INTRODUCTION TO ENVIRONMENTALLY SOUND CHOICE OF CONSTRUCTION AND INTERIOR MATERIALS

Supplementary material for municipal purchasing specialists
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INTRODUCTION
TO ENVIRONMENTALLY SOUND CHOICE
OF CONSTRUCTION AND INTERIOR MATERIALS

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CONTENTS

1. Introduction .................................................. 3
2. Necessity for green public procurement ........................ 3
3. Legal basis of green public procurement ........................ 5
4. Stages of green procurement process .......................... 6
5. Environmental product declarations, eco-labelling, environment management systems. Their use in the green procurement. ................................................................. 7
6. Green procurement criteria for chemicals in construction and interior articles ........................................ 9
7. Chemical substances in building articles – main risks evaluated based on reach regulation .......................... 11
8. Life-cycle assessment as GPP component ......................... 14
9. Analysis of life-cycle costs .......................................... 17
10. Eco-design .......................................................... 18
11. Embodied energy as an additional criteria for the green public procurement .................................................. 20
12. Icelandic experience in implementation of GPP ................. 24
13. Finnish experience in planning the municipal green contracts ......................................................... 25
14. Examples of GPP ..................................................... 25
15. Recommended literature .............................................. 28
1. INTRODUCTION

Each year European public authorities spend considerable portions of the EU Gross Domestic Product on purchase of goods, such as office equipment, building components, and vehicles; services, such as building maintenance, transportation services, cleaning and catering services. Public procurement shapes production and consumption trends and a significant demand from public authorities for greener goods creates or widens markets for environmentally friendly products and services. This also provides incentives for companies to develop environmental technologies.

A more sustainable use of natural resources and raw materials will bring benefits to the environment and economy in general by creating opportunities for emerging green economies. Such changes will also boost the competitiveness of European industry by stimulating innovation in eco-technologies which have been recognized as a high-growth sector where Europe is already a world leader. Studies have confirmed that there is considerable scope for cost-effective green public procurement (GPP), especially in sectors where green products are not more expensive than their alternatives (taking into account the life cycle cost of the product). Since greener goods are defined on a life-cycle basis, GPP will affect the entire supply chain and will also stimulate the use of green standards in private consumption.

The potential of GPP as a policy instrument has been increasingly recognized, and, over recent years, there has been growing political commitment to following the GPP principles at national, EU and international levels. In 2002, the OECD adopted a Recommendation on green public procurement. As a follow-up to the Johannesburg World Summit on Sustainable Development (September 2002), a Marrakech Task force on sustainable procurement was created with the aim of spreading sustainable (green) public procurement practices. Sustainable procurement policies have been launched in many OECD countries (USA, Japan, Canada, Australia, and South Korea) as well as in rapidly developing countries (such as China, Thailand, and Philippines).

Within the EU, GPP was first highlighted in the 2003 Commission Communication on Integrated Product Policy where Member States were recommended to adopt national action plans for the implementation of GPP. The new European legal framework for public procurement has clarified how public and local government purchasers can include environmental considerations in their procurement processes and procedures. Most recently, the renewed EU Sustainable Development Strategy (June 2006), set the policy objective for 2010 of bringing the average level of EU green public procurement up to the standard achieved by the best performing Member States in 2006.

2. NECESSITY FOR GREEN PUBLIC PROCUREMENT

Any company or institution which makes products or provides services has impacts on the environment. The measures for minimization of these impacts are the following:

- use of environment-friendly technologies,
- manufacturing of environmentally-friendly products,
- implementation of environment management systems,
- green public procurement (GPP).

Green Public Procurement is a tool in the environment policy allowing to

- minimize environmental impacts,
- facilitate social improvements,
- achieve budget savings.
The Green Procurement is a procurement process during which one opts for products with possibly less impacts on the environment compared to other products with the same functionality, based on the life-cycle costs.

In other words, the Green Public Procurement is systematic integration of environmental (also social) conditions into all activities related to public procurement of products or services, starting from identification of the needs, development of the respective specifications and assessment procedures and ending with monitoring of the achieved results (Fig. 1).

![Fig. 1. Aim of Green Public Procurement](image1)

Thus, there are differences between the ideologies of the conventional and the green procurement (Fig. 2).

![Fig. 2. Difference Between Conventional and Green Procurement](image2)

For instance, the GPP approach to procurement of office paper envisages

- purchase of paper made of used, regenerated paper fibre (recycled paper) or lawfully and/or sustainably obtained raw fibre.
- purchase of paper manufactured using low levels of energy and assuring low levels of emissions.
- exclusion of certain substances during manufacturing and bleaching of paper.

Aims of Green Public Procurement:

- to reduce emission of greenhouse gases,
- to reduce consumption of materials, water, and power,
- to reduce use of toxic chemicals,
3. Legal basis of green public procurement

- to reduce the quantities of waste,
- to improve indoor climate,
- to reduce the operation costs of power-efficient systems,
- to reduce reparation costs by using more durable and long-lasting systems,
- to reduce health insurance and sickness insurance payments by improving working conditions and reducing risks at work.

Pursuing of the green procurement procedures implies assessment of various properties of goods and services:
- whether the product contains any substances hazardous to environment or humans,
- whether it is made of renewables,
- whether the operation of the system requires high levels of power (or water),
- how to dispose of the system after it cannot be used,
- what the conditions for the provision of the service are.

Efficient green public procurement is based on:
- assessment of needs (whether and what to purchase),
- complete analysis of the life-cycle costs and benefits (initial price, costs of operation, waste management costs, budget savings, etc.),
- the most economically beneficial offer, including a competitive price, environment criteria.

Benefits from implementation of the Green Public Procurement:
- Financial savings – power-efficient, water-saving or other resource-saving products, services and structures considerably lower their operating costs. Environment-friendly goods often also have lower costs of disposal after their use.
- Efficient attainment of the aims of the environment and health policy – the green procurement is one of the most efficient tools for attainment of the aims of the environment or health policy. For instance, replenishment of the public transport fleet with low-level emission busses considerably contributes to improvement of air quality.
- Efficient attainment of social targets – it is an opportunity for better working conditions by assuring efficient and environmentally friendly room cleaning services, for example.
- Promotion of innovative solutions – Regular cooperation with suppliers of goods and services facilitates changes towards more environment-friendly goods and services on the market.
- Strengthening of support from the population – Consistently implemented environmentally friendly solutions allow to achieve that the population supports the work of government and local government institutions.
- Global input. – the green procurement allows to reduce the levels of CO₂ emissions.

Participants of Green Public Procurement:
- state institutions and organizations,
- local governments,
- private joint-stock companies and firms,
- individual consumers (“green” consumers) are also welcomed.

3. LEGAL BASIS OF GREEN PUBLIC PROCUREMENT

Since year 2004, the legal framework for public procurement in the EU member states consists of two directives on public procurement, which envisage inclusion of environmental considerations into procurement procedures in cases where the purchase does not exceed a certain threshold:

In Latvia, the requirements established in the European directives have been incorporated into the Law on Public Procurement and the Law on Procurement for Needs of Public Service Providers.

Pursuant to the directives on public procurement and, respectively, the Law on Procurement for Public Service Providers, customers and public service providers are entitled to establish environmental requirements during their procurement procedures, include them in the technical specifications for the subjects of procurement, including application of respective standards and eco-labelling, as well as include environment and power efficiency factors in the criteria for the economically most favorable offer.

### 4. STAGES OF GREEN PROCUREMENT PROCESS

Main stages of the Green Public Procurement:
- definition of needs,
- preparation of a clear technical specification,
- establishment of selection criteria,
- establishment of criteria for granting the agreement,
- adjustment of the implementation items of the agreement.

#### EXAMPLE OF ASSESSMENT OF NEEDS

The required volumes of paper can be reduced by the following measures:
- avoiding printing; maximum use of electronic document turnover and e-mail;
- use of multi-functional office equipment with duplex printing or copying options;
- centralization of printing;
- printing of the final document only;
- use of the blank side of a used sheet of paper for printing or copying;
- printing several reduced-size pages on one A4 sheet;
- informing users about opportunities for economizing paper.

#### ESTABLISHMENT OF CRITERIA

The criteria should be clearly defined by assigning numeric values or ranges to them. 

Examples:
- carton packaging should contain ≥ 80% of recycled raw materials,
- vehicles should meet the maximum levels of CO₂ emissions (CO₂ g/km): small-size vehicle ≤ 120,
- low viscosity of regenerated (minimum 25 % of regenerated base oil) motor lubricants should be used,
- the phosphor (P) content should not exceed 0.2 g per litre

Can be:
- exhausts from vehicles should comply with the EURO 5 Standard,
- products must not contain hazardous substances classified as carcinogenic under the provisions of Directive 1999/45/EC (R40, R45, R49).
5. Environmental product declarations, eco-labelling, environment management systems. Their use in the green procurement

Preparation of the technical specification should be based on the ecological properties of the product or service, scientifically justified assessment of the entire life-cycle, justified specifications of the performance and functionality in order to facilitate innovative and environmentally friendly offers, as well as in view of ecological specifications and sustained methods of production, i.e. power efficiency, renewable sources of energy, emissions, waste, possibilities of recycling, hazardous chemicals, etc. The Green Public Procurement envisions inclusion of the following components applicable to products and articles:

- products which include recycled raw materials,
- environmentally friendly products or raw materials (products are environmentally friendly if they are manufactured, used or enter the waste-flow with lower levels of environmental impacts and consumption of natural resources),
- products of biological origin,
- articles and systems which save energy and water,
- alternative fuels for vehicles,
- vehicles running on alternative fuels,
- substances which do not destroy the ozone layer.

Establishment of the criteria for selection (screening criteria) should be based on the list of criteria provided in the directives on public procurement. Where relevant, environment criteria should be included in the justification of the technical capabilities for the implementation of the agreement.

Establishment of the criteria for granting the agreement includes relevant environmental criteria for comparison of various environmentally friendly offers or introduction of the ecological element and giving it certain weight.

Currently, the Green Procurement covers several key groups:

- office equipment / IT (e.g., office paper, equipment, furniture),
- household appliances,
- energy consumption (e.g., lighting),
- consumption of natural resources (e.g., water consumption) and waste management,
- building materials (e.g., impacts of their composition on health),
- vehicles,
- foodstuffs and catering services.

To facilitate the Green Procurement, European Green Procurement Criteria have been established for several groups of products (published on the web page of the European Commission). These criteria are supplemented regularly.

5. ENVIRONMENTAL PRODUCT DECLARATIONS, ECO-LABELLING, ENVIRONMENT MANAGEMENT SYSTEMS. THEIR USE IN THE GREEN PROCUREMENT

Nowadays, several voluntary initiatives are known which entrepreneurs can pursue to reduce the adverse effects of their produce on environment and human health. Companies may join these initiatives to support better environmental performance of their products, and this may also be applied in the green procurement.

ENVIRONMENTAL PRODUCT DECLARATIONS

Environmental Product Declarations are meant for communication between the manufacturer and the consumer to provide clear and justified explanations for the advantages of the products to the customer. Although Environmental Product Declarations are voluntary, an international standard has been developed to establish the key principles of development and use of these declarations (ISO 14020). Thus, the purpose of the
Environmental Product Declaration is to support demand and supply of environmentally friendly products and services

- through provision of verifiable and accurate, non-misleading information
- and stimulation of a positive market movement towards constant improvement of environmental performance.

There are three types of environmental declarations (Fig. 3).

![Fig. 3. Types of Environmental Product Declarations](image)

**ECO-LABELLING**

The Type 1 Environmental Product Declarations are the most popular: eco-labelling which is a third-party, multiple-criteria programme which grants permission for use of the respective eco-labelling on the product, provided that it meets certain criteria. This compliance is verified by independent auditors. The most well-known eco-labelling is given in Figure 4.

![Fig. 4 Eco-labelling Signs](image)

To apply these criteria to the Green Procurement, it is essential that several key principles be followed:

- the criteria of eco-labelling can be used for preparation technical specifications and certification of compliance. Exclusive use of a certain type of labelling cannot be required in the technical specification.
- criteria of eco-labelling may be used for preparation of the technical specification if:
  - the requirements for the eco-labelling have been developed relying on scientific information,
  - the eco-labelling has been approved with involvement of all stakeholders (state, NGOs, industry associations)
  - the criteria for the eco-labelling are freely available to all interested parties.

The eco-labels which comply with such requirements are, for instance, the EU Ecolabel, the Nordic Ecolabel, as well as other eco-labelling systems. The eco-labelling criteria can be used in the Green Procurement. The criteria for the EU and Nordic Ecolabel can be recommended for use, as they are scientifically justified, discussed with social partners, and publicly available. The EU Ecolabel criteria are established for dozens of product groups. The Nordic Ecolabel criteria have been established for more than 50 product groups.

**SELF-DECLARATIONS**

A less known type is self-declarations. They are the second type of environmental product declarations, with the fundamental principles for their use being incorporated in international standard ISO 14021. Any company may develop its own environmental product declarations based on the following fundamental principles:
Green procurement criteria for chemicals in construction and interior articles

- any statement should be based on research before information is provided to the consumer,
- statements like “environmentally friendly”, “green”, “non-polluting” should not be used,
- several statements, such as “compostable”, “degradable”, “dismountable design”, “recyclable”, “recycled raw materials”, “reduced consumption of resources”, “reduced levels of waste”, should be used only if the product complies with certain requirements.

BRANCH DECLARATIONS

The third type of environmental product declarations is declarations based on voluntary industry initiatives under the provisions of Standard ISO 14025. Compliance with the criteria is verified and certified by a third party (independent auditors). Can be used for all products, provided that they meet the requirements established in the standard.

There are several international programmes in the Nordic states, such as the MVD Programme in Denmark and EPD SYSTEM in Sweden, for example, and also the global ones, such as the Global Environmental Declaration Network. Any company of the respective industry may join such programmes.

ENVIRONMENT MANAGEMENT SYSTEMS

There are several environment management systems (Figure 3) pursued by organizations to control and minimize the environmental impacts cause by the processes, products, and services resulting from the operation of the company. Several standards have been developed to establish the fundamental principles of environment management systems. Compliance with the standard is typically verified by an independent auditor, and compliance is confirmed by issuing a certificate. It should be noted that a management system does not mean that all manufactured products or services are safe and environment-friendly!

Within the Green Procurement, a technical specification may include a requirement that the company management system of the service provider should meet certain criteria based on known management system criteria, but no particular certificate can be required.

![Image](image.png)

**Fig. 5.** Environment management systems
1- Responsible action (chemical industry), 2 – International Environmental Management Standard EN/ISO 14001, 3 – European Eco-management and Audit Scheme (EMAS)

6. GREEN PROCUREMENT CRITERIA FOR CHEMICALS IN CONSTRUCTION AND INTERIOR ARTICLES

Unfavourable chemicals can be specified in two ways in the green procurement criteria:

- listing of certain unfavourable substances using their chemical names and CAS numbers.
- listing of unfavourable properties of chemicals using the classifier of chemicals:
  - the new classifier according to the Globally Harmonized System of Classification of Chemicals,
  - the old classifier which is gradually loosing force.
Typically, the unfavourable chemicals (properties) are accompanied by their maximum permissible concentrations in a chemical compound, material, or product, or the admissible level of emissions into the environment (indoors).

The legislation on chemicals (REACH) establishes the obligations of manufacturers of chemicals, compounds, and products regarding provision of information regarding the composition of chemicals (Fig. 6).

**Fig. 6. Supply of Information to Professional Users (REACH Regulation)**

However, when the REACH Regulation does not obligate to provide the information, the customer is entitled to require that such information be provided, and the supplier’s readiness to provide the requested information voluntarily may be one of the criteria of the green procurement.

The statutory requirements should be respected by all manufacturers and traders. Consequently, when pursuing the Green Procurement, it could be assumed that all offered products will comply with the statutory requirements. However, unfortunately, this is not always true. It is, therefore, recommended to require a confirmation that the product meets certain statutory provisions.

**REACH (1907/2006) Regulation Concerning the Registration, Evaluation, Authorization and Restriction of Chemicals**

The REACH Regulation imposes considerable restrictions on use of substances of very high concern (SVHC). The licensing procedure under the provisions of the REACH Regulation, Clause 57 applies to the substances which are:

- categorized as carcinogenic, mutagenic, or causing reproductive toxicity pursuant to Regulation 1272/2008,
- persistent, bioaccumulative and toxic (PBT), very persistent and very bioaccumulative (vPvB),
- substances implying a similar risk, such as endocrine disrupting substances (EDS).

It is planned that special licenses will be required for substances with such properties. Substances are assessed on EU level, relying on substance hazard and usage data prepared by manufacturers and licenses are issued only if the social and economic benefit from the use of the substance exceeds the potential damage to the environment and humans. The substances which have undergone the assessment procedure are included in Annex XIV of the REACH Regulation and may be used only with a license. In consideration of the slow progress of legislation, proactive companies may voluntarily quit using substances meeting the criteria for substances of very high concern to support environmentally friendly innovation and replace the substances of concern.

The REACH Regulation also provides a listing of substances subject to certain restrictions on their use in products and materials.
7. CHEMICAL SUBSTANCES IN BUILDING ARTICLES – MAIN RISKS EVALUATED BASED ON REACH REGULATION

There are many kinds of hazard effects in chemicals. Substances can have acute effects like toxicity on human health and/or environment. The other hazardous effects of chemicals can be effects like carcinogenity, mutagenity, reproductive toxicity, irritation and sensitization. With certain chemicals exist also characteristics like corrosivity, genotoxicity.

In toxicity there can exist different effects which can be against immune and central nervous system and behaviour or endocrine effects. Irritant substances are non-corrosive substances which cause skin hazards, swelling for the eyes etc. Under REACH, no information is required below 1 ton per annum production of such an irritating chemical. Skin sensization is a form which results in allergic reactions. SVHC substances are most hazardous and widely used in high volumes. In REACH these chemicals are called PBT (Persist, Bioaccumulation and Toxic) or vPvB (very persist, very bioaccumulation) chemicals. The chemicals can have one or many above characteristics like acute toxicity (T). This means effects occurring with a single dose after a short time, usually 14 days or after multiple doses within 24 h.

All substances produced by industry, in an amount of 1 ton per year, must be registered in ECHA. ECHA is the European Chemicals Agency which is situated in Helsinki, in Finland. If the chemicals are not registered, the following principles are exploited: ‘No Registration – No Market’ meaning that non-registered substances and non-registered uses can become illegal. This means that the current construction product regulation will require that a declaration of performance (DoP) must be supplied with each construction product, placed on the market, including emissions data information for possible hazardous substances, produced by the product during its all use phases. Virtually everyone in the supply chain, dealing with chemical substances, will have certain obligations. Manufacturers or importers of chemical substances or mixtures of chemical substances,
located in the EU, are the responsible parts of the supply chain of the chemicals. Downstream users processing chemicals, formulating preparations (mixtures) for the end-use or using formulated products as part of their business belong also under the REACH supply chain requirements.

In risk characterization of chemicals for human health, there are three main routes to exposure which are: 1) human exposure via the environment, 2) exposure of the workers in work places and 3) exposure of consumers through, e.g. some textile chemicals. From some construction products can also separate harmful emissions of substances to working air, and through possible exposure, the workers can have harmful effects. An old example is asbestos. As inhaled for very long times, like working in 20 years’ exposure and now in demolishing of old buildings, the compound short fiber asbestos can influence in asbestosis and cancer. There are rather little knowledge, on how the harmful substances, especially from the older construction materials, can to be leached into the indoor air. The floor construction can, e.g. be harmful in different humidity, gluing and surface materials conditions with different chemicals like formaldehyde from chipboards, phthalates and organic unknown compounds. For that reason, the modern recycling of construction materials is under many requirements.

The leaching of emissions can proceed on a molecular level by the different mechanisms. The main mechanisms for migration of chemicals from material surfaces are as follows: evaporation, dissolving, diffusion and the mixture of above mentioned (Fig.7).

Particulate matter and dust emissions on molecular level in indoor air are not visible. We stay the greatest part of our life, about 12 h/day in indoor area. The exposure chamber tests are rather difficult to carry out; they take a lot of time and are also reasonable expensive in their information. This makes the bases of evaluation of interior materials difficult for people. In green housing, it is good for that reason to follow-up the clarifications of instructions, materials safety labeling and Safety Data Sheets (SDSs). Article 33 in REACH requires that supplier of an article, containing SVHC or other CMR chemicals, must have the available SDSs. Suppliers must provide the receiver with sufficient information to allow safe use of an article. Content information for hazardous substances of construction products must be made obtainable for workers and users.

The present list of forbidden chemicals see web pages of ECHA.

It must be mentioned that REACH Regulation don’t use the word product directly, but instead of that, there is used the word article. In REACH, article means a “product” which has a certain outer form and surface. This form then, in many cases, determines, in the use, the article’s exploitation more predominantly than the chemical content of the product itself. However, the chemicals in products can determine the health and the other indoor and environmental characteristics like the accumulated amount of substances in the article to the inhaled air on the long-life scale. For that reason, the substance and mixture content in indoor materials is very important.

Any supplier of a construction and building article which contains hazardous substances in a concentration above of 0,1 % weight by weight (w/w), must provide sufficient information, available to supplier and consumer, from the hazardous substances, in order that the article is safe to use. The information includes as a minimum, the name of hazardous substance.

All kinds of the re-use of the building materials should take into account health and environmental effects. All supply chain in REACH; manufactures, importers, workers, users, recyclers and consumers should then
Chemical substances in building articles – main risks evaluated based on REACH regulation

It has been built up “green” information systems of building strategies towards 2020 for the most problematic building products with impurities like:

- Old window frames from early 1990’s, the elastic mastic of which can contain very toxic PCB chemicals
- Asbestos in repair of old, e.g. water pipe insulations in house cellars
- Building construction chipboard plates, e.g., in old kitchens which can contain urea formaldehyde clue which with water forms toxic formaldehyde vapor
- Building construction plates which can contain gypsum which in burning the recycled building wastes can form harmful sulfur emission
- Surface protecting chemicals of wooden products during the long transportations, e.g., from the 3rd countries. To these belong chemicals like short chain chlorinated hydrocarbon oils (C12 –C14), tributhyltin and bromated fire retardants
- Hazardous, hormonally to human and nature affecting, endocrine disrupting chemicals like Per Flour Octan Sulphonates (PFOS) in plasticized products
- Metals like Hg, Pb, Cr or Cd in forbidden products, e.g. old paints

To checking phases in recycling, belong then especially: 1) inventory of old building materials, 2) documentation to the “logbook”, 2) occurrence study of specific substances like occurrence of “phase-out substances” and metals in products. To chemicals under inventory are substances like ozone-depleting compounds, PCB, asbestos, lead, mercury (Hg), bromated flame retardants (PFDs) and PVC as typical “phase-out” substances. All building waste which can be contaminated by PCBs, must be handled and burnt nationally in the problem waste plant. The Norwegian Climate and Pollution Control Agency has published a summary of an information system from those building products that can contain the banned or in some way regulated chemicals which can be dangerous for importers, users and recyclers. All kinds of the re-use of the building materials should take into account health and environmental effects. All supply chain in REACH: manufactures, importers, workers, users, recyclers and consumers should then get enough and objective information to the possible further use.

Criteria for green products outside the questions concerning the harmfulness of chemicals takes into account also factors like the amount of producing energy and costs to produce green products for interior materials. To criteria to produce, exploit and use the new indoor materials belong then factors like:

- There are used, e.g., the new dry polishing of floors without wax. This is environmental-friendly and lowers the life-cycle costs,
- The carpets are 100 % recyclable and bio-decomposed,
- Linoleum carpets (trade name: e.g. Forbo) are 100 % from natural materials floor coverings and can be recycled,
- Textile carpets (trade names: e.g. InterfaceFLOR and Heuga 580) are the part in the “Mission Zero” program, where the whole life-cycle releases of a carpet are aimed to reach the zero release level at 2020,
- Textile carpets are produced by using renewable energy.

The specific details of the currently marketed indoor materials in buildings are found by the trade names of the products in Google. In Finland, there is also developed a material emission based M I and M II classification system for construction materials in buildings. Details from the Finnish classification system are presented in the table 1.
The Finnish building materials classification system for materials in volatile chemicals, odors and emissions

<table>
<thead>
<tr>
<th>Examined material qualities</th>
<th>Class M I, mg/(m²·h)</th>
<th>Class M II, mg/(m²·h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission total volatile organic compounds (TVOC). Minimum of 70% of compounds identified.</td>
<td>&lt; 0.2</td>
<td>&lt; 0.4</td>
</tr>
<tr>
<td>Emission of formaldehyde (HCOH)</td>
<td>&lt; 0.05</td>
<td>&lt; 0.125</td>
</tr>
<tr>
<td>Emission of ammonia (NH₃)</td>
<td>&lt; 0.03</td>
<td>&lt; 0.06</td>
</tr>
<tr>
<td>Emission of carcinogenics belonging to category 1 of the IARC monographs 1987</td>
<td>&lt; 0.005</td>
<td>&lt; 0.005</td>
</tr>
<tr>
<td>Odor: dissatisfaction with odor shall be below 15%</td>
<td>Is not odor</td>
<td>Is not significant odor</td>
</tr>
</tbody>
</table>

The Finnish indoor air requirements are given in the table 2.

Indoor air requirements in Finland

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Unit</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium and amines</td>
<td>µg/m³</td>
<td>20</td>
</tr>
<tr>
<td>Asbestos</td>
<td>fiber/cm³</td>
<td>0</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>µg/m³</td>
<td>50</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>mg/m³</td>
<td>8</td>
</tr>
<tr>
<td>Particulate matter, PM₁₀</td>
<td>µg/m³</td>
<td>50</td>
</tr>
<tr>
<td>Radon</td>
<td>Bq/m³</td>
<td>200 year average</td>
</tr>
<tr>
<td>Styren</td>
<td>µg/m³</td>
<td>1</td>
</tr>
<tr>
<td>One prevailing or many un-identified contaminants</td>
<td>HTP* (Impurities in work place air known to be hazardous)</td>
<td>One: 1/10 from work place value, many: Σ C/HTP &gt; 0.1</td>
</tr>
</tbody>
</table>

* – HTP – harmful emission effect after 8 h exposure

8. LIFE-CYCLE ASSESSMENT AS GPP COMPONENT

The increased awareness of the importance of environmental protection and the possible impacts associated with products, both manufactured and consumed, has increased interest in the development of methods to better understand and address these impacts. One of the techniques being developed for this purpose is life cycle assessment (LCA).

Life-cycle assessment is a process where a product is viewed from all aspects starting from extraction/output of raw materials and processing, production, storage, sale, consumption, and disposal (the from-cradle-to-grave principle). This assessment gives an idea of the consumption of raw materials, energy and water consumption required for the final product as well as of by-products (emission into the air, wastewater, and waste).
LCA mainly addresses the environmental aspects and impacts of a product system. Economic and social aspects and impacts are, typically, outside the scope of the LCA. Other tools may be combined with LCA for more extensive assessments.

LCA is an iterative technique. The individual phases of an LCA use results from the other phases. The iterative approach within and between the phases contributes to the comprehensiveness and consistency of the study and the reported results.

There are four phases in an LCA study (Fig.7):
- the goal and scope definition phase,
- the inventory analysis phase,
- the impact assessment phase,
- the interpretation phase.

The first part of an LCA study consists of defining the goal of the study and its scope.

The goal of an LCA states
- the intended application, the reasons for carrying out the study,
- the intended audience, i.e. to whom the results of the study are intended to be communicated, and
- whether the results are intended to be used in comparative assertions intended to be disclosed to the public.

The scope includes the following items:
- the product system to be studied; the functions of the product system or, in the case of comparative studies, the systems;
- the functional unit which is a key element of LCA and has to be clearly defined. The functional unit is the amount, weight and quality of the specific product investigated. Examples of the functional unit – 1 MWh of produced energy, 1 liter of milk from the supermarket, 1000 wash cycles etc. This enables comparison of two essential different production systems. A comparison of the environmental impact of two different systems with the same functional unit is therefore possible. The functional unit is depending on the type of questions we want to answer. All subsequent analyses are then relative to that functional unit, as all inputs and outputs in the Life Cycle Inventory (LCI) and consequently in the life cycle impact assessment (LCIA) profile are related to the functional unit.
- the system boundary; allocation procedures;
- impact categories selected and methodology of impact assessment, and subsequent interpretation to be used;
- data requirements; assumptions; limitations; initial data quality requirements; type of critical review, if any;
In the inventory analysis phase the relevant inputs and outputs of the product system are compiled and quantified. Inventory analysis involves data collection and calculation procedures to quantify relevant inputs and outputs of a product system:

- economy-environment system boundary
- flow diagram
- format and data categories
- data quality
- data collection and relating data to unit processes
- data validation
- cut-off and data estimation
- multifunctionality and allocation
- calculation method

Consequently, the flow diagram of the first two stages is as follows (Fig. 8).

The impact assessment phase of LCA is aimed at evaluating the significance of potential environmental impacts using the LCI results. In general, this process involves associating inventory data with specific environmental impact categories and category indicators, thereby attempting to understand these impacts.

The LCIA phase also provides information for the life cycle interpretation phase.

Interpretation is the phase of LCA in which the findings from the inventory analysis and the impact assessment are considered together or, in the case of LCI studies, the findings of the inventory analysis only. The interpretation phase should deliver results that are consistent with the defined goal and scope and which reach conclusions, explain limitations and provide recommendations.

Thereby LCA can assist in

- identifying opportunities to improve the environmental performance of products at various points in their life cycle,
informing decision-makers in industry, governmental or nongovernmental organizations (e.g. for the purpose of strategic planning, priority setting, product or process design or redesign),

- the selection of relevant indicators of environmental performance, including measurement techniques,
- marketing (e.g. implementing an ecolabelling scheme, making an environmental claim, or producing an environmental product declaration).

There are a variety of potential further applications in private and public organizations.

- environmental impact assessment (EIA);
- environmental management accounting (EMA);
- assessment of policies (models for recycling, etc.);
- sustainability assessment; economic and social aspects are not included in LCA, but the procedures and guidelines could be applied by appropriate competent parties;
- substance and material flow analysis (SFA and MFA);
- hazard and risk assessment of chemicals;
- risk analysis and risk management of facilities and plants;
- product stewardship, supply chain management;
- life cycle management (LCM);
- design briefs, life cycle thinking;
- life cycle costing (LCC).

9. ANALYSIS OF LIFE-CYCLE COSTS

A main objective of the life cycle costing analysis is to quantify the total cost of ownership of a product throughout its full life cycle, which includes research and development, construction, operation and maintenance, and disposal.

Life Cycle Cost (LCC) is the sum of all recurring and one-time (non-recurring) costs over the full life span or a specified period of a good, service, structure, or system. It includes purchase price, installation cost, operating costs, maintenance and upgrade costs, and remaining (residual or salvage) value at the end of ownership or its useful life.

The predicted LCC is useful information for decision making in purchasing a product, in optimizing design, in scheduling maintenance, or in planning revamping.

\[
\text{LCC} = C_{ic} + C_{in} + C_{e} + C_{o} + C_{m} + C_{s} + C_{env} + C_{d}
\]

where

- \(C_{ic}\) – initial cost: is the purchasing price of the component/system. This can be paid immediately or in several down payments over the years.
- \(C_{in}\) – installation cost: start up costs that the operator has to pay that are not included in the purchasing price, e.g. staff training cost, material losses.
- \(C_{e}\) – energy costs: the product of energy use and cost of different types of energy.
- \(C_{o}\) – operating costs: the yearly operating cost, excluding the energy cost.
- \(C_{m}\) – maintenance costs: cost of service and planned repairs.
- \(C_{s}\) – downtime costs: cost of unplanned stops.
- \(C_{env}\) – environmental costs: e.g. cost of environmental permits.
- \(C_{d}\) – decommission cost: estimated costs to decommission a product/plant at the end of its lifetime.

There are also financial factors to take into consideration if you choose to discount the costs to a certain year. These include:

- present energy price,
- expected annual energy price increase (inflation) during the life time,
- discount rate,
- expected equipment life.
When determining the energy costs, the effects of fixed charges, power charges, penalty charges for reactive power demand etc., must be included if possible. Corresponding factors must also be considered for energy forms other than electricity. In addition, the user must decide which costs to include, such as, maintenance, down time, environmental, disposal, and other important costs.

When all possible cost elements have been identified one has to find or estimate the cost for each element. Once the costs have been estimated the present value of all future costs and incomes have to be calculated by “net present value” = NPV

\[
NPV = \sum_{n=0}^{T} C_n \cdot \left(1 + X\right)^{-n}
\]

where

NPV – the net present value of future cash flows,

\(C_n\) – the nominal cash flow in the n-th year,

n – the specific year in the life cycle costing period,

X – the discount rate,

T – the length of the time period under consideration, in years.

The results of calculations is shown in Fig. 9.

If options are compared, such flows are made for each of the options.

10. ECO-DESIGN

Ecodesign can be defined as an activity aimed at lowering the environmental load of products/functionali
ties over their life cycle.

Ecodesign means systematic integration of environmental objectives into the design of products, processes and services.

Ecodesign practices are intended to develop environmentally compatible products and processes while maintaining or improving cost, performance and quality standards.

Ecodesign aims to satisfy the requirements of customers and other stakeholders in a way which causes less environmental impact.
Ecodesign involves using design practices leading to minimized material and energy use as well as maximized reuse and recycling.

Planning procedure and phases of Ecodesign are
- to identify and perform environmental targets,
- to identify and perform general targets,
- to set starting point of design,
- to meet requirements of environmental, legislation, customers etc.,
- to make checking lists during the process,
- to plan indicators to meet targets,
- to utilise iterative process,
- to apply systematic approach,
- to develop continuous improvement,

Ecodesign principles are in line with the seven eco-efficiency principles of World Business Council for Sustainable Development and they are
- minimizing energy intensity,
- minimizing the material intensity of goods and services,
- extension of product durability,
- increasing the efficiency of processes,
- minimizing toxic dispersion,
- promoting recycling,
- maximizing the use of renewable resources.

There are several reasons of eco-design
- ecological reasons
  - currently, we “spend” far more environment than we have. Facts prove that to secure an intact environment for the future, we must reduce “environment spending” now.
- economical reasons.
  - companies acknowledge a number of motives for applying Ecodesign,
  - confidence of the stakeholders, shareholders and customers, opening up new business sectors, an advantage in competition, maximizing profits, high cost of raw materials and energy and reduction of material input.
- social reasons
  - Ecodesign provides socially compatible conditions and quality of life, job creation and protection and is a precondition for socially and politically steadyness.

Action levels of Ecodesign are
- product level
  - at this level direct product improvements are possible through design of cycles (reuse, recycling), durability, reduction of material and energy use and avoiding toxicities.
- interface between product and use
  - at this level implementation takes place by involving the user into product development e. g. consideration of the user needs, development of new technological systems for new ways of utilization like leasing.
- regional level
  - including the region into product development by using local resources (raw materials, know-how, labor etc.) and taking the local needs into account may enable identification with the products.

Designers need simplified tools in their daily work. For this purpose the Eco-indicator method and the ECO-it screening tool are developed.

10 guidelines for Ecodesign can be characterized as the result of life cycle thinking:
- do not design products, but life cycles,
- natural materials are not always better,
- energy consumption: often underestimated,
• increase product life time,
• do not design products, but services,
• use a minimum of material,
• use recycled materials,
• make your product recyclable,
• ask stupid questions,
• become an O₂ member!

11. EMBODIED ENERGY AS AN ADDITIONAL CRITERIA FOR THE GREEN PUBLIC PROCUREMENT

Considerable amount of energy is converted in order to manufacture materials used for interior applications. Usually, the embodied energy is defined as the energy required in all life cycle stages of the material for preparation of the material in its final form to be used in various products, e.g. gypsum to be used in the gypsum board. However, it is also possible to characterize embodied energy of the final product, e.g. gypsum board. This would be the embodied energy of the construction element. Definition of the embodied energy may be as follows: "the total energy that a product may be said to “contain,” including all energy used in growing, extracting, and manufacturing it and the energy used to transport it to the point of use. The embodied energy of a structure or system includes the embodied energy of its components plus the energy used in construction". Initial embodied energy may be defined at different stages of life cycle of the material or construction (see Fig. 10.)
The main goal of the characterization of the embodied energy for the purpose of green procurement is to select the suitable material or products for interior construction with the lowest environmental burden comparing to other alternatives. Therefore, the material or product, i.e. the scope to be considered for determination of the embodied energy, has to be defined keeping this environmental goal in the mind.

The concern about embodied energy of construction materials arises because production of these materials is very energy intensive and there are estimates that approximately 20% of all energy consumed and CO₂ emissions generated are due to production of the materials to be used in products. One way to measure embodied energy is to sum up all the energy needed to extract, transport, process, etc. of the material in energy units per unit of mass, e.g. MJ/kg, or per unit of volume, e.g. MJ/m³. Embodied energy of construction materials varies in the wide range, e.g. from circa 1 MJ/kg for concrete to around 80 MJ/kg for stainless steel and further up to approx. 200 for Aluminum alloys. Table 3 shows that the embodied energy determined for the same type of building can also vary in considerable range.

### Table 3

<table>
<thead>
<tr>
<th>Embodied energy (GJ/m²)</th>
<th>Type of building</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6</td>
<td>Living</td>
<td>Hill (1978) (cited by Pullen)</td>
</tr>
<tr>
<td>3.9</td>
<td>Living</td>
<td>Edwards et al. (1994)</td>
</tr>
<tr>
<td>4.3-5.3</td>
<td>Living</td>
<td>D’ Cruz et al. (1990) (cited by Pullen)</td>
</tr>
<tr>
<td>4.9</td>
<td>Living</td>
<td>Pullen (1995)</td>
</tr>
<tr>
<td>5.0</td>
<td>Living</td>
<td>Lawson (1992) (cited by Pullen)</td>
</tr>
<tr>
<td>5.9</td>
<td>Living</td>
<td>Pullen</td>
</tr>
<tr>
<td>3.4-6.5</td>
<td>Office</td>
<td>Honey and Buchanan (1992) (cited by Pullen, 2000c)</td>
</tr>
<tr>
<td>4.3-5.1</td>
<td>Office</td>
<td>Cole and Kernan (1996)</td>
</tr>
<tr>
<td>5.5</td>
<td>Office</td>
<td>Oppenheim and Treloar (1995)</td>
</tr>
<tr>
<td>8.0-12.0</td>
<td>Office</td>
<td>Oka et al. (1993) (cited by Pullen, 2000c)</td>
</tr>
</tbody>
</table>

Embodied energy for certain type of material may differ in various studies depending on system’s scope which is considered for the studies, geographical location and the chosen method. Similarly, it can be said about differences in the embodied energy of buildings but apart from the above, mix of the materials and constructions used in the buildings usually vary considerably as well. Furthermore, embodied energy calculated per unit mass may give a completely different list of environmentally preferred material choices than the list based on the embodied energy per unit volume. Therefore, the correct choice might be to consider the embodied energy per functional unit, e.g. construction of 1 m² of wall with certain U-value (coefficient of heat transmission), with certain quality of interior (exterior) finishing and serving certain period of time. Unit of function has to be defined by the party organizing green procurement and has to be carefully selected in order to provide fair comparison between the alternatives.

There are various sources to obtain the data of embodied energy of materials and constructions from. Prof. Geoff Hammond and Craig Jones from the Department of Mechanical Engineering (University of Bath) have been working on a database which contains information about the embodied energy of a large number of building materials and this database has free access with registration. Another solution would be to use life cycle inventory (LCI) databases, such as ELCD – “European Reference Life Cycle Database” which is also freely accessible. ELCD database contains LCI data for various materials and construction systems. The data in ELCD database are well described and contain the inputs for calculation of the embodied energy for the studied product flow.
Embodied energy of the considered product or system can be calculated by summing up consumption of all energy sources. However, this would not provide a fair comparison of materials from environmental point of view since the energy sources used may be of different origin. Preferring the materials with largest share of renewable energy in the embodied energy would promote sustainability therefore the share of renewable energy has to be considered (Fig. 11).

Remaining reserves of non-renewable energy sources can be considered in order to prefer the energy sources with the largest known world reserves. Thus, materials could be selected by considering also extent of depletion of non-renewable energy sources \((EDNRES)\) which can be calculated as follows:

\[
EDNRES = \frac{e_1}{R_1} \times \frac{e_1}{E} + \frac{e_2}{R_2} \times \frac{e_2}{E} + \ldots + \frac{e_i}{R_i} \times \frac{e_i}{E}
\]

(1)

where
- \(e_i\) – embodied energy of non-renewable energy source \(i\);
- \(R_i\) – known world remaining reserves of non-renewable energy source \(i\);
- \(E\) – total embodied energy of the material.

Factors \(e_i/R_i\) in the equation (1) could be substituted with life cycle impact assessment characterization indicators for the category “depletion of abiotic resources” used in the method “CML 2002”. These indicators for various energy sources are expressed in kg of antimony equivalents per MJ, i.e. kg Sb eqv/MJ. There may be other solutions used for including extent of the depletion of non-renewable energy sources within evaluation of embodied energy.

Table 4 shows the criteria \(EDNRES\) calculated according to the formula (1) for various materials and constructions.
11. Embodied energy as an additional criteria for the green public procurement

**EDNRES of construction systems and materials (for 1 kg of material)**

<table>
<thead>
<tr>
<th>Construction systems</th>
<th>EDNRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced concrete</td>
<td>2.01E-17</td>
</tr>
<tr>
<td>Calcium silicate blocks</td>
<td>7.10E-17</td>
</tr>
<tr>
<td>Lightweight concrete block</td>
<td>8.04E-17</td>
</tr>
<tr>
<td>Anhydrous gypsum</td>
<td>8.33E-17</td>
</tr>
<tr>
<td>Particle board</td>
<td>1.28E-16</td>
</tr>
<tr>
<td>Oriented strand board</td>
<td>1.33E-16</td>
</tr>
<tr>
<td>Aerated concrete block</td>
<td>2.33E-16</td>
</tr>
<tr>
<td>Rock wool</td>
<td>2.39E-15</td>
</tr>
<tr>
<td>Gypsum plasterboard</td>
<td>2.44E-15</td>
</tr>
<tr>
<td>Glass wool</td>
<td>4.41E-15</td>
</tr>
</tbody>
</table>

Known world remaining reserves of non-renewable energy sources which were used in the calculation of EDNRES are shown in the Table 5.

**Known world reserves of non-renewable energy sources (EJ)**

<table>
<thead>
<tr>
<th>Energy resource</th>
<th>Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>22302</td>
</tr>
<tr>
<td>Oil</td>
<td>8569</td>
</tr>
<tr>
<td>Natural gas</td>
<td>6277</td>
</tr>
<tr>
<td>Nuclear</td>
<td>1020</td>
</tr>
</tbody>
</table>

Table 4 shows that glass wool has more than 200 times larger EDNRES than the reinforced concrete if calculated per 1 kg of material. However, when comparison is made based on 1 m² of wall surface with the same U value in W/(m²·K) then the concrete has about 20 times larger EDNRES than the required amount of glass wool material. However, glass wool would have to be installed within some supporting structure in order to form a wall. Therefore, the choice among solutions based on embodied energy can be made if comparison is made using finished construction with certain functional characteristics which allow for the fair comparison.

Thus, the above described three criteria containing embodied energy of material or construction system can be used for green procurement purposes:

1) total embodied energy per unit mass, unit volume or functional unit;
2) share of non-renewable energy source in addition to the first criteria;
3) extent of depletion of non-renewable energy sources in addition to the above 2 criteria.
12. ICELANDIC EXPERIENCE IN IMPLEMENTATION OF GPP

If to start from the beginning, the Icelandic government’s policy on *Green Public Procurement* (GPP) became effective in 2009. The overall objective of the policy is to promote environmental protection and advance sustainable development in the society. The specific aims of this policy are to ingrate environmental considerations at all levels of public procurement programs both products, services and work. It encourages public administration to adopt GPP, both the governmental level as well as the municipal local government sector.

GPP in Iceland mostly is set by European Procurement Directives.

Green procurement is gaining a strong foothold in Iceland. The law on public procurement (84/2007) contains references to green procurement or eco-friendly procurement. The law stipulates that public procurement may favor products/services that are eco-friendly and/or promote environmental awareness. An assessment of products and services currently purchased by the city revealed the huge saving potential of buying recycled paper for its offices, reorganising and downsizing its vehicle fleet and using environmentally-friendly cleaning products.

The Icelandic government considers eco-labeling to be an effective and efficient instrument to facilitate Sustainable consumption and production. The Icelandic government actively participates in administration of the *Swan* eco-label. The reference to the Nordic Svan ecolabel in the technical specifications increased by 100% in the last six months. Iceland is further enrolled in the European Union eco-label, the *Flower*, under the commitments of the European Economic Area agreement between Iceland and the EU. Icelandic enterprises can qualify and adopt the *Flower* – eco label. These two government run eco-labels, *Swan* and the *Flower*, are administrated by the Environmental Agency, the Icelandic government environmental body.

There are other sector-specific international eco-labels that have gained momentum in Iceland: the *Green flag* is an eco-label available for educational institutions; kindergartens, primary and secondary schools and colleges, the *Green globe* eco-label is available for tourist facilities and communities.

The building regulations which will be issued will specify the demands to be made regarding the design and planning of the building and the building of structures concerning their appearance and conformity with their immediate surroundings, their economical and utility value, access to them by disabled people, safety, technical execution and maintenance. Requirements shall be stated regarding foundations, construction materials, load-bearing capacity, thermal insulation, vapor barrier and insulation against noise, ventilation, light, installations, hygiene, fire protection, etc.

In cases of complicated design, a building officer may demand comments by legally authorized approval designers at the builder’s expense. Before they may be used for construction, construction materials and prefabricated construction units and buildings shall have received certification by an accredited construction testing laboratory stating that they meet the requirements of the building and fire-protection regulations, that they conform to standards and that they are suitable for the working methods used and suit local conditions in Iceland.

A building officer may demand that a manufacturer or importer produce a certificate or a test report from an accredited construction testing laboratory specializing in the relevant field stating that construction materials which are on sale meet the requirements of standards and the building regulations.

According to the Icelandic building code, it is not approved to use any material unless it has been tested for either the EU or the Innovation Center Iceland which test all building material.

The main guidelines concerning GPP and construction field are Nordic swan, European Eco-label and the guidelines provided by the Icelandic National Planning Agency.

Concerning the implementation of GPP in Iceland, it is necessary to mention that the level of Public Awareness has increased.

The main success factor implementing Public procurements was strengthening political support for sustainable development.
13. FINNISH EXPERIENCE IN PLANNING THE MUNICIPAL GREEN CONTRACTS

The remarks and common rules for green purchase procurement in municipal contracts are based on municipal authority interview in Lahti town. Roughly aim to municipal materials purchases is that from them in 2013 about 50 – 75 % or even more could take into account all the environmental criteria in the green purchases. The greenness of purchases are defined in purchase by certain comparison factors and principles. The officials plan the competition and in all decisions the “greenness” factors are focused in the final purchase. To criteria belong factors like: purchased products have environmental certificates, the company which makes the offer has a certified quality system in their company, e.g., ISO 9000 or equal, price/quality relation of the purchased has been shown by calculations to be the right and the price is desired price. Also in some public procurements innovativeness and newness value of the product, work load can be raised to one competition criteria. Logistics of the purchase can have great influence, also the fact that all wastes are cared for. From the good care of the environment during and after the constructing of a new building can also get competition points. Every criteria get points in procurement (point load in %), and the product which will be selected is by this way shown to be the best for final contract. To municipal procurement belong in some way also the information giving, instructions and education (training) possibilities before the contract. Every purchase competition is thoroughly evaluated and the final purchase decision is always public. In agreement based procurements, the follow-up system of the contract will also be arranged.

14. EXAMPLES OF GPP

TURKU

In Turku region, it was decided to develop projects for 31 buildings corresponding to the passive building standard. Courses and seminars were organised for experts and population to identify how the buildings would fit in the city plan, the criteria for the technical specification, the criteria for the evaluation of the offers, their timelines, etc.

The tender includes construction work, power supply and heating, ventilation and hot water supply systems. Criteria:
- thermal energy demand for heating ≤ 20 kWh/m²/g,
- total primary energy demand ≤ 130 kWh/m²/g,
- air circulation ≤ 0.6 l/h.

Criteria were introduced to reduce the number of applicants:
- calculation of life-cycle costs,
- CO₂ emissions depending on the chosen type of power generation – geothermal, woodchip or granule boiler, and similar.

THE LUUKKU HOUSE (FINLAND)

The Luukku House is a zero-energy house in the Finnish climate and a plus-energy building in Spain. The design of the Luukku House spans from the concept of a traditional Finnish house, closely linked with nature. Building materials were selected to achieve a low carbon footprint. In the Luukku House timber-based materials are used in a variety of applications from structure to insulation, cladding and interior finishes. The
design incorporates the innovative use of existing products and demonstrates the results of active product development. The building envelope is designed to prevent heat loss during the Nordic winter. This is achieved through the high air tightness of the core and thermal break exterior elements, thick insulation and careful detailing. The windows use a quadruple glazed frameless unit fixed directly to the frame. This results in excellent thermal insulation with no thermal bridges. Energy saving solutions include the use of interior materials for moisture and thermal buffering which enhance indoor air quality. The wooden interior panels are profiled to expose a high surface area to circulating air. These act to absorb and release moisture balancing the humidity levels in the house. Energy is produced by photovoltaic panels and solar thermal collectors. The energy balance has been calculated throughout the project as part of an interactive process where design solutions have been based on the results of energy simulation. The aim has been to find the most energy efficient solution possible without compromising the home-like atmosphere of the interior. Energy production and consumption, weather station information and the physical performance of the finished building are all monitored using constant, real-time metering. All information is available through one user interface, on the screen in the house and via the internet.

ROME

The municipality of Rome decided to organize GPP for catering services to pupils, including preliminary operations, cooking, servicing, and collection of waste.

Criteria:
- food and non-food waste should be sorted,
- washing and sanitation products should have negligible impacts on the environment,
- items for personal use, such as napkins, should be bio-degradable or recyclable,
- utensils made of ceramic materials, glass, and stainless steels should be used,
- use of genetically modified products in food and animal food is prohibited,
- the "guaranteed freshness" criterion should be respected
  - for fruit and vegetables, the time interval between harvesting and use must not exceed 3 days,
  - for meat, the time interval between vacuum-packing and use must not exceed 4 days,
- meat dishes should not be cooked more than twice a week,
- the menu is dictated by the season.

STOCKHOLM

The Council of Stockholm Region uses approximately 40,000 computers of various types. New and more stringent environment protection regulations applicable to procurement of computers were developed in year 2010.

Criteria:
- All systems must comply with the latest Energy Star standard for energy consumption
- Computers must not contain lead, mercury, PVH and halogenated flame retardants according to RoHS Directive 2002/95/EC
- The Typical Electricity Consumption (TEC) must 20% lower than the Energy Star criterion
- Computers must contain at least 10% of recyclable plastics
- All monitors must comply with the latest environment and use criteria according to the TCO Development Certificate (TCO Displays 5) or its equivalent.
REYKJAVIK (ICELAND)

The City of Reykjavik, which has a population of 120,000, has been incorporating environmental criteria into all its tenders for municipal cleaning services since 2008. Today, the city’s major buildings, for example all kindergartens, are cleaned by contractors certified by the Nordic Swan Ecolabel. The city’s demand for environmentally sound cleaning services caused a boom in the demand for ecolabels and certifications in Iceland. It also led to a number of companies setting up and implementing certified environmental management systems, such as ISO 14001.

ZURICH

In past years, Zurich used to procure shirts made of a mixture of polyester and other fibres for the needs of municipal services (hospitals, the police, etc.). The total volume was approximately 60,000 pieces per year. A decision was taken to change to procurement of 100% natural cotton shirts because production of synthetic fibres and products made of it often imply considerable environmental impacts. A tender for procurement of 4,000 natural cotton shirts was announced.

Criteria:
- Shirts must be of 100% natural cotton
- The fabric must comply with the requirements established in Eco-Tex Standard 100 Class II or an equivalent, which establishes
  - threshold values for potentially hazardous substances in direct contact with the skin,
  - maximum content of biologically active substances and flame retardants, the minimum values of colour fastness.

LATVIA

Having reviewed the documentation available for the Green Public Procurement (publications and tender regulations), one comes to the following conclusions:
- Several tenders contain general wording for environment protection requirements, such as: “... compliance with environment and nature protection requirements according to the requirements established by the Regional Environment Authority of the State Environment Service...”, “... assure environment-friendly construction operations...”, “... perform simplified renovation, in compliance with high power efficiency requirements and using environment-friendly building materials...”.
- A slightly better case is when the customer requires compliance with a certain construction standard or regulation, for example, “... the power saving calculations should be made according to LVS EN ISO 13790...”, “... reconstruction should comply with the requirements established in LBN...”.
- In some procurement procedures, one can see that the customer does not require a certain value for a criterion, but waits for the supplier to provide it and then assess the offer; for instance “... provide power efficiency solutions for the outer structures...”, “...provide heating and ventilation system solutions with heat recovery...”, “... assure transition to power-saving lamps...”.
- The technical specification is provided for the system (capacity, output etc.). However, the value of the efficiency ratio of the system is not required.
- There are projects in which values of certain criteria are provided with no reference to the source of such values; for example, “... power consumption threshold value per 1 m² a year for the heated area – 57.90 kWh/m² per year...”.
- There are few procurement procedures with paragraphs for compliance with environment protection requirements. Most frequently, the successful bidder is the one with the lowest price, unless a parameter is not in compliance with the standards. Other offers with materials of possibly higher quality are not considered.
15. RECOMMENDED LITERATURE


11. http://www.klf.no/no/Publikasjoner/Publikasjoner/2011/Mars/Regulerte-stoffer-i-byggevarer/?attachment=true


