Joint Research Centre

Institute for Prospective Technological Studies (IPTS)

European Commission’s Helpdesk on GPP - Webinar conference on

Sustainable Construction and Public Procurement

Approach to the EU GPP criteria for office buildings

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and Elena Garbarino

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Criteria development step by step

1. Stakeholder consultation
   - Product scope and definition
   - Economic and market analysis
   - Technical analysis
   - Improvement potential

2. Stakeholder feedback
   - Revised criteria proposal
   - Preliminary report
   - Policy analysis

3. Stakeholder feedback
   - Final criteria proposal
   - Draft criteria proposal
   - Technical background

PRELIMINARY REPORT

1st AHWG

2nd AHWG
Research on environmental performance of office buildings

Introduction

Environmental impacts of office buildings in future in comparison to other types of buildings are important due to:

- **Office buildings consume 10-20 times more energy than residential buildings** (kWh/m²a)

- Comfort conditions (well-being) are becoming more and more demanding related to energy consumption and indoor air quality
**Definition of office buildings**

**Office buildings** are those which contains **administrative, financial, technical and bureaucratic activities as core representative activities.** The office area must make up a vast majority of the total buildings gross area dedicated to purpose providing a service to other companies or to individuals.

Therefore, it could have associated other type of spaces, like meeting rooms, training classes, staff facilities, technical rooms, etc. **Excluded from this definition are parking areas that are not counted in this total buildings gross area.**

**Total estimated office building market**

- **20% of non-residential buildings is estimated as office buildings**
- They are concentrated in
  - moderate climate zones
  - as large buildings
  - erected before 1975

**Public office buildings** are estimated around **15% of the total office market**

⇒ significant importance for GPP criteria
Classification base on climate zone

<table>
<thead>
<tr>
<th>Climate zone</th>
<th>CDD below 345 and HDD above 4001</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Estonia, Latvia, Lithuania, Sweden, Finland</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Belgium, Ireland, Luxemburg, UK, The Netherlands, Slovenia, Austria, Hungary, Bulgaria, Germany, Slovakia, Denmark, Romania, Czech Republic, Poland</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>Malta, Portugal, Spain, Italy, France</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Cyprus, Greece</td>
<td></td>
</tr>
</tbody>
</table>

Office building stock A1
- New = 42.000
- Renovated = 162.000
- Existing = 722.000
- Total = 926.000

Office building stock B1
- New = 876.000
- Renovated = 1,208.000
- Existing = 6,626.000
- Total = 8,711.000

Office building stock C1
- New = 961,000
- Renovated = 1,600,000
- Existing = 5,632,000
- Total = 8,498,000

Office building stock C2
- New = 30,000
- Renovated = 192,000
- Existing = 761,000
- Total = 984,000

Office building stock C2
- New = 30,000
- Renovated = 192,000
- Existing = 761,000
- Total = 984,000
Classification base on building age

<table>
<thead>
<tr>
<th>Age</th>
<th>New buildings</th>
<th>Existing buildings</th>
<th>Renovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Constructions that result in a new stand alone structure or extension to an existing structure. Ecolabel/GPP criteria for the design phase are the most important ones</td>
<td>Building or structure that already exists. It also includes maintenance and operation activities</td>
<td>Construction that results in the fundamental remodelling or adaptation of existing elements of the building envelope, structure and renewal of key building services Ecolabel/GPP criteria should be focused on maintenance and use phase</td>
</tr>
</tbody>
</table>

### Table 3: 2011-2021 estimate of existing, to be renovated and new office buildings. Data in thousands

<table>
<thead>
<tr>
<th>Climatic zone</th>
<th>Existing</th>
<th>To be renovated</th>
<th>Newly built</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2021</td>
<td>Δ%</td>
<td>2011</td>
</tr>
<tr>
<td>A1</td>
<td>722</td>
<td>655</td>
<td>-9,28</td>
<td>162</td>
</tr>
<tr>
<td>B1</td>
<td>6,626</td>
<td>6,535</td>
<td>-1,37</td>
<td>1,208</td>
</tr>
<tr>
<td>C1</td>
<td>5,532</td>
<td>6,077</td>
<td>9,85</td>
<td>1,600</td>
</tr>
<tr>
<td>C2</td>
<td>761</td>
<td>707</td>
<td>-7,10</td>
<td>192</td>
</tr>
<tr>
<td>Total</td>
<td>13,642</td>
<td>13,972</td>
<td>2,42</td>
<td>3,162</td>
</tr>
</tbody>
</table>

Note 2011: All office buildings aged 41-50 suffer rehabilitation. All office buildings over 92 years are knocked down and replaced by the same number of new ones in the same year.

Note 2021: All office buildings aged 41-50 suffer rehabilitation, 50% of the office buildings aged 76-102 are knocked down and the rest remain as existing. New office buildings from the 2011 scenario are included as existing in the 2021 scenario, New office buildings are calculated from the knocked down office buildings (50% of the office buildings aged 76-102) and a yearly increase of 0.5% in relation to the 2011 stock.
Preliminary results of LCA assessments

LCA studies based on CEN-TC 350 including:
• Production phase
• Construction phase
• Use phase
• End-of-life phase

Office building base case:
• Size: 4620m²
• Lay-out: 3 floors
• Geometry: rectangular shape
• Orientation: East-west
• Glazing area: 30-50%

Office building locations:
• Madrid: climatic zone C2
• London: climatic zone B2
• Tallinn: climatic zone A1

## I. Key result of preliminary study ⇒ Importance of use phase

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Units (%)</th>
<th>MADRID, 30% glazing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Product</td>
</tr>
<tr>
<td>Greenhouse Warming Potential</td>
<td>kg CO₂</td>
<td>8,30</td>
</tr>
<tr>
<td>Depletition potential of ozone layer</td>
<td>kg CFC 11</td>
<td>12,07</td>
</tr>
<tr>
<td>Acidification potential</td>
<td>kg SO₂</td>
<td>0,59</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>kg (PO₄)³⁻</td>
<td>4,06</td>
</tr>
<tr>
<td>Photochemical ozone formation</td>
<td>kg Ethene</td>
<td>1,18</td>
</tr>
<tr>
<td>Abiotic depletion potential</td>
<td>kg Sb</td>
<td>94,23</td>
</tr>
<tr>
<td>Primary Energy consumption</td>
<td>MJ</td>
<td>5,51</td>
</tr>
<tr>
<td>Water Consumption</td>
<td>m³</td>
<td>0,87</td>
</tr>
</tbody>
</table>

The preliminary results of the study show in all the base cases under study that the main environmental impacts of new office buildings are related to the use phase: i.e. the consumption of water and energy.
II. Key result of preliminary study ⇒ Energy consumption during use phase is broken down as follows

- **15%** of total GWP is attributed to **EMBODIED ENERGY**
- **30-40%** of total energy consumption in the use phase is attributed to **HEATING & COOLING**
  - Assumptions:
    - Heat pump system with 80% efficiency
    - National electricity mix of the location
- **30%** of total energy consumption in the use phase is attributed to **LIGHTING**
- **30%** of total energy consumption in the use phase is attributed to **OFFICE EQUIPMENT**
III. Key result of preliminary study ⇒ Not all the aspects are considered in a LCA study

There are, however, other criteria areas identified as high concerning that are not covered by a LCA study, as for example:

**Use of hazardous materials**
- EC Regulation 66/2010 Art. 6.6 and art. 6.7

**Indoor air quality and well-being of the occupants**
- IAQ poorer in office buildings due to the additional emissions coming from the office equipments: $O_3$, PM, VOCs and SVOCs
- Noise
Facilities and information to promote sustainable habits of the occupants

Users behavior:

- Huge energy potential conservation shutting down personal computers, disconnecting office equipment for the night and turning lights
- Correct use of the building envelopment (windows, doors, blinds, etc)

Bicycling is a highly efficient mode of transportation providing: energy conservation, improved air quality, reduction of costs and improved personal health

Public transportation uses about one-half the fuel of private automobiles
GPP criteria for office buildings

Aim

- Providing recommendations for the procurement of newly constructed office buildings and major renovations
- Covering design, construction, use and disposal phases of the building
- Cover the main environmental criteria areas:
  a) **Energy consumption and use of Renewable Energy Sources (RES)**
  b) **Construction materials and products** (includes hazardous substances)
  c) **Water and waste management**
  d) **Indoor air quality** and **well-being of the end-users**
     (becoming more important because they directly affect the productivity and health of workers)
Cover other aspects: contractor’s experience, quality of construction, commissioning of services, performance monitoring and user interactions

**Applicability**

- MS have **large differences in climatic conditions** and construction traditions
- Each **purchaser** will have to **evaluate the appropriateness** of the proposed criteria
  - a) **Selection of combination of criteria**
  - b) **Selection of most appropriate phase construction** to be applied
  - c) **Selection of the best type of contract**
GPP criteria – POSSIBLE SELECTION CRITERIA

- Focused on an **economic operator’s ability to perform the contract they are tendering for**
  
  a) **Exclusion of certain construction and design teams**, which have repeatedly acted against environmental legislation and guilty of grave professional misconduct

  b) **Specific competence in sustainable building design and construction** (list of technical capacities and projects)

  c) **The contractor and design teams** shall have **relevant competence in elements for which it would be responsible under the contract** (i.e. energy and water efficiency construction design, use of RES, bio-architecture, use of building assessment tools, use of low environmental construction materials, good indoor environment standards, etc.)

  d) **Technical capacity to take the necessary environmental management measures**
GPP criteria – POSSIBLE TECHNICAL SPECIFICATIONS

Provide measurable requirements to evaluate the tenders:

**Energy**

a) **Minimum energy performance requirements during use phase**
   a) Class A rating or x% better than the highest rating (in comprehensive criteria)
   b) Top x% performance, if no A-G rating EPC exists

b) **Energy metering and efficiency training** (energy monitoring system to report the energy performance and to identify the possible deviations from projected performance)

c) **Installation of localized RES** (as comprehensive criteria) generating capacity within the building site itself or in cooperation with the unfinished spaces and near areas.
Construction materials and products

a) Core criteria:

a) Rational use of the natural resources/construction materials:
   1. reduce the material demand in design (possibility to reuse and renovating existing buildings)
   2. materials with the same functionality using the less possible materials

b) Use of construction materials and products complying with certain environmental criteria
   1. with verified environmental information (as Ecolabels Type I) or
   2. providing clear and transparent information based on LCA

a) **Core criteria:**

   d) Use of construction products and materials with high recycled content

   e) Materials with responsible sourced (e.g. certification schemes for wood and wood-based materials)

b) **Exclusion of certain substances** considered as **hazardous for any reason**

   a) Products which contain “Substances of very high concern (SVHC)” with reference to the art. 59 of EC Regulation 1907/2006

   b) Finishes products that release indoor air pollutants (e.g. VOC, CO2, CO, PM, Formaldehyde)
**Well-being**: based on international standards

a) **Ventilation rate** (minimum ventilation flow) with reference to the **Indoor air quality** standards

b) **Visual comfort and lighting systems**

c) **Thermal comfort**

d) **Acoustic comfort**

**Recycling facilities**

Inclusion of dedicated storage space for sorting the waste generated

**Water saving installations** *(as comprehensive criteria)*

Installation of water saving technologies in all sanitary and kitchen water facilities
GPP criteria – POSSIBLE AWARD CRITERIA
(as comprehensive criteria)

a) **Innovative energy efficient building service**
   Use of passive components e.g. insulation, daylight use, triple glazing in the windows, shadings

b) **Air tightness and insulation of the envelope**
   Ensuring No consequential defects in construction details that would be detrimental to the fabric air tightness and continuity of insulation

c) **Installation and commission of heating and cooling services**
   Heating and cooling service should be designed installed and commissioned in conformance with optimized designs and specifications
GPP criteria – POSSIBLE CONTRACT PERFORMANCE CLAUSES

a) **C&D waste management**
   Appropriate measures in place to reduce and recover waste that is produced during the construction process

b) **Waste management during the use phase**
   Management plan containing information on how to collect the waste generated, provision of monitoring of the waste streams and giving instruction on how to separate the waste streams

c) **Water saving management system**
   - water saving management plan which stipulates the recommended schedule, methods and assessment for the inspection of the water facilities
   - water monitoring system to report the overall (and that of each main stream) water consumption
### Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>CORE</th>
<th>COMPREHENSIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Exclusion of certain construction and design teams</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>1.2 Specific competence in sustainable building design and construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 The contractor and design teams shall have relevant competence in</td>
<td></td>
<td></td>
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<tr>
<td>elements for which it would be responsible under the contract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Technical capacity to take the necessary environmental management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Minimum energy performance requirements during use phase</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.2 Energy metering and efficiency training</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.3 Installation of localized RES</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>2.4 Rational use of the natural resources/construction materials</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.5 Use of construction materials and products complying with certain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>environmental criteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6 Recovery of construction materials</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Criteria</td>
<td>CORE</td>
<td>COMPREHENSIVE</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td></td>
<td>Selection criteria</td>
<td>Technical specification</td>
</tr>
<tr>
<td>2.7 Use of construction products and materials with high recycled content</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2.8 Materials with responsible sourced</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2.9 Exclusion of certain materials</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.10 Ventilation rate</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.11 Visual comfort and lighting systems</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.12 Thermal and acoustic comfort</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.13 Design and provision recycling facilities</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.14 Water saving installations</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3.1 Innovative energy efficient building services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Air tightness and insulation of the envelope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Installation and commission of heating and cooling services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Further development and future steps

- Further investigation is needed on the criteria ‘use of construction materials and products complying with certain environmental criteria’
  
a) Stakeholders favored selection from whole building perspective:
  - Alignment with CEN/TC 350 (EN 15643)
  - But very limited practical implementation by industry

b) EPD option should be further investigated, comparison at component or product level
  - Four mature EU EPD schemes
  - But only benchmarking within schemes supports improvement

- Evaluation of the equivalence within national schemes

- Relate criteria to common procurements routes. Different procurement routes imply different levels of client control over the design, specification, management and LCC of the building
Initial investigation of the level of equivalence

Selected certification schemes relating to the sustainability of buildings (significance market point of view):

**BREEAM, HQE, DGNB and LEED**

The selection of these schemes was based on:

a) they have developed versions that specifically address office or commercial buildings

b) they have gained a degree of market acceptance

c) they have developed international versions that can be used outside the borders of their original country

d) they have significant numbers of certifications outside of the original countries (4,886 buildings certified in 2011)
<table>
<thead>
<tr>
<th>Potential of the read-across</th>
<th>BREEAM</th>
<th>HQE</th>
<th>DNGB</th>
<th>LEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>High proportion but there are a number of gaps in criteria coverage and variations in methodology that would require addressing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further work</td>
<td>Energy, water consumption, materials and health and well-being.</td>
<td>Ventilation rates and lighting</td>
<td>GHG, % RE, easy dismantling &amp; recycling, IAQ, drinking water demand, control of users and acoustic comfort</td>
<td>Energy and atmosphere, water efficiency and IAQ</td>
</tr>
<tr>
<td>Verification</td>
<td>Independent 3rd party</td>
<td>3rd party is optional</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Balanced by accreditation body acting as the final certification body</td>
<td>Commercial separation of interests: applicant and verifier</td>
<td>Balanced by the accreditation body acting as the final certification body</td>
<td>Accreditation body checks and validates self-verifications and is also the certification body</td>
</tr>
</tbody>
</table>

Evaluation of the quality of assessment and verification processes
Procurements routes

SCI guide: Construction procurement
How can we better relate the criteria to processes?
Example 1: Separation of design and build
Design-led throughout the construction process

Initial phase
Feasibility and conceptual design

Preparatory phase
In-house design work or Design competition

Design team selection

Competitive tendering (1 or 2 stage)

Detailed design
Framework call-down

Appoint main contractor

Procurement
Site works contracts

Construction team

Construction

Operation and End of Life
Facilities management

Handover, defects and commissioning
Example 2: Combined design & build
Separation of client and contractor control over design

**Initial phase**
- Feasibility and conceptual design

**Procurement**
- Tendering (2 stage option)
  - Preliminary design options

**Preparatory phase**
- Preliminary design
  - Client selects preferred design

**Detailed design**
- Novation of design team
  - Appoint D&B contractor

**Construction**
- Construction process

**Post-completion**
- Facilities management
  - Handover, defects and commissioning
Example 3: Design, build, finance, operate
Private sector assumes long-term management and risk

Initial phase
Feasibility and conceptual design

Preliminary design
15-30 year LCC

Detailed performance specification

Procurement
Tendering (2 stage)

Negotiate cost, performance and risk

Detailed design

Contract DBOF partner

Construction
Energy Performance Contracts or PPP

Construction process

Detailed design

Facilities management

Post-completion

Upgrade interval
Conclusions

Key environmental areas of office buildings have been identified through a comprehensive research in which LCA and not-LCA aspects have been taken into consideration.

The GPP criteria for office buildings are at the last stage of development. Further development will mainly consist in:

- Clarifying the ‘use of construction materials and products complying with certain environmental criteria’
- Finalizing the analysis of the equivalence within national schemes
- Finalizing the analysis of the procurements routes in order to effectively set GPP criteria for environmental efficient buildings

It is foreseen to finalize the criteria during 2013.
Thank for your attention

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