STANDARDS FOR SUSTAINABLE CONSTRUCTION

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I. Standards, standardization bodies, European standardization

Standards

**European Standard (EN)** After its publication, a European Standard must be given the status of **national standard** in all CEN member countries.

**Harmonized Standard (hEN)** on the basis of a request /mandate/ made by the European Commission in support of its policies and legislation.

**International standard**

Standardization bodies:

The European Committee for Standardization (CEN)

The European Committee for Electrotechnical Standardization (CENELEC)

The European Telecommunications Standards Institute (ETSI)

International Organization for Standardization (ISO)
Relationship between Directives and standards

European Union Directives define ‘Essential Requirements' (e.g. related to health, safety and environment) that products must meet before they can be placed on the European market. The 'Essential Requirements' are mandatory.

Within the framework of the “New Approach” European Standards are used to provide presumption of conformity to 'Essential Requirements' of the Directives.

New Approach directives are total harmonization directives: the provisions of these directives supersede all corresponding national provisions. Harmonization is limited to Essential Requirements.

After two decades of operation, Under an EU Council and Parliament Decision (768/2008/EC), the 'New Approach' has been enhanced and extended to all sectors and integrated in the “New Legislative Framework for the marketing of products”, known as 'the goods package'.
European standardization is a very effective policy tool for the EU.

- to ensure a proper functioning of the Single market (to remove barriers to trade at European and international level.),
- to ensure a high level of consumer and environmental protection,
- more innovation and social inclusion,
- to increase competitiveness of enterprises.

A Strategic vision for EU Standards.

Moving forward to enhance and accelerate the sustainable growth of the European economy by 2020 COM(2011)311)

- Standardization processes should be accelerated, simplified and modernized.
- Standardization will play an important role in supporting the Europe 2020 Strategy for smart, sustainable and inclusive growth.
- European Standards are drafted in a global perspective. CEN has signed the 'Vienna Agreement' with the International Organization for Standardization (ISO), through which European and international standards can be developed in parallel.
II. Sustainable construction

Sustainable construction has in recent years been a major focus of attention.

By Sustainable Construction, we mean: the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a whole building’s life-cycle.

Sustainability is considered from an ecological, economical, social, functional and technical point of view.

Sustainable construction is the responsible approach towards environment and the reasonable spending of limited resources.

In this respect chartered engineers and consultants carry special responsibility. It is their duty to produce plans in conformity to the principles of sustainable construction and offer long-term technical and economically optimal decisions.
European policy and legislative developments

✓ Sustainable Development Strategy of the European Union (EU SDS) - a framework for a long-term vision of sustainability. /2009 Review of EU SDS/

EU SDS key objectives:
- Environmental protection        Social equity and cohesion
- Economic prosperity                Meeting international responsibilities

✓ EUROPE 2020 - A strategy for smart, sustainable and inclusive growth

✓ Lead Market Initiative for Europe /LMI/

Sustainable construction has been chosen as one of the six lead markets

This Market area includes sustainable solutions in residential and non-residential buildings and in infrastructure constructions.

- The sector is responsible for 30% of the global CO2 emissions.
- Energy efficiency in buildings - a key for the transformation of the EU’s energy system.
- Impact on natural resources (energy, water and materials)
  - More than 50% of all materials from earth are transformed into construction materials and products.
  - Impact on users’ convenience and welfare (accessibility, safety & security, indoor air quality, etc.).

As a consequence of the financial and economic crisis, building and infrastructure work fell by 16% between January 2008 and April 2012 across the EU-27

Strategy for the sustainable competitiveness of the construction sector and its Enterprises (31.7.12) / Eurocodes play a key role to strengthen the competitiveness of the sector /
LMI for sustainable Construction sector aims at:

✓ stimulating innovation
✓ improving the sustainability of construction by addressing the:

construction topics in LMI for sustainable construction

- Legislation
- Standardization, Labelling, Certification
- Green Public Procurement
- Life-cycle Assessment in Construction
- Life-cycle Costing in Construction
- Energy Efficiency in Buildings

Standardization has been identified as a key contributor to the LMI
Directives affecting environment and the field of construction

- Ecodesign Directive (energy related products)
- Energy Labelling Directive (energy related products)
- EcoLabelling Regulation
- EcoLabel for Buildings (first priority office buildings)
- Green Public Procurement (GPP)
- Construction and Demolition Waste (Waste Framework Directive)
- Resource Efficiency Roadmap
- Construction Products Regulation (CPR) → **obligatory CE marking of CPs 1th July 2013**
  - CPR repeals the Directive 89/106/EEC for construction products (CPD)
  - The Declaration of Performance (DoP: the key concept in the CPR)
  - New: Basic Requirement for Construction Works (BRCW 7) Sustainable use of natural resources
CEN construction portfolio

✓ Performance-based Harmonized product standards (more than 400 (hEN) standards in response to the CPD).

✓ Standards dealing with matters of design e.g. the structural Eurocodes, which provide a common European approach

✓ In parallel: Standards of CEN TC 350 - the response of CEN to the new challenges, firstly with specific environmental concerns and then with the wider subject of sustainability.

III. CEN TC 350 / ISO TC 59 SC 17

CEN TC350 “Sustainability of Construction work “ (Mandate M350 EC) - late 2005.

The work of the Technical Committee 350 (TC350) has been divided into six working groups:

CEN/TC 350/TG “Framework”
CEN/TC 350/WG1 “Environmental performance of buildings”
CEN/TC 350/WG2 “Building life cycle description“ (suspended in July 2009)
CEN/TC 350/WG3 “Product Level” (EPDs, communication formats etc.)
CEN/TC 350/WG4 “Economic Performance Assessment of Buildings”
CEN/TC 350/WG5 “Social Performance Assessment of Buildings”
CEN/TC 350/WG6 “Civil Engineering works” /new-November 2011/
CEN/TC350 Standards package

CEN/TC350 standards provide the horizontal EN-standardized methodology and indicators for the sustainability assessment of buildings using a life cycle approach in a transparent way.

The standards apply to all types of buildings, the assessment of the environmental, social and economic performance, taking into account technical characteristics and functionality of new buildings over their entire life cycle, and of existing buildings over their remaining service life and end of life stage.


TC350 standards are developed in accordance with the international framework of ISO standards (prevention of potential technical trade barriers, internal and international market).
# Standards for Sustainable Construction

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<td>EN 15942 Comm. Format B-to-B</td>
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**NOTE** At present, technical information related to some aspects of social and economic performance are included under the provisions of EN 15804 to form part of EPD.
Framework level Standards

A general framework document (EN 15643-1) and set of three framework documents based on sustainable pillars (ecology /EN 15643-2/, economic /EN 15643-4/ and social /EN 15643-3/)

**EN 15643-1:2010**  Sustainability of construction works - Sustainability assessment of buildings - General framework

This Framework Standard provides the **general principles and requirements for the assessment of buildings.**

**general principles:**

✓ European system for the assessment with the **performance based approach** in terms of:
  - Environmental performance (Mandate M/350)
  - Social performance
  - Economic performance

**Performance assessment at building level**

*All three dimensions of sustainability in an integrated assessment of the building's performance including technical and functional performance/*
Life cycle assessment approach (LCA)
The assessment at any stage of the construction project life cycle (product stage, construction stage, use stage and end of life stages of the building). Life cycle thinking on product, building and framework level.

Performance aspects and impacts can be expressed with Quantifiable indicators
CEN/TC350 (EN 15978 and EN 15804) provides the European standardized basket of indicators for sustainable construction Assessment for building and EPD for product. If a specific indicator is not included in the assessment, it is marked as “INA” (Indicator Not Assessed).

The standards do not provide valuation methods and do not set levels, classes or benchmarks for any measure of performance. I only deal with the analytical part of the building assessment methodology.
Valuation methods, levels, classes or benchmarks may be prescribed in the requirements for environmental, social and economic performance in the client’s brief, national building regulations, national application standards, building assessment and certification schemes, etc.

Objectives of assessment of the building
understanding the impact of the building and its site, make decisions and choices.
Modularity – impacts and aspects used to measure performance are recorded in “Information modules” at product and building level in the building life cycle.

Requirements for the assessment of buildings:

Object of assessment - The building, including its foundations and external works within the area of the building site.

Type of data and data sources in the assessments

- Environmental, Social and Economic Performance Requirements to the building
- Technical and Functional Requirements to the building: / structural safety, fire safety, indoor air quality, security, adaptability, energy efficiency, accessibility, recyclability, maintainability, durability and service life/.
- data sources - client’s brief , regulatory requirements, the project specification

Functional equivalency - Functional equivalent of a building

- derived from the technical and functional requirements
- include information on: type and use (required functions); area and/or volume; pattern of use (e.g. occupancy); design life and reference study period; location of the building

- forms the basis for comparison (comparison of the results only at building level; identical Functional equivalent for the individual dimensions of sustainability).
Requirements for communication

- **Results of the assessment** - in two main groups/impacts specific to building life cycle excluding operational energy and water use, impacts specific to operational energy and water use.

- **Functional equivalent**

- **Demands for environmental, social and economic performance** from client’s brief and/or regulations

- **Declared technical and functional performance**
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Concept of sustainability assessment – CEN/TC 350

Diagram showing the concept of sustainability assessment with various components and indicators.
Building level Standards

EN 15978:2011 Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method

EN 15978 specifies the calculation method, based on Life Cycle Assessment (LCA).

LCA - all stages of the building life cycle, based on data obtained from the EPD "information modules" (EN 15804). The assessment - all building related construction products, processes and services, used over the life cycle of the building.

The standard gives:

- the description of the object of assessment;
- the system boundary that applies at the building level;
- the procedure to be used for the inventory analysis;
- the list of indicators and procedures for the calculations of these indicators;
- the requirements for presentation of the results in reporting and communication;
- and the requirements for the data necessary for the calculation.

Under development:
pr EN 16309 - Assessment of social performance of buildings-Methods
WI 00350017 - Assessment of economic performance of buildings-Methods
Product level Standards

EN 15804:2012 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
/Relevant ISO standard - EPD of Build. Products (ISO 21930)/

The core Product Category Rules (PCR):

- Defines the parameters to be declared, the way in which they are collected and reported
- Describes which stages of a product's life cycle are considered in the EPD and which processes are to be included in the life cycle stages
- Defines rules for the development of scenarios
- Includes the rules for calculating the Life Cycle Inventory and the Life Cycle Impact Assessment

EPD based on core rules, all indicators for product stage, optional – for other stages

EN 15942:2011 Sustainability of construction works - Environmental product declarations - Communication format business-to-business
The aim - to ensure a common understanding.

CEN/TR 15941:2010 Sustainability of construction works - Environmental product declarations – Methodology for selection and use of generic data
The aim supports the development of EPD
## LIST OF INDICATORS / CEN TC 350

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<td>greenhouse effect</td>
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<td></td>
<td>destruction of the stratospheric ozone layer</td>
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<td>eutrophication photochemical</td>
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<td>formation of tropospheric ozone</td>
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<th>Input indicators of material and energy use</th>
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<tr>
<td>use of renewable resources other than primary energy</td>
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<tr>
<td>use of non-renewable primary energy</td>
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<td>use of renewable primary energy resources</td>
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<td>use of fresh water.</td>
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<th>Output indicators for secondary raw materials, waste and energy exports</th>
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<tr>
<td>materials for recycling</td>
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<tr>
<td>materials for energy recovery</td>
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<tr>
<td>Non-hazardous waste to landfills</td>
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<td>hazardous waste to landfills (except radioactive waste)</td>
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<td>radioactive waste to landfills</td>
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<td>Quality of water for use in buildings</td>
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<td>Humidity</td>
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<td>Indoor air quality</td>
<td>Security against interruptions of utility supply (e.g. electricity, water, district heating...)</td>
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<td>Acoustic performance</td>
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<td>Visual comfort</td>
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International Standardization

ISO TC59 SC17 - Building construction –Sustainability in building construction

ISO/TC59/SC 17 - standards for assessment of sustainability in the building sector
ISO/TC59/SC 14 -standards for service life planning of buildings

Assessment of sustainability of buildings is based on life cycle thinking, it is impossible to assess env or eco performance of a building without having scenarios on the use and durability of products incorporated in the building, information on the service life of building products.

CEN TC350 Standards are based, wherever possible, upon the ISO / SC17 and ISO SC 14 standards.

- ISO and CEN have a common assessment structure, based on the three pillars of SD – ENV, ECON, SOC aspects (equal importance), meeting requirements for technical and functional performance of the construction works, in regard to the whole life cycle of building (LCA) - basic tool for assessment LCA

- Up to now only environmental indicators clearly suggested. Social and economic indicators-only recommendations.

- The set of Indicators of ISO for Environmental Performance assessment is much broader based.

- The European standardization system recognizes the primacy of international standards. / by means of the Vienna agreement, which set out the framework for cooperation/
### The standards of SC17

<table>
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<tr>
<th>Environmental aspects</th>
<th>Economic aspects</th>
<th>Social aspects</th>
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</table>
| **Methodical basics** | ISO 15392: Sustainabilty in building construction – General principles  
| **Building products** | ISO 21930: Environmental declaration of buildings products |  |
European initiatives, concerning implementation of standards for products and sustainability assessment

- Construction Sector Network Project Environment - CSNPE /a forum for discussion and development of environmental topics/

CSNPE objectives:

- To focus on the consistency between EPD standards from CEN/TC 350 (EN 15804) and product standards
- To identify the possible guidelines for products CEN/TCs to provide information for EPDs and to help manufacturers to apply EPDs

CEN contribution to the EC LMI on sustainable construction

BT Working Group: BT/WG 206 - to identify the possibilities for improving the coherence, consistency and comprehensiveness of the portfolio of construction standards in the interests of sustainable construction.

- 7 Recommended actions and a strategies for meeting the Construction Performance Requirements
- Action 2 on potential needs for new process standards
- Action 5 on guidance for implementing standards from TC 350 in product standards.
/industry concerns EPDs/. 
more coordination of the various initiatives and policies at the various levels of the European Commission in many areas (with regard to Green Public Procurement, eco-labeling, ecodesign, recycling, waste management).

holistic approach from inside the Commission is needed. The Commission should talk with one voice, or try at least to communicate the full picture relating the ongoing EU initiatives.
IV. National building evaluation/certification tools. European and International initiatives/projects

- The CEN/TC350 standards provide a consistent framework for sustainability assessment of buildings.

- These standards do not provide valuation methods and do not set levels, classes or benchmarks for any measure of performance. They are tools that can be used within existing national schemes providing a more consistent basis for the ‘judgements’ on performance that need to be made. The Standards are flexible and provide room for local adjustments.

- A number of well-established European rating tools for buildings are applying LCA as a methodology for assessing the environmental performance of buildings, but different indicators. (Green Building Councils working together).

- The Sustainable Building Alliance (SBA) is conducting a pilot study with the goal to apply common indicators for assessing the sustainability performance of buildings in Europe and worldwide based on the European Standards of CEN TC 350.
Four dominant sustainability certification systems for buildings:

**BREEAM** - British - BRE Environmental Assessment Method

**BNB/DGNB** – German assessment systems - Bewertungssystem Nachhaltiges Bauen (BNB). DGNB (Deutsches Gütesiegel Nachhaltiges Bauen = German Seal for Sustainable Building), Most closely based on CEN TC 350 standards

**HQQE** - The French building evaluation and certification tool for buildings.

**LEED** - US- Leadership in energy and environmental design.

(Bulgaria: the Bulgarian Green Building Council (BGBC) certification scheme, based on the German DGNB’s scheme, founded 2009 – initiated by private persons, companies (members), and other industry representatives, used in a small number of projects.)

These buildings tools:

- strategy tools, communication tools
- not interconnected, not comparable - different understanding about indicators, measuring methods, benchmarking criteria and weighing methods

Harmonization is needed.

- CEN/TC 350 tools - at least everybody can speak the same technical language.
- Different Green Building certification schemes have to be comparable
- There should be one European system for the open European market.

The EC currently supports the development of instruments for this.
Projects supported by the European Commission

LEnSE project (FP6/EC) – Methodology Development towards a Label for Environmental, Social and Economic Buildings – European research project, supported by the European Commission within the Sixth Framework Program and responds to the growing need for assessing a building’s sustainability performance.

Perfection project (FP7/EC)- European Coordination Action for Performance Indicators for Health, Comfort and Safety of the Indoor Environment

SuPerBuildings (FP7/EC) “Sustainability and Performance assessment and Benchmarking of Buildings”

OPEN HOUSE (FP7/EC) “Benchmarking and mainstreaming building sustainability in the UE based on transparency and openness from model to implementation”

The main objective of OPEN HOUSE is to develop and to implement a common European transparent building assessment methodology.

The OPEN HOUSE project is closely linked to the SuPerBuildings project.

OPEN HOUSE is now at the final stage of developing the building sustainability assessment methodology, mainly based on the CEN TC 350 Standards.

The first OPEN HOUSE methodology guidelines will be implemented in 68 office building cases across Europe. / OPEN HOUSE Assessment Guidelines OPEN HOUSE Platform./
The Commission will propose approaches to mutual recognition or harmonization of the various existing assessment methods, also with a view to making them more operational and affordable for construction enterprises, the insurance industry and investors. This initiative will build on existing platforms, such as the CEN Construction Network, guides such as the JRC’s guide to Life Cycle Thinking and Assessment, and European research projects such as SuperBuildings and Open House.