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LEED AND BREEAM CERTIFICATION AS A TOOL FOR PROMOTING TIMBER CONSTRUCTION: OPPORTUNITIES AND LIMITATIONS OF USING WOOD IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT AND UKRAINE'S RECONSTRUCTION

Abstract. The paper examines the LEED and BREEAM certification systems as tools for promoting timber construction in the context of sustainable development and Ukraine's reconstruction. It substantiates that the advantages of wood are not automatic, but require confirmation through life-cycle assessment, environmental product declarations, responsible material sourcing, emissions control, fire safety and energy efficiency. It is shown that LEED and BREEAM can serve as a methodological framework for improving project quality, procurement transparency, access to finance and the formation of a low-carbon model for Ukraine's reconstruction.
Keywords: LEED; BREEAM; timber construction; sustainable development; reconstruction of Ukraine.

1. Introduction: the context of climate transformation and Ukraine's reconstruction

The contemporary paradigm of urban development faces unprecedented pressure caused by the climate crisis, rapid urbanisation and the need to decarbonise the building sector. Traditional materials - above all Portland cement and steel - have a significant carbon footprint at the production stage. Therefore, design decisions are increasingly assessed not only by initial cost, but also by full life-cycle performance, energy efficiency, occupant health and the responsible origin of resources.

For Ukraine, sustainable construction has not only an environmental dimension, but also a reconstruction dimension. The needs for recovery and reconstruction after wartime destruction are estimated at hundreds of billions of dollars, while the housing stock and public infrastructure require large-scale renewal. Therefore, decisions on materials, energy systems, design standards and procurement will have a systemic impact on life-cycle costs, energy security, access to international finance and the quality of the environment for residents [1].

Reconstruction creates a rare "window of opportunity" to change the logic of design: from minimum regulatory compliance to evidence-based assessment of environmental, economic and social outcomes. In this context, voluntary environmental certification systems can function as tools for quality management, transparency and comparability of projects, rather than merely as marketing labels [2], [5].

Why wood is considered a strategic material

The integration of mass timber and engineered wood into contemporary architecture goes beyond the simple substitution of concrete or steel. It is associated with biophilic design, the circular economy, prefabrication, reduced construction waste and the potential reduction of embodied carbon. However, these advantages are not automatic: they must be confirmed through life-cycle assessment, environmental product declarations, a transparent supply chain and material quality control [2], [6], [15], [16].

This is why LEED and BREEAM are relevant for analysing timber construction. They do not "award points for wood" as such, but reward verified outcomes: a lower carbon footprint, responsible material sourcing, low harmful emissions, effective waste management and a high-quality indoor environment [2], [6].

2. International environmental certification systems for buildings

International certification systems are multi-criteria in nature: they assess energy efficiency, water use, materials, waste management, indoor environmental quality, carbon footprint, management processes and other sustainability parameters. They make it possible to consider a building not as an isolated object, but as part of an ecological, economic and social system [2], [5], [8].

Table 1.

Comparative overview of the main international environmental certification systems for buildings

System	Brief profile	Materials, carbon and LCA	Relevance for Ukraine's reconstruction
LEED v5	USGBC's international system for the design, construction, operation and modernisation of buildings.	Increased emphasis on decarbonisation, energy efficiency, embodied carbon, low-emission materials and responsible product selection.	High: understandable to investors and useful for public and commercial projects.
BREEAM v7	A BRE system with a strong emphasis on evidence, independent assessment and a broad set of sustainability categories.	Life-cycle assessment, responsible sourcing, energy, carbon, health and wellbeing, management and waste.	High: useful for donor and portfolio programmes where an audit trail and quality verification are important.
DGNB	A German system built on a holistic approach to environmental, economic and sociocultural quality.	A strong methodological basis in LCA and LCC, with a focus on the life cycle and actual outcomes.	Methodologically strong, but currently less recognisable than LEED/BREEAM for rapid scaling in Ukraine.
EDGE	An IFC tool for emerging markets, focused on measurable resource efficiency.	A minimum 20% saving in energy, water and embodied energy/carbon in materials relative to a local baseline building.	Very useful as an entry-level tool for housing, rapid scaling and green finance.
WELL Building Standard	An IWBI system focused on health, wellbeing and indoor environmental quality.	Less focus on structural materials; more on air, water, light, comfort, materials and user experience.	Complements LEED/BREEAM for schools, hospitals, offices and housing, but does not replace LCA frameworks.

3. Why LEED and BREEAM were selected for analysis

LEED and BREEAM are two of the most influential and internationally recognised systems for assessing building sustainability. LEED is widely used as a global green building system, while BREEAM is positioned as a comprehensive sustainability assessment system with independent verification and broad application across different types of buildings [3], [5].

Their practical value for timber construction is that they move the discussion from general environmental claims to evidence. To obtain credits, a project must provide calculations, specifications, protocols, certificates of origin, test results, waste management plans and other documents. This is particularly important for Ukraine's reconstruction, where international donors and investors require a clear language for quality verification [4], [5], [6].

LEED and BREEAM can become drivers of the transition to low-carbon timber construction if they are used not as a "green badge", but as tools for changing technical specifications, procurement, the chain of evidence and public policy. Under this approach, wood can move from a niche material into the category of a strategic solution for schools, offices, rehabilitation centres, low-rise and mid-rise housing [2], [6].

Logic of promoting wood through certification:

- lower embodied carbon can be credited only after a proper life-cycle assessment and comparison with a baseline scenario [2], [6], [15];

- responsible wood sourcing must be confirmed by chain-of-custody certificates or equivalent evidence [6], [18], [19];
- low formaldehyde and volatile organic compound emissions require laboratory confirmation and control of associated materials - adhesives, coatings and sealants [2], [6];
- the advantages of prefabrication are realised through less waste, better quality control and clear documentation of material flows [2], [6].

4. LEED and BREEAM certification levels

The key methodological difference between the systems is that LEED operates through a point total after mandatory prerequisites have been met, whereas BREEAM determines a weighted percentage rating across assessment categories [3], [5], [7].

Table 2.

LEED and BREEAM certification levels

Level	Threshold	Explanation
LEED v.5		
LEED Certified	40-49 points	Basic level of compliance after mandatory prerequisites have been met
LEED Silver	50-59 points	Improved level of sustainability and energy efficiency
LEED Gold	60-79 points	High level of environmental and operational performance
LEED Platinum	80+ points	Highest LEED level; in v5, decarbonisation requirements for the highest level have been further strengthened
BREEAM v.7		
BREEAM Pass	≥ 30%	Initial level of certified sustainability
BREEAM Good	≥ 45%	A level that demonstrates a noticeable improvement over minimum practice
BREEAM Very Good	≥ 55%	Advanced good practice level for many types of buildings
BREEAM Excellent	≥ 70%	A high level often used as a target for high-quality development and public projects
BREEAM Outstanding	≥ 85%	The highest level, reflecting exceptional sustainability and evidence-based solutions

5. LEED v5 BD+C credits relevant to timber construction

In LEED v5, wood can benefit a project only if its advantages are translated into verified indicators: carbon footprint, reuse, low emissions, transparent product selection, construction waste management and indoor environmental quality [2].

Table 3.

Summary of LEED v5 BD+C credits relevant to timber construction

Code	Criterion / points	Practical significance for wood
IPc1	Integrated design process, 1 point	Promotes early coordination of the structural scheme, WBLCA, fire safety, acoustics and engineering solutions; for timber, this is key to avoiding late conflicts between architecture, structures and regulations [2].
EAc2	Reduction of peak thermal loads, 1-5 points	Timber and hybrid envelope systems can help through a high-quality envelope, thermal bridge control and prefabrication, but the credit assesses the outcome rather than the material [2].
EAc3	Enhanced energy efficiency, 1-10 points	Wood can support high energy performance through airtightness and well-designed details, but energy modelling and actual performance are decisive [2].
MRp1	Planning for zero-waste operation, prerequisite	Relevant to circularity, design for disassembly, reuse of components and planning of material flows [2].
MRp2	Quantification and assessment of	A mandatory requirement to account for embodied carbon in the

	embodied carbon, prerequisite	structure, envelope and materials; it creates the evidentiary basis for comparing timber with concrete or steel [2].
MRc1	Building and material reuse, 1-3 points	Supports adaptive reuse, reclaimed wood and the reuse of structural or finishing components [2].
MRc2	Reduction of embodied carbon, 1-6 points	One of the most important credits for wood: it rewards verified reductions in the embodied carbon of primary structures, envelopes and siteworks through WBLCA or EPD analysis [2].
MRc3	Low-emitting materials, 1-2 points	For wood, formaldehyde, VOCs, the safety of adhesives, sealants and coatings, and compliance with low-emission requirements are critical [2].
MRc4	Building product selection and procurement, 1-5 points	Promotes the selection of products with transparent data on impacts on climate, health, ecosystems, social responsibility and circularity; for wood, EPD, FSC/PEFC and the supply chain are important [2], [18], [19].
MRc5	Diversion of construction and demolition waste from landfill, 1-2 points	Prefabrication, control of offcuts, separation of clean wood streams and reuse of elements can strengthen the outcome [2].
EQp1/EQp2	Construction activity management and basic air quality, prerequisites	Relevant to pollution and moisture control during construction, material protection and proper ventilation after commissioning [2].
EQc1	Enhanced air quality, 1 point	Confirms that timber interiors and wood-based products comply with enhanced criteria for a healthy indoor environment [2].

6. BREEAM New Construction v7 credits relevant to timber construction

In BREEAM v7, timber construction is most closely linked to the categories of Management, Health and Wellbeing, Energy, Materials and Waste. As in LEED, wood is not an independent basis for receiving credits: LCA, emissions control, evidence of responsible sourcing and life-cycle planning are required [5], [6].

Table 4.

Summary of BREEAM v7 credits relevant to timber construction

Code	Criterion	Practical significance for wood
Man 02	Life-cycle cost assessment and service life planning	Timber systems are strong when their durability, maintainability and service cycle are planned at an early stage, rather than treated as a temporary solution [6].
Man 03	Responsible construction	Strengthens the case for factory fabrication of structures, better installation organisation, fewer "wet" processes and improved site control [6].
Hea 04	Indoor air quality	Assesses ventilation, pollutant control, VOCs and formaldehyde; wood is an advantage only when low-emission CLT, glulam, LVL, coatings, adhesives and varnishes are used [6].
Ene 01	Energy and carbon performance of regulated energy use	Wood does not guarantee credits, but can help through a high-quality envelope, airtightness, minimisation of thermal bridges and prefabrication [6].
Ene 02	Prediction of operational energy use and carbon	Low embodied carbon does not replace low operating costs; the competitiveness of a timber building increases in an integrated "energy + carbon" model [6].
Mat 01	Building life-cycle assessment	The main entry point for wood in BREEAM: timber and hybrid structures can achieve a better result if the LCA correctly demonstrates reduced environmental impact [6], [15].
Mat 03	Responsible sourcing of construction products	A key criterion for wood: legality of sources, FSC/PEFC or equivalent evidence, due diligence and traceability of raw material origin are required [6], [18], [19].
Wst 03a	Operational waste	Important for circularity: disassembly, reuse of elements, separation of material flows and planning for their management during operation [6].

7. Scientific and methodological grounds and cautions regarding the use of wood

The scientific evidence generally supports the thesis that mass timber and engineered wood can reduce embodied greenhouse gas emissions compared with reinforced concrete or steel structures. However, the outcome depends on system boundaries, the forestry scenario, the mode of material substitution, transportation, durability, reuse and the end-of-life stage [14], [15].

Life-cycle assessment is the key methodology for a correct comparison. Without the same calculation boundaries, the same functional unit, the same service life and transparent product data, claims about the "environmental friendliness" of a material remain insufficiently evidence-based. Therefore, LCA standards, EN 15978 for buildings and EN 15804 for environmental declarations of construction products are important for certification [15], [16], [17].

The conclusion regarding indoor environmental quality is also nuanced. Wood materials can have a positive or neutral effect due to moisture buffering and biophilic perception, but engineered wood products, adhesives, sealants, paints and varnishes may be sources of formaldehyde and volatile organic compounds. Thus, the certification advantage of wood arises only under disciplined material selection and ventilation control [2], [6].

A mass increase in demand for wood without control of sustainable forest management may reduce the climate benefit. Therefore, certification should cover not only carbon calculations, but also legality of origin, biodiversity conservation, traceability, the supply chain and risks of land-use change [6], [18], [19].

8. Relationship between LEED/BREEAM, energy efficiency and nZEB/ZEB

The updated EU Directive 2024/1275 on the energy performance of buildings makes zero-emission buildings the new standard for new construction in the EU. New public authority buildings are to move towards this standard from 2028, and other new buildings from 2030; at the same time, the calculation of life-cycle emission indicators is entering the legal framework [11], [12].

LEED and BREEAM do not replace regulatory nZEB/ZEB requirements or national energy certification. They function as a comprehensive overlay: they combine energy efficiency, material carbon, occupant health, responsible sourcing and waste management into a single market mechanism. For wood, this means that low embodied carbon must be accompanied by high operational performance [2], [6], [11].

For Ukraine's reconstruction, it is important not to oppose an "energy-efficient" building to a "low-carbon" building. The future competitiveness of a project will depend on the simultaneous achievement of several goals: low operating costs, low embodied carbon, a healthy indoor environment, adaptability, maintainability and a transparent supply chain [2], [6], [11].

9. Barriers and risks for the Ukrainian context

Table 5.

Key barriers and risks for the use of wood in certified projects in Ukraine

Barrier / risk	**Content and implications**
Fire safety and regulatory inertia	Fire safety rules in Ukraine include requirements for fire-retardant treatment of timber elements in attic coverings of buildings, except those of fire resistance class V; wider use of engineered wood requires mature practice in calculation, testing, expert review and detailing of connections [13].
Supply chain and evidence base	LEED and BREEAM promote not merely "wood", but documented wood: EPD, LCA, FSC/PEFC, traceability, emissions testing and a verified procurement chain. The Ukrainian market needs to build competences in carbon accounting and documentation [2], [6], [18], [19].
Indoor air quality and VOCs	Wood can be an advantage, but only if low-emission products and control of associated materials are ensured. Inappropriate adhesives, coatings, sealants or insufficient ventilation can turn the argument of a "healthy material" into a risk [2], [6].
Durability, operation and moisture regime	It is dangerous to treat wood as a cheap or temporary solution. Certification requires durability, controlled moisture, maintainability, a high-quality envelope

	and the possibility of disassembly or reuse [6], [15].
Gap between operational energy and embodied carbon	A timber project will not be sustainable if it has low embodied carbon but weak energy efficiency. Conversely, energy efficiency alone without material control loses part of its climate logic [2], [6], [11].

10. Benefits of LEED and BREEAM certification for Ukraine's sustainable reconstruction

Table 6.

Benefits of LEED and BREEAM certification for sustainable development and Ukraine's reconstruction

Benefit	Content of the benefit	Relevance for Ukraine's reconstruction
Measurable quality, not merely formal compliance with regulations	Certification assesses a building across a set of indicators: energy, water, materials, indoor environment, operational performance and resilience.	A transition from rapid recovery to durable, high-quality and economically justified construction.
Attraction of international finance and ESG	Certification creates verifiable evidence of compliance with environmental, social and governance requirements.	It can facilitate access to grants, loans and blended finance.
Reduction of operating costs	The systems encourage optimisation of energy, heat, water and engineering systems at early stages.	Important for housing, schools, hospitals and public buildings in conditions of high energy costs
Increased liquidity and investment attractiveness	Certified buildings are better perceived by the market and may have lower operational and regulatory risks.	Contributes to the revitalisation of the private sector in urban recovery.
Orientation towards nZEB/ZEB	LEED and BREEAM support high energy efficiency, heat recovery, renewable energy sources and a high-quality envelope.	Creates a bridge to the European course of decarbonisation and energy security.
Life-cycle assessment and carbon footprint reduction	Not only operational resources are considered, but also materials, construction, repairs, demolition and reuse.	Enables materials and structural decisions to be justified in a long-term perspective.
Rational use of resources	Encourages less waste, local and responsible materials, reuse and efficient water use.	Reduces the resource intensity of reconstruction and the burden on municipal systems.
Systemic project management	Requires early coordination between architects, structural engineers, building services engineers, contractors and the client.	Reduces the risk of rework, incompatible solutions and loss of funds.
Transparency and quality control	Provides for documentation of decisions, independent review and confirmation of compliance.	Increases the trust of donors, communities and society in reconstruction programmes.
Healthy indoor environment	Attention to air, light, thermal and acoustic comfort, and safe materials.	Critical for housing, schools, kindergartens, hospitals and rehabilitation centres.
Social resilience of communities	High-quality certified buildings better meet requirements for safety, comfort, inclusiveness and long-term operation.	Reconstruction becomes not only physical recovery, but also the creation of an environment for health, trust and sustainability.

11. Recommended algorithm for implementing a low-carbon project

The following route runs from the client's decision to certification and further scaling. It synthesises the official LEED and BREEAM processes, as well as the stages that are critical specifically for timber construction: LCA, EPD, fire safety, responsible material sourcing and the integration of requirements into procurement [4], [5], [6].

1. Client decision on a low-carbon project and definition of goals: certification level, target carbon profile, budget, schedule and building typology.
2. Early preliminary LEED/BREEAM assessment: selection of the scheme, checking credit achievability, and identifying mandatory prerequisites and risks.
3. Formation of an integrated team: architect, structural engineer, building services engineers, fire safety specialist, LCA expert, certification specialist/assessor, cost estimator and procurement specialist.
4. Selection of the structural system: mass timber, hybrid timber-concrete/steel, light timber systems or a combined scheme, taking into account fire resistance, acoustics, moisture and cost.
5. Initial modelling: energy model, WBLCA, thermal bridge analysis, and operation and maintenance scenarios.
6. Preparation of material requirements: EPD, FSC/PEFC or equivalent, low-emission adhesives/coatings, requirements for formaldehyde and VOCs, and requirements for packaging and waste.
7. Incorporation of requirements into tenders and contracts: material acceptance criteria, supplier documentation, responsibility for deviations and an evidence log for certification.
8. Detailed design: detailing of fire safety, moisture protection, acoustics, airtightness, disassembly and maintainability.
9. Construction and control: protection of wood from moisture, delivery control, photographic records, waste sorting, control of material substitutions and the evidence log.
10. Submission of evidence for certification: uploading documentation, review by GBCI for LEED or by the assessor/QA procedures for BREEAM, and correction of comments.
11. After commissioning: monitoring of energy, water and indoor environmental quality, maintenance management and feedback for subsequent projects.
12. Scaling: creation of standard terms of reference, a library of verified materials, procurement templates and a local LCA/EPD database for the Ukrainian market.

12. Conclusions

LEED and BREEAM can be effective tools for promoting timber construction in Ukraine, but only if they are applied as a methodological framework for managing quality, carbon, materials and evidence, rather than as a formal "green label" [2], [5].

Wood receives no automatic advantage in either system. Its benefits must be demonstrated through LCA, EPD, responsible sourcing, low emissions, fire safety, durability and control of operational performance [2], [6], [15].

For Ukraine, certification can create a language of trust between clients, communities, donors, investors and project teams. It makes it possible to compare projects, increase procurement transparency and reduce the risks of poor-quality reconstruction [4], [5].

The most promising approach is an integrated model of "energy + carbon + health + material origin + life cycle". This model makes it possible not to oppose wood to energy efficiency, but to combine it with nZEB/ZEB requirements, a healthy environment and the circular economy [6], [11].

The main constraints in the Ukrainian context are fire design, the shortage of local EPD/LCA competences, the incomplete maturity of supply chains, VOC control and structural durability. Overcoming these barriers requires not only technical solutions, but also market development, procurement standards and educational competences.

References

1. World Bank, Government of Ukraine, European Commission, United Nations. Ukraine Rapid Damage and Needs Assessment / recovery and reconstruction needs estimates, 2026. URL: https://www.worldbank.org/en/country/ukraine
2. U.S. Green Building Council. LEED v5 Reference Guide / Rating System for Building Design and Construction, November 2025 Edition. URL: https://www.usgbc.org/leed/v5
3. U.S. Green Building Council. LEED rating system: certification levels and point thresholds. URL: https://www.usgbc.org/leed
4. U.S. Green Building Council. Guide to LEED Certification. URL: https://www.usgbc.org/guide-LEED-certification
5. BRE / BREEAM. How BREEAM works: assessment categories and ratings. URL: https://breeam.com/about/how-breeam-works
6. BREEAM. New Construction Version 7 Resources and Technical Standard Summaries. URL: https://breeam.com/breeam-newconstructionv7/downloads
7. NBS. What is BREEAM? Rating thresholds and certification stages. URL: https://www.thenbs.com/knowledge/what-is-breeam
8. DGNB. About the DGNB System. URL: https://www.dgnb.de/en/certification/important-facts-about-dgnb-certification/about-the-dgnb-system
9. EDGE Buildings / IFC. EDGE Green Building Certification: 20% savings in energy, water and embodied carbon in materials. URL: https://edgebuildings.com/
10. International WELL Building Institute. WELL v2 overview: ten concepts of WELL. URL: https://www.wellcertified.com/certification/v2-pilot/
11. European Commission. Energy Performance of Buildings Directive (EU) 2024/1275. URL: https://energy.ec.europa.eu/topics/energy-efficiency/energy-performance-buildings/energy-performance-buildings-directive_en
12. European Commission. Calculation framework for new building life-cycle Global Warming Potential, 2026. URL: https://energy.ec.europa.eu/news/calculation-framework-new-building-life-cycle-global-warming-potential-2026-05-04_en
13. Ministry of Internal Affairs of Ukraine. Fire Safety Rules in Ukraine, Order No. 1417 of 30.12.2014. URL: https://zakon.rada.gov.ua/go/z0252-15
14. Churkina, G. et al. Buildings as a global carbon sink. Nature Sustainability, 2020. URL: https://www.nature.com/articles/s41893-019-0462-4
15. CEN. EN 15978:2011. Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method.
16. CEN. EN 15804+A2:2019. Sustainability of construction works — Environmental product declarations — Core rules for construction products.
17. ISO 14040:2006 / ISO 14044:2006. Environmental management — Life cycle assessment — Principles, framework, requirements and guidelines.
18. Forest Stewardship Council. FSC Chain of Custody Certification and responsible sourcing of forest products. URL: https://fsc.org/en/chain-of-custody-certification
19. PEFC. Chain of Custody certification and sustainable forest management. URL: https://pefc.org/standards-implementation/standards-and-guides/chain-of-custody