of-life scenarios. Use of timber should be seen as one lever within a broader decarbonization strategy in the built environment, not as a standalone solution. Therefore, mechanisms promoting use of timber should align with other decarbonization measures and integrate scientific evidence on conditions under which climate benefits from timber are more likely to emerge. Further, biodiversity and land use trade-offs cannot be ignored. Increased demand for timber can lead to forest degradation or biodiversity loss if sourcing isn't carefully managed. This undermines broader sustainability goals even if substitution benefits exist. Therefore, mechanism design for financial instruments and policy should align various decarbonization measures in the built environment and address potential trade-offs or adverse effects proactively in mechanism design through eligibility requirements such as deforestation-free supply chains and No Net Loss policy, implementation of environmental and social safeguards, and co-benefits. No Net Loss of biodiversity is essential not only as an environmental safeguard, but also for maintaining the climate integrity of timber-based mitigation claims and alignment with global biodiversity

targets. Complementary incentive mechanisms such as biodiversity crediting for enhanced forest management or habitat conservation may also offer viable opportunities for the timber sector and could be considered alongside carbon-based classifications.

Disclaimer: This white paper draws on academic work currently in progress. It is a non-peer-reviewed preprint and may be revised based on feedback or subsequent peer review.

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