Zero Carbon Certification
Draft Pilot Program Manual

Issued September 2025

INTERNATIONAL
LIVING FUTURE
INSTITUTE℠

living-future.org/zero-carbon/

Table of Contents

Acknowledgments

[This section is being finalized prior to final publication.]

Executive Summary

At Living Future, we envision a real estate industry that supports thriving communities and local economies, restores ecological health, and contributes to reversing climate change.

Zero Carbon Certification™, developed by the International Living Future Institute (Living Future) in 2018, addresses the building sector's significant contribution to the global climate crisis. Currently, building construction and operations are responsible for over 37% of global greenhouse gas emissions, which are directly linked to rising global temperatures and threats to human and ecological well-being. Living Future created the certification to provide a scalable pathway toward a climate-positive built environment.

This third-party verified, industry-recognized standard confirms that a project's operational and embodied carbon emissions have been reduced and neutralized. By meeting its performance requirements, organizations demonstrate a credible, comprehensive approach to carbon neutrality—enhancing both the resilience and asset value of their projects.

Industry Call to Action

The building sector is under increasing pressure to reduce carbon emissions—and forward-thinking developers, design and construction professionals, and facility managers are rising to meet the challenge. Living Future's Zero Carbon Certification provides a rigorous, third-party verified path to demonstrate that your buildings are not only high-performing, but carbon neutral in both operations and embodied emissions.

Pursuing Zero Carbon Certification helps you:

- Enhance asset value by aligning with investor ESG priorities and increasing market differentiation.
- Reduce long-term operating costs by improving energy efficiency and eliminating fossil fuel reliance.
- Mitigate risk from tightening regulations, potential carbon pricing, and stranded asset risks
- Improve portfolio climate performance through all electric buildings and validate energy and carbon impact reporting
- Attract and tenants and buyers seeking high-performance, climate-aligned spaces.
- Strengthen brand reputation as an industry leader in sustainability and innovation.

By certifying your projects, you're not just meeting today's expectations—you're setting the standard for the buildings of tomorrow.

Partner with the International Living Future Institute to lead the transition to a decarbonized built environment—and realize the financial and climate benefits of Zero Carbon Certification.

Zero Carbon Pilot Certification

Pilot Project Eligibility

To pursue Zero Carbon Certification, a project must meet the eligibility requirements established by Living Future. Projects must meet the following criteria. Living Future retains the right to determine final eligibility based on submitted project details.

1. The project team must commit the financial and practical resources to comply with technical requirements
2. The project team must commit to quarterly one-hour calls with Living Future to discuss program progress and feedback
3. The project must be classified under a single Living Future defined Typology: Existing Building, New Building, Building Renovation, or Interior. Landscape and INfrastructure projects are not eligible for the Zero Carbon Pilot.
4. Is of a primary building use that aligns with the program requirements and referenced standards, including but not limited to: commercial, educational, food service, hotel/lodging, industrial, institutional, multi-family residential, municipal, retail, warehouse, and mixed-use
    a. Healthcare projects should consult with Living Future prior to registering for the Pilot
    b. High-energy-intensity projects, such as labs, that do not align with the reference standards for energy reduction should consult with Living Future prior to registering for the Pilot
    c. Data centers and single family homes are not eligible for the Zero Carbon Pilot
5. The project team must have the legal right to pursue certification, including:
    a. Ownership of or leaseholder rights to the project site/building
    b. Access to relevant energy data and control of key energy systems
    c. Access to material quantities and product data for LCA takeoffs
6. The project must have a credible pathway to meeting the published program criteria
7. The project team must commit to tracking and submitting 12 continuous months of energy and carbon performance data, demonstrating Zero Carbon performance
8. The project must commit to submitting for Ready Audit no later than December 31, 2027 and Final Audit not later than June 30, 2029.
9. The project team must commit to a one hour feedback call with Living Future and completion of a program participation survey at the conclusion of the Pilot.

Application Process

Interested project teams may submit a project application through the Living Future website. The application must include the following:

- Project name and location
- Project team roster
- Project description
- Description of team's experience with Living Future certification programs
- Description of the program feasibility work completed to confirm eligibility

Living Future staff will review all applications. Staff may request a discovery meeting with the team to confirm eligibility details. Teams will be notified of their application approval by email. Living Future staff will support teams in completing the project registration, including acknowledgement of registration terms and conditions, and invoice process.

Pilot Project Consulting Support

Living Future provides comprehensive support to pilot project teams pursuing Zero Carbon Certification by offering strategic guidance, technical resources, and collaborative coaching throughout the certification process. From implementation support to final documentation and audit preparation, the Living Future team helps apply the program requirements to their project to eliminate operational and embodied carbon, develop renewable energy and offset strategies, and ensure compliance with program requirements. Through ongoing engagement throughout the pilot, the Living Future team works closely with project stakeholders to build capacity, resolve challenges, and advance carbon-neutral solutions that align with regenerative design principles.

As pilot participants, project teams can expect:

- One (1) kick off meeting to review program requirements and project timeline
- Five (5) one-hour dedicated consulting calls, to discuss program implementation and customization
- Quarterly check ins to discuss progress and share feedback with Living Future during the pilot
- One (1) audit prep meeting as the team prepares documentation for Ready Audit
- Participation promotion by Living Future (optional)

Audit and Certification Process

The audit process for Living Future's **Zero Carbon Certification** is a rigorous third-party review designed to verify that a project has fully met the program's requirements for eliminating both operational and embodied carbon. The process includes the following steps:

1. Audit Preparation

The project team has the opportunity to meet with the Living Future team to discuss outstanding questions and receive feedback. The team prepares and uploads all necessary documentation—project drawings, photos, narratives, contracts, offset receipts, and other supporting materials—for review by the auditor. Once complete, the team notifies Living Future that the certification application is ready for review, and Living Future issues the certification fee invoice.

2. Ready Audit Review

After the certification invoice has been paid, a third-party auditor assigned by Living Future conducts a detailed review of the submitted materials to assess compliance with Zero Carbon Certification requirements. This includes evaluating anticipated energy performance, carbon accounting methodologies, procurement strategies, and offset documentation.

3. Clarification Requests (Ready Audit Phase)

If further information or clarification is needed, the auditor issues clarification requests. The project team must respond with supplemental documentation and explanations to resolve all identified gaps.

4. Ready Designation

Once all Ready Audit clarification requests are addressed, the auditor issues a final report summarizing their findings. If all program requirements are met, the project receives a Ready Designation, confirming it is on track to achieve full certification following the performance period.

5. Final Audit Review

After completing the required 12-month performance period, the project team uploads verified performance data, case study responses, and any remaining documentation to the audit platform. The team then notifies Living Future that the submission is ready for Final Audit review. *Note: There is no additional fee for the Final Audit.*

6. Clarification Requests (Final Audit Phase)

As with the Ready Audit, the auditor may issue clarification requests during the Final Audit. The team must respond with any additional information necessary to verify compliance.

7. Final Audit Report

Once all clarifications are resolved, the auditor prepares a final report summarizing the project's performance and makes a certification recommendation to Living Future.

8. Certification Decision

Living Future reviews the Final Audit findings and issues the final certification decision. If approved, the project is formally certified as Zero Carbon, awarded certification materials, and publicly recognized in the Living Future project registry.

Feedback Commitment

The project team must commit to a one hour feedback call and written participation survey with Living Future upon completion of the Pilot Program.

TYPOLOGY

Every project is classified as either New Building, Building Renovation, Interior, Existing Building, or Landscape + Infrastructure Typology. To be eligible for certification, a project must have a construction and operations scope relevant to the certification being pursued. All projects, regardless of typology, must be in compliance with all local, state, and federal environmental laws and regulations.

NEW BUILDING

This Typology is for any project that encompasses the construction of a new building or a new addition and new interior materials and systems.

- Structure and enclosure: in scope
- MEP Systems: in scope
- Non-structural elements and finishes: in scope
- Site/exterior improvements: in scope
- Performance period start date: after construction completion and after typical occupancy has begun

BUILDING RENOVATION

This Typology is for any project that encompasses the alteration of either or both the thermal envelope or the major systems of an existing structure and new interior materials and systems.

- Structure and enclosure: in scope , all materials including newly installed, repaired, or existing-to-remain.
- MEP Systems: in scope, all materials including new, upgraded, and existing-to-remain equipment; all energy-using systems must be accounted for in EUI baseline and energy use reporting
- Non-structural elements and finishes: in scope
- Site/exterior improvements: All energy-using site lighting and equipment, all newly installed materials
- Performance period start date: after construction completion and after typical occupancy has begun

INTERIOR

This Typology is for any project that is a complete interior fit-out and does not substantially alter either the thermal envelope or the base building systems, including electrical, conditioning, ventilation, or water systems. The base building may be newly constructed or existing.

- Structure and enclosure: enclosure not in scope; small repairs or alterations to the structure within the Project Boundary are in scope
- MEP Systems: base building systems are not required to be tracked in the EUI baseline; fit-out MEP systems and equipment must be included in EUI baseline and target reporting; all energy use including tenant proportionate share of base building systems must be included in total energy use reporting
- Non-structural elements and finishes: in scope and must encompass alteration down to the studs of at least 50% of the non-structural floors, walls, and ceiling elements by combined area within the Project Boundary. Alterations below 50% must use the Existing Building typology.

- Site/exterior improvements: not in scope
- Performance period start date: after construction completion and after typical occupancy has begun.

EXISTING BUILDING

This Typology is for any project that encompasses an existing structure. Existing Buildings may have minimal renovation work that does not require a new certificate of occupancy or prevent normal building operations from occurring while the work is in progress. They may have no renovation work at all.

- Structure and enclosure: enclosure repairs and replacement are in scope and limited to 20% of the building thermal envelope by surface area; small repairs or alterations to the structure within the Project Boundary are in scope; projects with significant envelope or structural scope must us the Building Renovation Typology
- MEP Systems: in scope and limited to no more than 5% increase in system capacity, including like-kind replacement with, existing equipment with reconfiguration, and unaltered equipment; all systems must be accounted for in EUI baseline and energy use reporting
- Non-structural elements and finishes: in scope and limited to 30% or less of floor area within the Project Boundary. Projects above 30% must use an alternate typology.
- Site/exterior improvements: use, maintenance, repair, in scope
- Performance period start date: minimum five (5) years after issuance of most recent certificate of occupancy

LANDSCAPE + INFRASTRUCTURE

This Typology is for any project that either does not include an enclosed structure as part of its primary program or includes an enclosed structure that is not considered regularly occupied. Examples include parks, roads, bridges, plazas, outdoor sports facilities, trails, or utility structures.

PROJECT BOUNDARY

Every project must define a Project Boundary to be used consistently across all program requirements. The Project Boundary is the total area pursuing certification as projected on a site plan. This area includes all of the following:

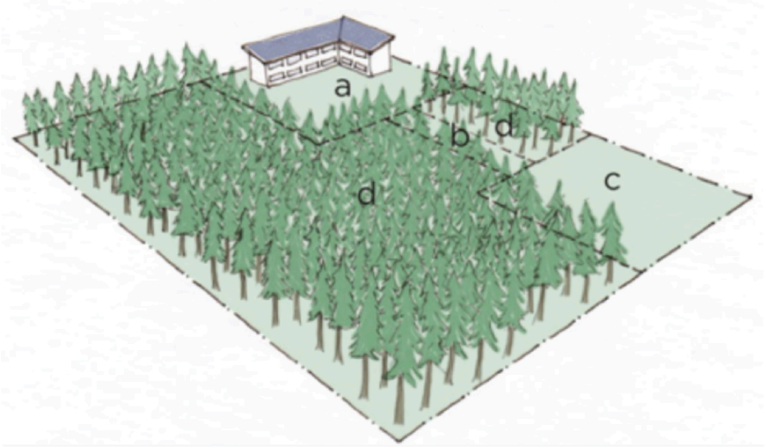
1. The building footprint, or the portion of the building footprint pursuing certification in accordance with Interior guidance;
2. All areas of the site, including all structures and infrastructure used to demonstrate compliance with any requirements and all areas of the site that are disturbed as part of the project scope of work, including construction staging areas. See Allowable Exclusions below.
3. All structured parking.

Projects are encouraged, but not required, to use the property boundary as the Project Boundary.

Allowable Exclusions
The following areas may be excluded from the Project Boundary at the discretion of the project team:

1. Land that is undisturbed and has no site energy use;
2. Building Renovation, Interior, Existing Building, and Landscape + Infrastructure Typology only: Areas that are owned by the certifying entity that do not contribute to the functioning of the certifying project.
    a. If disturbed, such areas must be restored to their original status and function prior to the Certification Audit.

For example, exterior laydown or staging areas that are utilized by an Interior project may be excluded from the boundary if they do not contribute to compliance with any requirements, but they must be restored to their original status and function prior to certification.



(a) = area of disturbance
(b) = area of conveyance
(c) = remote project area (such as geothermal well or greywater infiltration system)
(d) = Priority Natural Lands excluded from project
(a+b+c) = project boundary

Figure 2 Project Boundary with Exclusion

Interior Typology
The Project Boundary for an Interior project must comply with the definition above. If the project extends to multiple floors, the Project Boundary is determined by projecting the certifying area of each floor onto a single plan and calculating the total resulting area, ensuring that any areas of overlap are only counted once.

Campus or Other Large Sites Under Single Ownership
Since the property lines of a campus or other similarly large parcel of land owned by a single entity may exceed the boundaries of a given construction or operations scope, projects on campuses will likely need to define their Project Boundary independent of the property line, typically using a campus or site masterplan. Projects within campuses must include all disturbed areas in the Project Boundary, including all land used for construction work, utility conveyance, or staging. Undisturbed areas that are clearly linked to the certifying project (e.g., an associated courtyard or parking area) also must be included.

It is acknowledged that some areas within the Boundary, such as staging areas, may reasonably be included in multiple projects. The inclusion of such areas in future projects may not

permanently compromise their contribution to any projects reliant on them for compliance with any program requirementImperative. Parking that is shared with other buildings must be included in the Project Boundary on a prorated basis. In addition, any shared energy systems need to be included in performance calculations on a prorated basis, but do not need to be included in the Project Boundary.

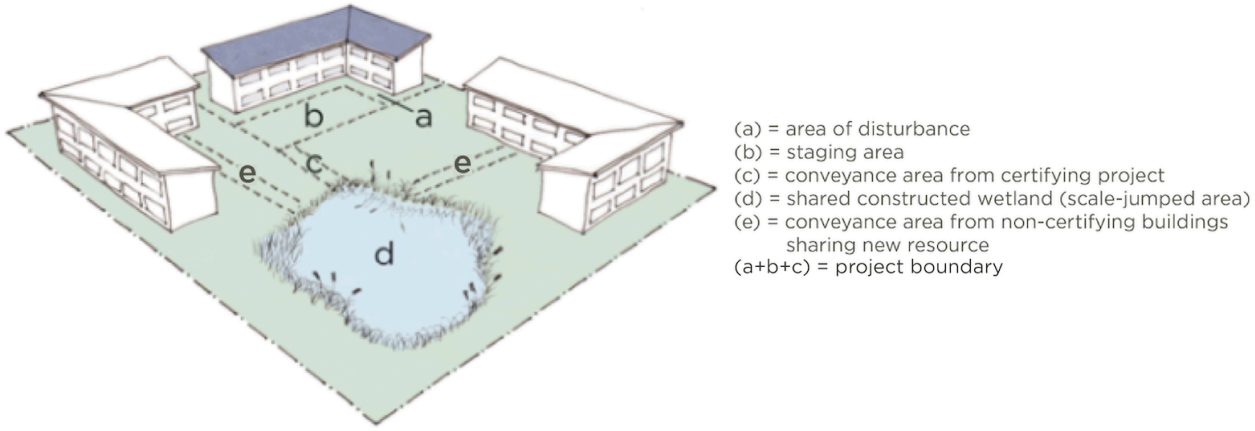


Figure 4 Campus Project Boundary

PROJECT FLOOR AREA

New Construction, Building Renovation, Existing Building, and Landscape + Infrastructure

For projects under the New Construction, Existing Building, and Building Renovation Typologies, the Project Floor Area is the sum of the area on all floors within the outside faces of the building's exterior walls, including all vertical penetration areas, areas for circulation, and shaft areas that connect one floor to another. Structured parking that is part of the building structure (not merely connected to it) is included in the Project Floor Area. The Project Floor Area does not include unenclosed exterior spaces such as decks, patios, or balconies, exterior surface parking, or structured parking that is structurally distinct from the project.

Interior

For Interior projects, the Project Floor Area must encompass the gross area of the building to be included in the certification as measured from the centerline of the walls defining the space. The Project Floor Area must include all areas within the scope of work for the project and define a space that is physically and visually distinct from the non-certifying parts of the building. The distinctions may be created by walls, halls, and/or separation by floor.

The Project Floor Area may not be gerrymandered to unreasonably exclude any spaces that are under the project's control and clearly part of the project due to a physical or visual connection, even if those spaces are not within the project's scope of work. For example, server rooms serving the project that are within the physical footprint of the project and are essential to the function of the project may not be excluded, even if they are not modified. Utility chases and other common spaces that are fully outside of a tenant's control are not considered part of the

project and may be excluded. Restrooms may be excluded from the boundary of an Interior project if the fixtures are not within the control of the project.

Program Intent + Requirements

INTENT

The intent of the Zero Carbon Certification program is to bring the vision of a fully decarbonized built environment into reality by evaluating, reducing, and offsetting both operational and embodied carbon impacts of buildings. This program fosters the development and use of carbon-free renewable energy resources and neutralizes the impacts of building materials and construction.

PROGRAM IMPACT FOCUS

OPERATIONAL CARBON REQUIREMENTS

Operational Carbon Scope

New buildings
Achieve a 20% improvement beyond the site energy use intensity (EUI) required by ASHRAE Standard 90.1-2022 or later (demonstrating compliance under Appendix G) or IECC 2024 or later. Combustion is not allowed within the project boundary for any purpose. Provide 100% of the operational energy use associated with the project by new on- or off- site renewable energy. Meter energy used by the project and report seasonal peak demand. Either: ● Submeter loads in accordance with ASHRAE 90.1-2022 Section 8.4.3, and also submeter any additional loads that are expected to represent 20% or more of the total energy consumption of the project; OR ● Alternatively, submeter all loads that are expected to represent 20% or more of the total energy consumption of the project.
Building Renovation
Either: ● Meet the site EUI required by ASHRAE Standard 90.1-2022 or later (per Appendix G) or IECC 2024 or later; OR

- Achieve a 50% reduction of EUI from a typical existing building of an equivalent climate, size, use and occupancy using Living Future-approved tools.

Combustion is not allowed within the project boundary for any purpose.

Provide 100% of the operational energy use associated with the project by new on- or off- site renewable energy.

Meter energy used by the project and report seasonal peak demand. Either:

- Submeter loads in accordance with ASHRAE 90.1-2022 Section 8.4.3, and also submeter any additional loads that are expected to represent 20% or more of the total energy consumption of the project; OR
- Alternatively, submeter all loads that are expected to represent 20% or more of the total energy consumption of the project.

Interiors

Either:

- Meet the site EUI required by ASHRAE Standard 90.1-2022 or later (per Appendix G) or IECC 2024 or later; OR
- Achieve a 50% reduction of EUI from a typical existing building of an equivalent climate, size, use and occupancy using Living Future-approved tools.

Combustion is not allowed within the project boundary for any systems within the project scope and control. The project must advocate to the building owner to request a phase-out plan for any base-building combustion.

Provide 100% of the operational energy use associated with the project by new on- or off- site renewable energy.

Meter energy used by the project and report seasonal peak demand. Either:

- Submeter loads in accordance with ASHRAE 90.1-2022 Section 8.4.3, and also submeter any additional loads that are expected to represent 20% or more of the total energy consumption of the project; OR
- Alternatively, submeter all loads that are expected to represent 20% or more of the total energy consumption of the project.

Existing Buildings

The whole building's site EUI must be less than either:

- The site EUI specified in the latest version of ANSI/ASHRAE/IES Standard 100-2024 for buildings of equivalent type and location; OR
- The EUI as specified using Carbon Risk Real Estate Monitor's (CRREM) Decarbonization Target Tool based on the year of the performance period for buildings with equivalent type and location.

Combustion is not allowed within the project boundary for any purpose.

Provide 100% of the operational energy use associated with the project by new on- or off- site renewable energy.

Meter energy used by the project and report seasonal peak demand.

Combustion

Combustion, for any purposes, is not allowed within the Project Boundary for New Building, Building Renovation, and Existing Building projects. Interiors projects served by combustion HVAC and domestic hot water base building systems outside of the project scope and control are allowed. Interiors projects served by combustion base building system must also advocate to the base building owner requesting a phase-out plan.

Renewable Energy

All renewable energy used for a Zero Carbon Certification project must be produced either directly on-site or procured from a dedicated, new off-site installation. On-site installations are those within the Project Boundary, whereas off-site installations are those that are outside this project boundary. All renewable energy systems must be:

- Additional;
- From allowed sources;
- Attributed to the project;
- Educational;
- Identifiable; and
- Metered.

Projects must retain the environmental attributes (e.g., RECs or equivalent) of any claimed renewable energy.

Additionality

All renewable energy systems and infrastructure must demonstrate additionality—meaning the investment directly contributed to the creation of new clean energy capacity that would not have otherwise occurred.

Eligibility Criteria:

- Claimed renewable energy systems must not pre-date the project, unless both of the following conditions are met:
    1. The systems were explicitly pre-planned to serve and be attributed to the current project or additional buildings.
    2. Attribution to the project does not displace or undermine the attribution of those renewable resources by another project.

Special Consideration for Building Renovations:

- Renewable energy systems that were already serving the project prior to renovation may be counted, as long as their attribution:
    - Is not being claimed by another project, and
    - Does not displace existing claims related to shared renewable resources

Allowed Sources

Renewable energy is defined as passive solar, photovoltaics, solar thermal, wind turbines, water-powered microturbines, direct geothermal, or fuel cells powered by hydrogen generated from renewably powered electrolysis. Project teams proposing to use a renewable energy technology other than what is indicated here must submit to Living Future for pre-approval.

Attribution

Renewables for the project must be shown to be solely attributed to the project (not double-counted) through ownership or contractual agreement, for a period of at least 15 years from the date of construction completion. Alternatively, 15 years worth of energy based on the energy consumed during the performance period may be purchased over a shorter duration if it attributed solely to the project. Leased projects may match the power contract timeline to the lease timeline if they provide a written commitment from the owner to continue to purchase compliant renewable energy for the full 15 year duration if the lease is renewed. Payment for the renewable energy claimed, if not provided from the owner, must be made on behalf of the project.

Educational

The generation of renewable energy systems must be highlighted and explained at the project site. Educational strategies may include signage, informational displays, building automation system (BAS) dashboards, or virtual tours of the systems.

Identifiable

All renewable energy systems must be physically identifiable, meaning they must be a contiguous installation with a known location and attributes, rather than a generalized power purchase.

Metered

On-site renewable energy systems must be directly metered to record current energy output in real-time and throughout the year. Directly owned on-site renewables must operate during the entire performance period.

Renewable Energy Ownership

When third-party ownership of renewable energy systems is allowed, it must feed the project directly and have a contract for 15 years minimum. In these instances, acceptable forms of renewable energy ownership include:

- Direct ownership
- Indirect ownership
    - Community Solar;
    - Renewable Energy Investment Fund; or
    - Power purchase agreement (PPA or vPPA).
- Other forms pre-approved by Living Future that are consistent with the intent of the certification.

Note that the purchasing of unbundled renewable energy certificates (RECs) is not an acceptable form of procurement.

Submetering

Projects may choose to submeter loads in accordance with ASHRAE 90.1-2022 Section 8.4.3, and also submeter any additional loads that are expected to represent 20% or more of the total energy consumption of the project. This may be a straightforward compliance pathway for projects without high process loads, which may have no additional loads to monitor.

Alternatively, projects submeter all loads that are expected to represent 20% or more of the total energy consumption of the project. This may be preferable for projects where some end uses specified in ASHRAE 90.1-2022 Section 8.4.3 will be particularly low.

FUGITIVE REFRIGERANT REQUIREMENTS

Fugitive Refrigerant Scope

New buildings, Building Renovation, and Existing Buildings
For all refrigerant-containing equipment in the project: ● Monitor, repair, calculate, disclose, and offset fugitive refrigerant emissions that occur during the 12-month performance period. ● Refrigerant leak checks must be performed annually. If leaks are detected they must be repaired before additional refrigerants are added to the leaking system. A member of the team must commit to reducing embodied and operational carbon within the mechanical, electrical and plumbing (MEP) industry by establishing and signing a company plan, or by signing the MEP 2040 Commitment.
Interiors
For all refrigerant-containing equipment within the control of the project: ● Monitor, repair, calculate, disclose, and offset fugitive refrigerant emissions that occur during the 12-month performance period. ● Refrigerant leak checks must be performed annually. If leaks are detected they must be repaired before additional refrigerants are added to the leaking system. Where refrigerant-containing equipment exists but is not within the control of the project, the project team must advocate to the building owner to monitor, repair, calculate, and disclose fugitive refrigerant emissions. Such projects must determine the refrigerant leakage associated with the project by one of these paths: A. Utilize disclosed refrigerant leakage if provided by the owner; OR B. Estimate refrigerant leakage by following the protocol in ASHRAE 228-2023, Section 7.3. A member of the team must commit to reducing embodied and operational carbon within the mechanical, electrical and plumbing (MEP) industry by establishing and signing a company plan, or by signing the MEP 2040 Commitment.

Refrigerant Emissions

Fugitive MEP refrigerant emissions are a main contributor to lifecycle stage B1 emissions. All projects must monitor, repair, calculate, disclose, and offset their fugitive refrigerant emission

leakage from all refrigerant-using equipment on site, including MEP equipment. Refrigerant leak checks must be performed annually. If leaks are detected they must be repaired before additional synthetic refrigerants are added to the leaking system. To calculate their annual fugitive emissions (which are considered in lifecycle stage B1), project teams must follow one or more of the following protocols to determine their fugitive MEP refrigerant emissions:

- ANSI/ASHRAE 228-2023 methods with applicable standard leakage rates;
- ANSI/ASHRAE 228-2023 methods with actual leakage rates from the installation of a permanent refrigerant leakage meter with the ability to calculate refrigerant leakage amounts;
- ANSI/ASHRAE 228-2023 methods with actual leakage rates from calculations based on yearly refrigerant purchase receipts; and/or
- MEP 2040 Refrigerant Impact Calculator with GHG Protocol equipment life expectancy and EPA refrigerant dataset leakage rate selected.

All fugitive refrigerant emissions incurred during the 12-month performance period must be offset through a one-time carbon offset purchase as outlined in the Carbon Offsets section.

For Interiors projects that estimate their refrigerant leakage, teams may work with the owner to determine the type and amount of refrigerants used in the system. The amount of refrigerant in shared systems may be prorated based on the net leasable area of the system footprint occupied by the project. If the owner is unable or unwilling to participate, teams must propose their own methodology to estimate the refrigerant associated with the project. Industry averages appropriate to the region may be considered in this case.

Team Commitment to Reducing MEP Carbon

A member of the project team, preferably the team's MEP engineer, must commit to reducing embodied and operational carbon within the MEP industry. The team member must establish and sign a company plan to reduce operational and embodied carbon of MEP systems, request low-GWP refrigerants during projects' design phases, advocate and include natural refrigerants wherever possible, and request EPDs for MEP products. Project teams with an individual or firm level MEP 2040 Commitment signatory meet this requirement.

EMBODIED CARBON REQUIREMENTS

Embodied Carbon Scope

New buildings
Demonstrate a 20% reduction in the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of primary materials, interior materials, and exterior materials included in the Project Boundary compared to a baseline building of equivalent size, function, and energy performance, and scope. Set a goal to achieve an embodied carbon threshold below 350 $kgCO_2e/m^2$ for upfront embodied carbon in lifecycle stages A1-A5. Projects unable to meet this threshold must clearly identify the technical limitations that prevent them from doing so. Projects must advocate to the five unique manufacturers or relevant industry trade groups representing the products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs.
Building Renovation
Demonstrate a 20% reduction in the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of primary materials, interior materials, and exterior materials included in the Project Boundary compared to a baseline building of equivalent size, function, and energy performance, and scope. Building Renovation projects may count the reuse of in-situ primary, interior, and exterior materials as up to half of the required embodied carbon reduction. Calculate and disclose the embodied carbon in the existing building. Set a goal to achieve an embodied carbon threshold below 350 $kgCO_2e/m^2$ for upfront embodied carbon in lifecycle stages A1-A5. Projects unable to meet this threshold must clearly identify the technical limitations that prevent them from doing so. Projects must advocate to the five unique manufacturers or relevant industry trade groups representing the products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs.
Interiors

Demonstrate a 20% reduction in the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of primary materials, interior materials, and exterior materials included in the Project Boundary compared to a baseline building of equivalent size, function, and energy performance, and scope.

Interior projects may count the reuse of in-situ interior materials within the Project Boundary as up to half of the required embodied carbon reduction.

Set a goal to achieve an embodied carbon threshold below 350 $kgCO_2e/m^2$ for upfront embodied carbon in lifecycle stages A1-A5. Projects unable to meet this threshold must clearly identify the technical limitations that prevent them from doing so. Calculate and disclose a tenant-proportionate share of the embodied carbon in the base building.

Projects must advocate to the five unique manufacturers or relevant industry trade groups representing the products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs.

Existing Buildings

Existing Building projects with construction scope must demonstrate a 20% reduction in the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 and/or B3-B5 of primary materials, interior materials, and exterior materials within the construction scope compared to a baseline building of equivalent size, function, and energy performance.

Existing building typologies are assumed not to have significant product- and construction-stage emissions. They have no overall carbon threshold requirements.

Existing Building projects must calculate and disclose 100% of the embodied carbon emissions associated with life cycle stages B1 and B3-B5 of all primary materials, exterior materials, interior materials, and mechanical, electrical, and plumbing (MEP) products. The calculation period must align with the certification performance period. Additionally, calculate and disclose the embodied carbon in the existing building.

Projects must advocate to the five unique manufacturers or relevant industry trade groups representing the products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs.

Calculation Guidance for A-Stage Carbon

Basic LCA Study Requirements

Required Materials

The foundation, structure, and enclosure of a building comprise its primary materials; an example scope is shown below in Table ZC-2. Interior construction and interior finish materials and exterior site materials such as roads, paths, paving, and special surfaces must also be considered. Exterior materials that must be considered include site materials such as roads, paths, paving, and special surfaces. Project teams must identify an equivalent list of materials that is applicable to their project.

Table ZC-2 Primary, Interior, and Exterior Materials Scope

Primary Materials	Substructure	• Foundations • Subgrade Enclosures • Slabs-On-Grade

	Shell	• Superstructure of Floors, Roof, and Stairs
		• Exterior Vertical and Horizontal Enclosures
		  • Cladding
		  • Insulation
		  • Fenestration
		  • Roof Assemblies

Interior Materials	Interior Construction	• Interior Partitions
		  • Framing
		  • Insulation
		  • Fenestration

	Interior Finishes	• Wall • Flooring • Ceiling
Exterior Materials	Site Materials	• Roads, Paths and Paving • Special Surfacing and Paving

Lifecycle Stages

Product and Construction Phase embodied carbon baselines for primary, interior, and exterior materials must include the carbon emissions associated with a material's raw material extraction/harvest, manufacturing, transportation, and installation. These are life cycle stages A1–A5, as defined by standard EN 15978 and as shown in Figure ZC-1. Emissions associated

with site activities (construction machinery, site offices, etc.) are identified as A5.2 emissions, while emissions due to materials wasted on site, inclusive of packaging, are identified as A5.3 emissions. Project teams must use an approved LCA tool to calculate the aggregated carbon-emissions impacts of the project materials within each stage.

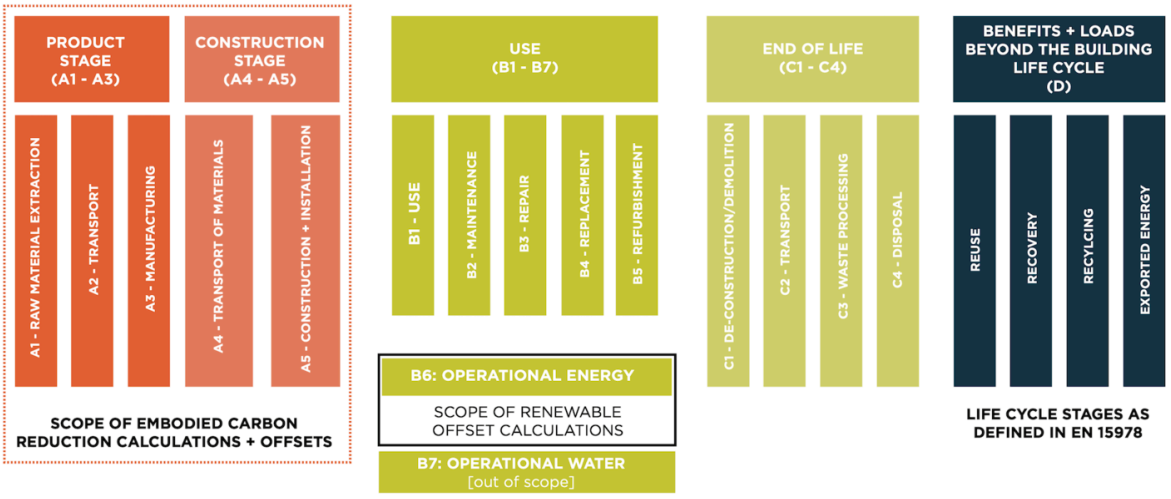


Figure ZC-1 Life Cycle Assessment Scope Diagram. Note: LCA Stage B6 is Operational Energy and is offset through the Operational Carbon requirements. Life Cycle Stages A1-A5 are offset through the Embodied Carbon requirements. Stages B1, and B3-B5 are included only for Existing Building typologies.

Calculations do not need to include materials that would create an undue burden to calculate, such as small and miscellaneous materials for which embodied carbon data are not readily available. This includes materials such as adhesives, fasteners, wet-applied coatings, and small hardware. Project teams should use their best judgment and include materials that are representative of the carbon impact of the assembly.

Tools used for whole building carbon analyses and life cycle assessment calculations must have the capability to complete a full upfront carbon (life cycle stages A1–A5) analysis, and calculations must be completed in accordance with ISO 14044.

If a project team uses a tool that only encompasses A1–A3, another tool must be used to calculate the emissions associated with life cycle stages A4–A5. Project teams are responsible for using the tools appropriately and accurately, reflecting the required level of analysis based on the project type.

Projects must use a standard 60-year reference study period when calculating embodied carbon for reporting consistency and industry alignment, and to ensure buildings with longer

life spans are not penalized for the carbon impacts of replacing materials over time.

Total carbon calculations must reflect the built condition of the project, including any substitutions during construction or otherwise that may have resulted in deviations from design calculations. For the construction phase (A5), teams must include embodied carbon impacts from pre-construction demolition (A5.1), site activities (A5.2) and material waste (A5.3), including demolished or deconstructed materials within the Project Boundary.

Demolition and Deconstruction of Existing Structures or Materials

Full or partial demolition or deconstruction of an existing structure, including the removal of elements and emissions from disposal of materials, must be treated as pre-construction works accounted for in A5.1 and reported separately. To calculate the carbon impacts associated with pre-construction demolition, actual figures should be used where possible, and must include transport to waste facilities, as well as waste processing and disposal impacts. If actual figures are not available, default figures from a national or regional standard must be sought and where available, cited, and applied to the project floor area of the existing areas being demolished that fall within the project boundary. If there are no national or regional default figures applicable to the project site, the standard assumption of 35 kgCO2e/m2 must be used for the embodied carbon of demolition activities.

Reuse of Existing Structures

For all typologies, project teams that reuse or repurpose existing structures are not required to claim the original emissions associated with any in-situ materials in the project's embodied carbon calculations or to purchase carbon offsets for these materials. However, project teams must claim and offset all embodied carbon associated with the refurbishment, transport, and installation (life cycle stages A3–A5) of the salvaged or reused materials. Any new materials added to the reused buildings must be claimed and offset.

Environmental Product Declarations (EPDs) and Data Accuracy

Project teams must ensure that all information used in embodied carbon assessments is as accurate as possible, prioritizing valid, product-specific and geographically relevant data. To guide the sourcing of embodied carbon data, the following hierarchy must be followed:

1. **Product-Specific Type III EPDs:** Data should first be sourced from Type III Environmental Product Declarations (EPDs) that are product-specific. EPDs must be developed according to ISO Standards (ISO 14025 and ISO 21930:2017) or EN Standard 15804 (plus Amendment 2), provided by qualified program operators on behalf of product manufacturers or industry organizations. For electrical equipment, EPDs compliant with EN Standard 50693 may be used. All EPDs must be valid, current, and meet the necessary protocols for scope, preparation, and verification.
2. **Industry-Average EPDs:** When no product-specific EPDs meeting the above criteria are available, teams may use industry-average EPDs from the relevant product category,

ensuring that the industry data listed is reflective of the region of the product's origin. Also see Embodied Carbon Data for MEP Products below.

3. **Life Cycle Reports:** If no EPDs are available, teams may use life cycle reports that have been externally reviewed for compliance with ISO 14040. These reports should provide a comprehensive life cycle assessment (LCA) that is applicable to the product or material in question. Teams must include additional data source uncertainty values, as identified in Quantification of Uncertainty in Building-Level LCA when using life cycle reports.
4. **Material-Based Estimates:** In cases where none of the above options are feasible, teams may develop estimates based on raw material take-offs from the product's region. These estimates must consider all relevant A1-A5 life cycle impacts and should be used with caution, noting the higher degree of uncertainty. Teams must include additional data source uncertainty values, as identified in Quantification of Uncertainty in Building-Level LCA when using material-based estimates.

Projects must advocate to the five unique manufacturers or relevant industry trade groups representing the products with the most embodied carbon for the project overall that do not have Type III EPDS or Industry Average EPDs. Advocacy must urge them to develop Type III EPDs and Industry-Average EPDs to increase the availability of accurate data for their product type. Teams may develop their own advocacy letter, or use these example templates.

EPD Databases

Living Future has identified the following non-exhaustive list EPD databases that project teams may use to search for materials with ISO-approved EPDs:

- EC3
- mindful Materials
- International EPD System
- Sustainable Minds
- UL SPOT
- The EPD Registry
- Eco Platform
- Institut Bauen und Umwelt e.V.

Embodied Carbon for MEP Products

Where EPDs for specific products are available, they must meet the requirements indicated in Environmental Product Declarations and Data Accuracy. For MEP products not covered by a specific EPD, use the Chartered Institution of Building Services Engineers (CIBSE) TM65 calculation methodology with product-specific mid-level calculation for included phases following local addenda, with the appropriate uncertainty factor applied per the guidance in Quantification of Uncertainty in Building-Level LCA.

To assess MEP products during early design phases if no generic EPDs are available, generic data points with the highest confidence level possible must be created using the CIBSE TM65 generic embodied carbon methodology. The CIBSE MEP product-level database may provide these values for some MEP products.

Whole-Project Baseline Guidance

Where projects are required to show an embodied carbon reduction from a whole-project baseline, the team must define the baseline themselves. No tools automatically generate the required baseline. Generally, the baseline building must:

1. Have the same project scope and function; a building of equivalent area, use type(s), and energy performance;
2. Be identical to the proposed design with the exception of any claimed reduction measures; and
3. Whenever the baseline is not identical to the design building, utilize materials and design parameters based on common industry practice for the building type, scale, and region, and which comply with all of the same applicable land use and building codes as the proposed design.

A whole building life cycle assessment must be completed for the baseline building in order to determine the total embodied carbon emissions for phases A1 - A5.

Project teams may use material type and quantity assumptions from either recently built project examples or a modeled baseline building with comparable properties to support these assumptions. Project teams modeling existing structures under the Building Renovation Typology may model the existing building elements that will remain using reasonable assumptions for structural design, material type, and takeoffs.
The project team must explain their process and logic for calculating the embodied carbon baseline values of the existing structure in the Embodied Carbon Reduction narrative or LCA calculations.

Eligible A-Stage Reduction Measures

Reductions can be achieved through material quantity reduction, material alternative, and product alternative.. Projects must demonstrate reductions to primary, interior, and exterior materials through identified intentional actions and quantify reductions using a baseline specific to a typical design of that project’s typology.

All embodied carbon reductions **must be associated with intentional actions** taken by the project team during the design and construction phases of the project. Project teams must

provide comparative embodied carbon evaluations or carbon-based specifications for material or product alternatives to document this intention.

For Building Renovation and Interior projects, elements retained from the original building are assumed to have no embodied carbon from their previous manufacture to include in the current project scope's A1-A5 assessment.

Eligible embodied carbon reduction strategies can be classified into one of three categories: material quantity reduction, material alternative, and product alternative. Example strategies to reduce embodied carbon within these categories may include, but are not limited to, those listed in Table ZC-3 below:

Reduction Type	Example Strategies
Material Quantity Reduction	• Building or material reuse • Advanced structural design for material efficiency • Prefabricated construction
Material Alternative	• Structural type alternative • Wall assembly alternative • Carbon-sequestering alternative
Product Alternative	• Salvaged product • Locally-sourced product • Product manufactured using renewable energy • Sustainably-harvested product

Table ZC-3 Embodied Carbon Reduction Categories and Example Strategies

Material Quantity Reduction

Building or Material Reuse, Reductions

The reuse of buildings is the most effective means to reduce the overall embodied carbon of a project. Project teams that reuse or repurpose existing structures are not required to claim the original emissions associated with any in-situ materials in the project's embodied carbon calculations or to purchase carbon offsets for these materials. For all Typologies, the impacts of any new materials used on the project must be calculated and offset.

For all Typologies, the use of salvaged primary, interior, and exterior materials brought into the project that were not originally there, or materials that were repurposed for a different use (ie: timber turned into flooring) in the project scope may contribute to meeting up to half of the embodied carbon reduction requirement. This contribution can be quantified by removing the embodied carbon impacts of the materials that would have otherwise been sourced. However, projects must still claim and offset all embodied carbon associated with the refurbishment,

transport, and installation (i.e., life cycle stages A3–A5, see Figure ZC-1) of the salvaged or reused materials.

Any reductions to the embodied carbon of materials are reflected in the Carbon Offset Calculation.

Product Alternatives

When project teams claim an embodied carbon reduction in materials via a product alternative or are showing selection of materials with a lesser impact, project teams must establish a product baseline.

Product baselines may be determined by one of the following:

1. By using Living Future-approved tools that establish product category baselines and reference the CLF North American Material Baselines Report (2023 or later). Currently this only includes the Embodied Carbon in Construction Calculator (EC3).
    a. If using EC3, the EC3 Average embodied carbon value for a product must be used as the baseline. Products in EC3 may, at the team's discretion, be filtered to match required performance characteristics prior to determining the average embodied carbon.
2. A review of comparable products in the same material category that reflect common industry practice for the building type and region. The project team must include methodology, data sources, and assumptions.

Biogenic Carbon

Any product claim of carbon sequestration must meet the requirements as specified in the EPDs and Data Accuracy section and be based on Product Category Rules (PCRs) in accordance with ISO 14025 and ISO 21930, including any eligibility and stage-specific requirements for carbon removal.

To calculate emissions impacts, removals of biogenic CO2 have a GWP of –1 kgCO2e per kg of CO2 removed; emissions of biogenic CO2 have a GWP of +1 kgCO2e per kg of CO2 emitted. This aligns with the approach used in EN 15804, EN 16485, ISO 14067, PAS 2050 and the Greenhouse Gas (GHG) Protocol. When reporting upfront (A1–A5) emissions, the product's net carbon-sequestering benefits must be used (accounting for biogenic carbon release stages A5–C4 in accordance with ISO 21930). Biogenic carbon calculations must be reported separately before being applied toward meeting embodied carbon reduction, threshold, and offset requirements.

For wood products, biogenic carbon may only use the negative characterization factor when the wood originates from sustainably managed forests, as defined by ISO 21930:2017, Section

7.2.11, Note 1, which includes "…wood products responsibly sourced and certified to the Canadian Standards Association (CSA), Forest Stewardship Council (FSC) and Sustainable Forestry Initiative (SFI) Standards, as well as all other standards globally endorsed by the Programme for the Endorsement of Forest Certification International (PEFC International) and the FSC." Products carrying a mixed sustainable forestry certification must only account for biogenic carbon in the certified portion of the product by multiplying the product's embodied carbon result by the product's certified percentage.

For additional guidance, see RICS Professional Standard: Whole Life Carbon Assessment for the Built Environment, 2nd edition in the Resources section. Section 4.11.1 and Appendix N of this RICS Professional Standard provide specific guidance for biogenic carbon calculations.

Quantification of Uncertainty in Building-Level LCA

Uncertainty in building-level Life Cycle Assessment (LCA) arises from various factors, including variability in data sources, geographic differences, temporal misalignment, and assumptions related to material performance.

Embodied carbon data sources must be selected to match the highest appropriate level of resolution using the data hierarchy outlined above and uncertainty must be disclosed and calculated. An uncertainty factor must be reported for the project's top five embodied carbon contributors based on each source's data representativeness.

Teams may elect to use the uncertainty calculations provided in the LCA tools. Alternatively, teams may follow the uncertainty methodology recommended in the "Sector Supplement for Measuring and Accounting for Embodied Emissions in the Built Environment," endorsed by the World Resources Institute Greenhouse Gas (WRI GHG) Protocol, the Royal Institution of Chartered Surveyors (RICS) Whole Life Carbon Assessment (WLCA) for the Built Environment Section 4.10.2 method, or the ASHRAE Standard 240 protocol included below (see Resources).

If the project team is using the tables below, each of the project's top five embodied carbon contributors must be reviewed for the level of confidence that the data used in their life cycle assessment is representative of the actual product used. The applicable points for each data quality factor must be summed per product using Table ZC-X, with the maximum uncertainty score being 40 for the most certain data. The team must report the corresponding uncertainty percentage from Table ZC-Y.

Table ZC-X ASHRAE 240P Data Representativeness Evaluation Table

Quality	Geographic Representativeness	Technological Representativeness	Product Representativeness	Temporal Representativeness	Data Granularity	Verifiability
Very Good	**10** - Region is representative (e.g. NYC and Northeast US)	**6** - Reflects the identical technology and characteristics (e.g. BF/BOF steel with 40% recycled content)	**6** - Data for actual product used	**8** - Year of data collection less than 3 years from year of construction	**5** - Site-specific data (factory-specific)	**5** - Third-party verified to EN 15804
Good	**7** - Region is geographically similar (e.g. NYC and Quebec)	**4** - Partially reflects technology and technical characteristics (e.g. BOF steel with incorrect recycled content)	**5** - Representative or average product adapted by relevant characteristic (e.g. data per m2 adapted by scaling factor	**6** - <5 years from year of construction	**4** - Manufacturer-specific (actual manufacturer used and averaged across factories or different factory site)	**4** - Independently verified to ISO 14025
Fair	**4** - Much larger region or global dataset (e.g. NYC and NAM)	**3** - Does not reflect specifics of the technology (e.g. steel generally)	**4** - Average data for product group of actual product used	**4** - <10 years from year of construction	**3** - Regional Sector Data	**3** - Peer reviewed to ISO 14044
Poor	**2** - Totally different context (e.g. China for EU)	**1** - Totally different technology (EAF steel for BOF steel)	**2** - Proxy data or data extrapolated from a group of datasets	**2** - Less than 15 years from year of construction	**2** - Global sector data	**0** - Not peer reviewed or not verified
Not Accepted				>15 years from construction		

Table ZC-Y ASHRAE 240P Data Uncertainty Factor

Uncertainty Score	<10	10 - <15	15 - <20	20 - <25	25 - <30	30 - <35	35 - <40	40
Uncertainty Factor	7%	6%	5%	4%	3%	2%	1%	0%

A-Stage Embodied Carbon Threshold

The embodied carbon threshold goal of 350 $kgCO_2e/m^2$ for upfront embodied carbon (life cycle stages A1–A5) originates from averages between the 2030 reduction targets in the following studies: Low Energy Transformation Initiative's (LETI's) Defining and Aligning: Whole Life Carbon & Embodied Carbon and Science Based Targets initiative's (SBTi's) A 1.5°C Pathway for the Global Buildings Sector's Embodied Emissions.

Note that the scope of the embodied carbon threshold aligns with the LETI and SBTi thresholds except for the exclusion of fixtures furniture and equipment (FF&E) to align with common industry procurement practices and other Living Future program reporting requirements.

~~Exterior materials and those associated with parking structures included in the project scope may be excluded from the carbon threshold, but must meet the overall reduction requirement and be included in the total CO2e calculation and offset.~~

This Living Future-approved embodied carbon threshold averages across a wide range of building types and LCA inputs, yielding a corresponding range of embodied carbon intensities.

As a result the embodied carbon threshold may be not appropriate for some building types. Projects may exceed the embodied carbon threshold of 350 $kgCO_2e/m^2$ only when the team can demonstrate that all reasonable options to reduce embodied carbon were considered and deemed infeasible for the project. The evaluation should include material reductions, substitutions, and alternate building design solutions. This evaluation is expected to go beyond business as usual for the team and LCA scope. Materials substitution costs, added soft costs, and added time for evaluation should be planned for when using this documentation pathway. The team must submit a narrative outlining the results of each evaluation, with calculations, drawings, or other visual representations and highlighting how the evaluation informed the final project design to reduce embodied carbon as much as possible. Projects exceeding the 350 $kgCO_2e/m^2$ threshold must demonstrate a 25% reduction in embodied carbon of primary, interior, and exterior materials, exceeding the default 20% reduction requirement.

Structured Parking

Where structured parking is part of the project and the project exceeds the 350 $kgCO_2e/m^2$ carbon cap with parking included in the calculation, teams must report the A-Stage embodied carbon of the project both with and without the structured parking included. Where the parking is also a structural component of the occupied building, teams must include a reasonable structural substitute for the garage in the calculations that exclude the garage.

For example, if structured parking is included below the building and serves as the foundation for the building, the project must include a reasonable foundation in the calculations that exclude the parking-related materials.

Separated calculations will allow teams to accurately report the total embodied carbon of the project in alignment with the LETI and SBTi thresholds and report the total embodied carbon of the full project scope for the purposes of Zero Carbon reporting and carbon offset purchases.

Pre-existing Building and Structure Calculations

Renovation, Interiors, and Existing Building typologies are required to calculate and disclose the embodied carbon in the existing building. This carbon is not required to be offset, but must be disclosed.

Teams may complete a detailed Life Cycle Assessment for this purpose. Alternatively, the use of alternative tools to estimate the embodied carbon in the existing building is allowed. These tools include, but are not limited to:

- Athena Impact Estimator
- C.Scale Decarbonization Tool

Where regional tools exist that are not on this list, project teams may contact Living Future for approval.

Use Stage (B-Stage) Emissions Information

This section includes clarifications on the use, maintenance, repair, replacement, and refurbishment of building products through the building's life cycle stages B2-B5. Requirements in this section only apply to Existing Buildings.

Calculation Parameters and Scope

Use Stage Emissions calculations are required only for Existing Building typologies. Because documenting these emissions varies from owner to owner and region to region, Living Future requires each project to submit a plan for calculating and documenting Use Stage emissions. These plans may:

1. document actual material quantities and impacts; AND/OR
2. estimate impacts based on costs; AND/OR
3. propose an alternative methodology.

Project teams may propose an alternative methodology for use stage emission tracking when tracking by actual quantity or cost is not feasible. Alternative methodologies must be pre-approved by Living Future.

Maintenance, Repair, Replacement, and Refurbishment During the Performance Period

The embodied carbon impacts of each module of the use stage must be reported separately for all maintenance, repair, replacement and refurbishment of the project's materials, products, and systems that occur during the 12-month performance period.

Existing Building projects must offset the calculated embodied carbon impacts of modules B3-B5, that occur during the 12-month performance period by a one-time carbon offset purchase as outlined in the Carbon Offsets section. Calculations do not need to include materials that would create an undue burden to calculate, such as small and miscellaneous materials.

The following impacts must be included for modules B2, B3, B4, and B5. For details and additional guidance, see RICS Professional Standard: Whole Life Carbon Assessment for the Built Environment, 2nd edition in the Resources section.

Maintenance (B2)
Teams must create a detailed maintenance plan that identifies and reduces the carbon impacts from maintenance processes and products required to sustain the functions of the building and building systems, including for cleaning, maintenance waste, and maintenance activity energy use. Reasonable maintenance scenarios should be developed based on facility management

and maintenance strategy reports, building engineer or facility manager input, facade access and maintenance strategies, life cycle cost reports, operations and maintenance manuals, and professional guidance. The plan must be signed by representatives from the owner and facility maintenance teams. Maintenance Plans must be implemented during the performance period and may be revised based on any lessons learned.

Repair, Replacement, and Refurbishment (B3-B5) Calculations
Teams must calculate and offset the emissions associated with the upfront carbon of the new material installed during the performance period, and the transportation and disposal of the discarded material. Upfront carbon must be calculated as described in Embodied Carbon Clarifications. Energy consumed in the use stage is reported according to the energy efficiency requirements only. Transportation emissions must be calculated by multiplying the emission factor by the tracked amount of fuel used to transport the wasted material to the disposal location or by estimating fuel use per the following calculation:

Transportation Emissions: Distance x Vehicle Fuel Efficiency x Emission Factor

Transportation emission factors may be used from either the latest EPA GHG Emission Factors Hub: Emission Factors for Greenhouse Gas Inventories or US Energy Information Administration (EIA) Carbon Dioxide Emissions Coefficients database.

Disposal emissions must be calculated by multiplying the emission factor by the actual waste disposed and adding the end-of-life processing emissions. Teams must use emission factors from EPA GHG Emission Factors Hub: Emission Factors for Greenhouse Gas Inventories for end-of-life treatment of sold products, or the latest version of the EPA Waste Reduction Model (WARM Tool) with local or regional waste diversion data. Weighted averages of basic components may be used for complex products that do not appear in these tools.

To account for the emissions associated with the disassembly of the product, the end-of-life processing emissions must be added to the disposal calculation. Teams may use EPDs and product LCAs to assume the same energy consumed during the assembly of the product will be used during disassembly. EPDs and product LCAs of similar products may be used if data is limited. Teams may not use end-of-life estimates from EPDs or product LCAs for waste diversion calculations. Avoided emissions from recycling may not be considered negative emissions. See CIBSE's TM65NA Embodied Carbon in Building Services: A Calculation Methodology for North America in the Resources section for more details.

Disposal Emissions: (Mass of Disposed Waste x Emission Factor of Waste) + Disassembly Emissions

Repair (B3)

The Repair (B3) lifecycle stage includes the carbon impacts associated with the replacement of components or the mending of worn, damaged or degraded parts during the performance period. This includes the disposal of failed parts. Repair (B3) is intended to provide a reasonable allowance for all processes and materials required to sustain the functions of the building that are not included in regular Maintenance (B2). During the performance year teams must monitor and record the impacts of all repaired materials.

Replacement (B4)
Replacement (B4) lifecycle stage includes any carbon impacts associated with the replacement of building elements, including all like-for-like, whole-number replacements of products, and systems during the performance period. Calculations must include attic stock and spare part stockpiles purchased for future use. During the performance year teams must monitor and record the impacts of all replaced materials and all impacts associated with material stockpiles.

Retrofit + Refurbishment (B5)
Retrofit + Refurbishment (B5), as distinct from Replacement (B4), are defined here as emissions associated with alterations or improvements to the building for it to meet a planned change in function or performance. This typically involves a predetermined change occurring during the service life of the building and is likely to be a sizeable amount of work scope, including an extension or alteration. Retrofit + Refurbishment (B5) activities include, but are not limited to: major changes to the layout of the interior space of the building to meet an anticipated use change or tenant change, the anticipated fit-out of an existing space, or the changing of HVAC systems.
Determining whether the replacement of material is to be included under B4 or B5 will depend on whether there is no change or improvement to the function or performance of the asset over the reference study period (B4), or it is part of a planned improvement of the asset required by the owner at the outset (B5). A Retrofit + Refurbishment (B5) assessment must include the same scope as the upfront embodied carbon, see Table ZC-4 Applicable Building Materials, with adjustments to other modules to reflect the overall change to the project.The consideration of biogenic carbon in B5 must be treated in the same way as for a new project and any net addition or removal of sequestered biogenic carbon from the asset during B5 must be reported separately.

Carbon Offsets

New Buildings

Offset: ● 100% of the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of added primary materials, exterior materials, interior materials, and mechanical, electrical and plumbing (MEP) products. ● Refrigerant leakage during the performance period.
Building Renovation
Offset: ● 100% of the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of added primary materials, exterior materials, interior materials, and mechanical, electrical and plumbing (MEP) products. ● Refrigerant leakage during the performance period.
Interiors
Offset: ● 100% of the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of added primary materials, exterior materials, interior materials, and mechanical, electrical and plumbing (MEP) products. ● Refrigerant leakage during the performance period.
Existing Buildings
Offset: ● 100% of the embodied carbon emissions associated with life cycle stages B1 and B3-B5 of all primary materials, exterior materials, interior materials, and mechanical, electrical, and plumbing (MEP) products. ● Refrigerant leakage during the performance period.

Offset Quality & Requirements

Carbon Offsets Approval Criteria

Carbon offsets may be sourced from any location in the world and consideration of local or community-based solutions is encouraged, but not required. Consideration of carbon offsets with additional ecological, cultural, human health, or equity benefits is also encouraged, but not required.

Carbon offsets must be certified carbon credits that ensure additionality, leakage prevention, permanence, audited verification, and retirement.

The following offset project types are permitted by Living Future:

1. Renewable energy projects including passive solar, photovoltaics, solar thermal, wind turbines, water-powered microturbines, direct geothermal, or fuel cells powered by hydrogen generated from renewably powered electrolysis. *Note that offsets must be from projects that meet the Living Future definition of Renewable Energy, which may be more narrow than definitions used by Green-e Climate or comparable programs*;
2. Landfill gas-to-energy projects where the methane would otherwise be released to the atmosphere.
3. Reforestation projects.

Carbon offsets must be issued in accordance with one of the following carbon offset approval options. All criteria listed for the option must be met.

Option 1: Approved High-Integrity Carbon Credits

Project teams may purchase high-integrity carbon credits from pre-approved third-party carbon credit validation programs to satisfy the carbon offset requirement. Credits issued and validated through the following programs may be used:

- Green-e Climate Certified carbon credits
- REDD+ projects certified through Vera's Verified Carbon Standard (VCS) under the VM0015 v1.1 "Methodology for Avoided Unplanned Deforestation" and "CCB 3rd Edition for Climate, Community, and Biodiversity

Option 2: Green-e Climate-eligible

Alternatively, projects may purchase credits that are Green-e Climate-eligible and third-party verified. Green-e Climate-eligible credits meet both of the following criteria:

- A certified credit issued by a Green-e Climate Endorsed Program (programs current as of 2024):
  - Gold Standard VER,
  - Verra/Verified Carbon Standard VCU
  - Climate Action Reserve CRT, or
  - American Carbon Registry ERT; and
- Complies with the Green-e Climate eligibility requirements provided on the Green-e Climate Endorsed Programs page. Scroll down to the descriptions of eligible project types for each program (note that the list of Project Type categories at the top of the page is not the

program-specific eligibility information).
    - Where the version of an endorsed program standard is cited in the listing, subsequent versions are also included

Green-e Climate Eligible. The following offset project types are approved as meeting the Green-e Climate eligibility requirements for purposes of Option 2 under the Living Future Carbon Offset Approval Criteria:

- Projects certified under methodologies that are CCP-approved by the Integrity Council for Voluntary Market (under Carbon Credit Category Assessment).
- Projects certified under the Verra ABACUS label.

Large-scale carbon sequestration assets and activities associated with the project owner must be audited through an approved third-party certifier in order to be claimed as a qualifying carbon offset. Project teams looking to pursue this pathway should contact Living Future for preapproval.

Prohibited Carbon Offsets

The carbon reducing function of on-site elements, such as native landscapes, may not be applied to the project as a carbon offset or otherwise accounted for in calculating the embodied carbon footprint of the project.

ENERGY RESILIENCY STRATEGY REQUIREMENTS

Resilience Scope

New Buildings, Building Renovation, Interiors, and Existing Buildings
All projects must complete a climate risk evaluation. The project team must consider site specific climate hazards, future climate projections, and community equity factors to inform a resilience strategy that reflects the project team's evaluation. All building projects must develop and implement a short-term resilience strategy to ensure occupant safety through evacuation or shelter-in-place events with continued performance of building emergency systems during grid disruptions, extreme weather events, or other emergencies. The strategy must include a plan for communicating implementation to occupants in the event of power disruptions or emergency conditions.

Energy Resilience Requirements

Climate Risk Evaluation

The intent of the climate risk evaluation is to ensure buildings and organizations are set up for long-term carbon reduction and energy performance under changing climate conditions, while

ensuring occupant safety and resilient operations during power disruptions and climate events. Project teams must evaluate climate risks specific to the site to determine how building design and operations can effectively respond to potential disruptions or threats to occupant safety. The evaluation must consider:

- Site- and building-specific climate hazards such as extreme heat, high winds, snow/ice, and wildfires
- Future climate projections, with a focus on extreme events rather than moderate changes
- Energy infrastructure and system resilience, including risks beyond the project's direct control
- Community equity factors that affect access to resilience hubs and energy resources during extreme events

Teams must submit a narrative summarizing the climate risk evaluation. This narrative should include:

- An overview of the evaluation process
- Key findings
- Examples of how the evaluation influenced design or operational strategies
- How the findings informed the project's overall resilience plan

Building Energy Resilience Strategy

The project team must develop and implement a short-term resilience strategy to ensure occupant safety and project resilience. The strategy must explain the evacuation strategy for building occupants or document access to a resilience hub accessible to all project occupants.

Projects with an evacuation strategy must document how evacuation is communicated to occupants and how safe evacuation is facilitated. Organization scale strategies are acceptable when the project team demonstrates that all requirements are met for the specific project pursuing certification. This strategy must:

- Ensure all occupants can be safely evacuated, even if public transportation is unavailable or conditions are not safe for walking or biking
- Include a decision-making process for when evacuation is necessary
- Outline communication protocols for informing occupants of evacuation procedures
- Provide documentation demonstrating a viable evacuation method for every occupant
- Include temporary power sources for charging communication devices to support the evacuation process

Projects with a resilience hub to meet the strategy requirements must must demonstrate the hub meeting the following criteria:

- Sized to accommodate all building occupants

- Habitable for a minimum of 24 hours
- Accessible to all occupants when activated per the resilience strategy
- Within the project boundary or directly accessible and walkable from the project and on the same owner's property

To be considered habitable for 24hours, the resilience hub must provide:

- Power for adequate lighting
- Heating and/or cooling to maintain safe indoor temperatures
- Backup power for charging cell phones and communication devices
- A refrigerator for storing medications, infant formula, and other perishable emergency supplies
- Equipped with a first-aid kit or emergency medical supplies

Projects with an emergency power system meet this requirement if the system is appropriately sized to support the building's energy resilience plan and all the conditions listed above can be met and demonstrated.

Community Energy Resilience Requirements

In place of a building-scale energy resilience hub, project teams may support off-site energy resilience strategies that positively impact the broader community. These community-scale interventions must meet the following criteria:

- Demonstrate additionality: The team must document that the intervention would not have occurred at the same scale without their direct support.
- Equivalent support: The team must show that the level of support provided is equal to or greater than what would be required to power a building-scale resilience hub for 24 hours.
- Accessibility and occupant benefit: The supported location must be accessible to all project occupants, and the team must demonstrate that equivalent safety and support measures are available to occupants, even if the intervention is located off-site.
- Community access: The intervention must be available to all members of the community during a time of crisis.

Community-scale energy resilience interventions may be excluded from operational and embodied carbon calculations if they are:

- Located outside the project boundary,
- Outside the control of the project owner, and
- Not relied upon for the day-to-day operations of the project seeking certification.

Exceptions

EC-014 Emergency Power Systems

If programmatic needs, basic project function, or code requirements mandate the inclusion of an emergency power system, the use of battery backup power is encouraged.

However, if backup needs exceed the capacity of the battery and sufficient battery power is not immediately feasible, combustion-based backup is allowed if the project team can demonstrate that they have minimized the amount of backup power required and that the alternative systems available will have a significant negative impact due to danger, inability to provide sufficient power, or significant environmental impacts. The project's need for combustion-based backup must be explained in the documentation narrative.

Additionally, combustion-based or industrial emergency backup may only be used if the generator:

- Is not included in the project's strategy for operation and any use during the 12-month performance period is included in the project's energy consumption calculations; and
- Does not impact adjacent properties through noxious emissions or noise.

If storage tanks for emergency power pose a negative impact due to significant danger related to density or other factors (e.g., projects located in Transects L5 or L6), the project team may include a hard-piped natural gas service to the emergency power system, if the gas service:

- Is not connected to the project's primary energy systems;
- Is sized exclusively for the emergency power system; and
- Includes a dedicated utility meter to account for any emergency use during the 12-month performance period.

Propane-based emergency backup boilers are acceptable in harsh climates for non-grid-tied projects.

The project team will need to provide a narrative explaining the need for backup power, particularly with regard to the project's size and function, and illustrating how every effort has been made to reduce the size of the system and prevent its use.

Documentation Requirements

EXISTING BUILDING

ZC-1 Energy Narrative + Schematic Drawing

READY AUDIT

Provide a narrative explaining:

- How the baseline EUI was determined, including a summary of the building attributes that were used for the baseline calculations and how those attributes vary from the project conditions.

- A discussion of the anticipated energy needs of the building, including major energy-using systems and strategies to reduce energy consumption.

- The metering strategy during the performance period with plans (if available) highlighted to show meter locations.

- Confirmation of a lack of combustion or a description of any combustion in or connected to the project and combustion phase-out plan if applicable.

    - Combustion-based DES phase-out plan, if applicable. Plans must describe a detailed timeline of the phase-out including anticipated dates and actions for the remaining life of the equipment, how changes will be implemented, and how the plan will be funded.

    - The plan must identify progress milestones for the first 12 months

- Descriptions of all backup power systems, implementation, and anticipated usage per year.

- Renewable energy production narrative.

        - Energy production strategies and schematics for energy produced on-site, if applicable.

        - Narrative explaining strategy to acquire renewable energy for off-site production.

Electrical and mechanical plans, schematics, and/or schedules as available. Existing buildings projects may provide labeled photos of primary MEP equipment or a recorded video walk through of mechanical spaces with narration to identify equipment types.

Summary, input, and output reports establishing the project's baseline EUI from either ANSI/ASHRAE/IES Standard 100-2024 or the Carbon Risk Real Estate Monitor's (CRREM) Decarbonization Target Tool.

ZC-2 Energy Use Data

FINAL AUDIT

A brief narrative regarding the project's energy use over the performance period, including lessons learned from building operations.

Twelve months of performance data in one of the following formats is required:

- Copies of utility bills for a continuous 12-month period, beginning with the designated start date of the performance period.

- If utility data is not available, metered data from a private system such as a building management system may be accepted if it is accompanied by a letter from project engineer or consultant on their letterhead verifying that the provided data is complete and accurate.

A narrative describing how the renewable energy system(s) are additional, from allowed sources, attributed to the project, educational, identifiable, and metered.

- Include the construction start date of each renewable system and the project construction start date. If the project construction start date follows the renewable energy construction start date, provide documentation showing that the systems were pre-planned for utilization and attribution to additional buildings.

- Include schematics and photos of systems if not already provided

If the project does not have ownership of renewable systems, contracts must be provided proving an agreement of at least 15 years for renewable systems. Alternatively, a PPA or vPPA may be provided showing that, in aggregate, sufficient power has been purchased equivalent to 15 years of building operation, even if the contract duration is less than 15 years.

If the project does not have energy bills (due to no connection to a utility or to being sub-metered from a larger-scale utility meter), also include:

- A letter, signed and stamped by the energy or mechanical engineer and co-signed by the project owner, substantiating that this is the case.

For projects with a DES phase-out plan, provide results of the first 12 months of the project's combustion-based DES phase-out plan. The results must include which steps of the phase-out plan have been completed and provide reasoning for any changes in the timeline provided during Ready

Audit.

ZC-3 Energy Tracking Tables

FINAL AUDIT

Completed Energy Production and Demand Table based on 12 months of performance data.

ZC-4 Fugitive Emissions Documentation

READY AUDIT

Provide a maintenance plan for fugitive emissions that addresses the following:

- Inventory and tracking, inspection of equipment, system retrofit, and end-of-life disposal for all equipment with refrigerants present.
- Plan to calculate fugitive refrigerant emissions that occur during the performance period.
- Identification and signature of the individual or organization that will implement the routine maintenance plan at least once yearly.

Provide one of the following:

1. A commitment to reducing embodied and operational carbon within the MEP industry. A team member (preferably a member of the MEP engineering team) must establish and sign a company plan to reduce operational and embodied carbon on MEP systems, request low-GWP refrigerants during projects' design phases, and request environmental product declarations (EPDs) for MEP products. OR
2. Proof of individual or company commitment to the MEP 2040 Commitment. A project team member must show their commitment from their company's statement on the MEP 2040 Why Sign? webpage or from a confirmation email after signing the MEP 2040 Commitment.

See the Fugitive Emissions Resources for additional support.

FINAL AUDIT

Provide the results of the refrigerant monitoring that occurred during the performance period. Include reports that summarize the results, including identifying leaks and repairing any such leaks. Include calculations documenting the fugitive refrigerant emissions.

ZC-5 Embodied Carbon Documentation

READY AUDIT

For the required reduction in embodied carbon (ONLY PROJECTS THAT HAVE A CONSTRUCTION COMPONENT):

The input assumptions and results from the selected life cycle assessment tool, showing:

- The project's primary, interior, and exterior materials embodied carbon baseline.
- The project's primary, interior, and exterior materials embodied carbon after reductions.
- Embodied carbon of materials and construction (A1-A3, A4, and A5; or B3-B5) of primary, exterior, and interior materials. Input assumptions for the A4 and A5 data must include the following:
    - A4: Transportation of 90% of material to the site, by cost, and include distances, number of trips/shipments, estimated fuel use, and CO2e conversion factors
    - A5: All temporary equipment on site, hourly usage estimate, equipment name and estimated fuel use, and CO2e conversion factors
- Uncertainty analysis and an applied uncertainty factor.

Materials documentation supporting reductions in primary, interior, and exterior materials claimed in the narrative, such as:

- Basis of Design statements.
- LCA hot spot analyses.
- Material specifications.
- Procurement requests or letters.

B-Stage Emissions:

LCA report highlighting the total embodied carbon of the project associated with life cycle stages B1 and B3-B5 of all primary materials, exterior materials, interior materials, and mechanical, electrical, and plumbing (MEP) products that are installed during the performance period.

Existing Building Disclosure:

Calculation output highlighting the embodied carbon in the existing building.

Advocacy:

Include documentation confirming advocacy to at least five unique manufacturers or trade groups representing products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs. Advocacy documentation may be combined into a single PDF or submitted as multiple files. Email correspondence, call logs, meeting minutes, and/or advocacy letters are examples of acceptable documentation. The recipient must be clearly identified for each element of documentation.

ZC-6 Carbon Offsets

FINAL AUDIT
Provide calculations showing the total carbon required to be offset. This includes:

- 100% of the embodied carbon emissions associated with life cycle stages B1 and B3-B5 of all primary materials, exterior materials, interior materials, and mechanical, electrical, and plumbing (MEP) products.
- Refrigerant leakage during the performance period.

Receipt from an approved carbon offset program as proof of purchase verifying the total amount of offsets purchased. Cost information may be redacted.

Narrative or link to the carbon offset project description. The description must include the project location and type.

ZC-7 Resiliency Strategy

READY AUDIT

Provide a copy of the climate risk evaluation report.

Provide a narrative description of the resilience strategy that will be implemented at the project; OR explaining support for the local community during a disaster in lieu of a building-specific strategy. As needed, provide marked-up plans and/or official policies supporting claims.

ZC-8 Case Study

FINAL AUDIT

Using the provided Case Study Template, all projects must provide detailed case study information describing the project team's approach, highlighting any lessons learned or particularly rewarding outcomes.

At the time of certification, the case study information will be uploaded to the Institute's website. These case studies are a means to celebrate projects and to educate the public about the successful implementation of Living Future's ambitious programs and framework.

NEW BUILDING

ZC-1 Energy Narrative + Schematic Drawing

READY AUDIT

A narrative which includes a basic schematic of the energy system, and describes the energy system, including:

- Building's anticipated needs including all subsystems of the energy-using systems
- Renewable energy production narrative.
    - Energy production strategies and schematics for energy produced on-site.
    - Narrative explaining strategy to acquire renewable energy for off-site production.
- Narrative description of a baseline building of comparable climate, size, use and occupancy.
    - Project teams using project-specific baseline pathway must also explain the methodology used in the calculation.
- Narrative describing strategies to reduce energy consumption from the baseline.
- Descriptions of all backup power systems, implementation, and anticipated usage per year.
- Confirmation of a lack of combustion or a description of any combustion in or connected to the project and combustion phase-out plan if applicable.

    - Combustion-based DES 12-month phase-out plan, if applicable. Plans must describe a detailed timeline of the phase-out including anticipated dates and actions for the remaining life of the equipment, how changes will be implemented, and how the plan will be funded.

- Narrative describing metering strategy during the performance period with plans highlighted to show meter locations.

    - Identify which loads are expected to be at least 20% of total energy consumption and verify how they are separately submetered.

Input and output reports establishing the project's baseline EUI and anticipated EUI with supplemental calculations highlighting the project's baseline EUI, target EUI, and anticipated EUI.

- Projects using ASHRAE 90.1-2022 must submit whole building energy simulation data in accordance with ASHRAE 90.1-2022, Appendix G.

- Projects using a baseline building with similar size and function must submit all metering or database output data used to calculate the baseline EUI.

ZC-2 Energy Use Data

FINAL AUDIT

A brief narrative regarding the project's energy use over the performance period, including lessons learned from building operations.

Twelve months of performance data in one of the following formats is required:

- Copies of utility bills for a continuous 12-month period, beginning with the designated start date of the performance period.

- If utility data is not available, metered data from a private system such as a building management system may be accepted if it is accompanied by a letter from project engineer or consultant on their letterhead verifying that the provided data is complete and accurate.

A narrative describing how the renewable energy system(s) are additional, from allowed sources, attributed to the project, educational, identifiable, and metered.

- Include the construction start date of each renewable system and the project construction start date. If the project construction start date follows the renewable energy construction start date, provide documentation showing that the systems were pre-planned for utilization and attribution to additional buildings.

- Include schematics and photos of systems if not already provided

If the project does not have ownership of renewable systems, contracts must be provided proving an agreement of at least 15 years for renewable systems. Alternatively, a PPA or vPPA may be provided showing that, in aggregate, sufficient power has been purchased equivalent to 15 years of building operation, even if the contract duration is less than 15 years.

If the project does not have energy bills (due to no connection to a utility or to being sub-metered from a larger-scale utility meter), also include:

- A letter, signed and stamped by the energy or mechanical engineer and co-signed by the project owner, substantiating that this is the case.

Additionally, if applicable, provide results of the first 12 months of the project's combustion-based DES phase-out plan. The results must include which steps of the phase-out plan have been completed and provide reasoning for any changes in the timeline provided during Ready Audit.

ZC-3 Energy Tracking Tables

FINAL AUDIT
Completed Energy Production and Demand Table based on 12 months of performance data.

ZC-4 Fugitive Emissions Documentation

READY AUDIT
Provide a maintenance plan for fugitive emissions that addresses the following:

- Inventory and tracking, inspection of equipment, system retrofit, and end-of-life disposal for all equipment with refrigerants present.

- Plan to calculate fugitive refrigerant emissions that occur during the performance period.

- Identification and signature of the individual or organization that will implement the routine maintenance plan at least once yearly.

Provide one of the following:

1. A commitment to reducing embodied and operational carbon within the MEP industry. A team member (preferably a member of the MEP engineering team) must establish and sign a company plan to reduce operational and embodied carbon on MEP systems, request low-GWP refrigerants during projects' design phases, and request environmental product declarations (EPDs) for MEP products. OR

2. Proof of individual or company commitment to the MEP 2040 Commitment. A project team member must show their commitment from their company's statement on the MEP 2040 Why Sign? webpage or from a confirmation email after signing the MEP 2040 Commitment.

See the Fugitive Emissions Resources for additional support.

FINAL AUDIT
Provide the results of the refrigerant monitoring that occurred during the performance period. Include reports that summarize the results, including identifying leaks and repairing any such leaks. Include calculations documenting the fugitive refrigerant emissions.

ZC-5 Embodied Carbon Documentation

READY AUDIT
For the required reduction in embodied carbon:

The input assumptions and results from the selected life cycle assessment tool, showing:

- The project's primary, interior, and exterior materials embodied carbon baseline.

- The project's primary, interior, and exterior materials embodied carbon after reductions.

- Embodied carbon of materials and construction (A1-A3, A4, and A5) of primary, exterior, and interior materials. Input assumptions for the A4 and A5 data must include the following:

    - A4: Transportation of 90% of material to the site, by cost, and include distances, number of trips/shipments, estimated fuel use, and CO2e conversion factors

        - A5: All temporary equipment on site, hourly usage estimate, equipment name and estimated fuel use, and CO2e conversion factors

- Uncertainty analysis and an applied uncertainty factor.

Materials documentation supporting reductions in primary, interior, and exterior materials claimed in the narrative, such as:

- Basis of Design statements.
- LCA hot spot analyses.
- Material specifications.
- Procurement requests or letters.

For the maximum embodied carbon threshold:

Report the total embodied carbon of the project to be offset, which includes primary, interior, exterior, and MEP products

If the project exceeded the threshold, provide detailed descriptions of what prevented the project from meeting the target. Explain what steps were taken to get as close to the threshold as possible.

Calculate and disclose the embodied carbon in the existing building.

Advocacy:

Include documentation confirming advocacy to at least five unique manufacturers or trade groups representing products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs. Advocacy documentation may be combined into a single PDF or submitted as multiple files. Email correspondence, call logs, meeting minutes, and/or advocacy letters are examples of acceptable documentation. The recipient must be clearly identified for each element of documentation.

ZC-6 Carbon Offsets

FINAL AUDIT
Provide calculations showing the total carbon required to be offset. This includes:

- 100% of the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of added primary materials, exterior materials, interior materials, and mechanical, electrical and plumbing (MEP) products.
- Refrigerant leakage during the performance period.

Provide documentation substantiating the purchase of compliant carbon offsets. Cost information may be redacted.

ZC-7 Resiliency Strategy

READY AUDIT

Provide a copy of the climate risk evaluation report.

Provide a narrative description of the resilience strategy that will be implemented at the project; OR explaining support for the local community during a disaster in lieu of a building-specific strategy. As needed, provide marked-up plans and/or official policies supporting claims.

ZC-8 Case Study

FINAL AUDIT
Using the provided Case Study Template, all projects must provide detailed case study information describing the project team's approach, highlighting any lessons learned or particularly rewarding outcomes.

At the time of certification, the case study information will be uploaded to the Institute's website. These case studies are a means to celebrate projects and to educate the public about the successful implementation of Living Future's ambitious programs and framework.

BUILDING RENOVATION

ZC-1 Energy Narrative + Schematic Drawing

READY AUDIT
A narrative which includes a basic schematic of the energy system, and describes the energy system, including:

- Building's anticipated needs including all subsystems of the energy-using systems
- Renewable energy production narrative.
    - Energy production strategies and schematics for energy produced on-site.

        - Narrative explaining strategy to acquire renewable energy for off-site production.

- Narrative description of a baseline building of comparable climate, size, use and occupancy.

    - Project teams using project-specific baseline pathway must also explain the methodology used in the calculation.

- Narrative describing strategies to reduce energy consumption from the baseline.

- Descriptions of all backup power systems, implementation, and anticipated usage per year.

- Confirmation of a lack of combustion or a description of any combustion in or connected to the project and combustion phase-out plan if applicable.

    - Combustion-based DES 12-month phase-out plan, if applicable. Plans must describe a detailed timeline of the phase-out including anticipated dates and actions for the remaining life of the equipment, how changes will be implemented, and how the plan will be funded.

- Narrative describing metering strategy during the performance period with plans highlighted to show meter locations.

    - Identify which loads are expected to be at least 20% of total energy consumption and verify how they are separately submetered.

Input and output reports establishing the project's baseline EUI and anticipated EUI with supplemental calculations highlighting the project's baseline EUI, target EUI, and anticipated EUI.

- Projects using ASHRAE 90.1-2022 must submit whole building energy simulation data in accordance with ASHRAE 90.1-2022, Appendix G.

- Projects referencing a baseline from Living-Future approved tools or databases must submit copies of the inputs and outputs from the tool.

ZC-2 Energy Use Data

FINAL AUDIT

A brief narrative regarding the project's energy use over the performance period, including lessons learned from building operations.

Twelve months of performance data in one of the following formats is required:

- Copies of utility bills for a continuous 12-month period, beginning with the designated start date of the performance period.

- If utility data is not available, metered data from a private system such as a building management system may be accepted if it is accompanied by a letter from project engineer or consultant on their letterhead verifying that the provided data is complete and accurate.

A narrative describing how the renewable energy system(s) are additional, from allowed sources, attributed to the project, educational, identifiable, and metered.

- Include the construction start date of each renewable system and the project construction start date. If the project construction start date follows the renewable energy construction start date, provide documentation showing that the systems were pre-planned for utilization and attribution to additional buildings.

- Include schematics and photos of systems if not already provided

If the project does not have ownership of renewable systems, contracts must be provided proving an agreement of at least 15 years for renewable systems. Alternatively, a PPA or vPPA may be provided showing that, in aggregate, sufficient power has been purchased equivalent to 15 years of building operation, even if the contract duration is less than 15 years.

If the project does not have energy bills (due to no connection to a utility or to being sub-metered from a larger-scale utility meter), also include:

- A letter, signed and stamped by the energy or mechanical engineer and co-signed by the project owner, substantiating that this is the case.

Additionally, if applicable, provide results of the first 12 months of the project's combustion-based DES phase-out plan. The results must include which steps of the phase-out plan have been completed and provide reasoning for any changes in the timeline provided during Ready Audit.

ZC-3 Energy Tracking Tables

FINAL AUDIT

Completed Energy Production and Demand Table based on 12 months of performance data.

ZC-4 Fugitive Emissions Documentation

READY AUDIT

Provide a maintenance plan for fugitive emissions that addresses the following:

- Inventory and tracking, inspection of equipment, system retrofit, and end-of-life disposal for all equipment with refrigerants present.
- Plan to calculate fugitive refrigerant emissions that occur during the performance period.
- Identification and signature of the individual or organization that will implement the routine maintenance plan at least once yearly.

Provide one of the following:

3. A commitment to reducing embodied and operational carbon within the MEP industry. A team member (preferably a member of the MEP engineering team) must establish and sign a company plan to reduce operational and embodied carbon on MEP systems, request low-GWP refrigerants during projects' design phases, and request environmental product declarations (EPDs) for MEP products. OR
4. Proof of individual or company commitment to the MEP 2040 Commitment. A project team member must show their commitment from their company's statement on the MEP 2040 Why Sign? webpage or from a confirmation email after signing the MEP 2040 Commitment.

See the Fugitive Emissions Resources for additional support.

FINAL AUDIT

Provide the results of the refrigerant monitoring that occurred during the performance period. Include reports that summarize the results, including identifying leaks and repairing any such leaks. Include calculations documenting the fugitive refrigerant emissions.

ZC-5 Embodied Carbon Documentation

READY AUDIT

For the required reduction in embodied carbon:

The input assumptions and results from the selected life cycle assessment tool, showing:

- The project's primary, interior, and exterior materials embodied carbon baseline.
- The project's primary, interior, and exterior materials embodied carbon after reductions.
- Embodied carbon of materials and construction (A1-A3, A4, and A5) of primary, exterior, and interior materials. Input assumptions for the A4 and A5 data must include the following:
    - A4: Transportation of 90% of material to the site, by cost, and include distances, number of trips/shipments, estimated fuel use, and CO2e conversion factors
    - A5: All temporary equipment on site, hourly usage estimate, equipment name and estimated fuel use, and CO2e conversion factors
- Uncertainty analysis and an applied uncertainty factor.

Materials documentation supporting reductions in primary, interior, and exterior materials claimed in the narrative, such as:

- Basis of Design statements.
- LCA hot spot analyses.
- Material specifications.
- Procurement requests or letters.

For the maximum embodied carbon threshold:

Report the total embodied carbon of the project to be offset, which includes primary, interior, exterior, and MEP products

If the project exceeded the threshold, provide detailed descriptions of what prevented the project

from meeting the target. Explain what steps were taken to get as close to the threshold as possible.

Calculate and disclose the embodied carbon in the existing building.

Advocacy:

Include documentation confirming advocacy to at least five unique manufacturers or trade groups representing products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs. Advocacy documentation may be combined into a single PDF or submitted as multiple files. Email correspondence, call logs, meeting minutes, and/or advocacy letters are examples of acceptable documentation. The recipient must be clearly identified for each element of documentation.

ZC-6 Carbon Offsets

FINAL AUDIT
Provide calculations showing the total carbon required to be offset. This includes:

- 100% of the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of added primary materials, exterior materials, interior materials, and mechanical, electrical and plumbing (MEP) products.
- Refrigerant leakage during the performance period.

Provide documentation substantiating the purchase of compliant carbon offsets. Cost information may be redacted.

ZC-7 Resiliency Strategy

READY AUDIT

Provide a copy of the climate risk evaluation report.

Provide a narrative description of the resilience strategy that will be implemented at the project; OR explaining support for the local community during a disaster in lieu of a building-specific strategy. As needed, provide marked-up plans and/or official policies supporting claims.

ZC-8 Case Study

FINAL AUDIT
Using the provided Case Study Template, all projects must provide detailed case study information describing the project team's approach, highlighting any lessons learned or particularly rewarding outcomes.

At the time of certification, the case study information will be uploaded to the Institute's website. These case studies are a means to celebrate projects and to educate the public about the successful implementation of Living Future's ambitious programs and framework.

INTERIORS

ZC-1 Energy Narrative + Schematic Drawing

READY AUDIT

A narrative which includes a basic schematic of the energy system, and describes the energy system, including:

- Building's anticipated needs including all subsystems of the energy-using systems
- Renewable energy production narrative.
    - Energy production strategies and schematics for energy produced on-site.
    - Narrative explaining strategy to acquire renewable energy for off-site production.
- Narrative description of a baseline building of comparable climate, size, use and occupancy.
    - Project teams using project-specific baseline pathway must also explain the methodology used in the calculation.
- Narrative describing strategies to reduce energy consumption from the baseline.
- Descriptions of all backup power systems, implementation, and anticipated usage per year.
- Confirmation of a lack of combustion or a description of any combustion in or connected to the project and combustion phase-out plan if applicable.
        - Combustion-based DES 12-month phase-out plan, if applicable. Plans must describe a detailed timeline of the phase-out including anticipated dates and actions for the remaining life of the equipment, how changes will be implemented, and how the plan will be funded.

        - If combustion-based systems that supply the project are out of the project's control, include a summary of advocacy to the building owner to request a phase out plan. If a phase out plan is available, include it.

- Narrative describing metering strategy during the performance period with plans highlighted to show meter locations.

    - Identify which loads are expected to be at least 20% of total energy consumption and verify how they are separately submetered.

Input and output reports establishing the project's baseline EUI and anticipated EUI with supplemental calculations highlighting the project's baseline EUI, target EUI, and anticipated EUI.

- Projects using ASHRAE 90.1-2022 must submit whole building energy simulation data in accordance with ASHRAE 90.1-2022, Appendix G.

- Projects referencing a baseline from Living-Future approved tools or databases must submit copies of the inputs and outputs from the tool.

ZC-2 Energy Use Data

FINAL AUDIT

A brief narrative regarding the project's energy use over the performance period, including lessons learned from building operations.

Twelve months of performance data in one of the following formats is required:

- Copies of utility bills for a continuous 12-month period, beginning with the designated start date of the performance period.

- If utility data is not available, metered data from a private system such as a building management system may be accepted if it is accompanied by a letter from project engineer or consultant on their letterhead verifying that the provided data is complete and accurate.

A narrative describing how the renewable energy system(s) are additional, from allowed sources, attributed to the project, educational, identifiable, and metered.

- Include the construction start date of each renewable system and the project

construction start date. If the project construction start date follows the renewable energy construction start date, provide documentation showing that the systems were pre-planned for utilization and attribution to additional buildings.

- Include schematics and photos of systems if not already provided

If the project does not have ownership of renewable systems, contracts must be provided proving an agreement of at least 15 years for renewable systems. Alternatively, a PPA or vPPA may be provided showing that, in aggregate, sufficient power has been purchased equivalent to 15 years of building operation, even if the contract duration is less than 15 years.

If the project does not have energy bills (due to no connection to a utility or to being sub-metered from a larger-scale utility meter), also include:

- A letter, signed and stamped by the energy or mechanical engineer and co-signed by the project owner, substantiating that this is the case.

Additionally, if applicable, provide results of the first 12 months of the project's combustion-based DES phase-out plan. The results must include which steps of the phase-out plan have been completed and provide reasoning for any changes in the timeline provided during Ready Audit.

ZC-3 Energy Tracking Tables

FINAL AUDIT
Completed Energy Production and Demand Table based on 12 months of performance data.

ZC-4 Fugitive Emissions Documentation

READY AUDIT
For projects with refrigerant-containing equipment within scope:

Provide a maintenance plan for fugitive emissions that addresses the following:

- Inventory and tracking, inspection of equipment, system retrofit, and end-of-life disposal for all equipment with refrigerants present.

- Plan to calculate fugitive refrigerant emissions that occur during the performance period.

- Identification and signature of the individual or organization that will implement the routine maintenance plan at least once yearly.

Provide one of the following:

5. A commitment to reducing embodied and operational carbon within the MEP industry. A team member (preferably a member of the MEP engineering team) must establish and sign a company plan to reduce operational and embodied carbon on MEP systems, request low-GWP refrigerants during projects' design phases, and request environmental product declarations (EPDs) for MEP products. OR

6. Proof of individual or company commitment to the MEP 2040 Commitment. A project team member must show their commitment from their company's statement on the MEP 2040 Why Sign? webpage or from a confirmation email after signing the MEP 2040 Commitment.

-

See the Fugitive Emissions Resources for additional support.

For projects with refrigerant-containing equipment serving the project but out of project control:

Provide documentation of advocacy to the building owner to monitor, repair, calculate, and disclose fugitive refrigerant emissions.

FINAL AUDIT
For projects with refrigerant-containing equipment within scope:

Provide the results of the refrigerant monitoring that occurred during the performance period. Include reports that summarize the results, including identifying leaks and repairing any such leaks. Include calculations documenting the fugitive refrigerant emissions.

For projects with refrigerant-containing equipment serving the project but out of project control:

Disclose the refrigerant leakage documented by the owner during the performance period; OR

Provide calculations estimating the fugitive refrigerant emissions based on known or estimated system volume, refrigerant type, and a rate of 4% annual leakage if the owner has a documented leakage detection protocol or 20% if the owner does not.

ZC-5 Embodied Carbon Documentation

READY AUDIT

For the required reduction in embodied carbon:

The input assumptions and results from the selected life cycle assessment tool, showing:

- The project's primary, interior, and exterior materials embodied carbon baseline.
- The project's primary, interior, and exterior materials embodied carbon after reductions.
- Embodied carbon of materials and construction (A1-A3, A4, and A5) of primary, exterior, and interior materials. Input assumptions for the A4 and A5 data must include the following:
    - A4: Transportation of 90% of material to the site, by cost, and include distances, number of trips/shipments, estimated fuel use, and CO2e conversion factors
    - A5: All temporary equipment on site, hourly usage estimate, equipment name and estimated fuel use, and CO2e conversion factors

- Uncertainty analysis and an applied uncertainty factor.

Materials documentation supporting reductions in primary, interior, and exterior materials claimed in the narrative, such as:

- Basis of Design statements.
- LCA hot spot analyses.
- Material specifications.
- Procurement requests or letters.

For the maximum embodied carbon threshold:

Report the total embodied carbon of the project to be offset, which includes primary, interior, exterior, and MEP products

If the project exceeded the threshold, provide detailed descriptions of what prevented the project from meeting the target. Explain what steps were taken to get as close to the threshold as possible.

Calculate and disclose a tenant-proportionate share of the embodied carbon in the existing building.

Advocacy:

Include documentation confirming advocacy to at least five unique manufacturers or trade groups representing products with the most embodied carbon for the project overall that do not have Type III EPDs or Industry Average EPDs. Advocacy documentation may be combined into a single PDF or submitted as multiple files. Email correspondence, call logs, meeting minutes, and/or advocacy letters are examples of acceptable documentation. The recipient must be clearly identified for each element of documentation.

ZC-6 Carbon Offsets

FINAL AUDIT
Provide calculations showing the total carbon required to be offset. This includes:

- 100% of the upfront embodied carbon emissions (tCO2e) associated with life cycle stages A1-A5 of added primary materials, exterior materials, interior materials, and mechanical, electrical and plumbing (MEP) products.
- Refrigerant leakage during the performance period.

Provide documentation substantiating the purchase of compliant carbon offsets. Cost information may be redacted.

ZC-7 Resiliency Strategy

READY AUDIT

Provide a copy of the climate risk evaluation report.

Provide a narrative description of the resilience strategy that will be implemented at the project. As needed, provide marked-up plans and/or official policies supporting claims.

Provide evidence of advocacy to the base building owner for the development of a building-level resiliency strategy and to community leaders for the support of community-scale energy resilience infrastructure.

ZC-8 Case Study

FINAL AUDIT
Using the provided Case Study Template, all projects must provide detailed case study information describing the project team's approach, highlighting any lessons learned or particularly rewarding

outcomes.

At the time of certification, the case study information will be uploaded to the Institute's website. These case studies are a means to celebrate projects and to educate the public about the successful implementation of Living Future's ambitious programs and framework.

Resources

ENERGY PERFORMANCE RESOURCES

Advanced Energy Design Guide

ASHRAE
A series of publications created to help projects achieve energy-efficiency recommendations within ASHRAE 90.1 and supporting teams targeting a goal to be net zero.

Architect's Guide to Integrating Energy Modeling in the Design Process

American Institute of Architects (AIA)
A report familiarizing architects with working knowledge of foundational energy modeling concepts, terminology, tools, and methodology.

Calls to Action: Templates for Letters

MEP 2040
Templates for outreach letters to gather data and advocate for low-GWP refrigerants in MEP systems, MEP equipment bill of material lists for embodied carbon advocacy, and MEP equipment product transparency.

Nordic Swan Stove Criteria Document

Nordic Swan Ecolabel
Information on Nordic Swan Stove requirements.

Zero Code: Offsite Procurement of Renewable Energy

Architecture 2030
A technical report analyzing the various options for off-site renewable energy procurement.

Zero Tool Energy Use Calculator

Architecture 2030
A web-based tool to support teams in setting achievable energy-efficiency targets based on project size, type, and location.

EMBODIED CARBON RESOURCES

A 1.5°C Pathway for the Global Buildings Sector's Embodied Emissions

Science Based Targets initiative (SBTi)
A draft report on the methodologies for the building industry to decarbonize in alignment with the United Nations Paris Agreement's goal to limit global warming to 1.5 degrees Celsius above pre-industrial levels.

A Brief Guide to Calculating Embodied Carbon

The Institution of Structural Engineers' (IStructE)
A guide and example calculation for calculating the embodied carbon of life cycle stages A1-A5.

AIA-CLF Embodied Carbon Toolkit for Architects

Carbon Leadership Forum
A downloadable resource which is divided into three parts, introducing the necessary steps and resources to take in reducing embodied carbon. "Part II: Measuring Embodied Carbon" is specifically focused on LCA methodologies, factors, and tools.

Bringing Embodied Carbon Upfront

World Green Building Council
A comprehensive report highlighting the need for immediate action toward embodied carbon reductions and outlining critical steps that various stakeholders can take in order to begin these efforts and meet lofty targets.

Carbon Smart Materials Palette

Architecture 2030
An online resource that provides material options with lower embodied carbon to replace traditional building materials.

Defining and Aligning: Whole Life Carbon & Embodied Carbon

Low Energy Transformation Initiative (LETI)
Resources for embodied carbon definitions, rating systems, and benchmarks to achieve the embodied carbon reductions needed to meet the United Nations Paris Agreement 1.5 degrees Celsius global warming threshold.

Embodied Carbon Action Plan (ECAP)

Building Transparency
A resource developed by Building Transparency and building owners and developers engaged in the Owners Carbon Action Network (ownersCAN). The ECAP includes downloadable templates for items including an EPD request letter, RFP language, Basis of Design language, and template Project Specification language.

Embodied Carbon Benchmark Study V1

Carbon Leadership Forum
A technical report with summarized results of a study wherein data from more than 1,000 building life cycle assessments were collected and analyzed.

Embodied Carbon in Building Materials for Real Estate

Urban Land Institute
A compact report outlining the business case for reducing embodied carbon and providing introductory steps all project teams can implement to lower the impact of their building projects.

Emission Factors for Greenhouse Gas Inventories

Environmental Protection Agency (EPA)
Guidance on how to convert fuel use during construction to GWP.

How to Calculate Embodied Carbon
The Institution of Structural Engineers' (IStructE)
A detailed guide of embodied carbon calculations and principles.

Life Cycle Assessment of Buildings (LCA): A Practice Guide

Carbon Leadership Forum
A technical report with guidance for building professionals regarding how to incorporate life cycle assessment into their typical projects.

North American Material Baseline Report

Carbon Leadership Forum
A downloadable resource that provides a baseline from which to compare products within a material or product category in order to set achievable targets.

Whole Building LCA: Reference Building Structure & Strategies

American Society of Civil Engineers
A book with guidance regarding the role structural engineers can play in reducing the life cycle impacts of a building.

Whole Life Carbon Assessment (WLCA) for the Built Environment, 2nd Edition

Royal Institution of Chartered Surveyors (RICS)
This WLCA standard mandates a whole life approach to reducing carbon emissions within the built environment and has been revised extensively to reflect advances in professional practice and updates to legislation and regulatory requirements.

FUGITIVE REFRIGERANT EMISSIONS RESOURCES

California Air Resources Board (CARB): R3 Registration and Reporting Checklists

California Environmental Protection Agency
This document consists of a series of one-page worksheets and forms to assist with the tracking and reporting of refrigerant usage, leak inspection, and repair.

Climate-Friendly Alternatives to HFCs

European Commission
This section of the European Union's Energy, Climate Change, and Environment website includes alternatives to high-GWP hydrofluorocarbons (HFCs). Numerous alternates are provided for various use cases, thermodynamic properties, and safety constraints.

Managing Refrigerant in Stationary Refrigeration and Air-Conditioning Equipment

Environmental Protection Agency (EPA)
Guidance on EPA regulations under Section 608 of the Clean Air Act that address the handling and recycling of refrigerants used in stationary refrigeration, air conditioning, and heat pump equipment.

Significant New Alternatives Policy (SNAP) Program

Environmental Protection Agency (EPA)
This program looks at overall risks to human health and the environment of existing and new substitutes for ozone-depleting substances, publishes low-GWP refrigerant alternatives, and promotes the use of acceptable substances, and provides the public with information.

Living Future Program Glossary

A-G Terms

100-Year Flood

A flood having a one percent chance of being equaled or exceeded in magnitude in any given year (not a flood occurring once every 100 years).

100-Year Floodplain

The area adjoining a river, stream, or watercourse covered by water in the event of a 100-year flood.

Adaptive Management

An ongoing process for improving management policies and practices by applying knowledge learned through assessment of previously employed policies and practices to future projects and programs. Also, the practice of revisiting management decisions and revising them in the light of new information.

Adaptive Plan

An Adaptive Plan is a plan for improving the ecological function of a site based on the principles of Adaptive Management, establishing the vision, goals, objectives, and quantitative metrics, as well as the monitoring and maintenance strategies, to be applied to a project.

Adaptive Reuse

The process of reusing a site or building for a purpose other than the original purpose for which it was built or designed.

Adjacent Properties

Properties or developments that share a property line with the project.

Affordable Housing

A project that is financially accessible (<30 percent of household income for gross housing costs, including utilities) to renters who make <60% of median family income (MFI) or unit owners who make <80% of median family income (MFI). The project must retain its affordable status for at least 40 years.

Agriculture

The science and art of cultivating the soil; including the allied pursuits of gathering in the crops and rearing livestock; tillage, husbandry, farming.

Agroforestry

A system of land use in which harvestable trees or shrubs are grown among or around crops or on pastureland as a means of preserving or enhancing the productivity of the land.

Alley

A narrow lane or passage, especially one between or behind buildings.

Alternative Daily Cover (ADC)

Material other than earthen material placed on the surface of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging.

Apiary

A place in which a colony or colonies of bees are kept, such as a stand or shed for beehives or a bee house containing a number of beehives.

Appropriate Durability

Designing or selecting products that last only as long as they need to function in the project, and can then be composted or recycled.

Aquaculture

The active cultivation (maintenance or production) of marine and freshwater aquatic organisms (plants and animals) under controlled conditions.

Aquaponics

A sustainable food production system that combines traditional aquaculture (raising aquatic animals such as snails, fish, crayfish, or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment.

Area of Disturbance

The area of land altered by the project, including land used for construction staging or any

construction activities, including tunneling or conveyance.

Authority Having Jurisdiction (AHJ)

The organization, office, or individual responsible for permitting and enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

Baseline Condition

A description of current biotic and abiotic elements of site prior to restoration, including its structural, functional and compositional attributes and current condition (per Society for Ecological Restoration, SER 2004).

Biomimicry

The imitation of natural biological designs or processes in engineering or invention.

Biomorph

A painted, drawn, or sculptured free form or design suggestive in shape of a living organism, especially an ameba or protozoan. Adjective: Biomorphic.

Biomorphy

The act of creating a biomorph.

Biophilia

The innate, evolutionary connection between human beings and nature and other living organisms.

Biosolids

The nutrient-rich organic material (byproduct) made from the stabilized sewage sludge from a composting toilet, other sewage treatment, or resource recovery facility. Biosolids can typically be recycled as a soil amendment for crops.

Black water

Discharged water containing solid and liquid human wastes from toilets and urinals. Also, called Sewage.

Brownfield

With certain legal exclusions and additions, the term “brownfield site” means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential

presence of a hazardous substance, pollutant, or contaminant. Brownfields are designated as such by the US Environmental Protection Agency (EPA) or equivalent state, county, or other jurisdictional body.

Business as usual (BAU)

Business as usual (BAU) is the baseline reference point for handprinting. In simplest terms, BAU refers to a repeat of past practices from the year before. More formally, it refers to: responding to this year's external forces with last year's approach. For companies that sell goods or services, BAU is: responding to this year's demand, with last year's products and processes. For projects, BAU is addressing current demands based on typical fixtures, materials, or processes.

Campus

Multiple buildings that are legally bound through ownership or contract and occupy a generally continuous area of land.

Car Sharing

Any on-demand mode that offers transport to more than one passenger at a time, or that facilitates independence from single occupancy vehicle (SOV) transport, including employer fleet vehicles, shuttle services, pay-as-you-go car sharing programs such as Car to Go or Zipcar, or scooter or bike shares.

Carcinogenic, Mutagenic, Reprotoxic (CMR)

Toxicity classification given to substances that cause or promote cancers, genetic mutations, and/or damage to reproductive systems.

Chain of Custody (COC)

COC certification traces the path of wood from forests through the supply chain, verifying that FSC-certified material is identified and separated from non-certified and non-controlled material as it makes its way from the forest to the market. The COC process ensures every stage of processing, manufacturing, and distribution is FSC certified.

Charitable Donation

An act or instance of presenting something as a gift, grant, or contribution to a charitable entity.

Charitable Entity

All entities (charitable organizations, religious institutions, non-profits, and private foundations) that meet the criteria for tax exemption under US Internal Revenue Code (IRC) 501© (3) and their international equivalents.

Chemical Abstracts Service Registry Numbers (CASRNs)

A unique numerical identifier for nearly every known chemical, compound, or organic substance. as assigned by the Chemical Abstracts Service, a division of the American Chemical Society.

Cisgender

Cisgender refers to an individual whose gender identity aligns with the one associated with the sex assigned to them at birth. For further information regarding gender-based and other identities, visit Outright International or pflag.

Closed-Loop Water Systems

Systems in which all water used on a project is captured, treated, used/reused, and/or released within a designated boundary, such as the Project Boundary (referred to as Project Area in LBC 4.0 and Core Green Building Certification).

Combined Sewer Systems

Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial sewage in the same pipe.

Combustion

Any burning or combustion of fossil fuels or wood products.

Commingled Waste

All relevant project waste streams, with the exception of soil and biomass, that are mixed together instead of being separated on-site. Commingled waste will need to be separated for re-use, recycling or other processing, and is typically taken to an off-site facility to be sorted into individual waste streams prior to recycling.

Commodity Products

Commodities are homogenous goods that are traded in bulk on a commodity exchange. Commodity prices are subject to supply and demand; and therefore are determined by their market as a whole. These types of products include agricultural goods, lumber, metals and fuels.

Compensation

Compensation, also known as remuneration, is monetary payment received by an employee as a salary or wages.

Conservation Easement

A deeded transfer of an interest in real property for the purpose of conserving or protecting the land or its resources for future generations. A conservation easement is legally binding and its restrictions are permanent and run with the land, meaning that not only the original owner but all subsequent owners are subject to its terms.

Construction Waste Material

Construction waste material includes all products and materials that are on the site of, purchased for, or used for the project, but not permanently installed in the final project, and may include demolition waste, temporary materials that are disposed of during or at the end of the construction period, and excess materials purchased for but not installed in the project.

Consumables

Non-durable goods that are likely to be used up or depleted quickly. Examples include office supplies, packaging and containers, paper and paper products, batteries, and cleaning products.

Continuous Simulation Model

A stormwater modeling approach that accounts for many sizes and intensities of storms, as well as variation in the time between storms. Typically based on long-term rainfall records rather than synthetic design storms, such models provide a more accurate representation of infiltration, evapotranspiration, and stormwater control measures than other forms of storm modeling.

Contract Manufacturing

A practice of manufacturing products on behalf of a firm or manufacturer that has provided designs, formulas and/or specifications for the purpose of producing a product as determined by contract.

Contract Worker

A person engaged to perform work on a contractual basis that is specified by timeframes and deliverables.

Copy Room

A dedicated room in a school or business containing two or more copy machines, multifunction copiers, large format printers, or similar commercial scale copy or printing equipment.

Core

Core, short for Living Future’s Core Green Building Certification, is a simple framework that outlines

the 10 best practice achievements (Imperatives) that a building must obtain to be considered a green or sustainable building.

Cradle-to-Gate

Cradle-to-gate refers to a scope (or boundary) of a life cycle assessment. This scope usually represents the life cycle stages from raw material extraction through material processing and product manufacturing, before the product leaves the manufacturer “gate” at the final manufacturing facility or assembly location.

Cradle-to-Grave

Cradle-to-grave refers to a scope (or boundary) of a life cycle assessment. A cradle-to-grave assessment addresses a full product life cycle from resource extraction (cradle) to the end-of-use fate. The use phase and disposal phase of the product are included in this case. Cradle-to-grave assessments are sometimes the basis for environmental product declarations.

Deconstruction

The systematic removal of materials from a project (building and site) for the purpose of salvage, reuse, and/or recycling.

Disadvantaged Business Enterprise (DBE)

DBE is a Federal certification program administered by the US Department of Transportation. The DBE certification applies to for-profit small business concerns where socially and economically disadvantaged individuals own at least a 51% interest and also control management and daily business operations. See https://www.transportation.gov/civil-rights/disadvantaged-business-enterprise for more information.

Disadvantaged Population

Socially or Economically disadvantaged populations include, according to the US Code of Federal Regulations, those who have been subjected to racial or ethnic prejudice or cultural bias within American society because of their identities as members of groups and without regard to their individual qualities and/ or socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same or similar line of business who are not socially disadvantaged.

District Energy System (DES)

District energy systems (DES) provide heating and cooling generated in one or more centralized plants producing hot water, steam, and/or chilled water, which then flows through a network of

insulated pipes to provide hot water, space heating, and/or air conditioning for nearby buildings.

Diverted Materials

Diverted materials are those that are recycled, reused, salvaged, composted. or otherwise diverted from landfills or incineration.

Diverted Waste

All items removed from the project that are then recycled, reused, salvaged, composted, or otherwise diverted from landfills or incineration.

Dune

A sand hill or sand ridge formed by the wind, usually in desert regions or near lakes and oceans.

Durables

Goods that have utility over time, rather than being depleted quickly through use. Examples include appliances, electronic equipment, mobile phones, and furniture.

Ecological Restoration

Any activity whose aim it is to ultimately achieve ecosystem recovery, insofar as possible and relative to an appropriate local Reference Habitat, regardless of the period of time required to achieve the recovery outcome (per Society for Ecological Restoration, International Standards for the Practice of Ecological Restoration).

Embodied Carbon

The greenhouse gas emissions associated with the raw material extraction, manufacturing, and processing, transportation, and installation, maintenance, and disposal of a building material (Carbon Leadership Forum 2023).

Energy Needs

All electricity, heating, and cooling requirements, including resilience strategies, of either grid-tied or off-grid systems. Backup generators are excluded.

Energy Use Intensity (EUI)

Energy use intensity expresses a building’s energy use as a function of its size or other characteristics, and is often expressed as energy (BTUs) per square foot per year.

Environmental Product Declaration (EPD)

A transparent and objective report that communicates what a product is made of and how it impacts the environment across its entire life cycle. EPDs can be completed to various scopes (e.g. product-specific, facility-specific, industry-wide) based on availability of data. EPDs satisfy all of the requirements of relevant Product Category Rules (PCRs) for a given product category or type and follow international standards, including ISO 14044, ISO 14025, ISO 21930 and EN 15804.

Equity

The just and fair inclusion into a society in which all can participate, prosper, and reach their full potential (per PolicyLink's "Equity Manifesto").

Essential Use

The essential use concept is applicable to uses of the most harmful chemicals. In determining whether use of a substance is essential for purposes of its standards and labels, Living Future will consider whether all of the following conditions are met:

- It is necessary for the health, safety, or critical functioning of society, AND
- there are no alternatives that are acceptable from the standpoint of environment and health.

Read more about the essential use approach to chemicals management.

Ethnobotanicals

Indigenous plants used by people of a particular culture and region. For Living Future Program Imperatives, ethnobotanicals must be used as food or medicine to count as agriculture.

Evapotranspiration

The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants. Evapotranspiration is measured as the sum of evaporation and plant transpiration from earth's surface into the atmosphere and is typically reported in millimeters per unit of time (i.e. mm/day).

Existing Historic Community

A community established and occupied before 1945, when the proliferation of suburban areas began.

Exterior Materials

Permanently installed site materials including roads, paths, paving, and special surfacing and

paving. This does not include sitework materials such as site preparation components, site utilities, or electrical site improvements.

Facade

The face of a building, especially the primary or front elevation.

Final Energy

Energy that is received and used by an end user.

Fit-for-Purpose Water

Water of a quality that is appropriate to the use/demand in question – neither over nor under purified.

Flexible Work Arrangement

Flexible work arrangements allow employees to adjust their working hours and locations to a schedule and format that is not standard for their industry or organization but that still includes the same number of hours and productivity.

Floodplain

A flat or nearly flat area of land adjacent to a river or stream that naturally experiences periodic flooding.

Floor Area Ratio (FAR)

The measurement of a building's gross floor area in relation to the size of the lot or parcel the building is located on.

- LBC 4.0 and earlier: FAR = Gross Floor Area / Total Project Area).
- LBC 4.1 and later: FAR = Gross Floor Area / Total Project Boundary).

Flow Duration Curve

A flow duration curve is a plotted graph of discharge in relation to percentage of time. In the case of stormwater, a flow duration curve shows the rate of runoff in relation to the duration of those rates.

Footprint

Any human impact on a site, usually with negative ecological implication. Note that this is not the same as the building footprint.

(LPC) A measure of negative impacts, generally those caused by either the operations and supply chain of an organization or the production and supply chain for a product.

Forest Stewardship Council (FSC)

An independent, non-profit, membership-led organization that protects forests for future generations and sets standards under which forests and companies are certified. Certification consists of three equally weighted principles — environmental, economic, and social — to ensure balance and the highest level of integrity.

Fractals

A figure or surface generated by successive subdivisions of a simpler polygon or polyhedron, according to some iterative process.

FSC 100%

The Forest Stewardship Council (FSC) 100% – or FSC 100% – label means that the wood within the product comes entirely from FSC-certified, well managed forests. The wood in the product has not been mixed with material of another material category throughout the supply chain.

FSC Mix

The Forest Stewardship Council (FSC) Mix – or FSC Mix – label means the wood within the product is from FSC-certified forests, recycled material, or controlled wood. The FSC Mix label is supplied with a percentage claim based on the volume of wood in the product.

Fugitive Emissions

Emissions from unintentional or intentional but irregular releases of greenhouse gasses (GHG) to the atmosphere which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening. Example: refrigerant leaks.

Full-Time Equivalent (FTE)

The hours worked by one employee on a full-time basis. Used to convert the hours worked by several part- time employees into the number of equivalent full-time employees.

Fully Occupied

To account for vacancy rates, a building is considered to be fully occupied when it is at 85% of full capacity and intended use.

Furniture, Fixtures and Equipment (FF&E)

Furniture, fixtures or other equipment that has no permanent connection to the structure of a

building or utilities and is not part of office systems furniture.

Gender Diversity

Gender diversity is the condition of having or being composed of people of differing genders. True gender diversity moves beyond the traditional gender binary to center the experiences of people who identify as women or transgender, including people who have a nonbinary gender identity such as agender, genderqueer, gender non-conforming, genderfluid, or others.

Gender Identity

The internal knowledge of one's identity as a particular gender, including but not limited to transgender woman, transgender man, cisgender woman, cisgender man, or of belonging to a non-binary identity such as agender, genderfluid, genderqueer, or others. For further information regarding gender-based and other identities, visit Outright International or pflag.

Geomorphology

The study of the characteristics, origin, and development of landforms.

Global Warming Potential (GWP)

The measure of radiative forcing impacts of particular greenhouse gasses in the atmosphere. GWP is the metric used to measure and track embodied carbon and is quantified in kilograms of CO_2 equivalent (kg CO_2e).

Greenfield

Land that was not previously developed or polluted.

Greywater

Water discharged from fixtures such as sinks, showers, laundry, drinking fountains, etc., but not including water discharged from toilets and urinals.

Gross Building Area (applicable only to LBC 4.0 and Core Green Building Certification)

The sum of all areas on all floors of a building included within the outside faces of its exterior walls, including all vertical penetration areas, areas for circulation, and shaft areas that connect one floor to another. Gross building area also includes structured parking, but does NOT include unenclosed exterior spaces such as decks, patios, or balconies, or exterior surface parking. Additional detail on defining the gross building area of different typologies is provided in the Project Area section of the Early Project Guide for LBC 4.0 and Core Green Building Certification.

Gross Revenue

Gross revenue is a figure that includes all income occurring during a particular time frame, before any expenses are deducted.

Groundwater

Fresh water supply that is located beneath the surface of the ground and is typically of suitable quality for potable and non-potable uses.

H-P Terms

Halogenated Flame Retardants (HFRs)

HFRs include PBDE, TBBPA, HBCD, Deca-BDE, TCPP, TCEP, Dechlorane Plus and other flame retardants with bromine or chlorine.

Handprinting

Handprinting is a compliance pathway that acknowledges the net positive impacts a project can create beyond the boundaries of the project site.

Handprints

Handprints are beneficial changes to environmental and social impacts. They are reported in positive numbers to represent positive impacts, in contrast to so-called footprints, which represent negative impacts. The reference point for the positive contribution is Business As Usual (BAU), which is essentially the typical way of doing something or the way it's been done in the past.

Additional information on handprinting can be found in the Living Product Challenge 2.0 Handbook, and for building project teams, also in the Early Project Guidebook.

Harvest On-Site

The removal of natural products from the project property with the intention to use them in the project.

Hazardous Materials

Materials that have been deemed dangerous or carcinogenic for humans or the environment

and/ or materials that exhibit one or more of the following properties: ignitibility, corrosivity, reactivity, or toxicity. Hazardous materials include asbestos, lead paint, or materials producing ionizing radiation, and must be disposed of in a specific manner, in accordance with local regulations.

Hazardous Waste

Waste that includes hazardous materials. Hazardous waste is required to be processed by a hazardous waste facility.

Historic Hydrology

The historic hydrology of a site reflects its condition in an undeveloped state. See the clarification regarding historic hydrology in LBC 4.1 or LBC 4.0 for additional information on how this definition is applied to the requirements of the Water Petal.

Homogenous Materials

A uniform solid, liquid or gas composed of one or more substances that cannot be mechanically disjointed in principle. It may be a chemical formulation or compound; a substance of unknown or variable composition, complex reaction product, or biological material (UVCB); or a combination of the two. Coatings and finishes such as plating, powder coats, enamels, etc., are considered unique homogenous materials" (Clean Production Action, 2015).

Human-Powered Lifestyle

A way of living that relies primarily on the power of human muscles to transport people and goods.

Human Scaled

Human scale is about the experience of a space as a pedestrian, rather than as a motorist. A built environment at human scale is "legible" when one is on foot or up close, and detail and texture can be perceived by sight or touch.

Hydroponics

A subset of hydroculture: a method of growing plants using mineral nutrient solutions, in water, without soil.

Infiltration

The process by which liquids, typically stormwater runoff, flows into and through the subsurface soil.

Ingredient

A discrete chemical, polymer, metal, bio-based material or other substance that exists in the finished product as delivered to site.

In Situ Materials

Existing materials in their original position on a project site that are fit for reuse or will be incapsulated or otherwise covered from view. In-situ materials do not require re-installation and may or may not require refurbishment.

Interior Materials

Permanently installed materials included in the wall, floor, ceiling finishes, and partitions of the building. This does not include miscellaneous items or moveable components such as furnishings, fixtures, or equipment.

Invasive Species

A species that is non-native to the ecosystem under consideration and whose presence harms human or ecosystem health.

Just Label

A label for organizations to disclose social equity ratings attained through the Just program.

Just Program

A voluntary disclosure tool and transparency platform for organizations to disclose social equity information.

Just Self-Assessment

A tool to help organizations social equity performance based on the Just program standard. This tool is meant for internal use not for public disclosure like the Just label.

Key Ecosystem Attributes

Broad categories developed as part of restoration standards to assist practitioners with evaluating the degree to which biotic and abiotic properties and functions of an ecosystem are recovering. In the Society for Ecological Restoration (SER) Guidelines. Includes six identified categories: absence of threats, physical conditions, species composition, community structure, ecosystem functionality, and external exchanges.
Complexity, self-organization, resilience, and sustainability of ecosystems typically increase with the attainment of these attributes.

Landscape Remnant

A pre-settlement native plant community or a plant community that has survived on a site to the present day.

Landscape Restoration

Reversion of a plant community back to a pre-determined state (such as pre-settlement) through management. Restorations usually involve removing a plant community that has taken over a native ecosystem or remnant and are often supplemented with seeds from plants that are native to the site.

Landscape Succession

The gradual evolution of vegetation toward a more complex and ecologically appropriate state.

Land Trust

A nonprofit organization that, as all or part of its mission, actively works to conserve land by undertaking or assisting in land or conservation easement acquisition, or by its stewardship of such land or easements.

Leachate

The liquid that is leftover after the composting of organic waste.

LGBT Business Enterprise (LGBTBE)

LGBTBE is a certification program administered by the National LGBT Chamber of Commerce (NGLCC) for eligible businesses that are majority-owned by lesbian, gay, bisexual, and transgender (LGBT) individuals. See https://www.nglcc.org/get-certified for more information.

Life Cycle Assessment (LCA)

A method to assess environmental impacts associated with all the stages of a product's life cycle (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair, maintenance, and disposal or recycling). Defined as compliant with the International Organization for Standardization's ISO 14044 standards.

Livestock

Animals kept or raised for food production, including cattle, sheep, bees, and similar animals.

Local

Of, relating to, or characteristic of a particular place: not general or widespread; primarily serving

the needs of a particular limited district. Living Future programs may have more delimited definitions (e.g., of certain distances or qualities) articulated in program requirements.

Low Risk Wood

Low risk is defined as a source country with a score of 80 or higher as reported on the The Nature, Economy and People Connected tool, where the country has laws and a low rating for both the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and Protected Sites and Species Sub-categories, and laws in at least 13 additional Sub-categories, including one law in each of the five Legal Categories. Reference tool: https://www.nepcon.org/hub/timber

Manufacturer

A person or company that makes goods for sale. Items used in manufacture may be raw materials, assemblies or component parts of a larger product.

Manufacturer Location (“Final Facility”, “Final Assembly Location”)

The final point of assembly, fabrication or manufacture of a system, product or building material.

Materials Construction Budget

The total cost of all permanently installed materials and systems furniture delivered to the site, excluding labor, soft costs and land. See additional information regarding calculation methods under the Materials Construction Budget Clarification in LBC.

Minority-Owned Business Enterprise (MBE)

MBE is a certification program administered by NWBOC for eligible businesses that are majority-owned by a racial or ethnic minority. See https://www.nwboc.org/basicinfo.html for more information.

Miscellaneous Hardware

Miscellaneous hardware is a single component or very simple assembly, that requires no on-site assembly, often aids in the installation of a larger product or system onsite, and is able to be quickly installed by a single tradesperson.

Multifamily Residence

Multifamily residence applies to a Project Boundary (referred to as Project Area in LBC 4.0 and Core Green Building Certification) that covers more than one “dwelling unit”, defined as a single unit designed for human habitation with permanent provisions for living, sleeping, eating, cooking,

and sanitation.

Municipal Potable Water

Water supplied by a city or town, or other large- scaled water systems operating at a similar scale to a municipal water system.

National Women Business Owners Corporation (NWBOC)

NWBOC is a third-party business certifying entity that administers certifications such as women-owned business enterprise (WBE), minority-owned business enterprise (MBE), and veteran-owned business enterprise (VBE). See https://www.nwboc.org/ for additional information.

Native Prairies

Diverse ecosystems dominated by grasses and other flowering plants called forbs; for the LBC native prairies can be either “landscape remnants” or “landscape restorations.”

Naturalized Plant

A plant that was introduced, but is established as if native: that is, having established sufficient population size to maintain itself in the environment, but not so abundant that it becomes invasive, dominating the system and outcompeting native species. Invasive plants that endanger native plants or ecosystems, that function without meaningful ecological checks on their abundance, are not considered naturalized for the purposes of the LBC.

Natural Lands Conservation

Natural Lands Conservation seeks the sustainable use of nature by humans, which could allow, for example, extraction of natural resources if done in a manner that permits their persistence for future generations. It includes maintaining diversity of species, genes, and ecosystems, as well as functions of the environment, such as nutrient cycling.

Natural Lands Preservation

Natural Lands Preservation prevents human use of a site for the protection of its biodiversity and the quality of ecosystem functions.

Net Operating Income

Net operating income is the measurement of an organization’s available income once operating expenses have been subtracted from its gross revenues. For the purposes of Living Future

programs, this figure excludes debt payments with associated interest and capital expenditures. This figure may not include depreciation, owner draws/owner distribution payments, or equity payments.

Nonbinary

The term nonbinary is widely used to describe a gender identity that cannot be categorized as either masculine or feminine. Nonbinary covers a wide range of gender experience; people identifying as nonbinary could experience their gender as a combination of male and female, neither male nor female, or as something completely independent of notions of conventional gender identities. For further information regarding gender-based and other identities, visit Outright International or pflag.

Non-governmental Organization (NGO)

A nonprofit organization that operates independently of any government, typically one whose purpose is to address a social or political issue.

Non-potable Water

Water that does not meet state and federal drinking water standards for human consumption, but is suitable for other low risk uses, such as toilet flushing, irrigation or laundry. The following uses are considered non- potable for purposes of compliance with I06 Net Positive Water: toilet and urinal flushing, landscape irrigation, cooling tower makeup supply, laundry, miscellaneous processes (e.g., equipment washing, dust prevention, etc.)

Oceania

For purposes of Living Future programs, Oceania is defined as Australia, New Zealand, Melanesia, Micronesia, and Polynesia.

Old-Growth Forest

Natural forests that have developed over a long period of time, generally at least 120 years, without experiencing severe, stand-replacing disturbance such as a fire, windstorm, or logging. Ecosystems distinguished by old trees and related structural attributes that may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function.

On-Site Harvest

On-site harvest is the removal of natural products from the project property with the intention to use them in the project.

On-Site Landscape

The planted area not used to comply with the requirements of Imperative 02, Urban Agriculture.

Operational Carbon

The greenhouse gas emissions associated with building energy consumption. (B6 as defined by EN 15978).

Operational Energy

The energy used during the service life of a structure to power base systems, such as lighting, heating, cooling, and ventilating systems. Operational Energy is differentiated from Process Energy, which is energy used to support a manufacturing, industrial, or commercial process that may be housed in a building.

Operations and Maintenance Manual

A document containing information about the building's various systems, including any ongoing actions the owner or property manager must take to ensure continuous optimization of the building's function and performance.

Part-Time Employment

Part-time employment is ongoing, but for fewer than 30 hours per week.

Pay Class

A pay class, also known as a job class, is a pay category defined by the organization based on characteristics such as job function, seniority, skills, experience, and responsibility. A pay class may have an associated salary range, but the class is not determined solely by pay.

Performance Period

A continuous 12-month period used for evaluating project performance. The performance period does not have to commence at the beginning of occupancy.

Permaculture

The conscious design and maintenance of agriculturally productive ecosystems that have the diversity, stability, and resilience of natural ecosystems. Permaculture is a philosophy of working with, rather than against, nature; of protracted and thoughtful observation; of looking at plants and animals in all their functions, rather than treating any area as a single-product system.

Persistent Bioaccumulative Toxins (PBTs)

Substances that do not easily break down in nature and tend to accumulate in species. As a result, they may be highly problematic even at low levels of release into the environment, as they bioaccumulate up the food chain leaving top predators with problematic levels of toxins in they bodies and causing irreversible harm.

Polyculture

Agriculture using multiple crops in the same space, in imitation of the diversity of natural ecosystems, and avoiding large stands of single crops, or monoculture.

Portfolio

For the purposes of the Living Building Challenge, a portfolio is multiple buildings that are owned by the same entity, but are spread out through a community or larger area.

Potable Water

Water that is fit for human consumption. In the US, potable water typically meets state and federal drinking water standards.

Pre-Development Hydrology

See historic hydrology.

Preventive Care

Preventive care reduces the risk of diseases and other medical conditions through routine health maintenance, providing education, and detecting potential health issues early. Examples of preventive care services include:

- Health risk assessments;
- Biometric screenings;
- Screening tests to check for diseases early;
- Vaccinations;
- Dental cleanings; and
- Health counseling and education.

Previously Developed

A site with existing or historic structures or on-site infrastructure, or a site that has experienced disturbance related to building activity, including monoculture agriculture. Roads built for natural resource extraction (e.g., logging roads or mining areas) do not qualify a site as previously developed.

Primary Dune

A continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

Primary Materials

The permanently installed building components that make up the majority of the structural, foundation and enclosure systems of a building.

Prime Farmland

Land that has been used for agricultural production at some time during the four years prior to the relevant Important Farmland Map date, or in the four years prior to the project, and where the soil meets the physical and chemical criteria for prime farmland or farmland of statewide importance as determined by the USDA Natural Resources Conservation Service (NRCS).

Priority Natural Lands

Priority Natural Lands include Pristine Greenfields, Wilderness, Prime Farmland, the 100-year Floodplain, and Thriving Vibrant Ecological Habitats and Environments.

Pristine Greenfield

Land that has not been impacted by humans and maintains thriving, viable habitat. Land that has not been developed, but has been altered and degraded through ranching, mono-culture agriculture, crowding, pollution or other means is not considered pristine greenfield.

Process Chemical

Process chemicals are defined as chemicals used in the manufacturing process in the final manufacturing facility that come into contact with the product pursuing certification. For example, surfactants, solvents and lubricants in the product manufacture are to be considered. General cleaning products used in the facility are not included.

Process Energy

Energy consumed to support a manufacturing, industrial, or commercial process. This is in contrast to Operational Energy which is energy used during the service life of a structure to power base systems, such as lighting, heating, cooling, and ventilating systems.

Process Water

Water required to produce the product at the final facility, including but not limited to water used for material production, machine operation, and rinsing.

Product

A finished good composed of one or more homogeneous materials that are in turn made up of chemical substances, or a combination of one or more materials and substance(s), or one or more substances. A product may be made of one or more homogeneous materials. A product may also be organized into parts, which are in turn made up of one or more homogeneous materials. A product may also function as part of another product (Health Product Declaration Collaborative).

Product Category Rules (PCR)

A set of defined rules necessary for developing an Environmental Product Declaration (EPD) for products fulfilling the same function. PCRs follow international standards such as ISO 14025 and enable transparency and comparability between product EPDs.

Product Share Pathway

The Product Share pathway allows a manufacturer to certify a product, or products, that require(s) only a limited fraction of a facility's production capacity. This pathway requires a manufacturer to offset only the impact of the product pursuing certification on-site, when the production of that product accounts for less than 75% of the facility's total output by dollar value or weight. A Product Share of Net Positive Energy, Water and Waste includes all process energy used to make the product as well as its share of facility lighting, heating and cooling. Worker water usage, waste treatment, administrative office energy and water use and facility-wide stormwater management are excluded from the Product Share certification requirements.

Project Area (applicable only to LBC 4.0 and Core Green Building Certification)

The entire scope of the project and all areas disturbed by the project work including areas of construction, staging and conveyance, which is typically, but not necessarily, all land within the property line. Project Area must be consistent across all Imperatives. Additional detail on defining the Project Area is provided in the Project Area section of the Early Project Guide for LBC 4.0 and Core Green Building Certification.

Project Boundary (referred to as Project Area in LBC 4.0 and Core Green Building Certification)

The entire scope of the project and all areas disturbed by the project work including areas of construction, staging and conveyance, which is typically, but not necessarily, all land within the property line. The Project Boundary must be consistent across all Imperatives.

See additional requirements for defining the Project Boundary under Cross-Petal Compliance Details.

Project Floor Area (referred to as Gross Building Area in LBC 4.0 and earlier)

New Construction, Building Renovation, Landscape + Infrastructure

For projects under the New Construction and Building Renovation typologies and buildings within a Landscape + Infrastructure project, the Project Floor Area is the sum of all areas on all floors of a building included within the outside faces of its exterior walls, including all vertical penetration areas, areas for circulation, and shaft areas that connect one floor to another. The Project Floor Area also includes structured parking, but does NOT include unenclosed exterior spaces such as decks, patios, or balconies, or exterior surface parking.

Interior Typology

For Interior projects, the Project Floor Area must encompass the gross area of the building to be included in the certification as measured from the centerline of the walls defining the space. The Project Floor Area must include all areas within the scope of work for the project and define a space that is physically and visually distinct from the non-certifying parts of the building. The distinctions may be created by walls, halls, and/or separation by floor.

See additional requirements for defining the Project Floor Area under the Cross-Petal Compliance Details.

Project Water Discharge

All water leaving the building or site including stormwater, greywater, and black water.

Public Art

Art displayed for the benefit of the general public.

Q-Z Terms

Reclaimed Water

Reclaimed or recycled water, also referred to as wastewater reuse, water reclamation, or purple pipe, is the process of diverting greywater and/or domestic sewage into a system where it can be used for non-potable applications.

Recycled Materials

Post-industrial or post-consumer materials that have been significantly processed or altered from their previous form before reaching their current form.

Red List

The Red List contains twenty-two classes of harmful and polluting chemicals considered to be the worst in class in the building industry. Each chemical class contains a multitude of individual chemicals, identified by their Chemical Abstract Services Registry Number, or CASRN. Taken together, these classes comprise nearly eight hundred individual ingredients. The Red List is a resource to show manufacturers precisely which ingredients are prohibited from inclusion in Living Buildings.

Reference Habitat

An intact habitat containing similar structure and function as the ecosystem that would have naturally occurred on the site, acknowledging that ecosystems are dynamic, and adapt and evolve over time in response to changing environmental conditions.

Regularly Occupied Space

A space used by a full-time employee, part-time employee, resident, extended period visitor, or any other person for 4 or more hours per day for 2 or more days in a week.

Regular Occupant

A full-time employee, part-time employee, resident, extended period visitor, or any other person who uses a project space for 4 or more hours per day for 2 or more days in a week.

Renewable Energy

Energy generated through passive solar, photovoltaics, solar thermal, wind turbines, water-powered microturbines, direct geothermal or fuel cells powered by hydrogen generated from renewably powered electrolysis. Nuclear energy is not considered renewable for purposes of LBC or Core. Combustion-based sources are also neither renewable nor allowed in LBC/ Core projects without an Exception.

Renewable Energy Certificate (REC)

Renewable Energy Certificates (RECs) are proof that energy has been generated from renewable source and are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource.

Reprotoxin

Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin,

may produce or increase the incidence of non-heritable adverse effects in the progeny and/or impairment of male or female reproductive functions or capacity.

Salvaged Materials

Used building materials that can be repurposed wholly in their current form or with slight refurbishment or alterations. Salvaged consumer goods that are reused as building, finish, or furniture at the end of their life may contribute to a project's salvaged count. Salvaged large furniture items or art elements listed in the specifications can count toward salvaged count when the product is being reused as a salvaged material.

Sensitive Ecological Habitat

Habitat that is threatened, endangered, or particularly vulnerable to changes in the local ecology. Examples include, but are not limited to, wetlands, dunes, old-growth forests, and native prairies.

Service-Disabled Veteran-Owned Small Business (SDVOSB)

SDVOSB is a certification program administered by the Government Services Exchange for eligible businesses that are majority-owned by veteran US citizens. See Government Services Exchange for more information.

Sewage

Sometimes called "black water," sewage is discharged water containing solid and human wastes from toilets, urinals and sometimes sinks.

Single-Event Models

Single-event stormwater models are limited to a single design storm event, e.g., a 50-year storm. They are typically used to estimate the expected volume, rate, or quality of stormwater, to design best management practices and hydraulic structures, and to evaluate the effectiveness of water quality treatment of stormwater control measures.

Single-family Home or Residence

Single-family home or residence applies to a Project Boundary (referred to as Project Area in LBC 4.0 and Core Green Building Certification) covering no more than one "dwelling unit" defined as a single unit designed for human habitation with permanent provisions for living, sleeping, eating, cooking, and sanitation. The unit may be attached or detached.

Small Mechanical Component

Part of a complex mechanical product composed of at least 10 parts that is no more than 10% of

the total product assembly by weight and volume.

Smoking

Smoking is generally defined as inhaling and exhaling the fumes of burning plant material. For purposes of Living Future requirements, smoking includes combustion of tobacco, cannabis, and controlled substances, and generation of emissions produced by electronic smoking devices.

Social Handprints

Beneficial changes to social impacts (also see Handprints).

Stormwater

Precipitation that falls on the ground surfaces of a property.

Stormwater Detention

Stormwater detention is an area where stormwater is temporarily stored, or detained, and is eventually allowed to drain slowly when water levels recede in the receiving channel.

Stormwater Retention

Stormwater retention holds, or retains, stormwater. With the exception of the water lost to evaporation and to absorption by the soil, retention infrastructure is able to store water for indefinite periods.

Stormwater Runoff

Stormwater runoff is generated from rain and snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground.

Structured Parking

Parking that has at least one level of vehicles not at grade; either elevated, underground, or under a building or other space built to be occupied by humans.

Surplus Materials

Excess materials available as a result of unintentional over-purchasing or incorrect specifications that are available for installation on a separate project.

Systems Furniture

A modular furniture system that might include work surfaces, cabinetry, file systems, and flexible partitions to create or furnish a series of office workspaces.

Thriving Vibrant Ecological Environments and Habitats

For purposes of the LBC and Core standards, “thriving, vibrant ecological environments and habitats” are one class of Priority Natural Land which includes places with high-quality or important ecological function, and/or critical ecology, that may not meet the definition of wilderness or pristine greenfield. Also see guidance under Ecological Clarifications in Ecology of Place, for LBC 4.1 or LBC 4.0.

Total Site Area

The area of land in the Project Boundary (referred to as Project Area in LBC 4.0 and Core Green Building Certification), minus any sensitive ecological areas.

Transgender

Transgender refers to those whose gender identity does not align with the sex or gender ascribed at birth. For further information regarding gender-based and other identities, visit Outright International or pflag.

Transit

Formal or informal multi-rider service that travels between regular, designated stops. Single-occupancy ride- hailing services are not considered transit.

Vernacular

Elements that are of, relating to, or characteristic of a period, place, or group. Domestic, native architecture, or other anthropogenic environments, giving a sense of belonging that is unique to the locality.

Volatile Organic Compound

A volatile organic compound (VOC) is any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. As gases, VOCs are emitted into the air from products or processes and are often harmful to human health and to the environment by themselves, as well as by reacting with other gases to form other air pollutants after they are in the air.

Water Balance

A numerical account of how much water enters and leaves a set boundary over a specified period.

Wetlands

Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Whole Facility Pathway

When the dollar value of the output of Living Product(s) exceeds 75% of the dollar value or weight of the facility's total output, a manufacturer must pursue the Whole Facility compliance path, which requires that the entire manufacturing facility meet the on-site requirements of LPC. Whole Facility compliance simplifies the certification process since Product Share of impact does not need to be calculated for each product individually. Every product produced at a facility that has pursued the Whole Facility path will be understood to be Net Positive within LPC for Energy, Water and Waste.

Wilderness

A wild and uncultivated region, as of forest or desert, largely undisturbed by human activity, that retains ecological functions and biodiversity characteristic of the ecosystem in its natural state; and/or a tract of land officially designated as wilderness and protected by the U.S. government. Within this definition, traditional practices of indigenous communities are not considered disturbance.

Women-Owned Business Enterprise (WBE)

WBE is a certification program administered by NWBOC for eligible businesses that are majority-owned by women. See https://www.nwboc.org/basicinfo.html for more information.

Wood Containing Product

Any product containing wood at greater than or equal to 5-10% by weight or characterized by obvious visual wood components. The wood portion of wood-containing products must be included in FSC wood calculations.

Worker Cooperative

A worker cooperative, also known as a cooperative-based organization, is an enterprise that involves one or more classes of membership, in which worker members participate in the profits, oversight, and often management of the enterprise using democratic practices, and in which there are clear criteria for becoming a worker-owner.

Working Port

A harbor town or city where ships may take on or discharge cargo.