



Designation: E2921 – 22

Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems¹

This standard is issued under the fixed designation E2921; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice provides criteria to be applied irrespective of the assessment (LCA) tool that is used when LCA is undertaken at the whole building level to compare a final whole building design to a reference building design.

1.2 The purpose of this practice is to support the use of whole building Life Cycle Assessment (LCA) in building codes, standards, and building rating systems by ensuring that comparative assessments of final whole building designs relative to reference building designs take account of the relevant building features, life cycle stages, and related activities in similar fashion for both the reference and final building designs of the same building.

1.3 The criteria do not deal with building occupant behavior, possible future changes in building function, building rehabilitation or retrofit, or other matters that cannot be foreseen or reasonably estimated at the design or permitting stage, or both where this practice applies.

1.4 Only environmental impacts and aspects of sustainability are addressed in this practice. The social and economic impacts and aspects of sustainability are not addressed in this practice.

1.5 This practice does not deal with basic LCA methodology, calculation methods or related matters that are covered in cited international standards.

1.6 This practice does not supersede or modify existing ISO standards for the application of LCA at the product level, nor does it address any of the following related applications:

1.6.1 Aggregation of building products Environmental Product Declarations (EPD) at the whole building level;

1.6.2 Rules for applying EPDs in a building code, standard, or rating system; and

1.6.3 Comparability of building product EPDs.

NOTE 1—ISO 14025 and ISO 21930 provide guidance on use and comparability of building products EPDs.

1.7 This practice does not specify the impact categories or sustainability aspects to be addressed in building codes, standards, or building rating systems and users of this practice conform to the impact category requirements specified in the applicable code, standard, or rating system.

1.8 The text of this standard contains notes that provide explanatory material. These notes shall not be considered as requirements of the standard.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.10 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[E631 Terminology of Building Constructions](#)

[E2114 Terminology for Sustainability Relative to the Performance of Buildings](#)

2.2 *Other Standards:*³

[ISO 21930 Sustainability in building construction – Environmental declaration of building products](#)

[ISO 14025 Environmental labels and declarations – Type III environmental declarations – Principles and procedures](#)

¹ This practice is under the jurisdiction of ASTM Committee E60 on Sustainability and is the direct responsibility of Subcommittee E60.01 on Buildings and Construction.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

ISO 14040:2006 Environmental Management – Life Cycle Assessment – Principles and Framework
 ISO 14044:2006 Environmental Management – Life Cycle Assessment – Requirements and Guidelines
 ISO 14050 Terminology

3. Terminology

3.1 For terms related to building construction, refer to Terminology **E631**.

3.2 For terms related to sustainability relative to the performance of buildings, refer to Terminology **E2114**.

3.3 For terms related to LCA (for example, product system, input, output) refer to ISO 14050 Terminology.

3.4 *Definitions of Terms Specific to This Standard:*

3.4.1 *building, n*—a shelter comprising a partially or totally enclosed space(s), erected by means of planned forces of forming and combining materials. **E631**

3.4.2 *building, v*—the act or process of construction. **E631**

3.4.3 *building product, n*—an item manufactured as an independent unit capable of being joined with or used with other elements for incorporation in buildings.

3.4.3.1 *Discussion*—Derived from definition of “building component” in Terminology **E631**.

3.4.4 *building service life, n*—the period of time after installation during which a building (or its parts) meet or exceed the performance requirement(s).

3.4.5 *characterization factor, n*—factor derived from a characterization model that is applied to convert an assigned life cycle inventory analysis result to the common unit of the category indicator.

3.4.5.1 *Discussion*—The common unit allows calculation of the category indicator result (ISO 14044).

3.4.6 *impact category, n*—a class representing environmental issue of concern to which life cycle inventory analysis results may be assigned.

3.4.7 *life cycle assessment (LCA), n*—compilation and evaluation of the inputs, outputs, and the potential environmental impacts of a product system throughout its life cycle.

3.4.8 *life cycle inventory analysis (LCI), n*—phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle.

3.4.9 *modular building, n*—a partially or completely assembled building that complies with applicable codes and regulations of the authority having jurisdiction at the time of construction and is constructed in a manufacturing facility using a modular construction process.

3.4.10 *operating energy, n*—energy loads that are related to building space conditioning, lighting, service water heating, or ventilation for human comfort.

3.4.11 *plug loads, n*—all energy use by devices, appliances, and equipment connected to convenience receptacle outlets during the building service life.

3.4.12 *process energy, n*—energy loads that are not directly related to building space conditioning, lighting, service water heating, or ventilation for human comfort, sometimes referred to as ‘process loads.’

3.4.13 *reference building design, n*—a building design created to be used as a benchmark, or baseline, against which a final design is compared.

3.4.14 *reference service life, n*—service life of a building product that is known or expected under a particular set, that is, a reference set of in-use conditions and that shall form the basis of estimating the service life under other in-use conditions.

3.4.15 *whole building life cycle assessment (whole building LCA), n*—life cycle assessment of the complete building enclosure, structural systems, interior walls, and interior finishes and trim of a building, which may include operating energy, but excludes furniture and attached cabinetry.

3.4.15.1 *Discussion*—More information on study boundaries of the LCA is included in **6.3**.

4. ISO Compliance

4.1 The procedures used for building product LCA shall be compliant with ISO 14040 and ISO 14044.

5. Significance and Use

5.1 This practice provides criteria that building design teams shall use to compare the environmental impacts associated with a reference building design and a final building design, including additions to existing buildings where applicable.

5.2 This practice deals specifically with material selection for initial construction, including associated maintenance and replacement cycles over an assumed service life, taking operating energy use into account if required or explicitly allowed under the applicable code, standard, or rating system.

6. Criteria

6.1 *Building and Product Service Lives:*

6.1.1 Unless otherwise specified by the applicable code, standard, or rating system, the building service life shall be no less than 75 years.

6.1.2 The same building service life shall be assumed for the reference building design and for the final design.

6.1.3 Product replacement schedules shall reflect the reference service lives for individual products or materials and the consequent number of replacements required over the assumed building service life.

6.1.4 When the reference service life of a product is less than the assumed building service life, the aggregate impacts associated with the number of product replacements necessary to equal the service life of the building shall be included. When the reference service life of the product is greater than the assumed building service life, the impacts associated with the product shall not be discounted to reflect the remaining product service life.