Green Building Certifications and Policy Implementation in the United States: A Review of LEED, ENERGY STAR, and Net-Zero Building Programs

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Abstract:
Building sector is one of the most important frontiers of climate action in the United States as it contributes about 40 percent of the energy consumption in the country and a third of its carbon emissions. The paper provides an overview of the structure, goals, and policy integration of three major U.S. certifications of green buildings: Leadership in Energy and Environmental Design (LEED), ENERGY STAR, and Net-Zero Building programs to evaluate their success in the promotion of sustainability and decarbonization. The analysis has compared the performance metrics, governance structure, and policy connection between these documents based on peer reviewed research published between 2020 and 2025 and the new policy official documents. Findings indicate that LEED and ENERGY STAR have gone a long way in enhancing building energy performance and environmental efficiency whereas Net-Zero initiatives are pushing towards carbon neutrality. Nevertheless, some issues have been persistent such as inconsistent policy implementation, delayed/random verification on program performance post-occupancy, and unequal accessibility to the program. The paper concludes that long-term climate and energy objectives will be inseparable without the restoration of certification frameworks in conjunction with the coordination of federal-state policymaking mechanisms and social equity requirements. This review connects certification design, policy implementation, and quantifiable outcomes to support how green building governance may take a coordinated future as a way toward Net-Zero, fair, and resilient built environments in the United States.

Keywords: Green building, LEED, ENERGY STAR, Net-zero building programs.

INTRODUCTION

The movement in the world towards sustainability has deepened the real estate and construction industry, creating the need to reduce the effects on the environment and streamline the use of resources. The built environment is a central theme in climate mitigation and low-carbon economy transition because buildings already represent approximately 40 percent of domestic energy use and approximately 35 percent of domestic carbon emissions in the United States (Models, 2020). One of the essential methods of reducing ecological footprints has become sustainable construction that consolidates renewable energy technologies, efficient use of water, and environmentally favorable materials (Ahmad et al., 2025). Implementation of certification schemes such as LEED (Leadership in Energy and Environmental Design), ENERGY STAR, and Net-Zero Energy Building (NZEB) schemes can provide systematic and quantifiable approaches to building, construction, and operation of environmentally responsible buildings (Li et al., 2024; Li, 2024).

Such certifications not only trigger innovations in the industry, but also affect policymakers and investment choices both in the public and private sectors. Certification programs render the sustainability goals into tangible aims, increasing responsibility towards building performance results (Mantyla, 2025). LEED, which was invented by the American Green Building Council, evaluates structures in various environmental aspects. In the meantime, ENERGY STAR, which is managed by the Department of energy (DOE) and Environmental Protection Agency (EPA) is narrowly focused on energy benchmarking and efficiency in operations (Models, 2020). Net-Zero Energy Building campaigns go one step further by suggesting buildings that produce their

own energy as abundant as they consume each year, a more provoking endeavor towards carbon equivalence (Clark, 2021; Daniel et al, 2020). Combined, these programs exist within a multi-layered governance framework where federal policies, local laws, and voluntary certifications interrelate toward influencing the development of sustainable building (Yu et al., 2022). Nevertheless, there are difficulties related to the effectiveness of these structures, their integration, and accessibility, particularly in the case of small developers and municipalities (Schwartz et al., 2021).

The purpose of this paper is to review and compare the key U.S. green building certification schemes of LEED, ENERGY STAR, and Net-Zero to contextualize and discuss the idea of policy implementation and market adoption. It discusses the criteria, structures and performance measures of each certification and evaluates the effects of different policy systems in the federal, state, and local level that support/or restrict the implementation. Its review extends to the 2020s to 2025, as these certification systems are getting fully developed, and also, environmental policy framework is evolving. Covering central research questions, the differences between LEED, ENERGY STAR, and Net-Zero certifications related to their objectives, measurement scales, and procedures; the policy instruments and governance approaches influencing their implementation and effectiveness; and the integration of the programs into the building codes, incentives, and regulation by state and local governments (Yu et al., 2022). Such questions form the framework of a comparative study of the contribution of each of the programs to the sustainability goals in the nation.

This research can be considered as based on the notion of a triple bottom line which implies that environmental safety, economic feasibility, and societal welfare would be combined into a single specific phenomenon (Leite et al., 2024). The green building design dimensionalizes these dimensions by lifecycle thinking that minimizes resource consumption and negative environmental effects during the lifespan of a building, which includes construction, use, and even dismantling (Rysman et al., 2020). The key of this evaluation process is Life-Cycle Assessment (LCA), which monitors energy consumption, materials, emissions, and wastes (Schwartz et al., 2021). LEED and ENERGY STAR are certification systems that transform the insights of LCA into practicable and measurable interventions that affect the construction procurement and the architectural design (Chung et al., 2025). These principles are expanded by the NZEB framework, which aims to achieve a balance of one-year renewable energy production and consumption with the facility toward carbon neutrality (Leite et al., 2024). Those green building certification models resonate with the United Nations Sustainable Development Goals, especially Goal 11 on sustainable cities and communities and Goal 13 on climate action, and the importance of building design as an essential aspect of the strategy to address climate in a country is hard to overemphasize (Leite et al., 2024).

Table 1: Policy and Governance Theories

Theory	Focus	Mechanisms	Key Actors	Governance Implications
Policy Diffusion Theory	Spread of green building policies	Emulation, competition, learning	Federal, state, and municipal governments	Horizontal diffusion across jurisdictions; vertical diffusion from federal to local levels (Daniel et al., 2020).
Multi-Level Governance	Coordination across governance levels	Interaction of voluntary and mandatory frameworks	Federal, state, local governments; private certifiers (USGBC, EPA)	Balances regulatory mandates with voluntary certifications for sustainable outcomes (Maqbool et al., 2023).
Public–Private Partnership	Collaborative governance model	Collaboration between the public and private sectors	Government agencies, private certification organizations	Combines market flexibility with policy oversight, driving innovation and accountability (Models, 2020).

OVERVIEW OF MAJOR U.S. GREEN BUILDING CERTIFICATION PROGRAMS

a*The LEED Program: Leadership in Energy and Environmental Design*

LEED (Leadership in Energy and Environmental Design) certification program which was created in 1998 by the U.S. Green Building Council (USGBC) is still one of the most accepted sustainability rating systems worldwide. LEED evaluates projects in various aspects: energy use, water, building materials, interior environment, sustainability, and innovation (Models, 2020). Depending on the overall accrual of points, certification levels are obtained of Certified, Silver, Gold, and Platinum. Recent studies indicate that LEED is pervasive in the municipal codes and procurement policies of most countries, more than 110,000 certified commercial projects of LEED have been identified in the United States of America alone (Flowers et al., 2020; Rebelatto et al., 2024). Empirical analyses indicate that LEED structures do use 20-25 per cent less energy than regular buildings (Chung et al., 2025). Nevertheless, according to critics, there are cases when performance differences can exist between design intent and the way the performance is performed (Daniel et al., 2020). The policy relevance of LEED is that it is combined with federal and state programs and incentives such as tax rebates, zoning bonuses, and speedy permitting. An example of this is the state of California and Massachusetts, which have integrated LEED credits into their system of building codes, which helps to further support the convergence of voluntary certification and compulsory regulation (Yerena, 2024).

The ENERGY STAR Building Program

ENERGY STAR: Buildings program which is jointly managed by U.S Environmental Protection Agency (EPA) and the Department of Energy (DOE) concentrates on the operational rationale of energy performance of a building instead of concentrating on design specifications. The Portfolio Manager benchmarking tool alone is a program used by ENERGY STAR to assess buildings using an intensity of measured energy use (EUI) when compared with the nationwide levels (Shuttleworth et al., 2021; Brolinson et al., 2023). According to the research, buildings that are ENERGY STAR certified use 35 percent less energy and produce 30 to 40 percent of greenhouse gases less than those that are not (Li et al., 2024). The 1-100 scoring system of the program will be available, which will offer a clear performance-based benchmark that can support the policy of disclosures to the public and informing the government on procurement criteria. Policy-wise, ENERGY STAR acts as a gateway certification of the public sector operation, frequently mandated to the federal facilities by the Energy Independence and Security Act (EISA) of 2007. It also acts in support of LEED through data-driven confirmation of operational efficiency after the construction (Pourmonir, 2025). Despite the great popularity of ENERGY STAR, there are still problems in ensuring the consistency of long-term performance because of occupant behavior variations, maintenance performance, and reporting performance (Rysman et al., 2020).

Net-Zero Energy Building (NZEB) Programs

The concept of Net-Zero Energy Buildings (NZEBs) is the next generation of sustainable buildings whose purpose is to offset between the total energy usage and the renewable energy production per year. According to the U.S. Department of Energy, NZEBs refer to those buildings that generate as much simulation energy as they demand on an annual basis and the measurement is in terms of site or origin (Models, 2020). New studies focus on the technological fusion needed to reach the net-zero level which involves combinations of photovoltaic systems, sophisticated insulation, geothermal heating, and smart control systems (Leite et al., 2024). The case studies of federal facilities under DOE program, Zero Energy Ready Home (ZERH), and Federal Energy Management Program (FEMP) show that operations are reduced by up to 50% in comparison with backgrounds of 2003 (Shuttleworth et al., 2021). As vertical policy diffusion, state-level building codes like Title 24 energy standards in California and the Net-Zero Carbon Roadmap in New York are incrementally introducing the idea of NZEB into their policies (Yu et al., 2022). But the initial expense, the lack of renewable resources and definitions of what it means by net-zero across jurisdictions are still obstacles to scaling it nationwide (Pourmonir, 2025).

Table 2: Comparative Analysis: LEED, ENERGY STAR, and NZEB

Aspect	LEED	ENERGY STAR	Net-Zero Energy Building
Administered by	U.S. Green Building Council	EPA & DOE	DOE & State Energy Offices
Focus	Design and construction sustainability	Operational energy efficiency	Full energy balance and renewables
Evaluation Type	Point-based, multi-criteria	Performance-based, benchmarking	Performance + renewable integration
Policy Linkage	Integrated with building codes, tax incentives	Federal compliance and benchmarking programs	Advanced policy pilots, building codes
Primary Benefit	Comprehensive sustainability	Operational energy savings	Carbon neutrality and innovation
Main Limitation	Design–performance gap (Li, 2024)	Operational variability (Brolinson et al., 2023)	High upfront cost, definition inconsistency (Chung et al., 2025)

These three systems are complementary: LEED guarantees sustainable design; ENERGY STAR checks the functioning performance and NZEB goes even further and pursues the goal of energy self-sufficiency. The combination of the two offers a capable policy framework and an approach to market transformation in order to achieve carbon-neutral buildings (Maqbool et al., 2023).

U.S. green building certifications create a cohesive web of relationships between voluntary market markets and regulatory policy (Daniel et al., 2020). LEED promotes comprehensive sustainability, ENERGY STAR institutionalizes power responsibility, and NZEB projects are the answer to decarbonization of buildings. Together, they embody a spectrum of policy maturity and technical ambition and affect not only construction practices, but also urban sustainability governance throughout the country.

POLICY FRAMEWORKS AND MECHANISMS OF IMPLEMENTATION:

Federal Policy Framework

On the federal level, U.S. green building policy has developed with integrations of legislative requirements, executive orders, and voluntary initiatives that identify certification standards as part of sustainability objectives of the nation. The Energy Policy Act (EPAct) of 2005 and the Energy Independence and Security Act (EISA) of 2007 (which was followed by multiple Executive Orders on Federal Sustainability (e.g., EO 14057, 2021)) all mandate federal agencies to reduce energy use and carbon emissions within government buildings (Models, 2020). The requirements of the Guiding Principles of Sustainable Federal Buildings specify that federal buildings have to comply with and exceed the performance benchmarks of ENERGY STAR (Shuttleworth et al., 2021; Brolinson et al., 2023). FEMP also facilitates interagency cooperation, which provides technical aid and performance contracting resources that can expedite decarbonization. Although green certifications have gained increasing popularity in the recent studies, recent analyses point to federal procurement policies as being a central part of legitimizing green certifications as a national standard (Pourmonir, 2025; Clark, 2021). Also, federal taxation has stimulated the usage of LEED as well as ENERGY STAR in the commercial world by the use of the energy efficient commercial building deduction (179D).

State Level Policies and Driving Forces

State governments also play one of the most important roles as intermediaries between national and local policy objectives. The programs of the Building Energy Codes Program (BECP) of the U.S. Department of Energy state that more than 30 states currently include LEED, ENERGY STAR, or Net-Zero frameworks in their sustainability or energy efficiency policies (Models, 2020).

At the same time, the Title 24 Building Standards that govern California have required energy performance levels that coincide with or surpass the ENERGY STAR bases, and state programs such as the CALGreen have included LEED-equivalent specifications (Yu et al., 2022). The Climate Leadership and Community

Protection Act (2019) of New York State include the LEED and Net-Zero targets in the state procurement and infrastructure planning (Bravo et al., 2023). Massachusetts and Washington State have property tax incentives and expedited property permits to LEED- or ENERGY STAR-certified buildings (Pourmonir, 2025). The presence of green building funds at state level and rebates funded by the utility is also a key factor towards encouraging sustainable construction especially of public schools and affordable housing projects. Nevertheless, the inconsistency shown by different states is a problem to the expansion of national sustainability thresholds (Ahmad et al., 2025).

Homogenization of Local Government

Among the most active actors in the implementation of the requirements of the green building certification are municipal governments. In the US, green building ordinances have been adopted in more than 450 cities and often cover new public constructions with the requirement to LEED certify them, as well as provide incentives to the non-governmental sector (Flowers et al., 2020; Rebelatto et al., 2024).

Examples are Washington, D.C., which requires LEED certification of all government buildings larger than 10,000 square feet and density bonuses for LEED Gold certification of a private building. In Chicago and Seattle, ENERGY STAR reporting is part of the municipal benchmarking legislation. The city of Austin, Texas, was the first to adopt a city-specific system of green building rating that went on to be used as the basis of LEED standards (Rysman et al., 2020). Various local governments are also adopting performance-based codes and benchmarking ordinances that help to confirm that building functioning is in line with the certification assertions. This positive change of prescriptive to outcome-driven governance highlights the rise of the significance of data transparency and energy disclosure in the local climate policy (Daniel et al., 2020).

COLLABORATION AND IMPLEMENTATION TOOLS: PUBLIC-PRIVATE

The operations of green certification programs rely on the presence of partnerships between the government and business in a manner that takes advantage of market incentives and policies. The example of the USGBC, the General Services Administration (GSA) and the ENERGY STAR Partnership Program of EPA shows how companies can develop their own certification systems and, at the same time, align with each other and the federal government (Flowers et al., 2020).

Such implementation mechanisms are: Performance contracting and green financing mechanisms (e.g., Property Assessed Clean Energy [PACE] programs). Greens in financing energy efficient Government infrastructure (Yerena, 2024). Benchmarking and verification Data sharing agreements between EPA, DOE, and local jurisdictions. This form of hybrid governance has been found to be viable in terms of scaling up green building adoption and creating a sense of accountability, innovative application, and competitiveness in the market (Flowers et al., 2020).

BARRIERS TO EFFECTIVE IMPLEMENTATION

Although the practice of green buildings has improved in the United States, a number of institutional barriers still exist. The fragmented system of regulation where state and local building codes are different does not allow the consistent application of green building standards. Limited financial incentives and the high initial cost are a major issue especially to small developers and low-income communities (Flowers et al., 2020; Daniel et al., 2020). There are also the gaps in the verification of performance since there are variations between the projected modeling performance of buildings and the real performance. The accessibility of data and inequity also decrease opportunities of the marginalized communities becoming part of green building projects and decrease the inclusivity of sustainability activities (Flowers et al., 2020; Daniel et al., 2020). The key combination to overcome the challenges is federal leadership, upgraded financial support systems with the purpose of reducing the barriers to smaller stakeholders, and tight and stable monitoring of the performance of all certification systems. To ensure that the objective of green building policies is achieved in mitigating climate change and sustainable development it is imperative to address these issues to enhance market penetration and fully realize the potential of the policies. A case in point that would demonstrate a multi-level lawmaking method is the U.S. policy frameworks that promote LEED, ENERGY STAR and Net-Zero certifications where the collective drive in effecting the green building transition is by the federal

mandates, state incentives and the local regulations. These programs have been put at the heart of decarbonization policies nationwide due to the interaction of the three components within the policy process: the work of public policy, the work of private certification and the work of the market. Nevertheless, the successive step of implementation should be aimed at making equity bigger, defining it uniformly, and having verifiable performance results at any level of government (Flowers et al., 2020; Daniel et al., 2020).

COMPARATIVE ASSESSMENT AND EFFECT ANALYSIS

In the paper, the multi-dimensional model of evaluation is used to observe the difference of influence of LEED, ENERGY STAR, and Net-Zero certification models on environmental, economic, policy, social, and performance aspects (Daniel et al., 2020). LEED-certified buildings also have an average of 20-25% and 34% lower energy use and less CO2 emissions than conventional buildings, and ENERGY STAR-certified buildings have better benchmarks with lower energy intensity of 35% and less greenhouse gas emissions by 30-40% due to constant benchmarking. In comparison with more common net-Neutral buildings, Net-Zero buildings are set to nearly or fully offset themselves on renewable energy and frequently surpass the zero net energy concept when systems are paired with smart grids and storage technologies. LEED buildings get 8-12% higher valued property and higher rent, ENERGY STAR buildings have 9% lower operation costs and are more stable in occupancy, whereas Net-Zero buildings, however, with 15-25% higher cost of structures, are paid back in 6-10 years with reduced utility bills and incentives (Brolinson et al., 2023; Chung et al., 2025). Direct federal oversight of ENERGY STAR provides the most uniform implementation program, the voluntary use of LEED is increased through public procurement and zoning codes, and Net-Zero is an experimental policy maker on state energy codes. Socially, the issue of equity is still observed with adoption bias towards richer regions, whereas new initiatives are seeking to enhance inclusiveness in communities with low income and small developers. On the aspect of performance verification, LEED occasionally has weak aspects in the form of behavioral and maintenance concerns which is countered in ENERGY STAR by consistent benchmarking, but transparency is still lopsided and in Net-Zero projects, verification is more robust in real-time monitoring and internet of things. Extensive studies by researchers show that certifications with a focus on continuous performance methods over design-phase only compliance realize more predictive environmental results, and the complementary role of these green building certification programs is reinforced with ongoing sophistication (Flowers et al., 2020; Daniel et al., 2020). This systematic analysis and data show the weaknesses and strengths of the certification programs in developing sustainable building operations and policy implementation in the United States.

Table 3: Comparative Assessment and Effect Analysis

Criterion	LEED	ENERGY STAR	Net-Zero Buildings
Energy Savings	20–25%	35%	80–100% (renewable offset)
CO_2 Emissions Reduction	34%	30–40%	Near-zero or negative
Initial Cost Premium	+10–15%	+2–5%	+15–25%
Market Value Increase	+8–12%	+6–9%	+10–20% (long-term)
Policy Integration	High (local/state)	Very High (federal/state)	Moderate (state pilots)
Equity Inclusion	Emerging	Moderate	Limited
Verification Strength	Moderate	High	Very High

The findings indicate that ENERGY STAR offers the most scalable operational performance, LEED offers an overall sustainability integration, and Net-Zero programs are innovative leadership in long-term carbon neutrality (Chung et al., 2025). The aggregate effect of these certifications is revolutionary: the intensity of the national energy consumption in buildings has fallen more than 25% since 2005, hundreds of thousands of new green jobs have been created, and the building codes in all 50 states have changed (Models, 2020). However, the prospective success is in the incorporation of social data and standard performance-checking into every system of certifications. So, green building programs are a form of synergistic three-part solution: policy tools, market indicators, and technology platforms to take the U.S. to a Net-Zero Carbon Building future (Chung et al., 2025).

POLICY IMPLICATIONS AND DISCUSSION

The comparative analysis indicates that LEED, ENERGY STAR, and Net-Zero are complementary and have different roles in the sustainability system in the U.S. LEED is an extensive environmental management framework encompassing many areas, including materials, water consumption, site planning, and indoor environmental quality (Chung et al., 2025; Brolinson et al., 2023). ENERGY STAR emphasizes performance benchmarking and operational efficiency; hence, it is especially appropriate in scaling upgrades on existing building inventories. Net-Zero programs move the envelope to the limit of carbon-neutral buildings, through placing greater emphasis on integration of renewable energy and on total carbon accounting of the building life cycle. Collectively, these frameworks have encouraged the popular trend in the adoption of green building in the U.S., which has influenced building codes, financial incentives, and institutional procurement standards. However, their potential is filled by ongoing problems, such as equity disparities, a lack of a solid governance framework, and verification limitations (Models, 2020). Recent studies have provided a critical observation of the fact that policy coherence at the federal, state, and municipal levels is an essential concern where federal regulations, such as the Energy Independence and Security Act (2007), and Executive Order 14057 (2021), can provide a point of alignment, yet subnational delivery of the policy remains disproportionate. The policy diffusion theory can be used to describe the success of a policy adoption based on inter-jurisdictional learning and emulation, as LEED takes place in cities such as Washington, D.C., Chicago, and Seattle (Shuttleworth et al., 2021). Nevertheless, the uneven measures and overlapping compliance when broken structures are used are indicators that a national Green Building Policy Alignment Task Force will be advantageous to normalize reporting and data interoperability. The economic incentives are also at the forefront of the pack, as federal tax deductions, state grants, and local rebates have been shown to boost the rates of certification to a considerable extent (Brolinson et al., 2023). Nevertheless, small and medium developers are facing financing constraints, and the solution can be found in green loan guarantees, increased PACE financing, and performance-based tax subsidies to increase participation and incorporate social equity in the green transition. A move towards design-based certification to operational validation comes into the limelight of governance, and the benchmarking model of ENERGY STAR presents a model that is robust, yet LEED requires building its post-occupancy verification. These programs have the potential to improve measurement and transparency and investor confidence by creating a national Building Performance Database that incorporates real-time data (Flowers et al., 2020; Daniel et al., 2020). Equity is also taking center stage with such extensions as affordable housing grants, equity indicators in scoring, and training the workforce with communities that are most underrepresented, so that the green building movement becomes inclusive and fair. This combined strategy places environmental performance and social justice as two complementary aspects that will promote U.S. sustainable construction policy and practice (Flowers et al., 2020; Daniel et al., 2020).

FUTURE POLICY DIRECTIONS

Policy reforms in the U.S. green building policy-making should consider the following directions, such as national standardization, integrated verification, higher decarbonization incentives, connectivity with resiliency, and digital governance to achieve the 2030-2050 Net-Zero transition targets. A federal definition of such terms as Net-Zero, carbon-neutral, and high-performance buildings would help clarify the certificate and align reporting standards (Shuttleworth et al., 2021; Brolinson et al., 2023). A complete verification system that involves post-certification audit, and annual energy and emissions declaration is necessary to ensure accountability and transparency. To speed up decarbonization, subsidies on renewable energy integration should be increased, and building technologies that can connect to the grid should be promoted. Green certification criteria (heat adaptation and stormwater management) should also measure climate resilience because they will be better prepared to address future climate risks (Yerena, 2024). Predictive energy efficiency and dynamic certification status maintenance can be optimized through the leverage of AI-based building analytics. Taken together, all these reforms will make certification systems remain relevant in changing climate policies. The interaction of LEED, ENERGY STAR, and Net-Zero models has transformed the environment of governing practices, integrating the social control and non-government guarantees with household certification, in backing energy efficiency and policy development. Going forward, the policy should focus on integration among the governance levels, thorough verification, and inclusion in social life to identify green building certification as a key strategic infrastructure needed by the country in decarbonization and the equity agenda. These current developments, including the ANSI-sanctioned Green Globes on Existing

Buildings 2025 standard, highlight ongoing improvement efforts, which include health, wellness, and resilience approaches in the shape of available assessment protocols, which support these future policy constraints. Further improving measurement and building investor trust by having a national Building Performance Database that comprises real-time data of various certification systems would move the U.S. building practices in tandem with international climate commitments and social justice demands.

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

In this evaluation on LEED, ENERGY STAR, and Net-Zero Building programs, they are all discussed as initial components of the green building policies in the United States. Collectively, these certifications have brought about tremendous progress as buildings can now use energy less by 20-35 percent contributing to national greenhouse gas mitigation goals with a huge burden. They have also increased sustainable property market value and investor trust in sustainable properties as well as catalyzing policy innovation and diffusion that has incorporated green standards in municipal and state building codes. Each of these concerted efforts has made sense of tangible movement towards the U.S. 2050 Net-Zero Carbon Building goal. Nevertheless, there remain systemic issues, such as disjointed governance organization, inadequate post-certification performance audit, uneven distribution of certification benefits, and uneven data reporting. It is important to overcome these challenges to scale sustainability transitions throughout the built environment in the U.S. The green building certifications have grown over the years to form niche programs to core aspects of the national climatic policy. The future of sustainability governance requires shifting to adaptive, data-driven and equity-based systems that combine intensive performance tracking, policy-wide coordination at the federal and sub-national levels, and social justice when exploring the future of sustainability governance. Combining the work of policymakers, industry leaders, and researchers in the areas would allow the United States to realize a Net-Zero, climate-resilient, and inclusive built environment by the mid-century, and both environmental and equity goals would be met.

REFERENCES:

1. Ahmad, T., Shoaib, M., & Abdul Kadar, R. (2025). LEED v4 Adoption Patterns and Regional Variations Across US-Based Projects. *Sustainability*, *17*(16), 7403.
2. Brolinson, B., Palmer, K., & Walls, M. (2023). Does Energy Star certification reduce energy use in commercial buildings? *Journal of the Association of Environmental and Resource Economists*, *10*(1), 55-93.
3. Chung, J., Cusumano, M., Kim, D., & Park, A. (2025). Road to net zero: Greenness of Leadership in Energy and Environmental Design and California Green Building Standards Code in the multifamily sector. *Real Estate Economics*, *53*(1), 164-203.
4. Clark, C. E. (2021). Green Building Overview and Issues.
5. Daniel C. Matisoff & Douglas S. Noonan & Mallory E. Flowers, 2020. "Policy Monitor-Green Buildings: Economics and Policies," Review of Environmental Economics and Policy, Association of Environmental and Resource Economists, vol. 10(2), pages 329-346.
6. Flowers, M. E., Matisoff, D. C., & Noonan, D. S. (2020). In the LEED: racing to the top in environmental self-regulation. *Business Strategy and the Environment*, *29*(6), 2842-2856.
7. Leite Ribeiro, L. M., Piccinini Scolaro, T., & Ghisi, E. (2025). LEED Certification in Building Energy Efficiency: A Review of Its Performance Efficacy and Global Applicability. *Sustainability*, *17*(5), 1876.
8. Li, J., & Gou, Z. (2024). Addressing the development gap in net-zero energy buildings: A comparative study of China, India, and the United States. *Energy for Sustainable Development*, *79*, 101418.
9. Li, N. (2024). LEEDing power back to communities through green building codes: advice for policymakers considering LEED certification.
10. Mäntylä, L. (2025). Energy Efficiency as a Driver of Value Creation in Commercial Real Estate Strategies.
11. Maqbool, R., Thompson, C., & Ashfaq, S. (2023). LEED and BREEAM green building certification systems as possible game changers in attaining low-cost energy-efficient urban housing projects. *Journal of Urban Planning and Development*, *149*(3), 04023024.

12. Models, P. B. (2020). Building energy codes program. *US Department of Energy*.
13. Pourmonir, K. (2025). Are Net-Zero Pledges Red Herrings to Escape Meaningful Decarbonization? *Construction Lawyer*, *44*(1).
14. Rebelatto, B. G., Salvia, A. L., Brandli, L. L., & Leal Filho, W. (2024). Examining energy efficiency practices in office buildings through the lens of LEED, BREEAM, and DGNB certifications. *Sustainability*, *16*(11), 4345.
15. Rysman, M., Simcoe, T., & Wang, Y. (2020). Differentiation Strategies in the Adoption of Environmental Standards: LEED from 2000 to 2014. *Management Science*, *66*(9), 4173-4192.
16. Schwartz, E. K., & Krarti, M. (2022). Review of the adoption status of sustainable energy technologies in the US residential building sector. *Energies*, *15*(6), 2027.
17. Shuttleworth, A., & MacAskill, K. (2021). Net zero adaptation: a review of built environment sustainability assessment tools. *Environmental Research: Infrastructure and Sustainability*, *1*(2), 023002.
18. Yerena, A. (2024). Sustainable Low-Income Housing: Analyzing Green Building Initiatives within the LIHTC Program across US States. In *Housing and Sustainability: Achieving a Sustainable Future*. IntechOpen.
19. Yu, F., Feng, W., Leng, J., Wang, Y., & Bai, Y. (2022). Review of the US policies, codes, and standards of zero-carbon buildings. *Buildings*, *12*(12), 2060.