


TREES

Training for Renovated Energy Efficient Social housing

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Intelligent Energy  Europe

Section 2 Tools

2.4 Sustainability assessment

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Introduction to the topic.

Sustainability in building construction

“Sustainability in building construction” is a topic that can include many environmental approaches.

The following is an introduction to international standards, frameworks and guidelines for sustainable assessments methodology.

Some tools will be presented

Content

- Introduction
- Principles for assessment of environmental performance
- Methods and tools
- Examples
 - GB tool
 - Eco-homes
- Addresses

Principles for assessment of environmental performance of buildings

The aim of an sustainable assessment process of a building is to examine the ability of a building to contribute to sustainable development with regard to the environmental dimension.

It also aims to communicate and/or to improve the environmental performance of building.

Goals can be defined and achieved by supporting the decision making process in design, construction, transfer, operation, refurbishment and demolition of buildings.

An improvement of the environmental performance of a building requires appropriate operation of the building over its lifetime.

(ISO /p dts 21931)

Tools or guides should be used in planning phase to identify :

- ▶ **Measures that are necessary to improve the buildings to a defined level of sustainability**
- ▶ **Evaluation of comparable actions**
- ▶ **Inform the planners and/or owners about the consequences of improving environmental quality of the buildings.**
- ▶ **Give the building a “ green” certificate or labelling document. Certificate awarded can be used for promotional purposes.**

Issues for environmental assessment

The issues shall include:

- ▶ **Generic environmental impacts**
- ▶ **Building environmental aspects**
- ▶ **Issues related to energy and mass flows**
- ▶ **Issues related to indoor environment**
- ▶ **Issues related to the local environment**
- ▶ **Issues related to the management process**
- ▶ **Issues related to life cycle stages**

(ISO /PDTS21931)

Generic environmental impact

▶ Climate change

- Greenhouse gas emission

▶ Depletion of natural resources

- fossil fuel depletion
- minerals extraction
- water abstraction

▶ Pollution

- Ozone depletion
- Acidification of land and water sources
- Human toxicity
- Ecotoxicity
- Eutrophication
- Photo-oxidants creation potential

▶ Health and well-being

- comfort
- health
- quality of life

▶ Land and ecology

- Biodiversity
- Ecological value
- Land take
- Landscape

Typical Building Environmental Aspects

- ▶ **Materials choices and related LCI data**
- ▶ **Energy systems (including envelope)**
- ▶ **Lighting systems**
- ▶ **Ventilations systems**
- ▶ **Outdoor spaces**
- ▶ **Water systems and drainage**
- ▶ **Acoustic systems**
- ▶ **Flexibility**
- ▶ **Durability**
- ▶ **Deconstructability**
- ▶ **Recyclability**
- ▶ **Maintainability**
- ▶ **Security Systems**
- ▶ **Fire protection systems**

Range of sustainability issues to be included.

- ▶ Based on a survey made in a EU-project called LEnSE specialists gave priority to the following issues:
- ▶ Environmental issues:
 - Resource use
 - Climate change
 - Biodiversity
 - Air quality
- ▶ Social issues.
 - Well being
 - User comfort
 - Occupants` health

Typical issues related to energy and mass flows

Material use differentiated Primary energy use

into :

- Use of non-renewable material resources
- Use of renewable material resources
- Use of substances classified as hazardous or toxic according to national or international regulation

differentiated into :

- Use of fossil fuel
- Use of renewable primary energy
- Waste production differentiated into
 - Reuse/recycling or energy recovery
 - Disposal
 - Water use
- Emissions to air, water, and soil

Typical issues related to the indoor environment

- ▶ indoor air quality (e.g.. quality of ventilation, emitted hazardous substances, odour conditions etc.)
- ▶ hygro-thermal conditions (air temperature, humidity etc.)
- ▶ *visual conditions (glare, access to daylight and exterior views, quality of light)*
- ▶ acoustic conditions
- ▶ quality of water
- ▶ intensity of electromagnetic fields
- ▶ radon concentration

Sustainable Assessment- and Design tools

- ▶ Compared with LCA- tools, the sustainable assessment tools put focus on environmental qualities, also include factors as comfort, health, illumination, amenities in housing and surroundings. Sustainable assessment tools provide a more global rating system than LCA.
- ▶ No international harmonisation have been done between different tools. Some tools are for experts with high competence, others are user-friendly and suitable for practical implementation in the design phase.
- ▶ GBTool will be presented as an example of assessment tool for sustainable buildings.

Sustainable performance assessments requires knowledge of:

- ▶ energy use, type's and mix
- ▶ water consumption
- ▶ materials; types, quantities, supply chain and logistics, service life
- ▶ life expectancy
- ▶ servicing, maintenance, repair and refurbishment
- ▶ scenarios for the end of life including demolition / deconstruction / recovery / recycling / final disposal
- ▶ occupants behaviour described by scenario of use
- ▶ building's location and its influence on user transportation
- ▶ building management operations that affects energy consumption and/or water consumption, waste
- ▶ production, including commissioning of buildings systems
- ▶ infrastructure; drainage and transport

Source: ISO/PDTS 21931

GB Tool – an example on assessment method based on rating- and weighting system.

- ▶ GBTool is the software implementation of the Green Building Challenge (GBC) assessment method that has been under development since 1996 by a group of more than a dozen countries. The methodology have continuously been under development**
- ▶ The generic software can be modified by national teams to suit their local conditions**
- ▶ The system is a framework, not a simulation model. Users are expected to use other software tools to simulate energy performance, estimate embodied energy and emissions, predict thermal comfort and air quality etc.**

List of some issues covered by GBTool

Resource Consumption	Net consumption of delivered energy Net consumption of land Net consumption of potable water Net consumption of materials
Environmental Loadings	Emission of greenhouse gases Emission of ozone-depleting substances Emission of gases leading to acidification Solid wastes Liquid wastes Impacts on Site and Adjacent Properties

Performance criteria and weighting

- ▶ **The relative importance of criteria for environmental performance must lead to the use of a weighting system for aggregation**
- ▶ **The weighting system varies depending on national, regional or local contexts and conditions and should provide a method for addressing such variances.**
- ▶ **The underlying data of the method shall be documented.**
- ▶ **The weighting factors shall appear explicitly in the assessment method documentation.**

The weighting process need benchmarking to common practice or mean local values.

B Energy and Resource Consumption		2,6	21 %	0,5
B1 Total Life Cycle Non-Renewable Energy		4,7	32,8%	1,5
B1.1 Predicted non-renewable primary energy embodied in construction materials		Active	25,0%	
Intent	<i>To minimize the embodied primary energy used in the building, annualized over the estimated lifespan of the building.</i>	Applicable phases (Active if green)		
Indicator	Estimate of embodied primary energy used for structure, envelope (excl. glazing), and major interior components, as determined by a program designed to estimate embodied energy and emissions through Life Cycle Analysis; also, estimate of lifespan.	Dsn		
Information sources and notes	Note that minimization of embodied energy may not always be optimal. For example, the greater embodied energy associated with high thermal mass will, in most cases, reduce operating energy, and the total net lifecycle energy could then be reduced.	Occupancies used		
Applicability	For Total building, all sizes.		Office	Retail
Office				
Relevant Design information	Office Occupancy net area =4400 m2	MJ/m2 per yr.	Perform. Score	Wtd. Score
	Estimated building lifespan (see Basic worksheet) =50			
Design value (predicted)	The embodied energy used in the structure and building envelope of the Office Occupancy, as determined an acceptable LCA-based estimating method, is :			
Negative		88		-1
Acceptable practice	The embodied energy used in the structure and building envelope of the Office Occupancy, as determined an acceptable LCA-based estimating method, is :	80		0
Good Practice		56		3
Best Practice		40		5

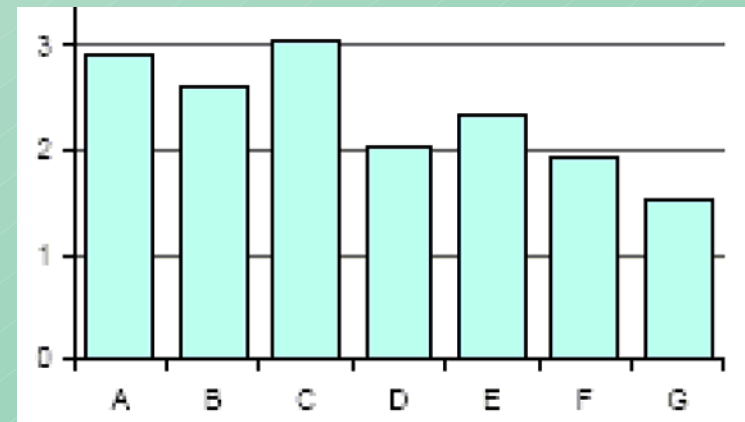
Quick overview of the weighting system and presentation of performance results.

In the weighted summation approach, the score is calculated by first multiplying each value by its appropriate weight followed by summing of the scores for all criteria. If the scores are measured on different measurement scales, they must be standardized to a common dimensionless unit before weighted summation can be applied.

Example on performance results based on GBTool-weighting system

<i>To see a full list of issues go to the Issues worksheet; to alter weights, go to the Weights worksheets.</i>		
	Active Weights	Weighted scores
A Site Selection, Project Planning and Development	13 %	2,9
B Energy and Resource Consumption	21 %	2,6
C Environmental Loadings	21 %	3,1
D Indoor Environmental Quality	17 %	2,0
E Functionality and Controllability of Building Systems	8 %	2,3
F Long-Term Performance	8 %	1,9
G Social and Economic aspects	13 %	1,5
Total weighted building score		2,4

0= Acceptable practice
3_ Good practice
5= Best practice



The method is flexible (List of other issues covered by GBTool)

- ▶ **Service Quality**
 - ▶ Air Quality and Ventilation
 - ▶ Day lighting, Illumination and Visual Access
 - ▶ Noise and Acoustics
 - ▶ Flexibility and Adaptability
 - ▶ Maintenance of Performance
 - ▶ Controllability of Systems
 - ▶ Construction Process Planning
 - ▶ Performance Tuning
 - ▶ Building Operations Planning
 - ▶ Transportation Management Planning
 - ▶ Life cycle costs
 - ▶ Capital Costs
 - ▶ Operating and maintenance costs
- ▶ **Pre-Operation Planning**
- ▶ **Economics**

EcoHomes –environmental rating for homes.(UK)

- ▶ **EcoHomes is the homes version of BREEAM. It provides an authoritative rating for new, converted or renovated homes, and covers both houses and apartments.**
- ▶ **EcoHomes balances environmental performance with the need for a high quality of life and a safe and healthy internal environment.**
- ▶ **www.ecohomes.org**

Goals in a planning process.





- ▶ Lowering the energy demand and the consumption of operating materials
- ▶ Utilization of reuseable or recyclable building products and materials
- ▶ Extension of the lifetime of products and buildings
- ▶ Risk-free return of materials to the natural cycle
- ▶ Comprehensive protection of natural areas and use of all possibilities for space-saving construction

7 performance area:

- ▶ Operational energy and carbon dioxide (CO₂) issues
- ▶ *Water* consumption and water efficiency
- ▶ *Pollution*: Air and water pollution issues
- ▶ Materials
- ▶ Transport-related CO₂ and location-related factors
land use.
- ▶ Ecological value conservation and enhancement of the site
materials
- ▶ *Health and well-being*: Indoor and external issues

Weightings and rating system

Credits are awarded in each area according to performance. A set of environmental weightings then enables the credits to be added together to produce a single overall score. The building is then rated on a scale of PASS, GOOD, VERY GOOD or EXCELLENT, and a certificate awarded that can be used for promotional purposes.

	Rating	Score (%)
	Pass	36
	Good	48
	Very Good	58
	Excellent	70

Some Sustainable Assessment Tools available on internet

LEGEP	www.legep.de
EcoHomes	www.ecohomes.org
EcoProfile	http://www.byggsertifisering.no/oekoprofil/
Eco Effect	www.ecoeffect.org
EcoBau	www.eco-bau.ch
GB Tool	www.greenbuilding.ca
LEED	www.nrdc.org/buildinggreen