Standard Guide for General Principles of Sustainability Relative to Buildings[1]

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1. Scope

1.1 Sustainabilty has three types of general principles: environmental, economic, and social. This guide covers the fundamental concepts and associated building characteristics for each of the general principles of sustainability.

1.2 This guide distinguishes between ideal sustainability and applied sustainability. Ideally, human activities would not require making trade-offs among environmental, economic, and social goals. However, this guide recognizes that, in applying sustainability principles to buildings, decision makers must often balance opportunities and challenges associated with each of the general principles.

1.3 This guide identifies general methodologies associated with the decision-making process used in pursuing sustainability.

1.4 This guide addresses buildings individually and in aggregate (collectively).

1.4.1 The general principles identified in this guide are applicable to all scales of building projects, including: interior spaces, individual buildings and groups of buildings, infrastructure systems, and land use.

1.4.2 The general principles identified in this guide are applicable to all life-cycle stages of a building and its components, including: material extraction, product manufacturing, product transportation, planning, siting, design, specification, construction, operation, maintenance, renovation, retrofit, reuse, deconstruction, and waste disposal of buildings.

1.5 A variety of tools and standards exist that qualify and quantify impacts of buildings, building materials, and building methods in terms of one or more of the general principles of sustainability. It is not within the scope of this standard to recreate or replace these tools.

1.6 This guide does not provide direction as to the specific implementation of the general principles; nor does it provide direction as to the specific weighting of principles necessary for achieving balance.

1.7 Applying the principles in this guide will require professional judgment. Such judgment should be informed by experience with environmental, economic, and social issues as appropriate to the building use, type, scale, and location.

1.8 This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E631 Terminology of Building Constructions

E917 Practice for Measuring Life-Cycle Costs of Buildings and Building Systems

E2114 Terminology for Sustainability Relative to the Performance of Buildings

2.2 *ISO Standards:*[3]

ISO 14040 Life Cycle Assessment

3. Terminology

3.1 *Definitions:*

3.1.1 For terms related to building construction, refer to Terminology E631.

3.1.2 For terms related to sustainability relative to the performance of buildings, refer to Terminology E2114. Some of these terms are reprinted here for ease of use.

[1] This guide 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), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, http://www.iso.ch.

3.1.3 *biodiversity*, *n*—the variability among living organisms from all sources including: terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.

3.1.4 *deconstruction*, *n*—disassembly of buildings for the purpose of recovering materials.

3.1.5 *ecosystem*, *n*—community of biological organisms and their physical environment, functioning together as an interdependent unit within a defined area.

3.1.5.1 *Discussion*—For the purposes of this definition, humans, animals, plants, and micro-organisms are individually all considered biological organisms.

3.1.6 *green building*, *n*—a building that provides the specified building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after its construction and specified service life.

3.1.6.1 *Discussion*—A green building optimizes efficiencies in resource management and operational performance; and, minimizes risks to human health and the environment.

3.1.7 *indoor environmental quality (IEQ)*, *n*—the condition or state of the indoor environment.

3.1.7.1 *Discussion*—Aspects of IEQ include but are not limited to qualitative and quantitative measures for thermal comfort, light quality, acoustic quality and air quality.

3.1.8 *life-cycle assessment (LCA)*, *n*—a method of evaluating a product by reviewing the ecological impact over the life of the product.

3.1.8.1 *Discussion*—At each stage, the product and its components are evaluated based upon materials and energy consumed, and the pollution and waste produced. Life stages include extraction of raw materials, processing and fabrication, transportation, installation, use and maintenance, and reuse/recycling/disposal. ISO 14040 defines LCA as the compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life-cycle.

3.1.9 *life-cycle cost (LCC) method*, *n*—a technique of economic evaluation that sums over a given study period the costs of initial investment (less resale value), replacements, operations (including energy use), and maintenance and repair of an investment decision (expressed in present or annual value terms).

3.1.9.1 *Discussion*—LCC is distinct from LCA in that LCA is an environmental review methodology and LCC is an economic review methodology.

3.1.10 *non-renewable resource*, *n*—resource that exists in a fixed amount that cannot be replenished on a human time-scale.

3.1.10.1 *Discussion*—Non-renewable resources have the potential for renewal only by the geological, physical and chemical processes taking place over hundreds of millions of years. Non-renewable resources exist in various places in the earth's crust. Examples include iron ore, coal, and oil.

3.1.11 *perpetual resource*, *n*—a resource that is virtually inexhaustible on a human time scale.

3.1.11.1 *Discussion*—Examples include solar energy, tidal energy, and wind energy.

3.1.12 *renewable resource*, *n*—a resource that is grown, naturally replenished, or cleansed, at a rate which exceeds depletion of the usable supply of that resource.

3.1.12.1 *Discussion*—A renewable resource can be exhausted if improperly managed. However, a renewable resource can last indefinitely with proper stewardship. Examples include: trees in forests, grasses in grasslands, and fertile soil.

3.1.13 *reuse*, *v*—using a material, product or component of the waste stream in its original form more than once.

3.1.14 *sustainability*, *n*—the maintenance of ecosystem components and functions for future generations.

3.1.15 *sustainable building*, *n*—see **green building**.

3.1.16 *sustainable development*, *n*—development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *carbon sinking*, *n*—an approach to offset carbon dioxide emissions through the absorption potential of forests and other vegetation.

3.2.2 *Design for the Environment (DfE)*, *n*—the systemic consideration of design performance with respect to environmental, health, and safety objectives over the full product life-cycle.

3.2.3 *external costs/benefits*, *n*—economic impact associated with the action of a party that is not borne by that party, but rather by a third party or parties.

3.2.3.1 *Discussion*—This is intended to include economic costs and benefits associated with environmental and social impacts arising out of the action.

3.2.4 *green roof system*, *n*—an assembly that supports an area of planting/landscaping, built up on a waterproofed substrate at any level that is separated from the natural ground by a human-made structure.

3.2.5 *heat island effect*, *n*—a phenomenon in which urban air and surface temperatures are higher than nearby rural areas due to the replacement of natural land cover with pavement, buildings, and other infrastructure.

4. Significance and Use

4.1 Every building and building product has environmental, economic, and social impacts. These impacts occur at all life-cycle stages in multiple ways and on local, regional, and global scales. It is imperative to understand the nature of these impacts and their relationship to the general principles of sustainability in order to address the opportunities and challenges they present in buildings.

4.1.1 Buildings impact the environment. In order to advance sustainability, it is necessary to identify environmental impacts, mitigate negative environmental impacts, and promote positive environmental impacts.

4.1.2 Buildings have economic impacts. In order to advance sustainability, it is necessary to quantify and optimize life-cycle costs/benefits and external costs/benefits to the greatest extent possible.

4.1.3 Buildings impact society. In order to advance sustainability, it is necessary to identify the health, safety, and welfare impacts, and to contribute to a positive quality of life for current and future generations.