



Green Building Certification System Review

Findings Report
Appendices A–E

Meredith J. Holland

Prepared for the U.S. General Services Administration by LMI.

June 2024

Version 1.1

This document is a revised version that incorporates technical corrections from the original document.

Appendix A

Green Building Certification System Review

Background Information

Federal Drivers that Shaped 2023–2024 Evaluation Criteria

Multiple federal statutes and mandates specify green building performance requirements that agencies must meet. The following list highlights the major mandates and executive orders that informed the evaluation criteria used to assess green building certification systems.

- *EISA (42 U.S.C. 17092)* (<https://www.congress.gov/110/plaws/publ140/PLAW-110publ140.pdf>)
 - *Section 436(h), which specifies the following criteria be evaluated for a green building:*
 - *“(i) efficient and sustainable use of water, energy, and other natural resources;*
 - *(ii) use of renewable energy sources;*
 - *(iii) improved indoor environmental quality through enhanced indoor air quality, thermal comfort, acoustics, day lighting, pollutant source control, and use of low-emission materials and building system controls;*
 - *(iv) reduced impacts from transportation through building location and site design that promote access by public transportation; and*
 - *(v) such other criteria as the Federal Director determines to be appropriate.”*
- Green Building Certification Systems Requirement for New Federal Buildings and Major Renovations of Federal Buildings Final Rule (October 14, 2014) (<https://www.federalregister.gov/documents/2014/10/14/2014-24150/green-building-certification-systems-for-federal-buildings>).
- Guiding Principles for Sustainable Federal Buildings and Associated Instructions (December 2020) (https://www.sustainability.gov/pdfs/guiding_principles_for_sustainable_federal_buildings.pdf).

Certifications and Standards Not Included in GSA’s 2023–2024 Review

Over the past two decades, the number and availability of green building certification systems increased significantly. This review identifies whole-building certification systems that promote a sustainable and environmentally sound approach to the certification of green buildings. GSA did not include product certifications, building

standards, or codes that lack a specific certification process for achievement nor certification systems that focus on only one aspect of building performance.

- **GSA’s review excluded standards.** The Whole Buildings Design Guide (WBDG) describes a **standard** as “a set of guidelines and criteria against which a product can be judged.”¹ Organizations such as the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), and ASHRAE established several common standards related to building practices through consensus-based processes. The International Standards Organization (ISO) acts as the central body for defining and developing worldwide standards adopted into law or industry best practice. ISO defines a standard as a document, established by consensus, “that provides for common and repeated use as rules, guidelines, or characteristics for activities or their results.”²
- **GSA’s review excluded product certifications.** Product certifications signify that a specific product (in this case, used in the construction, renovation, operation, or maintenance of a building) meets a certain standard and provides some environmental benefit. Examples include EPA’s ENERGYSTAR, WaterSense, and Green Seal certifications. Building certification systems often require or suggest the use of certified products as a method of obtaining compliance with a metric or credit of the system.
- **GSA’s review excluded certification systems that only focus on one aspect of building performance,** like health-promoting building certification systems such as WELL and FitWell. These systems do not measure high-performance design and operation attributes outside of those that have a potential effect on occupant comfort and health. They focus on attributes like indoor environmental quality and building design and operation strategies to address and measure wellness-promoting building features and policies. Despite excluding health focused certification systems from this review, GSA supports their goals and their role in furthering a holistic approach to building certification.
- GSA’s review excluded whole-building certification systems for building types that are not representative of the GSA and federal building portfolio. Office buildings represent most building types within the federal portfolio of buildings; therefore, GSA limited the scope of its review to commercial buildings for new construction or major renovation projects and existing buildings.

Certification System Overviews

GSA reviewed the following certification systems in detail in this review process:

- BOMA BEST 4.0 for Sustainable Buildings for existing buildings, (<http://www.bomabest.org>).
- Building Research Establishment’s Environmental Assessment Method (BREEAM) USA In-Use Commercial for existing buildings, version 6 (<http://www.breeamusa.com>).

¹ Whole Building Design Guide: <https://www.wbdg.org/resources/green-building-standards-and-certification-systems>.

² Whole Building Design Guide: <https://www.wbdg.org/resources/green-building-standards-and-certification-systems>.

- Green Building Initiative (Green Globes) for existing buildings and new construction, 2021 and 2023 (<http://www.thegbi.org>).
- Leadership in Energy & Environmental Design (LEED) for existing buildings and new construction, version 4.1 (<https://new.usgbc.org/leed>).
- Living Building Challenge (LBC) for existing buildings and new construction, version 4.0 and Core Green Building Certification for existing buildings and new construction (<https://living-future.org/lbc>).
- Passive House Institute US, Inc. (PHIUS), 2021 CORE and 2021 ZERO for new construction, and 2021 CORE REVIVE and 2021 ZERO REVIVE for existing buildings (<https://www.phius.org/>).

System owners provided the information below on each system to GSA as supplemental information in their completed survey submission.

BOMA BEST



Building Types: Currently, BOMA BEST 4.0 for Sustainable Buildings includes certifications for existing buildings.

System Development & Update: BOMA BEST 4.0 for Sustainable Buildings was developed through a process of stakeholder revision and development. During the revision phase, over 150+ stakeholders provided input on business processes, air/HVAC, custodial, energy and water, health and wellbeing, innovation, legislative topics, net zero carbon, resilience, site and landscaping, tenant operated buildings, verification, waste, and the circular economy. During the development phase, three consultants developed the first draft of the assessment questionnaires, and five advisory groups were formed to solicit feedback. Once the questionnaires were finalized, a 2-month pilot was initiated where 20+ buildings provided valuable feedback for the overall program.

BOMA BEST 4.0 for Sustainable Buildings is the latest of six iterations of the BOMA BEST program and includes completely overhauled certification requirements. The system is updated every 3 to 4 years to maintain concurrence with industry standards via stakeholder feedback. In addition, all BOMA BEST users can submit suggestions for program modification or areas of clarification through the Technical Update Request (TUR) process at any time. The modifications are managed and resolved by the volunteer BOMA BEST Technical Committee, which is comprised of industry stakeholders like subject matter experts, consultants, building managers, and verifiers.

Registration & Certification Fees: Costs vary depending on the asset class of the property and the square footage or on the number of units in multi-unit residential buildings (MURBs). A continuous certification program, the BOMA BEST portfolio program, is available with reduced annual fees. In the portfolio program, there is an annual fee for each property (depending on the asset class) that ranges from a minimum of \$240 to \$5,930. Light Industrial and Open-Air retail classes are priced at \$8.40 per 1,000 square feet, with a minimum fee of \$240 and maximum fee of \$1,570 a year.

MURBs are priced at \$4.62 per unit, with a maximum fee of \$1,570 a year. There is no additional cost other than travel costs for onsite visits, which are billed at cost.

Assessment & Certification: BOMA BEST assessors are independent, third-party individuals who meet BOMA BEST requirements, have received formal training on the BOMA BEST program, and have signed a code of ethics forbidding any conflict of interest. They enter into contractual agreements with a local BOMA association or directly with BOMA Canada (including U.S.-based projects). Only those assessors who have satisfactorily completed the BOMA BEST training may verify a BOMA BEST assessment.

There are currently 120 buildings certified under BOMA BEST 4.0 for Sustainable Buildings in the United States. To date, no federal buildings have been certified.

BREEAM USA In-Use



Building Types: BREEAM USA In-Use version 6 includes certifications for existing buildings.

System Development & Update: BREEAM USA In-Use is based primarily on scientific research rather than stakeholder consensus. Global consultations on sustainability topics set the framework for BREEAM rating systems, with scientific research determining the performance levels for each credit. Industry consultation plays a role in system development, but changing the technical content requires scientific evidence.

BREEAM USA In-Use Version 6 was updated in 2020. Since the launch of the previous standard in 2016, investors, owners, managers, and sustainability professionals have provided feedback, which was considered in the context of the building science that drives BREEAM's development. The draft update was published and a comment period open to all stakeholders was publicized. Comments were submitted, gathered, considered, and publicly responded to in a published document.

Registration & Certification Fees: BREEAM USA In-Use system registration costs \$1,200 per asset. The fees are \$1,500 for Part 1 Asset Performance certification and \$1,500 for Part 2 Management Performance certification. The fee for a licensed BREEAM USA In-Use assessor is independent of BREEAM USA and is determined between the client and the assessor.

Assessment & Certification: BRE America trains and licenses assessors to conduct BREEAM USA In-Use assessments. All licensed assessors are listed on the BREEAM USA website and clients choose the assessor who will conduct their assessment. BRE America is not responsible for arranging or establishing fees for project assessments.

There are currently 371 buildings certified under BREEAM USA In-Use. To date, no U.S. federal buildings have been certified.



Green Globes

Building Types: Currently, Green Globes 2021 and 2023 include certifications for existing buildings, building interiors, and new construction and major renovation.

System Development & Update: Since becoming an approved ANSI Standards Developing Organization (SDO) in 2005, Green Globes has used ANSI approved procedures to develop standards, eventually producing ANSI/GBI 02-2023: Green Globes Assessment Protocol for Existing Buildings and ANSI/GBI 01-2021: Green Globes Assessment Protocol for Design, New Construction, and Major Renovations, which are the basis for Green Globes for Existing Buildings 2023 and Green Globes for New Construction 2021, respectively. The consensus bodies that developed and approved the Existing Buildings and New Construction standards are composed of individuals balanced equally between users, general interest parties, and producers. Both consensus bodies are supported by technical experts in working subcommittees and task groups and by public participation in periodic public comment forums.

Green Globes' consensus process conducts the following independent reviews: 1) annual review by ANSI of Green Globes' procedures for compliance with ANSI Essential Requirements, 2) third-party review by ANSI of the consensus process used to create the standards before receiving ANSI approval, and 3) an audit of Green Globes every 5 years before SDO designation renewal. To create ANSI/GBI 02-2023: Green Globes Assessment Protocol for Existing Buildings, Green Globes for Existing Buildings 2021 criteria was used as a pre-draft standard and underwent an ANSI-approved consensus process in 2021–2023. Green Globes is following its ANSI-approved continuous maintenance procedures to update and improve ANSI/GBI 01-2021 and ANSI/GBI 02-2023.

Registration & Certification Fees: Certification fees depend on building size and characteristics, type of certification, and level of assessment services. Project registration costs \$1,500 and is the first step to achieving certification. Assessment and certification fees are determined by square footage and the volume and type of buildings. Fees range from \$5,225 to \$21,500 for existing buildings and \$4,120 to \$15,500 for new construction buildings. There are no fees associated with the interpretations or appeals processes.

Assessment & Certification: Green Globes staff act as liaisons between project teams/owners and trained, independent third-party assessors who conduct project reviews and determine certification levels. Assessors are selected based on qualification (experience in design, engineering, energy analysis/management, commissioning, construction, and/or facility management). Once an assessor is assigned, contact information for an assessor is then given to the project team/owner by GBI.

There are currently 3,575 buildings in the United States certified under Green Globes. Of these, 774 are U.S. federal buildings.



LEED

Building Types: LEED version 4.1 includes certifications for existing buildings, building interiors, and new construction and major renovation.

System Development & Update: In developing the LEED certification system, USGBC used a voluntary consensus-based process, as defined in the Office of Management and Budget (OMB) Circular A-119.³ Volunteer-based committees first review the LEED credit categories and draft changes to the rating system. Changes can be submitted by the LEED Steering Committee (LSC), subject matter committees, or by LEED members. All proposed changes are reviewed by the LSC and must be approved before being released for public comment; all comments received during the public comment phases receive individual responses. The development process involves at least two drafts and two public comment periods. After this phase, USGBC members vote on the draft. To be accepted, the draft must receive positive votes from 66 percent of the voting members.

Registration & Certification Fees: Fees for LEED certification vary by building project size, membership status, and complexity. For organization members at the Silver, Gold, and Platinum levels, system fees for registration and certification of building projects range from \$4,550 for a building with 50,000 square feet and combined certification review to \$47,850 for a building with 749,999 square feet and split review. The certification fees for larger buildings are determined by the Green Business Certification Incorporated (GBCI). Credit appeals are \$600–\$900.

LEED volume certification offers reduced fees for organizations with multiple of certain kinds of projects. For projects certified in the past 3-year period (2015–2017), the average total cost (including registration, certification, and supplemental reviews, appeals, and interpretations) was approximately \$5,770, with an average gross floor area of 96,000 square feet.

Assessment & Certification: LEED projects are certified by GBCI, a separately incorporated entity with its own certified assessors. For every LEED project, three GBCI assessors are assigned to review all submitted documentation. The assessors independently apply LEED's system criteria (prerequisites and credits) to determine the level of certification achieved. The certification process involves a preliminary and final review and lasts 2 to 3 months from the time the documentation is first submitted by the LEED project team to the time when certification is determined by GBCI.

There are currently 33,565 U.S. buildings certified under LEED BD+C and LEED O+M. Of these, 2,507 are U.S. federal buildings.

³ OMB, Executive Office of the President. Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities. Last revised January 27, 2016.



The Living Building Challenge

Building Types: Currently, the LBC includes certifications for existing buildings, building interiors, and new construction and major renovation.

System Development & Update: The International Living Future Institute (ILFI) developed the LBC standard through a voluntary process that involved soliciting input from stakeholders. No documented consensus process was used during the initial development or for subsequent periodic updates. Stakeholders, including project teams and product manufacturers, may submit requests through the LBC's Dialogue online platform, which are reviewed by ILFI. Changes to the standard are only made after research and industry consultation have been conducted. The LBC's standard has been refined and adjusted six times since its original release in 2006; there is no set frequency for these updates.

Registration & Certification Fees: Certification fees are based on the project type, size, and desired certification. The Living Building Challenge and Core Green Building certifications have a registration fee of \$5,000 and the certification fees are \$7,000 and \$3,500 at a minimum, respectively. The Zero Carbon and Zero Energy certifications have a registration fee of \$2,500 and the certification fees are \$3,500 and \$2,000 at a minimum, respectively.

Assessment & Certification: Qualified, expert individuals have been carefully selected by the Institute to be Auditors and perform Audits for specific programs. Auditors are assigned a project based on availability, geographic proximity, and technical expertise. They must confirm their independence from the project and that there is no conflict of interest in their performing the audit. Auditors meet regularly to receive updated training, review program standards and new updates, and learn procedural improvements and updates.

Currently, there are three buildings in the United States certified under the LBC.



Passive House Institute US, Inc.

Building Types: Currently, PHIUS includes certifications for existing buildings, building interiors, and new construction and major renovation.

System Development & Update: The standards are developed collaboratively by staff and a volunteer Technical Committee, with public comment. The Technical Committee is not merely advisory but has decision authority over matters brought to it by staff, including the major standards update milestones in 2015, 2018, 2021, and 2024 (as well as some project certification appeals). The technical committee operates using a modified consensus process—consensus is sought for three ballots on a motion, and a decision can be made by supermajority vote thereafter. Public comment input has been

collected for these milestone update versions. The draft documents are publicly accessible, but the comments themselves are not. Comments are responded to collectively, rather than individually.

Major version updates have been issued on a 3-year cycle since 2015. Formal mid-cycle adjustments were made after the 2015, 2018, and 2021 versions. Minor changes to the requirements, and clarifications thereof, are made by updating the Certification Guidebook as needed.

Registration & Certification Fees: Project certification fees are based on the project type, size, and desired certification. The lowest certification fee is \$2,200 for a single-family residential building. Fees range from \$2,750 to \$52,225 for a multifamily residential building and from \$2,200 to \$45,075 for nonresidential buildings.

Assessment & Certification: PHIUS conducts the standard-setting and also operates a program of certification to the standards. For the Design Certification phase, a project submitter and their independent qualified PHIUS Certified Consultant (CPHC) submit design documentation for review by PHIUS staff members. At the construction phase, an independent, 3rd party PHIUS Certified Rater or Verifier does field quality assurance inspections and submits reports to both their RESNET provider and to PHIUS. PHIUS staff members review to determine final certification. The independent design consultant and quality assurance professionals are selected by the project submitter/owner. The PHIUS staff reviewers are assigned by the PHIUS's Director of Project Certification.

Currently, there are 392 buildings in the United States certified under PHIUS. To date, no U.S. federal buildings have been certified.

Appendix B

2023 Market Analysis Results

In Phase I of this 5-year review, GSA evaluated the market for available green building certification systems, then narrowed the list to systems meeting its screening criteria. The following criteria determined the systems selected by GSA:

1. Currently available for use in the U.S. commercial buildings market and not limited to one climate zone or geographic region.
2. Addresses buildings (rather than individual products) with multiple performance and sustainable design attributes in EISA, including energy, water, natural resources, and environmental quality.
3. Validated by an independent, third-party assessor.
4. Incorporates (where feasible) measurable or calculated metrics to assess building performance as opposed to qualitative metrics that reflect evidence of intent. For example, directly measuring a building's generated waste (quantitative) to baseline and reduce over time rather than simply developing a waste management plan (qualitative, suggesting only evidence of intent to reduce building waste).

GSA found over 100 systems available in the market. The following six building certification systems met the initial screening criteria for further assessment:

1. BOMA BEST (<http://www.bomabest.org>).
2. BREEAM USA (<http://www.breeamusa.com>).
3. Green Globes (<http://www.thegbi.org>).
4. LEED (<https://new.usgbc.org/leed>).
5. LBC (<https://living-future.org>).
6. Passive House Institute US, Inc. (PHIUS) (<https://www.phius.org/>).

Table B-1 in this appendix details the findings of the market analysis. The tables include a row for each system, followed by a column for the results of each screening criteria (Y, N, or N/A). An "X" in the first column indicates which systems met all screening criteria. Once a system did not meet one of the screening criteria, the reviewer did not assess the system against the remaining criteria, marking the subsequent criteria as "N/A."

Table B-1. Building Certification Systems Evaluated in Phase I, Market Review, 2023

Meets All Criteria	Certification System Name	Criteria 1: Availability	Criteria 2: Relevance	Criteria 3: Third-Party Certification	Criteria 4: Measurability
	Active House	N	Y	N/A	N/A
	ANSI/GBI 01-2021 Green Globes Assessment Protocol for Design, New Construction and Major Renovations	Y	Y	N/A	N/A
	ASHRAE 189.1 Standard for the Design of High-Performance, Green Buildings	Y	N	N/A	N/A
	ASHRAE Building Energy Quotient Program (Building EQ)	Y	N	N/A	N/A
	ARZ Building Rating System (Lebanon)	N	Y	N	N/A
	BEAM PLUS	N	Y	N/A	N/A
	BERDE	N	Y	N	N/A
	BIT Building	Y	Y	N	N/A
	BOMA 360 Performance Program	Y	N	N	N/A
X	BOMA Best (US)	Y	Y	Y	Y
X	BREEAM (Building Research Establishment's Environmental Assessment Method)	Y	Y	Y	Y
	BREEAM Canada	N	N/A	N/A	N/A
	BREEAM Green Leaf	N	N/A	N/A	N/A
	BREEAM NL	N	N/A	N/A	N/A
	BREEAM-NOR	N	N/A	N/A	N/A
	BRI LCA (Japan)	N	N/A	N/A	N/A
	California Green Building Standards Code (CALGREEN)	Y	N/A	N/A	N/A
	Casa Colombia	N	N/A	N/A	N/A
	CASBEE (Comprehensive Assessment System for Building Environmental Efficiency)	N	N/A	N/A	N/A

Table B-1. Building Certification Systems Evaluated in Phase I, Market Review, 2023

Meets All Criteria	Certification System Name	Criteria 1: Availability	Criteria 2: Relevance	Criteria 3: Third-Party Certification	Criteria 4: Measurability
	B.E.S.T.	N	N/A	N/A	N/A
	CEPAS (Comprehensive Environmental Performance Assessment Scheme)	N	N/A	N/A	N/A
	City of Boulder Green Points (CO)	N	N/A	N/A	N/A
	DGNB System - New Construction 2020 International Version	N	N/A	N/A	N/A
	Earth Advantage (Pacific Northwest)	N	N/A	N/A	N/A
	Earth Advantage Commercial (EAC) Program	N	N/A	N/A	N/A
	Earth Craft (Southeast)	Y	N	N/A	N/A
	ECDG–Japan	N	N/A	N/A	N/A
	EcoIndicator (Netherlands)	N	N	N/A	N/A
	EcoInstall (Netherlands)	N	N	N/A	N/A
	EcoPro (Germany)	N	N	N/A	N/A
	EcoQuantum (Netherlands)	N	N	N/A	N/A
	EDGE	Y	N	N/A	N/A
	EkoProfile (Norway)	N	N	N/A	N/A
	Energy Star Portfolio Manager	Y	N	N/A	N/A
	Energy Star NextGen Certification	Y	N	N/A	N/A
	Enterprise Green Communities	Y	N	Y	N/A
	Envest 2	N	N	N/A	N/A
	Environmental Classification of Properties (Finland)	N	N	N/A	N/A
	Environmental Profiles of construction materials, components and buildings (UK)	N	N	N/A	N/A
	EP Label	N	N	N/A	N/A

Table B-1. Building Certification Systems Evaluated in Phase I, Market Review, 2023

Meets All Criteria	Certification System Name	Criteria 1: Availability	Criteria 2: Relevance	Criteria 3: Third-Party Certification	Criteria 4: Measurability
	Equer (France)	N	N	N/A	N/A
	Estidama Pearl Rating System	N	N	N/A	N/A
	FitWell Certification	Y	N	N/A	N/A
	GBC Quartieri (Italy)	N	N	N/A	N/A
	Green Star South Africa GBCSA (South Africa)	N	Y	Y	N/A
	GBTool	N	N	N/A	N/A
	Global Reporting Initiative (GRI)	Y	N	N/A	N/A
	GOBAS (Green Olympic Building Assessment System)	N	N	N/A	N/A
	Green Building Rating System–Korea	N	N	N/A	N/A
	Green Globe 21 (UK)	N	N	N/A	N/A
X	Green Globes US	Y	Y	Y	Y
	Green Key Global	Y	Y	N/A	N/A
	Green Leadership Tool (Finland)	N	N	N/A	N/A
	Green Leaf Eco-Rating Program	N	N	N/A	N/A
	Green Mark Scheme	N	Y	N/A	N/A
	Green Rating System (Sri Lanka)	N	Y	N/A	N/A
	Green Rating for Integrated Habitat Assessment	N	Y	N/A	N/A
	Green Star rating tool (Australia)	N	Y	N/A	N/A
	Green Star (Alaska)	N	N	N/A	N/A
	GreenShip	N	Y	Y	N/A
	HK BEAM (Hong Kong Building Environmental Assessment Method)	N	Y	N/A	N/A

Table B-1. Building Certification Systems Evaluated in Phase I, Market Review, 2023

Meets All Criteria	Certification System Name	Criteria 1: Availability	Criteria 2: Relevance	Criteria 3: Third-Party Certification	Criteria 4: Measurability
	Homestar	N	Y	Y	N/A
	HQE (High Environmental Quality)	N	Y	N/A	N/A
	HVS International ECOTEL Certification	N	N	N/A	N/A
	ICP (Investor Confidence Project)	Y	N	Y	N/A
	Indian Green Council (IGBC)	N	Y	N	N/A
	International Green Construction Code	Y	N	N/A	N/A
	Investor Ready Energy Efficiency	Y	N	N/A	N/A
	ISO 14001 Environment Management System (EMS)	Y	N	N/A	N/A
	KCL-ECO	N	Y	N/A	N/A
	Labs21	N	Y	N/A	N/A
	Laboratory Benchmarking Tool	Y	N	N/A	N/A
	LCA-House (Finland)	N	N	N/A	N/A
	LCAiT (Sweden)	N	N	N/A	N/A
	LEED Brasil	N	Y	N/A	N/A
	LEED Canada	N	Y	N/A	N/A
	LEED India	N	Y	N/A	N/A
	LEED Italia	N	Y	N/A	N/A
	LEED Mexico	N	Y	N/A	N/A
X	LEED (Leadership in Energy and Environmental Design)	Y	Y	Y	Y
	Legoe (Germany)	N	N	N/A	N/A
X	Living Building Challenge	Y	Y	Y	Y
	Miljöbyggnad (Sweden)	N	Y	N/A	N/A

Table B-1. Building Certification Systems Evaluated in Phase I, Market Review, 2023

Meets All Criteria	Certification System Name	Criteria 1: Availability	Criteria 2: Relevance	Criteria 3: Third-Party Certification	Criteria 4: Measurability
	Minnesota Sustainable Building Guidelines*	N	N	N/A	N/A
	NABERS (National Australian Built Environment Rating System)	N	Y	N/A	N/A
	NABERSNZ	N	Y	N/A	N/A
	NEN 2916:2004 nl	N	N	N/A	N/A
	Net-Zero Energy Building (NZEB)	Y	N	N/A	N/A
	Parksmart	Y	N	Y	N/A
X	Passive House US, Inc (PHIUS)	Y	Y	Y	Y
	PEER	Y	N	N	N
	Protocol ITACA	N	N	N/A	N/A
	REGENERERS (Finland)	N	N	N/A	N/A
	SBAT (Sustainable Buildings Assessment Tool)	N	N	N/A	N/A
	Scottsdale's Green Building Program	Y	N/A	N/A	N/A
	Seattle Green Building Standard	Y	N/A	N/A	N/A
	SEED (Pakistan Green Building Council)	Y	N/A	N/A	N/A
	SITES (GBCI)	Y	N	Y	N/A
	SPI Green Firm Certification	Y	N	N/A	N/A
	Swiss DGNB	N	Y	Y	N/A
	The Sustainability Tracking, Assessment & Rating System (STARS)	Y	Y	N/A	N/A
	Three Star System	N	Y	N/A	N/A
	Total Resource Use and Efficiency (TRUE)	Y	N	N/A	N/A






Table B-1. Building Certification Systems Evaluated in Phase I, Market Review, 2023

Meets All Criteria	Certification System Name	Criteria 1: Availability	Criteria 2: Relevance	Criteria 3: Third-Party Certification	Criteria 4: Measurability
	Tokyo Metro Green Building Program	N	N	N/A	N/A
	TQ Building Assessment System (Total Quality Building Assessment System)	N	Y	N/A	N/A
	Verde edificios 2022	N	Y	N/A	N/A
	WELL Building Standard	Y	N	Y	N/A

Appendix C

Review Findings

This appendix includes the findings from the system owner surveys, as reviewed and revised as necessary by GSA. Following the independent verification and evaluation of the submitted survey responses, GSA reviewed the findings in detail and made a final determination regarding the alignment of each sub-criterion with the federal building requirements.

In the matrix that follows, the system owners initially indicated a  (Yes) or  (No) for all sub-criteria. GSA’s review determined that the items shown with a  (Partially Met) were addressed by the system but were not in full alignment with the federal building requirement(s). Additionally, GSA found some items that system owners marked with a  (Yes) did not meet the federal building requirement(s) and, therefore, changed them to a  (No). A note at the end of each affected item indicates this.

GSA has also summarized these findings in Chapter 3 of the report.

Table C-1a. Summary of Findings—New Construction Certification Systems


























Effectiveness Criteria: Employed Integrated Design Principles						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Integrated Design and Management	Does your system address integrated design and management?					
Sustainable Siting	Does your system address sustainable siting?					
Stormwater Management	Does your system address stormwater management?					
Infrastructure Utilization and Optimization	Does your system address infrastructure utilization and optimization?					
Commissioning	Does your system address Commissioning?					

Table C-1b. Summary of Findings—New Construction Certification Systems

Effectiveness Criteria: Optimize Energy Performance						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Energy Efficiency	Does your system address energy efficiency?	⚠	✓	✓	✓	✓
Energy Metering	Does your system address energy metering?	✓	✓	✓	✓	⚠
Renewable Energy	Does your system address renewable energy?	✓	✓	✓	✓	✓
Benchmarking	Does your system address benchmarking?	⚠	✓	✓	⚠	✓

Table C-1c. Summary of Findings—New Construction Certification Systems

Effectiveness Criteria: Protect and Conserve Water						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Indoor Water Use	Does your system address indoor water use?	✓	✓	✓	✓	✓
Water Metering	Does your system address water metering?	✓	✓	✓	✓	✗
Outdoor Water Use	Does your system address outdoor water use?	✓	✓	✓	✓	✗
Alternative Water	Does your system address alternative water?	✓	✓	✗	✓	✗

Table C-1d. Summary of Findings—New Construction Certification Systems

Effectiveness Criteria: Enhance the Indoor Environment						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Ventilation and Thermal Comfort	Does your system address ventilation and thermal comfort?	✓	✓	✓	✓	✓

Table C-1d. Summary of Findings—New Construction Certification Systems

Effectiveness Criteria: Enhance the Indoor Environment						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Daylighting and Lighting Controls	Does your system address daylighting and lighting controls?	✔	✔	✔	✔	✘
Low-emitting Materials and Products	Does your system address low-emitting materials and products?	✔	✔	✔	✔	✔
Radon Mitigation	Does your system address radon mitigation?	✔	✔	✘	✘	✔
Moisture and Mold Control	Does your system address moisture and mold control?	✔	!	✘	✔	✔
IAQ During Construction and Operations	Does your system address IAQ during construction and operations?	✘	✔	✔	✔	✔
Environmental Smoking Control	Does your system address environmental smoking control?	✔	✔	✔	✔	✔
Integrated Pest Management	Does your system address integrated pest management?	✔	✔	✔	✔	!
Occupant Health and Wellness	Does your system address occupant health and wellness?	✔	✔	✔	✔	✘

Table C-1e. Summary of Findings—New Construction Certification Systems

Effectiveness Criteria: Reduce the Environmental Impact of Materials						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Recycled Content	Does your system address recycled content?	!	!	!	!	✘
Biobased Content	Does your system address biobased content?	!	!	!	!	✘
Environmentally Preferable Products	Does your system address environmentally preferable products?	✔	✔	✔	✔	✔

Table C-1e. Summary of Findings—New Construction Certification Systems

Effectiveness Criteria: Reduce the Environmental Impact of Materials						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Ozone Depleting Substances	Does your system address ozone depleting substances?	!	✓	✗	✓	✓
Hazardous Waste	Does your system address hazardous waste?	!	✓	✓	✗	✗
Solid Waste Management	Does your system address solid waste management?	✓	✓	✓	✓	✗

Table C-1f. Summary of Findings—New Construction Certification Systems

Effectiveness Criteria: Assess and Consider Building Resilience						
Sub-criteria	Questions	Green Globes NC	LBC NC	LBC Core NC	LEED BD+C	PHIUS NC
Risk Assessment	Does your system address hazardous waste?	✓	!	!	✓	✗
Building Resilience and Adaptation	Does your system address solid waste management?	✓	✓	!	✓	✓

Table C-2a. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Employed Integrated Design Principles								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Integrated Design and Management	Does your system address integrated design and management?	!	✓	✓	✓	✓	!	✓
Sustainable Siting	Does your system address sustainable siting?	✓	✓	✓	✓	✓	✓	!

Table C-2a. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Employed Integrated Design Principles								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Stormwater Management	Does your system address stormwater management?	✘	✔	✔	✔	✔	✔	✘
Infrastructure Utilization and Optimization	Does your system address infrastructure utilization and optimization?	✔	✔	✔	✔	✔	✔	✘
Commissioning	Does your system address commissioning?	✔	✘	✔	⚠	⚠	✘	✔

Table C-2b. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Optimize Energy Performance								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Energy Efficiency	Does your system address energy efficiency?	⚠	✔	✔	✔	✔	⚠	✔
Energy Metering	Does your system address energy metering?	✔	✔	✔	✔	✔	✔	⚠
Renewable Energy	Does your system address renewable energy?	✔	✔	✔	✔	✔	✘	✔
Benchmarking	Does your system address benchmarking?	✔	✔	✔	✔	✔	✔	✔

Table C-2c. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Protect and Conserve Water								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Indoor Water Use	Does your system address indoor water use?	⚠	✔	⚠	✔	✔	✔	✔
Water Metering	Does your system address water metering?	✔	✔	✔	✔	✔	✔	✘
Outdoor Water Use	Does your system address outdoor water use?	⚠	⚠	✔	✔	✔	✔	✘
Alternative Water	Does your system address alternative water?	✔	✔	✔	✔	✘	✔	✘

Table C-2d. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Enhance the Indoor Environment								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Ventilation and Thermal Comfort	Does your system address ventilation and thermal comfort?	✔	✔	✔	✔	✔	✔	✔
Daylighting and Lighting Controls	Does your system address daylighting and lighting controls?	✔	✔	✔	✔	✔	✔	✘
Low-emitting Materials and Products	Does your system address low-emitting materials and products?	✔	✔	✔	✔	✔	✔	✔

Table C-2d. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Enhance the Indoor Environment								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Radon Mitigation	Does your system address radon mitigation?	✓	✓	✓	✓	✗	✗	✓
Moisture and Mold Control	Does your system address moisture and mold control?	✓	✓	✓	!	✗	✓	✓
IAQ During Construction and Operations	Does your system address IAQ during construction and operations?	✓	✓	✓	✓	✓	✓	✓
Environmental Smoking Control	Does your system address environmental smoking control?	✗	✓	✓	✓	✓	✓	✓
Integrated Pest Management	Does your system address integrated pest management?	✓	✓	✓	✓	✓	✓	!
Occupant Health and Wellness	Does your system address occupant health and wellness?	✗	✓	✓	✓	✓	!	✗

Table C-2e. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Reduce the Environmental Impact of Materials								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Recycled Content	Does your system address recycled content?	✗	!	✓	!	!	!	✗

Table C-2e. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Reduce the Environmental Impact of Materials								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Biobased Content	Does your system address biobased content?	✘	⚠	✔	⚠	⚠	⚠	✘
Environmentally Preferable Products	Does your system address environmentally preferable products?	✔	✔	✔	✔	✔	✔	✔
Ozone Depleting Substances	Does your system address ozone depleting substances?	✔	✔	✔	✔	✘	✔	✔
Hazardous Waste	Does your system address hazardous waste?	✔	✔	✔	✔	✔	✔	✘
Solid Waste Management	Does your system address solid waste management?	✔	✔	✔	✔	✔	✔	✘

Table C-2f. Summary of Findings—Existing Buildings Certification Systems

Effectiveness Criteria: Assess and Consider Building Resilience								
Sub-criteria	Questions	BOMA BEST	BREEAM	Green Globes EB	LBC EB	LBC Core EB	LEED O+M	PHIUS EB
Risk Assessment	Does your system address risk assessment?	✔	✔	✔	⚠	⚠	✘	✘
Building Resilience and Adaptation	Does your system address building resilience and adaptation?	✔	✔	✔	✔	⚠	✔	✔

Appendix D

2023 Completed Green Building Certification System Surveys

To be determined.

Appendix E

Abbreviations

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
BOMA	Building Owners and Managers Association
BREEAM	Building Research Establishment's Environmental Assessment Method
Building EQ	ASHRAE Building Energy Quotient Program
CALGREEN	California Green Building Standards Code
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
CFR	Code of Federal Regulations
CEPAS	Comprehensive Environmental Performance Assessment Scheme
CPHC	PHIUS Certified Consultant
DOE	U.S. Department of Energy
DOE Rule	The Green Building Certification Systems Requirement for New Federal Buildings and Major Renovations of Federal Buildings Final Rule, DOE
EISA	Energy Independence and Security Act of 2007
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act
GBCI	Green Business Certification Incorporated
GBI	Green Building Initiative
GOBAS	Green Olympic Building Assessment System
Green Globes EB	Green Globes for Existing Buildings
Green Globes NC	Green Globes for New Construction
GRI	Global Reporting Initiative
GSA	U.S. General Services Administration

Guiding Principles	The Guiding Principles for Sustainable Federal Buildings, December 2020
HK BEAM	Hong Kong Building Environmental Assessment Method
HQE	High Environmental Quality
IAQ	Indoor Air Quality
ICP	Investor Confidence Project
IGBC	Indian Green Council
ILFI	International Living Future Institute
ISO	International Standards Organization
LBC	Living Building Challenge
LBC EB	Living Building Challenge for Existing Buildings
LBC NC	Living Building Challenge for New Construction
LEED	Leadership in Energy & Environmental Design
LEED BD+C	LEED v4 for Building Design and Construction
LEED O+M	LEED v4 for Building Operations and Maintenance
LSC	LEED Steering Committee
MURBs	Multi-Unit Residential Buildings
NABERS	National Australian Built Environment Rating System
NZEB	Net-Zero Energy Building
OMB	Office of Management and Budget
PHIUS	Passive House Institute US, Inc.
PHIUS EB	PHIUS for Existing Buildings
PHIUS NC	PHIUS for New Construction
SBAT	Sustainable Buildings Assessment Tool
SDO	Standards Developing Organization
STARS	The Sustainability Tracking, Assessment & Rating System
TUR	Technical Update Request
TQ	Total Quality
TRUE	Total Resource Use and Efficiency
USGBC	U.S. Green Building Council
WBDG	Whole Buildings Design Guide