

Comparasion of International and Indonesian Green Building Standards: Opportunities for Regulatory Harmonisation

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ABSTRACT

The building sector accounts for nearly 40% of global energy-related emissions, positioning it as a critical area for climate change mitigation and sustainable development. In line with the Paris Agreement, Indonesia has committed to reducing emissions by 29% unconditionally and up to 41% with international support by 2030. Compared to other G20 members, however, Indonesia's Nationally Determined Contribution (NDC) remains modest, with the building sector underrepresented in its roadmap. Strengthening green building regulation is therefore essential to closing this gap. This study conducts a comparative analysis of three international rating systems—LEED (United States), Green Mark (Singapore), and Green Star (Australia)—and two Indonesian frameworks: the Greenship Rating System and Banyuwangi Regency Regulation No. 1 of 2022. Using a qualitative documentary approach, the research evaluates these frameworks across three dimensions: core criteria, assessment mechanisms, and contextual adaptation. Secondary data were drawn from official certification guidelines, regulatory documents, and published case studies, including Banyuwangi International Airport, which achieved Greenship Gold Certification under the municipal regulation. The findings indicate that while international systems emphasize comprehensiveness, innovation, and performance verification, Indonesian frameworks prioritize tropical adaptation and regulatory compliance. The Banyuwangi case demonstrates the potential of local governments to institutionalize sustainability but also highlights the limitations of narrow regulatory scope. The study identifies four strategies for harmonization: integrating LEED's verification mechanisms, Green Mark's tropical efficiency benchmarks, Green Star's social dimensions, and scaling progressive local initiatives nationally. By adopting these strategies, Indonesia can enhance the global credibility of its green building frameworks, strengthen the building sector's contribution to its NDC 2030 targets, and reduce the gap with other G20 countries, thereby advancing both national and global climate goals.

Key Words: Green building; Rating systems; Regulatory harmonization; Indonesia; NDC 2030; G20

INTRODUCTION

The building sector has been recognized as one of the largest contributors to global carbon emissions, responsible for nearly 40% of the world's energy-related emissions (UNEP, 2023). This significant impact places buildings at the center of climate change mitigation strategies, particularly in achieving global net-zero targets by 2050 (Aram et al., 2022; Jaumotte et al., 2021). To address these challenges, a variety of green building rating systems have emerged internationally, including Leadership in Energy and Environmental Design (LEED) in the United States, Green Mark in Singapore, Green Star in Australia, and the Building Research Establishment Environmental Assessment Method (BREEAM) in the United Kingdom. Each of

these systems reflects not only technical considerations of energy and environmental performance but also embodies the socio-cultural and regulatory priorities of their respective regions.

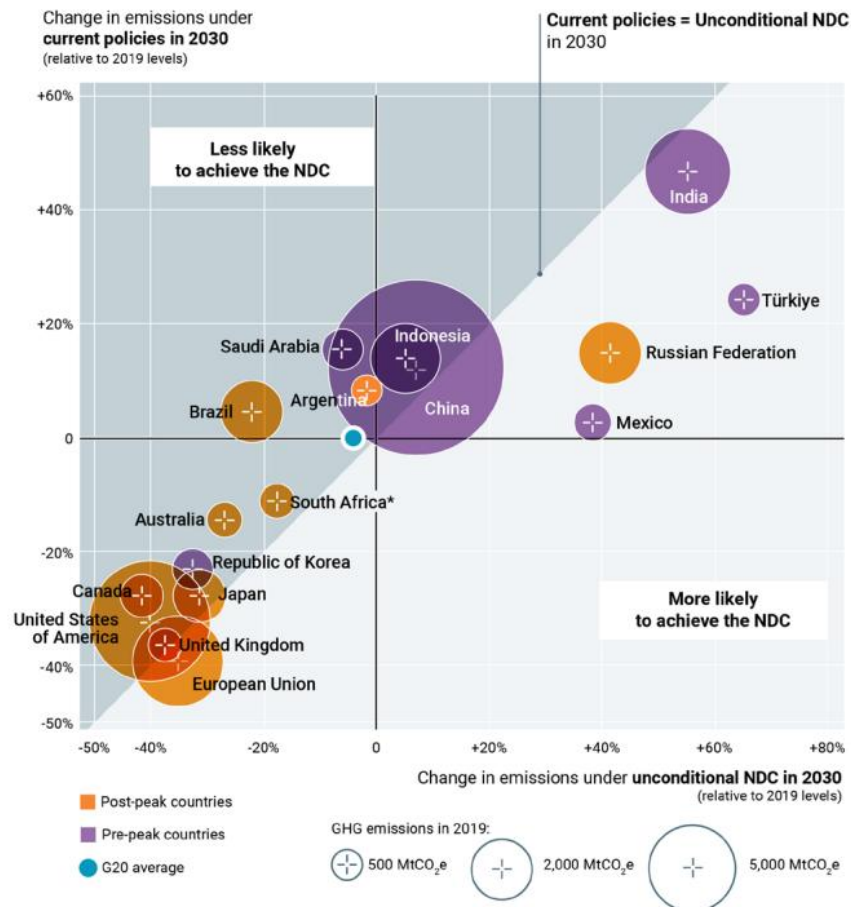


Figure 1. Indonesia's position in implementing the 2030 NDC targets compared to other G20 member countries (UNEP, 2023)

In line with the Paris Agreement, countries have pledged Nationally Determined Contributions (NDCs) as pathways toward achieving their climate targets for 2030 and beyond (den Elzen et al., 2022). Indonesia has committed to reducing its emissions by 29% unconditionally and up to 41% with international assistance by 2030 (Sentot Sudarwanto & Daryanti, 2025). Compared to other G20 members, many of which have already pledged more ambitious reductions or net-zero targets by 2050, Indonesia's commitment remains relatively modest (UNEP, 2023). Furthermore, while Indonesia's NDC highlights the energy and land-use sectors, the building sector is still underemphasized, despite its substantial contribution to national energy demand and carbon emissions (Hastuti, 2024). In contrast, several G20 countries, such as the European Union, the United States, and Japan, have explicitly integrated building efficiency standards and sustainable building strategies into their NDC roadmaps (Le et al., 2023; Song et al., 2024; Þórólfssdóttir et al., 2023). This gap highlights the urgent need for Indonesia to reinforce its building regulations to better align with global climate commitments.

Within this context, Indonesia has taken important steps to strengthen its green building framework. The Greenship Rating System, introduced by the Green Building Council Indonesia (GBCI) in 2010, was developed to adapt sustainability principles to the tropical climate and national regulatory framework (Meidayanti Mustika et al., 2021). At the national level, Ministerial Regulation of Public Works and Housing (PUPR) No. 21 of 2021 provides a framework for green building assessment in Indonesia. At the local level, Banyuwangi Regency introduced Regulation No. 1 of 2022 as a regional instrument to implement building governance within its jurisdiction.

While the Banyuwangi regulation does not directly derive from the Ministerial Regulation, it operates within the broader national regulatory system, particularly through the adoption of mechanisms such as Building Approval (PBG), Certificate of Feasibility (SLF), and technical compliance procedures. This indicates that the relationship between the two regulations is characterized by indirect alignment within a multi-level governance framework, where national policies provide overarching direction and local governments adapt and operationalize these principles according to regional contexts.

Despite these developments, there remains a significant gap between Indonesia's local frameworks and globally recognized standards. International systems emphasize innovation, continuous performance verification, and social well-being, whereas Indonesian frameworks are still evolving and primarily emphasize climatic adaptation and regulatory compliance. Previous research has examined international standards and Greenship separately, yet limited attention has been given to the integration of local regulations within the global discourse on sustainable buildings.

This study aims to address this gap by conducting a comparative analysis of international and Indonesian green building standards, focusing on the Greenship Rating System and Banyuwangi Regulation No. 1/2022. In particular, the study distinguishes between different governance approaches, including voluntary rating systems, government-supported certification schemes, and mandatory regulatory frameworks. In the Indonesian context, the Greenship Rating System operates as a voluntary certification tool developed by the Green Building Council Indonesia, primarily driven by market incentives and professional adoption. In contrast, Banyuwangi Regulation No. 1 of 2022 represents a mandatory approach, requiring compliance with green building principles through local governance mechanisms. Internationally, most rating systems such as LEED and Green Star are voluntary in nature, relying on market recognition and certification value to drive adoption. However, systems like Green Mark in Singapore demonstrate a hybrid model, where certification is integrated with government policies and, in some cases, linked to regulatory requirements. This distinction is essential to understanding how sustainability principles are implemented across different institutional contexts.

LITERATURE REVIEW

Green Building Concepts

The concept of green building has evolved as a response to the urgent need to reduce environmental impacts of the construction sector while enhancing occupant well-being and long-term resource efficiency (Ilmi & Sunarya, 2025; Sukma & Cahyono, 2025; Waskitaningrum & Avenzoar, 2024). According to the World Green Building Council, a green building is one that, in its design, construction, and operation, reduces negative environmental impacts and creates positive outcomes for people and the natural environment (Nain et al., 2021; Dharmatanna et al., 2026). Core dimensions typically include energy efficiency, water conservation, material sustainability, indoor environmental quality, site management, and innovation.

Global Rating Systems

Globally, several rating systems have emerged as benchmarks for sustainable building practices.

- **LEED (Leadership in Energy and Environmental Design)**, developed in the United States, is one of the most widely recognized systems, employing a point-based framework across categories such as energy, water, materials, and indoor environment (Tsirovasilis et al., 2025).
- **Green Mark**, introduced by Singapore's Building and Construction Authority (BCA), emphasizes tropical climate adaptation through metrics like Envelope Thermal Transfer

Value (ETTV) and Residential Envelope Thermal Value (RETV), with strong focus on energy performance and cooling efficiency (Kimura & Meng, 2021).

- **Green Star**, managed by the Green Building Council of Australia (GBCA), adopts a holistic approach that incorporates environmental, economic, and social sustainability dimensions, including health, biodiversity, and community engagement (Udawatta et al., 2020).
- **BREEAM**, developed in the United Kingdom, is among the earliest rating systems, prioritizing environmental performance verification through rigorous assessment protocols (Tsirovasilis et al., 2025).

These rating systems reflect not only technical performance but also contextual values shaped by each country's climate, governance, and societal priorities.

Indonesian Rating and Regulatory Frameworks

Indonesia has introduced its own framework through the Greenship Rating System, developed by the Green Building Council Indonesia (GBCI) in 2010. Greenship evaluates buildings across six categories: appropriate site development, energy efficiency, water conservation, material resources, indoor health and comfort, and building management. Unlike LEED or Green Star, Greenship is specifically tailored to tropical climatic conditions and national regulatory structures.

National-level support is reflected in Law No. 28 of 2002 on Buildings, SNI 03-1736-2011, and the Ministerial Regulation PUPR No. 21 of 2021 on Green Building Assessment, which formalize sustainability as part of building codes. At the local level, Banyuwangi Regency Regulation No. 1 of 2022 on Green Buildings has emerged as a pioneering example of municipal-level regulation, mandating sustainable design practices and enabling projects such as the Banyuwangi International Airport to achieve Greenship Gold Certification. The regulation operates within the Indonesian regulatory hierarchy and is aligned with higher-level regulations governing building construction, particularly Government Regulation No. 16 of 2021. It adopts national mechanisms such as Building Approval (PBG), Certificate of Feasibility (SLF), and technical compliance standards. In terms of green building principles, the regulation defines a green building as one that demonstrates measurable performance in energy efficiency, water conservation, and resource management across its lifecycle. These aspects indicate a performance-oriented approach, although implementation remains largely compliance-based.

Previous Studies and Identified Gap

Previous scholarship on green building in Indonesia has focused primarily on the adoption and implementation of Greenship in commercial or public buildings (Lendra et al., 2025; Sahid et al., 2020). Some comparative studies have examined Greenship in relation to LEED or Green Mark, highlighting similarities in criteria and challenges in certification processes (Doan et al., 2023; Saleh et al., 2024). However, limited attention has been directed to the role of local government regulations, such as Banyuwangi's, in bridging the gap between national standards and global benchmarks.

This research addresses this gap by situating local regulations within the broader comparative discourse of international and Indonesian green building frameworks. It contributes to understanding how harmonization between global standards and local adaptations can support Indonesia's progress toward its 2030 Nationally Determined Contribution (NDC) commitments, particularly within the building sector that remains underrepresented in current policy frameworks.

RESEARCH METHODOLOGY

This research employs a qualitative comparative approach that relies on documentary analysis and secondary data review to examine the similarities and differences between global and Indonesian green building frameworks. The focus of the study is on three international rating systems LEED, Green Mark, and Green Star and two Indonesian frameworks, namely the Greenship Rating System developed by the Green Building Council Indonesia (GBCI) and Banyuwangi Regency Regulation No. 1 of 2022 on Green Buildings. These systems represent different governance levels and institutional characteristics, ranging from global and national professional certification schemes to locally enforced regulatory instruments. This distinction is important to ensure that the comparison accounts not only for technical criteria but also for the governance structures that shape their implementation.

The selection of LEED, Green Mark, and Green Star is based on their representation of different governance models and geographical contexts. LEED is globally recognized and widely adopted across multiple countries, representing a market-driven certification system developed by a professional organization. Green Mark reflects a government-integrated framework that aligns certification with national sustainability policies, particularly in tropical contexts. Green Star represents a nationally developed rating system by a professional council that incorporates broader environmental and social sustainability dimensions. In contrast, the Indonesian frameworks represent two distinct governance approaches. The Greenship Rating System operates as a voluntary certification tool developed by a professional association, while Banyuwangi Regency Regulation No. 1 of 2022 functions as a mandatory regulatory instrument implemented at the local government level. This combination allows the study to compare not only technical criteria but also differences in governance hierarchy, including global, national, and local levels, as well as voluntary and mandatory mechanisms.

Data for the study were drawn from multiple sources to ensure reliability and triangulation. Official documents, including rating manuals and certification guidelines from USGBC, BCA, GBCA, BRE, and GBCI, served as the primary sources. Indonesian national and local regulations, such as Law No. 28 of 2002 on Buildings, SNI 03-1736-2011, and Ministerial Regulation PUPR No. 21 of 2021, were also examined. In addition, peer-reviewed academic publications, conference papers, and institutional reports provided critical insights into the development and application of green building systems. Finally, the study utilized previously published compilations and tabulated datasets of certified buildings as secondary sources to supplement the analysis.

The comparative framework was structured around three analytical dimensions: (1) the core criteria of each system, such as energy efficiency, water conservation, material use, indoor environmental quality, site management, innovation, and social aspects; (2) the assessment mechanisms, including point allocation, weighting structures, certification tiers, and performance verification; and (3) the contextual factors of each framework, such as socio-cultural integration, climatic adaptation, and regulatory support. A case illustration of Banyuwangi International Airport was included to demonstrate the practical interaction between local regulations and the Greenship certification process.

This study acknowledges its limitations, particularly its reliance on secondary data rather than primary fieldwork. As such, the findings emphasize comparative structures and conceptual implications rather than empirical validation of operational performance. Future research could build upon this study by integrating quantitative energy and emissions data, along with stakeholder perspectives, to enhance the robustness of the analysis.

ANALYSIS AND DISCUSSION

The comparative analysis shows important differences between international green building frameworks and Indonesian systems. While global rating tools emphasize innovation, comprehensiveness, and international recognition, Indonesian frameworks prioritize tropical adaptation and regulatory alignment.

Table 1. Comparative Overview of Global and Indonesian Green Building Standards

System	Core Focus	Strengths	Limitations	Contextual Notes	Reference
LEED (USA)	Energy, water, materials, IEQ, innovation, regional priorities	Comprehensive, internationally recognized, strong market value	High cost; complex process; less suited for tropical contexts	Widely adopted as global benchmark	Tsirovasilis et al., 2025
Green Mark (Singapore)	Energy efficiency, tropical climate adaptation (ETTV, RETV)	Effective for humid tropical climates; strong government support	Narrow scope; limited social considerations	Reflects Singapore's efficiency-driven governance	Liu et al., 2021
Green Star (Australia)	Holistic: energy, water, transport, biodiversity, health, innovation	Integrates social/community values; addresses circular economy	Documentation intensive; resource demanding	Reflects Australia's community-oriented culture	Undawatta et al., 2021
Greenship (Indonesia)	Site, energy, water, materials, indoor comfort, building management	Contextualized for tropical Indonesia; aligned with national codes	Limited innovation & verification; lacks global recognition	Developed by GBCI for Indonesia	Lendra et al., 2025

System	Core Focus	Strengths	Limitations	Contextual Notes	Reference
Banyuwangi Regulation (2022)	Localized implementation of green building principles	Progressive municipal policy applied in Banyuwangi International Airport (Gold)	Limited scope; lacks innovation and lifecycle monitoring	Pioneer of municipal-level regulation	Perda No. 1/2022; PP No. 16/2021

Table 1 highlights not only the technical aspects of each green building system but also their institutional and geographical contexts. Each framework reflects the priorities of its originating country, shaped by climatic conditions, governance structures, and policy approaches. For instance, Green Mark emphasizes tropical energy performance due to Singapore's climate, while Green Star incorporates social and community dimensions reflecting Australia's sustainability agenda. In contrast, Indonesian frameworks such as Greenship and Banyuwangi Regulation emphasize climatic adaptation and regulatory alignment. This comparison demonstrates that green building standards are not only technical instruments but also products of their socio-political and environmental contexts.

As reflected in Table 1, LEED offers a globally accepted standard with comprehensive criteria; however, its high certification cost and limited adaptability to tropical climates reduce its accessibility in developing countries. This finding is consistent with previous studies that highlight cost barriers and contextual limitations in applying LEED outside its original context (Tsirovasilis et al., 2025; Doan et al., 2023). Green Mark demonstrates strong technical adaptation for tropical climates, particularly through ETTV and RETV indicators, aligning with research emphasizing its effectiveness in addressing cooling-dominated environments (Kimura & Meng, 2021). However, its relatively limited integration of social sustainability dimensions has also been noted in prior studies.

Green Star expands the scope of sustainability by incorporating community health, biodiversity, and circular economy principles, reflecting broader socio-environmental priorities in Australia (Udawatta et al., 2020). Despite this, its resource-intensive documentation requirements may limit its applicability in developing contexts. In contrast, Greenship adapts sustainability principles to Indonesia's tropical conditions and aligns with national regulatory frameworks, supporting findings from previous studies that highlight its contextual relevance (Lendra et al., 2025). However, consistent with earlier research, it remains limited in terms of innovation, global recognition, and continuous performance verification when compared to international systems (Doan et al., 2023).

These comparisons indicate that while international systems excel in innovation and global benchmarking, locally developed frameworks prioritize contextual adaptation and regulatory alignment, revealing a structural gap between performance-driven certification systems and compliance-based regulatory approaches.



Figur 2. Blimbingsari Banyuwangi International Airport (Source: author)

A notable local innovation is Banyuwangi Regency Regulation No. 1 of 2022, which mandates the implementation of green building principles within municipal governance. Its practical application can be observed in the Banyuwangi International Airport (Figure 2), a landmark project that achieved GreenShip Gold Certification. In this case, the regulatory framework functions as an enabling mechanism, while the GreenShip Rating System provides the technical assessment criteria. The airport demonstrates the integration of key green building aspects, including passive cooling strategies, natural ventilation, daylight optimization, and the use of locally sourced materials. These features align with both GreenShip criteria and the performance-oriented principles outlined in the Banyuwangi regulation, particularly in terms of energy efficiency, resource conservation, and climate-responsive design (Dharmatanna, 2023; Dharmatanna & Hidayatun, 2021). Empirical studies further indicate that the implementation of such strategies significantly enhances user comfort, contributing up to 66.6% of perceived environmental quality (Cahyaningrum & Yudianto, 2023). In addition, the incorporation of renewable energy systems, natural lighting, cross ventilation, and water reuse strategies reflects alignment with core GreenShip categories such as energy efficiency, water conservation, and indoor environmental quality (Rossa et al., 2023; Aprilian & Rizaldi, 2023).

From a broader perspective, the design also incorporates climate-responsive and biophilic strategies that are consistent with global sustainability approaches, particularly in enhancing energy efficiency and resource management. However, not all aspects of global green building systems are directly transferable to the Indonesian context. Advanced performance metrics, innovation credits, and lifecycle monitoring commonly emphasized in systems such as LEED remain limited due to technological, economic, and regulatory constraints. Conversely, passive design strategies, climatic adaptation, and resource efficiency are highly relevant and effectively implemented.

This case demonstrates that local green building practices in Indonesia tend to prioritize contextual adaptability and feasibility, while selectively adopting global sustainability principles. It highlights the importance of a hybrid approach, where global benchmarks are adapted to local climatic, economic, and institutional conditions rather than applied uniformly.

Strategies for Harmonization

Several pathways for harmonization emerge from this analysis. First, Indonesia could adopt continuous performance verification, as in LEED, to ensure buildings maintain sustainability beyond certification. Second, tropical efficiency benchmarks from Green Mark could strengthen

Greenship in addressing energy-intensive cooling demands. Third, social and community well-being indicators from Green Star could broaden Greenship's scope, embedding cultural and health dimensions into certification. Finally, expanding progressive local initiatives such as the Banyuwangi Regulation to other municipalities could enhance regulatory enforcement and accelerate the diffusion of green building practices.

By pursuing these strategies, Indonesia can position its frameworks to better align with global standards while retaining cultural and climatic relevance. This alignment would not only enhance the credibility of Greenship internationally but also strengthen the building sector's contribution to Indonesia's Nationally Determined Contribution (NDC) 2030, where commitments remain modest compared to other G20 countries. Strengthened green building regulation thus becomes a key instrument for bridging global expectations with local realities.

CONCLUSION

This study demonstrates that differences in green building standards are not solely technical but are fundamentally shaped by governance structures, including variations in institutional levels (global, national, and local) and implementation mechanisms (voluntary versus mandatory). By comparing international systems such as LEED, Green Mark, and Green Star with Indonesia's Greenship framework and Banyuwangi Regency Regulation No. 1 of 2022, this research highlights how sustainability principles are translated differently across regulatory and professional contexts. The findings show that international systems are characterized by their comprehensiveness, innovation, and global recognition, while Indonesian frameworks emphasize climatic adaptation and regulatory alignment. The case of Banyuwangi International Airport illustrates how local regulations can function as enabling instruments, while voluntary certification systems such as Greenship provide technical evaluation tools, demonstrating a complementary relationship between governance and assessment mechanisms.

Despite these advancements, significant gaps remain in Indonesia's frameworks, particularly in terms of innovation, social integration, and long-term performance verification. Addressing these gaps is essential for achieving regulatory harmonization with global best practices. Four strategic pathways are identified: (1) adopting continuous performance verification mechanisms similar to LEED; (2) strengthening tropical-specific technical benchmarks inspired by Green Mark; (3) embedding social and community dimensions as emphasized in Green Star; and (4) expanding progressive local policies such as Banyuwangi's across other municipalities.

By pursuing these strategies, Indonesia can enhance the robustness and credibility of its green building frameworks while maintaining contextual relevance. More importantly, such harmonization would strengthen the role of the building sector in contributing to Indonesia's Nationally Determined Contribution (NDC) 2030, positioning it as a key instrument in bridging global sustainability targets with local implementation realities.

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