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DIPLOMA THESIS

GREEN PUBLIC PROCUREMENT OF BUILDINGS

2020 Lukáš PAVEL

CATHOLIC UNIVERSITY OF LEUVEN

FACULTY OF ENGINEERING TECHNOLOGY

Department of Sustainable Buildings

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Ekologicky Šetrné Veřejné Stavební Zakázky

I declare that I have elaborated this thesis on my own, only with the guidance of Ing. Michal Vondruška, Ph.D and Arch. Alexis Versele.

Furthermore, I declare that all the documents I drew from are listed in the bibliographic citations.

05.01.2019 …….

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I have been writing the whole this thesis abroad. If anyone decides to stay in a place unknown to him, many problems naturally arise. I would like to thank all the good people, who helped me in the “New World”.

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Annotation

This diploma (master) thesis deals with the issue of Green Public Procurement of constructions – concretely buildings – in Europien Union area. Green Public Procurement can be understood as *"a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured"*. [1, p. 4] Sometimes it is just called Green purchasing. [2] The content of the thesis introduces readers to the approach to environmentally friendly public procurement from the perspective of the Czech Republic and Flanders - a federal region of the Kingdom of Belgium.

The thesis has two main objectives. To inform and inspire a possible public builder on various ways of green public employer (owner of future building) and to draw attention to any deficiencies. The second, perhaps more serious, objective is to stimulate a discussion of the professional public, which would lead to better and more efficient Green Public Procurement.

Anotace

Diplomová práce se zabývá problematikou Green Public Procurement staveb – konkrétně budov - v prostředí Evropské Unie. Green Public Procurement lze chápat jako Šetrná veřejná správa [3] či Zadávání zelených veřejných zakázek [4]. Obsah práce zasvěcuje čtenáře do přístupu k zadávání environmentálně šetrných veřejných zakázek z pohledu České republiky a Vlámska – federativním regionem Belgického království.

Práce si klade dva hlavní cíle. Informovat a inspirovat případného veřejného stavebníka k různým způsobům zeleného zadávání veřejné zakázky a upozornit ho na případné nedostatky. Druhým, cílem je podnítit diskusi odborné veřejnosti, která by vedla ke kvalitnějšímu a efektivnějšímu zadávání environmentálně šetrné veřejné stavební zakázky. Pro oba cíle jsou využívány zahraniční zkušenosti, které mohou nabídnout neobvyklý pohled na problematiku.

Key Words

Green Public Procurement, Green Building, Sustainability, Criteria, Circularity

Klíčová slova

Environmentálně šetrné zadávání veřejných zakázek, Zelená budova, Udržitelnost, Kritéria, Oběhové hospodářství

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1. Introduction

„On the lake's shore the pine grove rustles,
Thrushes' noble psalm and other birdsong
Mingles with maidens voices across the vale;
All living creatures honour youthful May." [6]

„Na břehu jezera borový šumí háj,
z něj drozdů slavný žalm i jiných ptáků zpěv
mísí se u hlasy dolem bloudících děv;
veškeren živý tvor mladistvý slaví máj." [5]

Karel Hynek Mácha as a significant representative of Czech literary romanticism beautifully described his love of nature in his poem called May. Romantic poets commonly used theme of nature because of its idealistic wildness and purity – because it is ideal. Over the past few decades we have seen an increase in interest of environment in society. Unlike romantic poets the reason for increasing interest is not admiration. Increasing number of people is worried about future of our environment. A lot of people are worried that our environment is suffering and needs people to treat it gently.

This environmental awareness should also be reflected in the preparation of the building contract. The public sector should lead by example. Green Public Procurement for Buildings contains requirements for sustainable development. This work should serve as a guide for public contracting authorities to inform them on important aspects and to inspire green building solutions. This thesis is based on the procedures of two countries - Flanders (Belgium) and the Czech Republic. The different approaches and perspectives of both countries are a good basis for expert discussion to improve the shortcomings of green public procurement.

2. Theoretical part

Theoretical part of this thesis provides general information about Green Public Procurement and its legal backgrounds (including obligations and fundamentals of construction delivery systems).

2.1 Green Public Procurement

Public Procurement is a process of an acquisition of works, supplies or services for any public organisation such as the state, municipalities or funded organizations. Although each client in the private sector can set its rules for purchasing, public procurement must be managed according to legislation. The reason for the creation of this law is above all the determination of fair and public favourable conditions and transparency in the selection of the winner of the selection procedure. Safety, durability and durability are some of the conditions which can be considered favourable to the public. Lately, environmental condition has also seen increase in importance. The importance of the environmental aspect has become so great that it was necessary to define a special type of public procurement – public procurement called GREEN. [2]

Green Public Procurement (hereinafter GPP) can be understood as *"a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured"*. [1, p. 4] Sometimes it is just called Green purchasing. [2] It is very important to realize, that public sector has big power – for example government expenditures on works, goods and services correspond approximately 14 % of the gross domestic product of the European Union which is about EUR 1,8 trillion per year. [7] Thanks this power, public sector can influence a market by positive motivation, not by restriction. By requiring "green approach", the public sector will really stimulate innovation and the development of environment-friendly services and products. This approach has a major impact on **construction**, transport and health services, because these industries represent a large share of the market. [8, p. 4]

Construction is an extensive industry with a large number of specifics. The construction industry can be divided into four basic groups:

- buildings,
- transport and underground construction,
- water management structures,
- special constructions (pylons, underground collectors). [8]

This thesis is focused on **buildings**. Building constructions as a residential, industrial, civic or agricultural building can be green in many ways. Basic and determining factors of green buildings are:

- energy (power) consumption,
    - minimized energy consumption throughout the building's lifecycle, from construction and application of materials, during the operation of the building, to its demolition,
    - new and renovated buildings bring lower costs of operation and maintenance,
    - building users interact directly with environmentally friendly attitudes,
    - renewable and low-carbon technologies are integrated into common building energy processes,
- drinking water consumption,
    - minimizing drinking water consumption,
    - wastewater utilisation - grey and rainwater retention for safe use in indoor operation of buildings,
- healthy indoor environment,
    - healthy indoor environment helps reduce fatigue, improves concentration and work performance, contributes to overall user comfort,
    - suitable indoor temperatures,
    - sufficient supply of fresh air,
    - natural daylight suitably complemented by artificial, simultaneously reducing energy consumption, appropriate colour design,
    - dealing with acoustics,
    - ergonomics and the right choice of materials for equipment including furniture,
- minimization of waste and its reuse,
    - the use of durable materials during construction, generating less waste,
    - waste disposal and re-use in accordance with the building's life cycle,
    - involving building users in the process of material reuse and recycling,
- creating landscape character,
    - helping to reclaim and revitalize polluted areas – brownfields, creating “green” spaces,
    - restoration of urban areas, getting biodiversity. [4, p. 4]

Sustainability and Circularity are two important concepts connected with this list of factors.

2.1.1 Sustainability

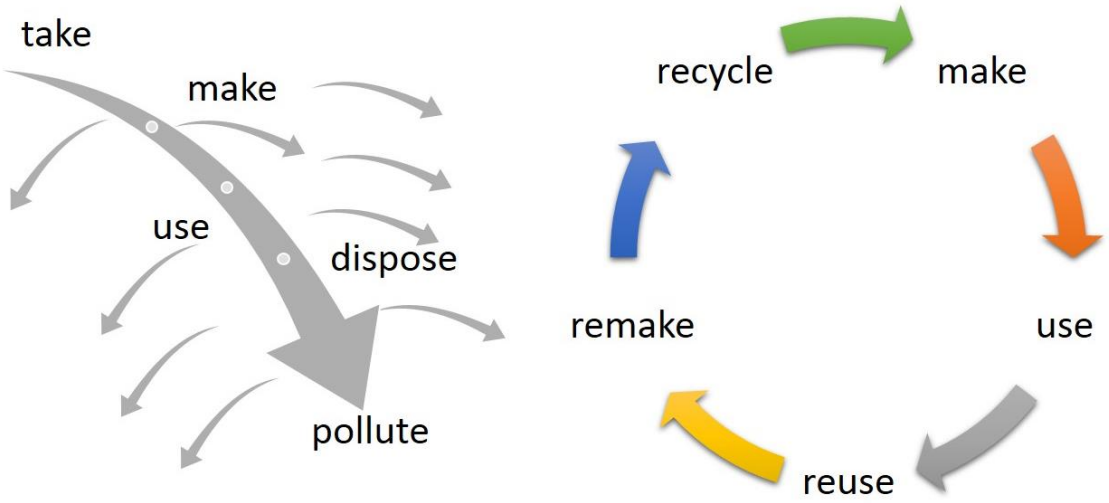
*"**Sustainability** focuses on meeting the needs of the present without compromising the ability of future generations to meet their needs. The concept of sustainability is composed of three pillars: economic, environmental, and social—also known informally as profits, planet, and people."* [9] Sustainability motivates clients, owners or investors to focus on a time period (years, decades) and forces them to consider even more factors than only the profit. To achieve sustainable development, it is necessary to have a plan to follow. This has been internationally discussed and 17 goals of sustainable global development have been set up by the UN as result. This plan has been holding till 2030 when it is to be fulfilled. [10]

Pic. 1: Sustainable development goals [10]

2.1.2 Circularity

Circular economy, also abbreviated as **Circularity**, is *"an industrial economy that is restorative or regenerative by intention and design. (…) the core of [the Circular Economy] is the circular (closed) flow of materials and the use of raw materials and energy through multiple phases"*. [11, p. 5] Circularity deals with two types of materials and both of them have their own circle, which follows different logic. First type includes organic materials which are recycled very well and it is not an issue to return them into biosphere. The second group of materials operates with synthetic substances. Design and means of production of said materials should enable their extraction and reusability from final products which contain them. [12]

Pic. 2: Linear versus circular economy [13]



Circular economy is not only interesting idea and theoretical vision. Already in December 2015, the European Commission adopted an Action Plan for the Circular Economy. The proposed measures should contribute to "closing the cycle" of the product life-cycle. Increased promotion of recycling and reuse is expected to bring benefits to both the environment and the economy. According to the Report from The Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions on the implementation of the Circular Economy Action Plan (hereinafter COM(2019) 190 final) of March 4, 2019, *"implementing the Circular Economy Action Plan has accelerated the transition towards a circular economy in Europe. At the same time, a stronger, shared vision of the circular economy can only boost ongoing efforts to modernise the EU industrial base to ensure its global competitive edge and preserve and restore the EU's natural capital."* [14]

As regards construction industry, COM(2019) 190 final deals mainly with topic of waste management. Construction and Demolition waste is the largest waste stream of the European Union (based on volume). That's why the European Commission is introducing **EU Construction and Demolition Waste Protocol and Guidelines**. *"Its overall aim is to increase confidence in the Construction and Demolition waste management process and the trust in the quality of Construction and Demolition recycled materials. This will be achieved by:*

- *Improved waste identification, source separation and collection;*
- *Improved waste logistics;*
- *Improved waste processing;*
- *Quality management;*
- *Appropriate policy and framework conditions."* [15]

2.1.1 Summary and conclusion

GPP is important type of Public Procurement. This public procurement includes sustainable development and nature protection requirements. This specific type of public procurement is one of the instruments to achieve the environmental objectives that the EU Member States have jointly committed to. Joint environmental commitments for the Czech Republic and Belgium were set not only within the EU but also within the UN. [10]

One important way to achieve sustainable development is implementation of circular economy (Circularity), i.e reuse, sharing, repair, remanufacturing and recycling to minimize resource input and minimize waste and pollution. In the EU Action Plan for the Circular Economy, the EU sets following targets and concrete procedures. *"Key elements of the revised waste proposal include:*

- *A common EU target for recycling 65% of municipal waste by 2035;*
- *A common EU target for recycling 70% of packaging waste by 2030;"* [14]

One of the main objectives of the Circular Economy Action Plan is the generating new jobs. It should not be a target, but only a consequence. If jobs are created just to be, there is no pressure to increase work efficiency. This is a contradiction with the idea of Circularity, which wants to use all resources, including human resources, effectively.

The above objectives are not a sudden idea but are the result of a continuous effort to improve the environment. Thanks to the long-term development of the EU and its environmental components, the EU is now one of the leaders in environmental protection.

2.2 Legal Background

This section explains the development of GPP and its current legal conditions, which are identical for the Czech Republic and the Kingdom of Belgium - the Flemish Region. The author focuses on the union legislation and EU recommendations for setting green criteria. Building certification systems - that are internationally identical - are also described in this chapter. The analysis and comparison of Czech and Flemish background for GPP and their specific criteria recommendations are provided in the practical part of this thesis (chapter 3.1).

2.2.1 Development of EU law in the field of environment and public procurement

The vast majority of laws and measures of the European Union countries, dealing with the protection of nature and the environment are based on the EU institutions or their predecessors. It is interesting, because European Union has evolved from primarily economic organizations - European Communities (the European Coal and Steel Community, the European Atomic Energy Community, and the European Economic Community) and the environmental policy was not included into the main areas of interest. Primary law (founding treaties) mentioned only the standard of living and living conditions and also toxic substances used in agriculture. During further development of the EU, various extensions and additions were added, including objectives, principles, scope and methods for environmental activities. [16, p. 11-13]

Environment Action Programmes also had a further impact on the development of Union environmental protection. Wide range of environmental legislation has been introduced, serving as general framework for future development of the Union's environmental policy. First Action Programme, adopted in the period 1974-1975, identified the main areas of interest for these policies (air and water pollution, waste, …), and proposed fundamental processes and timetables for achieving improvements in these areas. Furthermore, a special section of the European Commission for environmental protection was established. Next action programmes continued with the same ideas, refining them with new goals and responding to current topics related to nature. [16, p. 14-17]

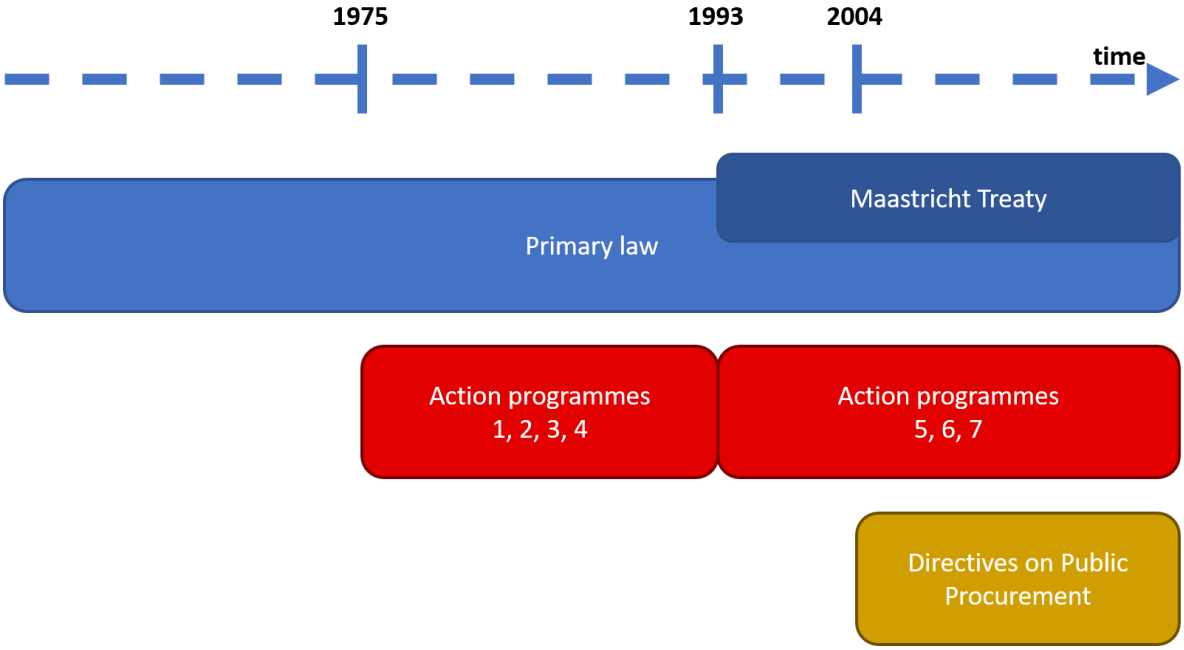
An important organization, which seriously started setting an environmental policy is **The Court of Justice of the European Union** (hereinafter the "CJEU"). Based on all treaties and Action programmes, the CJEU defined policy of environment (and public procurement as well) as we know it today. Importance of the CJEU is also described as follows : *„the Court appears to be making the most innovative contributions to the development of European environmental law."* [17, p. 178]

The **Maastricht Treaty**, which laid down precise rules that could effectively enforce the integration of environmental protection, came into force in 1993. These rules were set on the basis of the CJEU's interpretations of all existing treaties and action programmes. In the following years, there was an improvement in water quality, a reduction in cross-border air pollution, and more. [18, p. 99]

Next important legal instrument was Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts. It incorporates *"environmental*

requirements for the technical specifications of a given contract" into public procurement. [19] This directive was replaced with a new directive in 2014 (**2014/24/EU**). [20] This new Directive, which responds to new requirements and previous experience, currently determines the possibility for contracting authorities to meet environmental needs.

Pic. 3: Development of main EU documents governing GPP [own processing]



Picture number 3 shows, that first GPP was influenced only by founding **treaties (primary law)**, then **plans** to improve the environment (Action programmes) were established and now there are **directives** that directly determine how to incorporate environmental criteria into a public contract. In case of disputes, the CJEU shall decide and its conclusions shall be the basis for future improved documents.

2.2.2 Current union law recommendations for GPP of buildings

Section 2.1 describes that public procurement is divided into 3 groups: **works**, **supplies** or **services**. This thesis is mostly focused on construction work (works), designing building documentation (supplies) and facility management (supplies). Very often, public procurement is a combination of these groups (for example Design-Build or Design-Build-Operate projects – Project Delivery Methods are described in section 2.3). In this case the directive 2014/24/EU *says that "a contract should be deemed to be a public works contract only if its subject-matter specifically covers the execution of activities listed in Annex II, even if the contract covers the provision of other services necessary for the execution of such activities."* [20, p. 2, (8)] This Annex is attached in this thesis as Annex No. 1. A simplified list of activities can be seen in Tab. 1.

Tab. 1: A simplified list of activities for public procurement group Works [own processing, 20]

Division	Group	Subject
45		Construction
	45.1	Site preparation
	45.2	Building of complete constructions or parts thereof; civil engineering
	45.3	Building installation
	45.4	Building completion
	45.5	Renting of construction or demolition equipment with operator

The above describes general public procurement. The most important tools, which turn a regular public procurement into a green one, are the **requirements** and **criteria** in the tender documentation for tendering the contractor. There are three basic types of criteria – Technical specifications, Selection and Award criteria. [20]

Technical specifications are the real technical requirements of the client (owner of the building), which must be unconditionally fulfilled. Within GPP for buildings, this can be energy consumption, drinking water consumption or minimization of waste and its reuse.

Selection criteria are employer requirements for suppliers. This might include consideration of past performance, relevant experience, technical ability, sustainability, health and safety record, innovation, resource availability, management skills and systems, proposed methodology and so on. The selection criteria only relate to the personal and qualitative situation of the candidates and tenderers.

Award criteria (also called as Grant or Evaluation criteria) are aspects of a contractor offer, which are evaluated individually. The final evaluation is composed from each partial evaluation criterion. Award criteria serve for the qualitative and substantive evaluation of the tenders submitted and their mutual comparison and assessment. [20, 25]

An example of selection criteria is, for example, the submission of The certificate regarding compliance with tax obligations. An example of Technical specification is, that since the 1st of January 2019 every new public building must have NZEB (**n**early **z**ero **e**nergy **b**uilding) standard (due to directive 2010/31/EU). [21] Evaluation criteria example is in general shown in the Tab. 2.

Tab. 2: Example of evaluation criteria for construction works [own processing]

% of evaluation	Criterion name
60	low price
30	construction time
10	waste management

Every contracting authority should set it's requirements very carefully and make it's intentions very clear. *"Contracts should be awarded on the basis of objective criteria that ensure compliance with the principles of transparency, non-discrimination and equal treatment, with a view to ensuring an objective comparison of the relative value of the tenders in order to determine, in conditions of effective competition, which tender is the most economically advantageous tender. It should be set out explicitly that the most economically advantageous tender should be assessed on the basis of the best price-quality ratio, which should always include a price or cost element."* [20]

To make the directive easier to understand and implement, European Commission developed **EU GPP criteria** for priority sectors which facilitate the inclusion of green requirements in public tender documents. To this date, wide range of priority sectors has their EU GPP criteria (list of them is attached as Annex N. 2). Green Public Procurement Criteria for **Office Building Design, Construction and Management** (hereinafter the "OB-GPP criteria") focuses on a building as a system rather than individual components, so they will be described in detail. Other EU GPP criteria connected with building only deal with specific items as Water-based heating systems, Indoor lighting, Taps and showerheads etc. OB-GPP criteria *"provide procurers with a basis for selecting tenderers according to their competencies, set technical specifications at different levels of ambition, as well as encouraging tenderers to bring forward innovative design solutions."* These criteria are divided into 7 phases, because it is common for these phases to have their own public procurement:

A. Selection of the design team and contractors;
B. Detailed design and performance requirements;
C. Strip-out, demolition and site preparation works;
D. Construction of the building or major renovation works;
E. Installation of energy systems or the supply of energy services;
F. Completion and handover;
G. Facilities management. [22]

Individual phases can be procured separately or together. The document contains specific real regulations that can be copied directly into the tender documentation or directly into the contract. Contracting authority can both use all the criteria or select few. It is also possible to put custom criteria into the documentation, however they must comply with directive 2014/24/EU..

Although OB-GPP criteria describe only several criteria, the selected ones are interested in the most harmful environmental impacts of buildings. *"Evidence gathered from office buildings*

across Europe indicates that their most significant environmental impacts relate to energy use during their occupation. The most significant contributors are lighting, heating, cooling and ventilation. (...) The production of construction products is responsible for the next most significant environmental impacts." Recycling and re-use are an opportunity to improve the impact of the production of construction products – Circular economy. A large amount of emissions are generated in the case of transporting large-volume building materials with a high weight. The transport can be eliminated by using local sources, produce the products very close to building site or recycle or re-use on the construction site existing structures and products. Next important aspect is the lifespan of the building and its elements. The production of a quality product with a long service life is more environmentally friendly than the frequent replacement of old products with new ones. This knowledge is closely related to **Life Cycle Impact** of products and materials. Life cycle impact evaluation is a useful tool for assessing green designs, it is included also into OB-GPP criteria. [22, p. 6] These areas of significant environmental impact and suggested approaches to them can be seen in the Pic. 4.

Pic. 4: Proposals to reduce environmental impact [22, p. 8]

Key Environmental Areas in Office Buildings life cycle and Key Environmental Impacts	**Proposed EU GPP Office Buildings approach**
Key environmental areas • Primary energy consumption and associated greenhouse gas emissions during use of and travel to and from the building • Depletion of natural resources, embodied energy and emissions associated with the manufacturing and transportation of building materials • Waste generation during site preparation. construction, use and demolition of the building • Deterioration in indoor air quality due to emissions of hazardous substances from building products and the intake of particulate air pollution from the external environment • Pollution of the local environment and deterioration of local air quality due to emissions from vehicles used to travel to and from the building • Water consumption during use of the building Key life cycle environmental impacts and parameters for resource use: • The following environmental impact categories along the product life cycle are considered to be the most important ones: global warming potential, acidification, exploitation of renewable and non-renewable primary energy resources eco-toxicity, human toxicity, eutrophication, abiotic resource depletion and water consumption , use of secondary and re-used materials and waste material flows	• Design and construction to achieve high energy efficiency performance and low associated CO_2 emissions • Installation of high efficiency and renewable energy technologies which make use of site-specific opportunities to reduce energy consumption and CO_2 emissions • Design and specification to reduce the embodied impacts and resource use associated with construction materials • Design, specification and site management to minimise construction and demolition (C&D) waste and to use building products or materials with a high recycled or re-used content • Specification of fit-out and finishes that minimise hazardous emissions to indoor air • Ventilation design in order to ensure healthy air and minimise the intake of external air pollution • Specification and installation of water saving technologies • Installation of physical and electronic systems to support the ongoing minimisation of energy use, water use and waste arisings by facilities managers and occupiers • Implementation of staff travel plans to reduce transport related fuel use and CO_2 emissions, including infrastructure to support electric vehicles and cycling

Total number of OB-GPP criteria is 44. All of them are shown in the Tab. 3.

Tab. 3: List of OB-GPP criteria [22, p. 9-36]

A. Selection of the design team and contractors		A1. Competencies of the project manager
		A2. Competencies of the design team
		A3. Competencies of the main construction contractor and specialist contractors
		A4. Competencies of DBO contractors and property developers
		A5. Energy Management System
B. Detailed design and performance requirements	TECHNICAL SPECIFICATIONS	B1. Minimum Energy performance
		B2. Lighting control systems
		B3. Building energy management system
		B4. Low or zero carbon energy sources
		B5. Staff travel plan and infrastructure
		B5. Recyclable waste storage
		B6. Water saving installations
		B7.1 Thermal comfort conditions
		B7.2 Daylighting and glare control
		B7.3 Ventilation and air quality
	AWARD CRITERIA	B8.1 Minimum Energy performance requirements
		B8.2 Building life cycle GWP (Global Warning Potential)
		B9. Low or zero carbon energy sources
		B10.1 Performance of the main building elements
		B10.2 Incorporation of recycled content in concrete and masonry
		B10.3 Performance requirements for CO2e emissions from the transportation of aggregates
C. Strip-out, demolition and site preparation works		C1. Demolition waste audit and management plan
D. Construction of the building or major renovation works	TECHNICAL SPECIFICATIONS	D1. Sourcing of legal timber by the lead construction contractor
		D2. Installation and commissioning of building energy systems
		D3. Site waste management
		D4. Selection of fit-out materials and finishes
	CONTRACT PERFORMANCE CLAUSE	D5. Installation and commissioning of building energy systems
		D6. Incorporation of recycled content
		D7. Sourcing of legal timber
		D8. Site waste management
E. Installation of energy systems or the supply of energy services		E1. Heating systems, including Combined Heat and Power (CHP)
F. Completion and handover	TECHNICAL SPECIFICATIONS	F1. Quality of the completed building fabric
	AWARD CRITERIA	F2. Installation and commission of low or zero carbon energy sources
	CONTRACT PERFORMANCE CLAUSES	F3. Quality of the completed building fabric
		F4. Lighting control systems
		F5. Building energy management system

		F6. Installation and commissioning of low or zero carbon energy sources
		F7. Recyclable waste storage
		F8. Air quality testing
G. Facilities management	TECHNICAL SPECIFICATIONS	G1. Building energy management system
		G2. Energy performance contract
		G3. Waste management system
	CONTRACT PERFORMANCE CLAUSE	G4. Energy performance contract
		G5. Waste management system

Some of them are extended by a more comprehensive approach. These comprehensive criteria take into account more aspects or higher levels of environmental performance. Example of one OB-GPP core criteria is shown in the Pic. 5, comprehensive one in the Pic. 6.

Pic. 5: Detailed design and performance requirements – B3 core criterion [22]

B3. Building energy management system

A building energy management system (BEMS) shall be installed and commissioned that provides occupants and facilities managers with real-time information on the building's energy use by using networked sensors and a minimum of half hourly utility metering.

The user interface shall allow for information on the buildings energy use to be analysed and downloaded by occupants and facilities managers without requiring significant training.

The performance of key aspects of the building that can be controlled by the system shall be easy to adjust i.e. lighting, heating, cooling.

Verification:

The Design team or the Design & Build tenderer or the DBO tenderer shall provide specifications for the BEMS including information about the user interface. They shall additionally demonstrate how information will be displayed, reported and made available to at least the facilities and/or energy managers for the building.

Pic. 6: Detailed design and performance requirements – B3 comprehensive criterion [22]

B3. Building energy management system

A building energy management system (BEMS) shall be installed and commissioned that provides occupants and facilities managers with real-time information on the building's energy use by using networked sensors and a minimum of half hourly utility metering.

The user interface shall allow for information on the buildings energy use to be analysed and downloaded by occupants and facilities managers without requiring significant training. Occupants shall also be able to adjust comfort conditions in zones of the building.

The performance of key aspects of the building that can be controlled by the system shall be easy to adjust i.e. lighting, heating, cooling. Additionally the system shall allow for:

- Analysis and control of energy uses for different zones within the building (as a minimum for heating, cooling, lighting);
- Performance optimisation according to ambient conditions inside and outside the building, and;
- Diagnosis of the reason for any deviations from design performance.

2.2.3 Building certification as a criterion

If the owner hesitates to set his own green criteria and even use the OB-GPP criteria, (s)he can use **building certification** as a criterion. Building certifications describe design, construction and use, and possibly disposal. The building will receive the required certificate if the standard of building design practices with an emphasis on sustainability is followed.

BREEAM (Building Research Establishment Environmental Assessment Method) launched in 1990 is the first green building rating system in the world. The BREEAM rating uses performance benchmarks that are set according to the established criteria. The evaluation concerns the building specification, its design, construction and use. Many categories from energy to ecology are considered. They include aspects related to energy and water use, indoor environment (health and quality of life), pollution, transport, materials, waste, ecology and management processes. A specific national version of BREEAM is introduced in the Netherlands. Thanks to its specific approach to the Dutch market, BREEAM is the most popular certification in the Netherlands. The great popularity of BREEAM penetrates across the border into Flanders in Belgium. [27]

LEED (Leadership in Energy and Environmental Design) is one of the most popular green building certification programs used worldwide. Compared to British BREEAM, it is more popular in America because it was founded in the United States in 2000. The LEED rating system is consists of detailed criteria for which a building can earn points. These criteria are

divided into 6 major credit categories (Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality and Innovation in Design) and other secondary categories where extra points can be earned. *"Buildings can qualify for four levels of certification:*

- ***Certified:*** *40-49 points*
- ***Silver:*** *50-59 points*
- ***Gold:*** *60-79 points*
- ***Platinum:*** *80 points and above"* [28]

SBTool (Sustainable Building Tool) is a lesser known certification tool and methodology for expressing the sustainability level of a building. SBTool methodology is used in many countries of the world and SBTool certification is performed nationally in Spain, Italy, Portugal and Czechia (called **SBToolCZ**). A team of experts from the Faculty of Civil Engineering of the Czech Technical University in Prague participates in the development of the methodology. This methodology is primarily used by public sector. [29]

There are much more building certifications on international market (e.g. WELL certification for internal quality assessment), but the mentioned ones are most used in Czechia and Belgium and the most relevant for this thesis. [30]

2.2.4 Summary and critical analysis

After many years of development, the clearly defined law for GPP was brought about by the Directive on the coordination of procedures for the award public contracts - nowadays 2014/24/EU. This Directive includes environmental requirements and criteria that can be applied to the tender. Here it is necessary to seriously consider what criteria will be chosen.

Is it prudent to strictly require, for example, prior experience if it is desirable for the public that the contractor come up with an innovative green solution? If GPP is to be a catalyst for environmental progress, the criteria in this area should be as restrictive as possible. Therefore a public owner should focus more on technical specifications and contract performance clauses. There can be many such criteria. In addition to setting own criteria according to the directive, it is possible to draw inspiration from already prepared criteria directly from the European Commission.

This document is an excellent assistant in setting contract criteria from the design team selection phase to the facility management. However, this range may seem not enough. The building's life cycle does not end with facility management but with disposal. Although some of the criteria in the document address the circular economy (e.g. in the design phase or implementation phase where waste management is described), **OB-GPP criteria** does not address the actual disposal phase. The phase of preparing a public contract for the disposal of an existing old building should be included into the document.

On the other hand, the OB-GPP criteria document correctly includes demolition in the life cycle cost assessment. If disposal costs were not included, the winning bid may not be sustainable. As an example, a comparison of wooden and aluminium windows can be used. Aluminium windows normally have the double lifetime of wooden windows and therefore have lower maintenance costs, however recycling aluminium windows is significantly more demanding than wooden ones. [41]

Another suitable criterion may be to achieve a certain level of building certification. Of course, this criterion can specially be used in tender documentation containing the designing of the building. Although certification should assess the sustainability of a building - hence its entire life cycle, certification as a criterion is relevant only for design tenders, or even tenders for realization. Unfortunately, there are no retroactive checks on whether the requirements are being met in operation (the author has not found examples of revocation of certification). Another weakness of building certification is the disregard of the location. Only a few countries (such as the Dutch LEED) have certification requirements for their specific environmental conditions. For example, buildings with gold LEED certification in the Czech Republic and Florida are assessed on the same basis, being located in different climatic conditions and affected by each country's specific economy. Therefore, it is more convenient to use in the PP such certifications that are adapted for the localization (such as SBToolCZ for the Czech Republic).

Very often, the life cycle phases of a building are tendered together according to different delivery systems.

2.3 Project Delivery methods

Every building project phase, since pre-investment phase to demolition, has its specific needs and therefore specific procurement. The procurements can be associated, or on the contrary divided into procurement in more detail.

2.3.1 Presentation of relevant methods

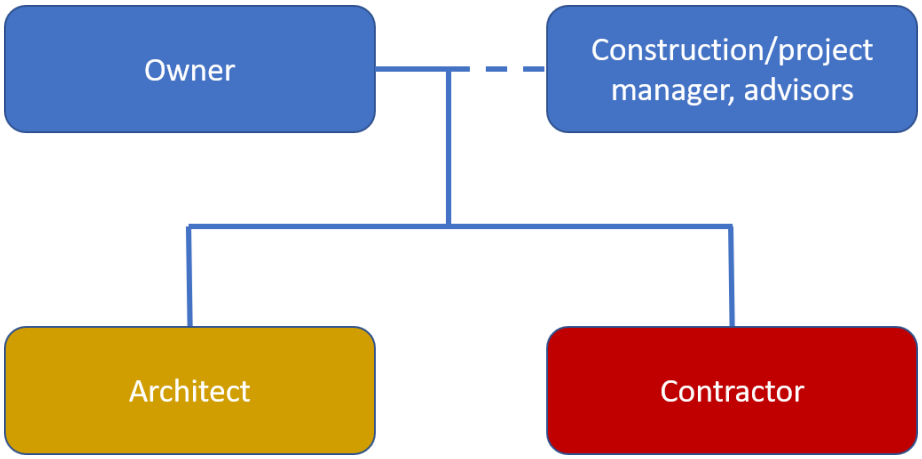
The most used procurement ways are defined as Project Delivery methods, sometimes also called delivery systems. Each has specific advantages and disadvantages that the building owner has to consider according to his requirements. The delivery system determines the correlation between the level of risk and the level of project control. A lot of delivery methods exist, however only the most relevant ones are mentioned in this thesis.

Design-Bid-Build (DBB) method is traditional delivery system which separates preconstruction and construction phases (note for Czech reader: Investiční fáze) into 3 main parts:

- design,
- bidding (tender),
- construction.

DBB project begins by hiring an architect or civil engineer designer who creates drawings and technical specifications (design documents). The designer usually frames an aggregated project cost estimate and schedule, too. *"Once the design documents are completed, a Request for Bids (sometimes called a Request for Proposal) is created and sent to contractors."* Contractors submit their bid prices for the project and the contractor with the lowest bid price gets the contract. [23] The structure of DBB is shown in the Pic. 7. Basic advantages and disadvantages are shown in Tab. 4.

Pic. 7: Diagram of DBB system [own processing]

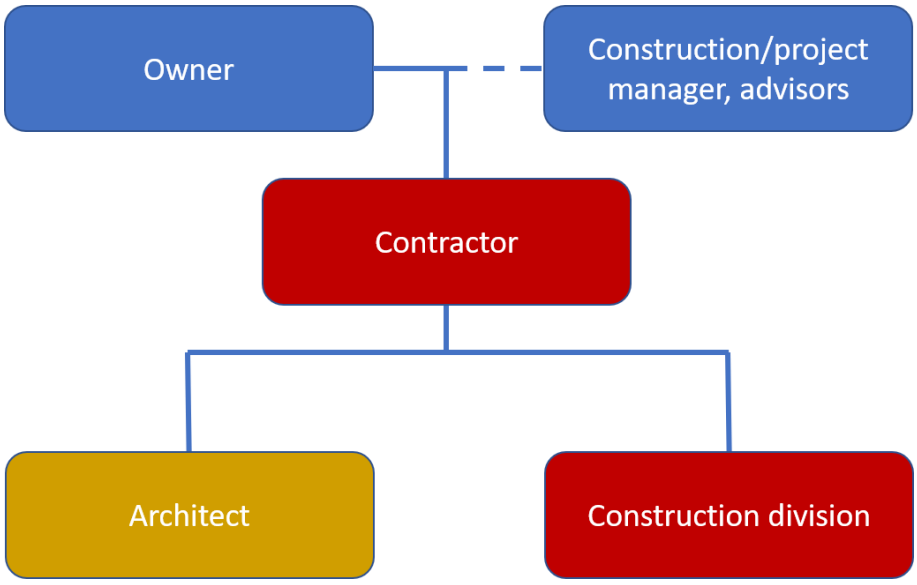


Tab. 4: DBB advantages and disadvantages [24, p. 35]

Advantages	Disadvantages
well known	isolates the contractor from the design process --> potential for project cost increases due to conflicts between the design documents and the constructability of the project in the field.
clear idea of the work price	
low work price	requires a strict sequence of project phases and makes it impossible to save time

In **Design-Build** (DB) contracts client (owner) enters into a contract only with one supplier to deliver the building project from design to hand over the completed building. *"Since the team is responsible for both the design and the construction components, pricing changes are kept to a minimum, and are usually isolated only to those instances where unknown conditions or owner requests necessitate cost increases. (...) The DB method provides the ability to deliver a project on a tight schedule, as projects can be split up and delivered in a package approach, where individual components are designed and built as needed to achieve the final completion date."* [23] The structure of DB is shown in the Pic. 8. Basic advantages and disadvantages are shown in Tab. 5.

Pic. 8: Diagram of DB system [own processing]



Tab. 5: DB advantages and disadvantages [24, p. 35]

Advantages	Disadvantages
risk transfer to contractor	The owner partially loses control of the project
fast-tracking --> omitting time to bidding a construction company	It is necessary to precisely formulate owner's idea of the project
more room for contractors' innovations	More demanding and more expensive project changes during realization
only one contract	higher price than DBB

Engineering, Procurement Construction (and commissioning in turnkey) (EPC) is specific type of DB contract. Beyond DB, it also includes initial commissioning and quality control. EPC is used mainly in technologically complicated projects. Contractor is responsible for sufficient technology operation.

Next project delivery methods **Design-build-operate** (DBO) or **Design-build-operate-maintain** (DBOM) include facility management in one public contract for project preparation and realization. Thus, the public contract in this case includes both the project preparation and implementation of the work and its administration for a contractually determined period. [4, p. 17] *"The common form of such a contract is a **Public Private Partnership** (PPP), in which a public client enters into a contract with a private contractor to design, build and then operate the project, while the client finances the project and retains ownership. (...) This differs from a design build finance and operate (DBFO) contract in which the contractor also finances the project and leases it to the client for an agreed period (perhaps 30 years) after which the development reverts to the client."* [23] Contractor is motivated to design a building very properly to reduce operating costs and make measures required effective. Unfortunately, there are experience especially in infrastructure construction - not common for buildings. DBO diagram is same as DB structure.

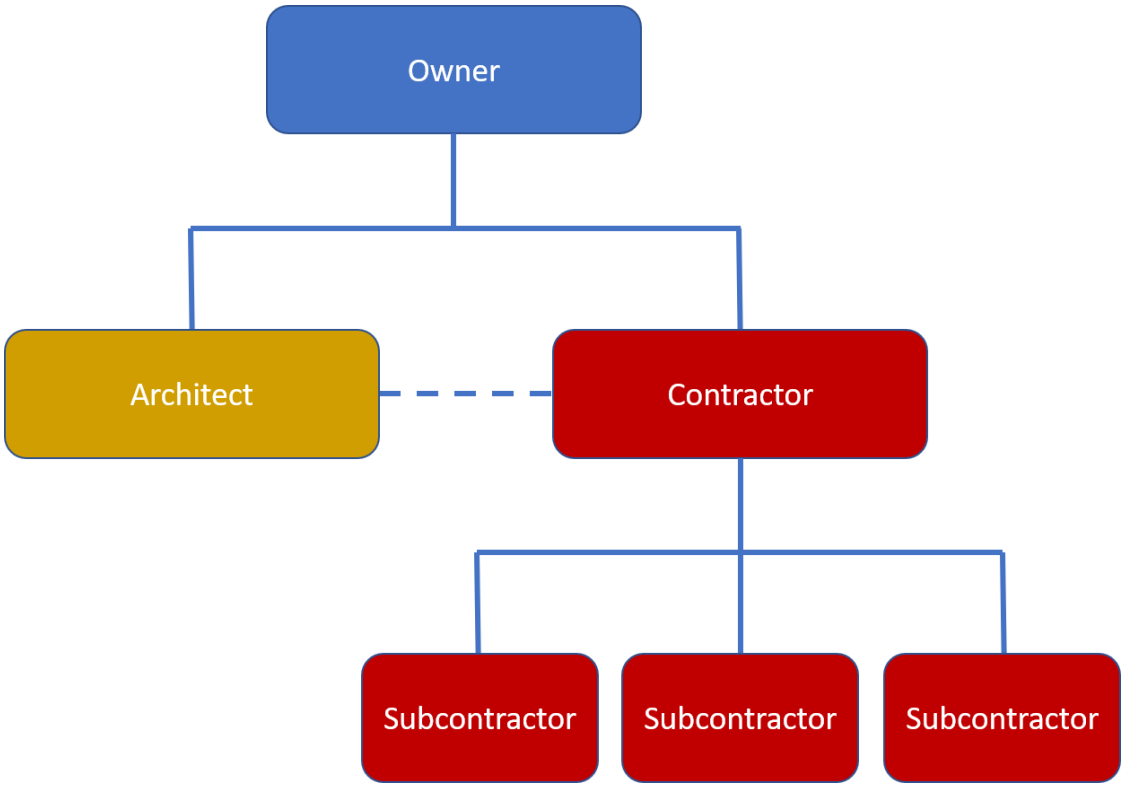
Tab. 6: DBO advantages and disadvantages [23]

Advantages	Disadvantages
higher quality of design, building works and service is assumed	complicated contract preparation
	higher price than DB
	not often for buildings

Construction Management at Risk (CMAR)'s mission is to provide the owner with professional management in all phases. The construction manager (CM) is the client's representative with taking over the implementation risks. In this delivery method the design work and construction work are contracted separately. The selected CM becomes a project team

member early on in the project process and, working directly with the owner and the architect. *"The CM provides input on items such as project budget, construction cost estimating and the overall schedule as well as providing review of design drawings to identify constructability issues and potential cost savings."* The price (Guaranteed Maximum Price) is usually set as cost + fixed fee. The CM bids subcontractors for separated package – parts of building (earthwork, foundation engineering, supporting structure, …). The construction manager is at risk, so if there is some extra work caused by bad management, the CM pay the extra cost from its profit margin. *"This process may also be applicable to some projects that involve complex integration between disciplines or multiple phases of construction, where the oversight and coordination delivered by a construction manager is extremely beneficial."* [25]

Pic. 9: Diagram of CMAR system [own processing]

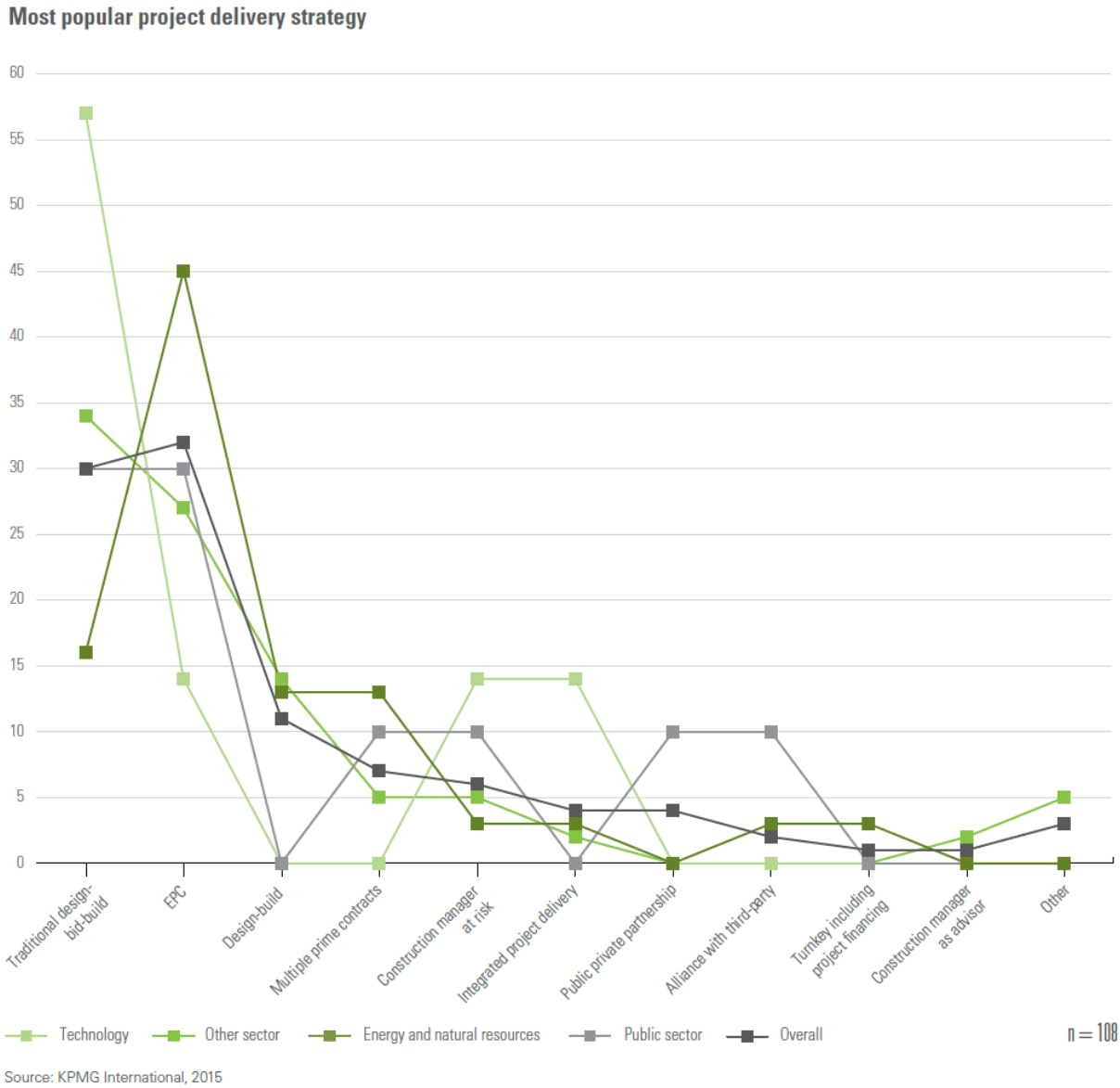


Tab. 7: CMAR advantages and disadvantages [24, p. 41]

Advantages	Disadvantages
risk transfer to contractor	effective only with large projects
fast-tracking	owner retains responsibility for the proposal
reducing the owner's management skills requirements	
working with package milestones and a fixed fee motivates CM	reduced control of the project owner

Although much more Project Delivery Systems exist, the mention ones are the most relevant for this thesis. In 2015 KPMG company released Climbing the Curve - 2015 Global Construction Project Owner's Survey, where it introduced the Most popular project delivery strategies. In the Pic. 10 there is depicted a gray line that shows the popularity of Delivery Methods for the public sector.

Pic. 10: Most popular project delivery strategy [26]



2.3.2 Contract templates

Writing contracts is a complex discipline - especially in a complex industry such as the construction industry. Therefore, efforts have been made to create a transparent contract model where the rights and obligations of both parties are fairly balanced. Such contracts are very

desirable for public procurement, which is extremely committed to transparency. For example, *"The German Construction Contract Procedures (VOB) is the basis for all public construction contract and procurement procedures in Germany."* [31]

FIDIC (F*édération Internationale Des Ingénieurs-Conseils = International Federation of Consulting Engineers*) is a globally recognized international organization that brings together national associations of consulting engineers in about 100 countries around the world. (Czechia - Czech Association of Consulting Engineer - cace.cz, Belgium - Organisation des Bureaux d'Ingenieurs-Conseils, d'Ingenierie et de Consultance - ori.be) [32] However, it is most popular in French-speaking countries (especially France, Switzerland and Belgium-Wallonia) due to its long tradition. FIDIC is known primarily for its family of contract templates, which are currently the most widespread contractual standards in the construction industry in the implementation of construction projects. [33, p. 224] There are a large number of standardized FIDIC contract conditions. They differ from each other mainly depending on the type of construction method used and other details. OB-GPP guidance also refers to red, yellow and gold FIDIC: *"This guidance is structured to reflect the key activities and decision points in the procurement process, as well as some of the common contract forms that are used in the European Union. Specific reference is made to the International Federation of Consulting Engineers' (FIDIC) contracts for construction works (Red Book), design and build (Yellow Book) and design, build and operate (Gold Book)."* [22]

Red book FIDIC is currently the most used exemplary type of FIDIC book. The delivery method is Design - Bid - Build (DBB), in which the project documentation for the work is processed by the client, who is also largely responsible for it. Also, the introduction of the institute of the construction manager acting on the one hand as a representative of the client and on the other hand in some cases as an independent arbitrator of the contracting parties (for example in deciding on claims, etc.) This contract is very popular with contracting authorities for infrastructure construction. Red FIDIC book is also used by important Czech state organizations by default - Directorate of Roads and Motorways (ŘSD), Railway Infrastructure Administration (SŽDC) and Waterways Directorate of the Czech Republic (ŘVC). [34]

Yellow book FIDIC is based on a red book, however it includes also designing – delivery system Design - Build (DB). Compared to the traditional delivery method (DBB), it is not widespread, but more potential for the public owner is expected in the coming years. [34]

Silver book FIDIC is also used for Design - Build, a risk is shifted more to contractors than the Yellow Book does. Next specification is that it is a turnkey delivery (EPC).

Gold book FIDIC is used for construction projects realized by the method of Design - Build - Operate (DBO), so it combines a standardized yellow book contract with an operating contract – can be used for PPP projects. In this case, the contractor is not only responsible for the design and execution of the work, but also for its operation and maintenance. Compared to the Yellow Book, it provides a facility renewal fund that covers the cost of renewing worn-out parts of equipment. It also provides the possibility of the client to withhold a certain part of the payment if the contractor does not properly maintain the work. [34]

There are many other FIDIC contracts as **Green book** (simple contract especially for work with relatively low investment costs) or **White book** (used, for example, to regulate the relationship between the client and the designer, technical supervisor or construction manager), but they are not used too much. [34]

2.3.3 Summary and critical analysis

In the construction industry, a large number of types of procurement procedures and the possibility of a method of awarding as required by the contracting authority are possible. It is not possible to describe all possible variants in detail, however, the need for a quality tender or formulation of requirements is for each order. The owner should always consider the importance of the building and its adequate ambitions. Simple projects are better procured by the traditional supplier method, on the other hand, for complex constructions, more attention should be paid to the complexity and risk reduction of the project. Green requirements can turn simple public procurement into a complex one. Therefore, alternative delivery methods could be used more often in this case to improve transparency and reduce risk. The Construction Management method is also a viable opportunity. It would be beneficial to divide the contract into individual parts where the owner would take over the structure, but specific technologies would be supplied by specialized companies using the DBO system. However, demanding coordination and design can be expected in this case. The various proposals are more discussed in chapter 3.3 Deficiencies and their improvements.

Although each contract is an original and must always be studied in detail, clear formulation and good logical structure is beneficial for both contractor and supplier. If each public institution used model contracts, the frameworks of which are known to each tenderer in advance, a reduced number of misunderstandings, greater transparency and possibly a reduction in the time to prepare the tender could be expected. However, the employer must bear in mind that the contract must be balanced and should not be changed in principle. In that case, the contract ceases to be a model. For example, if the owner sets excessive retainages or extreme penalties that may threaten the existence of the contractor, the contract is no longer balanced.

3. Practical part

The practical part is focused on the main objectives of this thesis. Since this work also aims to be kind of a textbook for a possible owner of a public building, the information from the theoretical part can be considered as practical, however the following paragraphs illustrate the real use of GPP in the Czech Republic and Flanders. 3.1 Comparative analysis explains the differences in GPP between Czechia and the Flemish Region. A reader can see the different approaches on real good practice projects of both countries in chapter 3.2. Finally, the GPP is evaluated as whole. Several deficiencies are presented, and possible solutions are offered.

3.1 Comparative analysis of Czech and Flemish requirements and evaluation

Sharing different views and approaches is rewarding. This part is not looking for the winner or the loser. Main target of this section is to provide overview of main differences between both regions. Based on this evaluation it is possible to find several opportunities for mutual improvement. Opportunities for improvement are presented in section 3.3. Summary and critical analysis. It is necessary to establish scope of comparison. This thesis is written during an internship abroad in the Belgian city of Ghent. Belgium is a federal kingdom where, in certain cases, individual regions have their own laws and regulations. As Belgium is trilingual, optional recommendations and recommended approaches may also differ between regions. Ghent is a city in Flanders, so if necessary, this thesis works with Flemish regulations and approaches. If the conditions are the same throughout the kingdom, or if regional specificities cannot be determined, federal data will be used.

3.1.1 Public procurement comparison of both countries

The thesis author's original hypothesis at the beginning of the internship abroad was that the requirements for public procurement and evaluation methods would be completely different in Flanders than in the Czech Republic. But the opposite is true - the types and procedures of public procurement are almost identical, due to membership in the European Union. One of the EU's main and original objectives is to reduce obstacles and disparities in interstate trade. Thanks to the European laws that Member States have to implement in their laws, the types of public procurement procedures in Belgium and the Czech Republic are very similar. All medium and higher value contracts must normally be awarded through competitive tendering procedures. Tab. 8 shows the types of public tendering procedures.

Tab. 8: EU types of public tendering procedures [own processing, 35]

TYPE OF PROCUREMENT	DESCRIPTION
Open procedure	In an open procedure **anyone** may submit a full tender. This procedure is used most frequently.
Restricted procedure	Anyone may ask to participate in a restricted procedure, but only those who are **pre-selected** may submit tenders.
Competitive negotiated procedure	In competitive negotiated procedures anyone may ask to participate, but only those who are pre-selected will be invited to submit **initial tenders** and to **negotiate**.
Competitive dialogue	This procedure can be used by a contracting authority with the aim of proposing a method of addressing a **need defined** by the contracting authority.
Innovation partnership	This procedure may be used when there is a need to purchase a good or service that is still **unavailable on the market**. A number of companies may participate throughout the process.
Design contest	This procedure is used to **obtain an idea for a design**.

The contracting authority may, depending on the circumstances and the needs, use the following additional forms of procurement:

- **framework agreement** with companies for tenders requiring recurring purchases,
- electronic **dynamic purchasing system** for repeat purchases (for restricted procedure),
- an **electronic auction** for the final choice of the winner.

Although each state must implement these types of procedures in its own law, it can detail it according to its own specifics. If the value of the contract exceeds the set threshold (limit), the contracting authority is obliged to proceed in accordance with more general European law instead of the law of the local country. This threshold is currently set at EUR 5,548,000 for construction contracts and EUR 144,000 for services and supplies. This threshold is set to be reviewed in 2020. [35]

The implementation of these types in **Belgium** is set on federal and regional level. This thesis deals with **Flemish** type adjustment. Flemish procedure list is shown in the Tab. 9.

Tab. 9: Flemish types of public tendering procedures [own processing, 36]

TYPE OF PROCUREMENT		DESCRIPTION
Standard award procedures	Open tender procedure	With only the price as award criterion.
	open tender request procedure	With multiple award criteria.
	Restricted tender procedure	With only the price as award criterion.
	Restricted offer request procedure	With multiple award criteria.
Negotiation procedures	Negotiation procedure without announcement	Candidates will be selected in advance without notice.
	Negotiation procedure without publication via accepted invoice	Order without specification document.
	Negotiated procedure with publication	Restricted procedure with negotiation.
	Simplified negotiated procedure with publication	Open procedure with negotiation.
Specific procedures	Public works concession	The government grants the concession holder the right to operate the work, where appropriate for a fee, in exchange for the concession holder's commitment to either setting up the work or designing and establishing the work.
	Competitive dialogue	Aim of proposing a method of addressing a need defined by the contracting authority.
	Design competition	Practically same as European Design contest - is used to obtain an idea for a design.
	Social housing procedure	Allows to use a suitable procedure for design and construction of a social housing complex. Mostly part of PPP.
	Working competition	Relates to the design and execution of a work.

Compared to the 6 European procedures, Flanders has 13 procedures but there are often only different options for the original types of procedures. There are 2 types of open procedures, 2 restricted procedure and 4 negotiation procedures. There are three ways of handling new procurements: Public works concession, Social housing and Working competition. Working competition can be used, if the contract for works concerns both the preparation of a design and the execution thereof. Innovation partnership is not mentioned in this Flemish list, because the federal regulation is used in this case. [36]

Czech law contains only 9 official tender procedures. The Czech Public Procurement Act [37] divides them into the categories Below-limit, Over-limit procedures and two other specific ones – see Tab. 10.

Tab. 10: Czech types of public tendering procedures [own processing, 37]

TYPE OF PROCUREMENT		DESCRIPTION
Below-limit tendering	Simplified below-limit procedure	Simplified open procedure up to the order value of CZK 20 million (approx. EUR 800,000).
Over-limit tendering	Open procedure	In an open procedure anyone may submit a full tender. This procedure is used most frequently.
	Restricted procedure	Anyone may ask to participate in a restricted procedure, but only those who are pre-selected may submit tenders.
	Negotiated procedure with publication	The contracting authority makes the selection of candidates first by sending a request for participation, which includes a preliminary tender and qualifications.
	Negotiated procedure without publication	The contracting authority shall directly invite one or more tenderers to submit a tender. The negotiated procedure is initiated by sending a written invitation to tender to one or more tenderers with whom the contracting authority wishes to negotiate the possibility of performance of the public contract.
	Competitive dialogue	This procedure can be used by a contracting authority with the aim of proposing a method of addressing a need defined by the contracting authority.
	Innovation partnership	This procedure may be used when there is a need to purchase a good or service that is still unavailable on the market. A number of companies may participate throughout the process.
Special tendering	Concession procedure	Regulates the conditions and procedure of the contracting authority in concluding concession contracts in the framework of cooperation between contracting authorities and other entities.
	Tendering in the simplified regime	For social and other special services listed in Annex 4 to Act 134/2016 Coll. (e.g., Healthcare, Welfare, Benefits, Postal Services).

There are 3 types of open tendering procedures in Czech law. It can be simplified for low-value contracts and for specific and marginal services. Although the Design contest is not directly mentioned in the list of PP procedures, it is included in the Czech Public Procurement Act. This type is classified under Part Six - Special Procedures - TITLE IV - § 143. This Act contains a non-traditional rule - Concession procedure. It was included after the repeal of Act No. 139/2006 Coll. on concession proceedings.

An overview of both countries and the EU can be found in Tab. 11. It shows what type of European procedure each Czech or Flemish procedure belongs to.

Tab. 11: Comparing the types of procedures mentioned countries [own processing]

EU	BE-VL	CZ
Open procedure	Open tender procedure	Simplified below limit procedure
		Open procedure
	Open tender request procedure	
		Tendering in the simplified regime
Restricted procedure	Restricted tender procedure	Restricted procedure
	Restricted offer request procedure	
Competitive negotiated procedure	Negotiation procedure without announcement	Negotiated procedure WITHOUT publication
	Negotiation procedure without publication via accepted invoice	
	Negotiated procedure with publication	Negotiated procedure WITH publication
	Simplified negotiated procedure with publication	
Competitive dialogue	Competitive dialogue	Competitive dialogue
Innovation partnership	*(federal law)*	Innovation partnership
Design contest	Design competition	*(only as one of the special procedures)*
-	Public works concession	Concession procedure
-	Social housing procedure	-
-	Working competition	-

In addition to the different PP procedures, Flanders and the Czech Republic differ in the use of **model contracts** in public projects. While Czech public employers use FIDIC [34] contracts (so far rather for transport infrastructure projects), model contracts are not used for Flemish public buildings. [41]

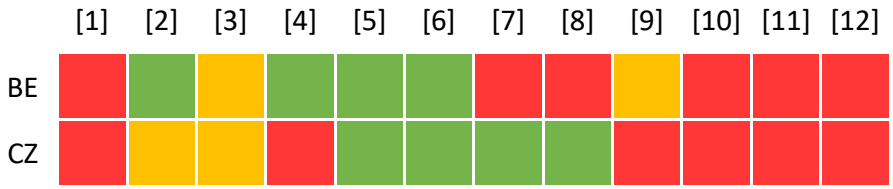
Comparison of public procurement of both countries can be done not only based on conditions and possibilities of procedures, but also in terms of **factual results**. This view shows that Belgium and Czechia are not only similar in terms of population and good beer. All EU countries are subject to EU directive regulations, such as on public procurement. In the **Single Market Scoreboard** (for 2018), where member countries are evaluated by twelve key aspects of public procurement, the Czech Republic and Belgium have the same rating. The Pic. 11 shows the aspects and their boundaries, when they are satisfactory or unsatisfactory. Tab. 12

demonstrates the results of each aspect (red unsatisfactory, yellow average, green satisfactory) for Belgium and Czechia. [38]

Pic. 11: List of PP indicator [38]

[1] Single bidder	≤ 10%	> 20%
[2] No calls for bids	≤ 5%	≥ 10%
[3] Publication rate	> 5%	< 2.5%
[4] Cooperative procurement	≥ 10%	< 10%
[5] Award criteria	≤ 80%	> 80%
[6] Decision speed	≤ 120 days	> 120 days
[7] SME contractors	> 60%	< 45%
[8] SME bids	> 80%	< 60%
[9] Procedures divided into lots	> 40%	< 25%
[10] Missing calls for bids	≤ 3%	> 3%
[11] Missing seller registration numbers	≤ 3%	> 3%
[12] Missing buyer registration numbers	≤ 3%	> 3%

Tab. 12: Results of indicators [38, own processing]



The most interesting indicator for this thesis is the 5 Award criteria. It shows, that both countries do not only decide on the basis of price, but also take into account quality. Unfortunately, this indicator is very general and does not include construction or green criteria. There are currently no sources explaining why market scoreboard does not include sustainability or circularity. The results of all evaluated countries can be seen in the Pic. 12: Overall performance of evaluated countries. [38]

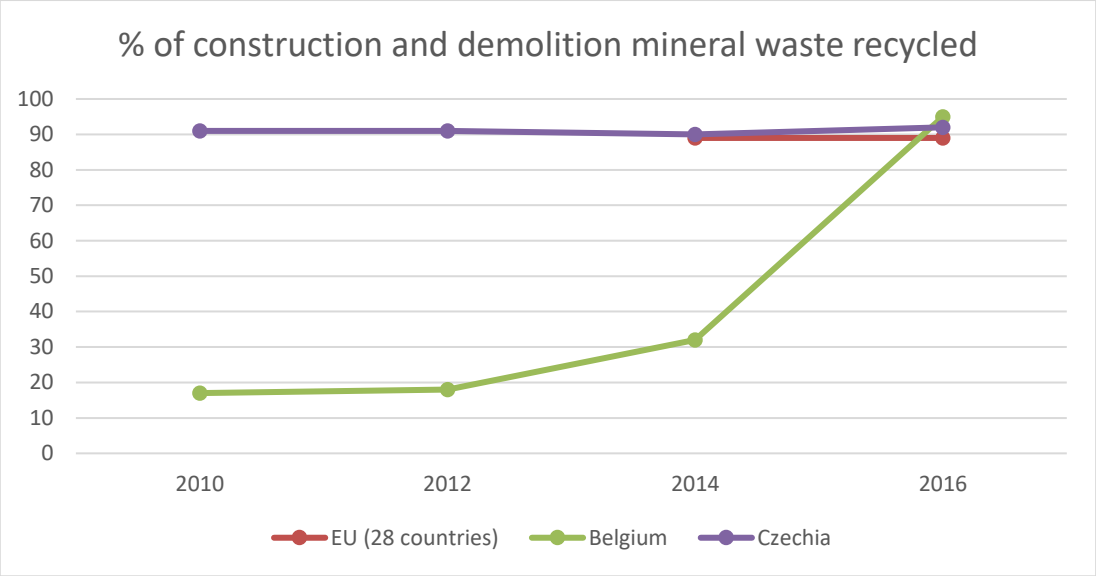
3.1.2 Circularity comparison

This section presents findings of comparison of European countries in terms of circularity done by **Eurostat**. [39] It uses 4 basic indicators: Production and Consumption, Waste Management, Secondary Raw Materials, Competitiveness and Innovation. Waste Management indicator includes Recovery rate of **construction and demolition waste**. *"The indicator is the ratio of construction and demolition waste which is prepared for re-use, recycled or subject to material recovery, including through backfilling operations, divided by the construction and demolition waste treated as defined in Regulation (EC) No 2150/2002 on waste statistics. (...) Only non-hazardous waste is taken into account."* [39] In this indicator, the Czech Republic and Belgium are above the EU average (last data from 2016) - see Tab. 13 and Pic. 13.

Tab. 13: % of construction and demolition mineral waste recycled [39, own processing]

Time / Country	2010	2012	2014	2016
EU (28 countries)	-	-	89	89
Belgium	17	18	32	95
Czechia	91	91	90	92

Pic. 13: Graph of development of construction waste utilization [39, own processing]



EU data is only mentioned for two measurements, as the previous ones did not include Croatia, which joined the EU in 2013. Assessing the development of the EU is therefore very complicated but seems stable (both values are the same). The Czech Republic also has a long-term stable value of recycled waste. A very favourable development can be seen in Belgium. Ten years ago, it was among the worst members in construction recycling, but managed to be among the above EU average. For the coming years, however, there is an assumption that further improvements will not be so dynamic.

3.1.3 Recommended criteria

This chapter describes the both countries' differences in two groups. **Selection criteria** are described separately because they do not almost directly concern the green criteria. One of the few green Selection criteria may be the previous GPP experience. The second group consist from **Technical specification** and **Award criteria**.

Selection criteria of both countries are not particularly different. Unlike Czechia, Belgium has specific instrument for public procurement. Kruispuntbank van Ondernemingen (Crossroads Bank for Enterprises – hereinafter CBE) is a federal database that brings together companies and their information in one place. CBE allows access to the following public data for each registered entity:

- *"company registration number;*
- *name;*
- *status;*
- *type (natural person or legal person);*

- *start date;*
- *address;*
- *legal form;*
- *contact data (telephone no. and fax no., email address and website);*
- *economic activities;*
- *certifications, licences or registrations that are of importance for third parties or whose publication is mandatory;*
- *ex officio striking off of the entity for failure to submit their financial statements;*
- *name and first name of the founders and/or persons who perform a legal function within the entity;*
- *legal situation;*
- *characteristics;*
- *links between entities;*
- *capital;*
- *duration of the entity, if limited;*
- *fiscal year-end and start and end date of the exceptional fiscal year, if any;*
- *date of the General Meeting;*
- *links to databases containing data not recorded in the CBE;*
- *start date of this data."* [40]

This centralized database can assist the contracting authority in setting the Selection Criteria. If the selection criteria are too strict, it is possible to check the number of potential candidates. CBE also provides clear categories and subcategories by industry and 8 classes by contract amount. Only entities that qualify for the given (sub)category and class can participate in the tender. *"For example: A contractor with a recognition in class 2 sub-category D5 may only perform carpentry work whose amount does not exceed EUR 275,000."* [40]

On the other hand, CBE may appear as bureaucratic uselessness. For each procurement, every selection criterion must be checked every time (by verified confirmation from banks, special authorities, etc.) and cannot be relied on only by CBE. [41] In Annex No. 4 there is the CBE screenshot with data of the construction company Artes Depret. CBE has its advantages, but nowadays it does not represent any advantage for GPP.

Environmental criteria are used to achieve **GPP** (in Chapter 2.2.2). However, since each construction project is unique, the criteria for each tender are also specific. Therefore, most of the green requirements and award criteria are not strictly required but are only recommended. In the source of these recommendations, the Czech Republic and Flanders differ from each other.

The Flemish government published a manual for achieving GPP called Manual: Sustainability considerations in public procurement. [42]. Another good step is that on the same website of the Flemish Government, you can find a hyperlink to the European Union manual - Buying Green ([8]).

The Flemish governmental **Manual** explains the whole GPP theme, including procedures and criteria. Although the title of the document is a manual, it does not contain specific recommendations for green criteria. For example social aspects can also be included in sustainability criteria. It also mentions at the outset *Belgian Federal Public Procurement Act* (*Artikel 81, §3, 1e lid van de Wet Overheidsopdrachten*) which makes it possible to set a criterion at any life cycle stage. [42, p. 33-34] The manual mentions 5 areas for green criteria:

- Lifecycle costs;
- Social considerations;
- Environmental considerations;
- Award criteria tailored to a functional contract description;
- Practical. [42, p. 33-39]

The **lifecycle costs award** of a contract is based on the most advantageous offer. Based on Article 81 of the Public Procurement Act, this can be determined in three different ways, at the option of the contracting authority:

- Based on the price. It is still possible to award with price as the sole award criterion in those cases where the technical specifications are sufficiently clear
- Based on the costs, taking into account the cost effectiveness. This also includes the life cycle costs.
- Based on the best value for money. [42, p. 34]

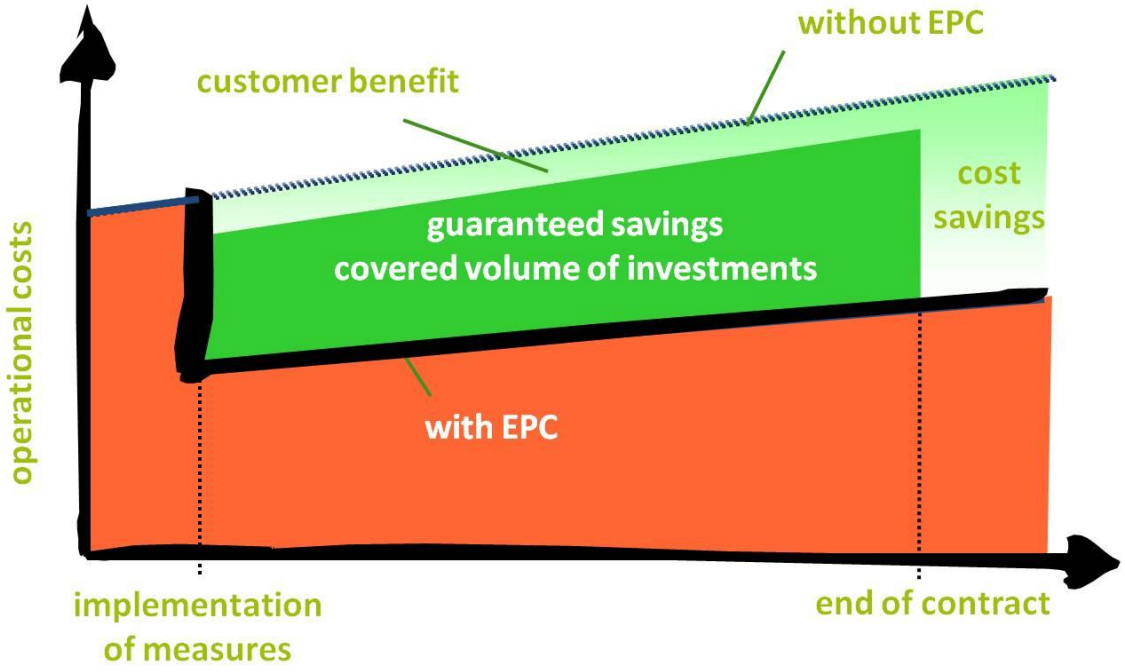
The second approach addresses the life cycle cost, considering projected future estimates of the costs attributed to external environmental impacts (due to §2 of Article 82 of the Public Procurement Act) Methods of estimating these costs must be based on objectively verifiable and non-discriminatory criteria. It is even possible to express the monetary value of external environmental aspects such as CO2 emissions or air pollution. [42, p. 34-35]

Social considerations as an award criterion are not described in detail in the manual. Although the social aspect is clearly part of the philosophy of sustainability, it came into law only based on Directive 2014/24/EU following the judgment of the Court of Justice of the European Union (case C-368/10). [42, p. 35]

Since the Manual is intended for general GPP and not just for buildings, the document recommends for **Environmental considerations** as an award criterion purchase of recycled paper, a duplex printer or the purchase of an eco-labeled car. [42, p. 35-36]

Award criteria tailored to a functional contract description are used when the performance of the product / work (defined as the Technical Specifications) is required. It is important to include award criteria that reward tenderers if their tenders meet the minimum requirements in the technical specifications. *"The difficulty with this purchasing technique is the development of reliable calculation and comparison methods to be able to objectively assess the bids."* EPC (Energy Performance Contracting) calculation can be used to supply energy to buildings. [42, p. 36-37] EPC is contract for the provision of specific services related to energy consumption, where the total amount of payments depends on the level of efficiency of these services, that is on the specific savings at the customer. [43]

Pic. 14 EPC graph [43]



The **Practical** section emphasizes the weighting of award criteria. Each project is specific and requires individual assessment. The Manual sets an example 20 % for suitable weighting of the sustainable award criterion. However, this Award criterion percentage also depends on the strictness of the green technical requirements set. [42]

The Manual: Sustainability considerations in public procurement is very beneficial document for public purchasers who are only getting familiar with GPP. However, it is too general for the preparation of construction project contracts.

Compared to their Belgian counterparts, documents published by **Czech Government** are different. The Ministry of the Environment is responsible for the GPP agenda. On the website of the Ministry of the Environment, the Czech Government also refers to EU documents (European Commission methods for GPP - including the OB GPP criteria) and to its own Methodology for Environmentally Responsible Approach in Public Procurement. However, the link to the methodology does not work and the website contains only links to the introductory chapter (4 introductory pages) and links to a few methodological sheets for selected product categories. Among the selected methodological sheets, there is none about the construction of buildings. At least a link to the Socially Responsible Public Procurement (Socially Responsible Public Procurement) website, where examples of good practice considering environmental or social parameters, can be viewed positively.

The field of construction belongs to the Ministry of Industry and Trade. In the area of green buildings, there is close cooperation between this ministry and **Czech Green Building Council** (hereinafter CZGBC). This non-profit organization brings together companies from different sectors of the economy with which they strive to achieve a state where buildings will have zero environmental impact throughout their life cycle. [44]

One of the tools developed by the CZGBC is the **Green Building Procurement Guide** [4]. This sophisticated document leads in detail a possible public employer (building owner). Although the introduction of the document generally describes the disadvantages of low-price competition and the possibilities of GPP, the other pages of the manual are purely practical. It describes step by step the phases of a building project (from the project preparation to the management of the building) and their public procurement, including the recommendations of the PP procedure (open, restricted, negotiated, …). It also shows the advantages and disadvantages of merging phases into one public contract. It describes the possibility of including architectural competition and the possibility of alternative supply methods such as DB and EPC. Appendix of this guide-book includes the recommended real summary GPP criteria. They are divided into the following groups:

- Criteria for architectural competition or study;
- Social-cultural and functional criteria;
- Economic criteria;
- Procedural criteria;
- Environmental criteria. [4]

The list of individual criteria is shown in Tab. 14 - 18. For each criterion, motivation, target, type of building, formulation of the criterion, target parameters and possibly a reference document are given. Very often the criteria are adjusted for both main phases - design and implementation. All the criteria with their data can be seen in Annexes No. 4 - 8. The structure of the arrangement and the detail of the criterion data are shown in the example Fresh air quantity - see Tab. 19. [4]

Tab. 14 Summary criteria for architectural competition or study [4]

SUMMARY CRITERIA FOR ARCHITECTURAL COMPETITION OR STUDY
Building energy concept including natural ventilation
Evaluation of alternative energy sources within the Building Energy Performance Certificate
Water management concept
Alternative transport support concept
Ecological building concept
Public discussion of construction

Tab. 15 Social-cultural and functional criteria [4]

SOCIAL-CULTURAL AND FUNCTIONAL CRITERIA
Amount of fresh air
Indoor air free of harmful volatile substances
Visual comfort and daylight
Acoustic comfort
User influence on comfort
Inclusive access and facilities of the building

Tab. 16 Economical criteria [4]

ECONOMICAL CRITERIA
Life Cycle Costing
EPC – Energy Performance Contracting

Tab. 17 Procedural criteria [4]

PROCEDURAL CRITERIA
Commissioning, Clerk of works = specialized site technical Supervision (ITS)
Building Information Modelling

Tab. 18 Environmental criteria [4]

ENVIRONMENTAL CRITERIA
The quality of the building envelope against the reference building
Flexible reaction and reduction of energy losses of the heating system
Airtightness of building envelope
Specific energy demand for heating
Power consumption against reference building
Consumption of non-renewable primary energy
Environmental cycle criteria: Global warming potential; Environmental acidification potential; Potential of eutrophication of the environment; Ozone depletion potential; Potential of ground-level ozone formation
Elimination of the influence of the thermal island of cities - roofs
Elimination of the influence of the thermal island of cities - outside the roof
Drinking water consumption
Choice of building materials with respect to the environment
Prevention of floods and load for the sewer system during heavy rainfall
Background of the building and surroundings for alternative transport
Separate waste management in the building

Tab. 19: Criterion Example – Amount of fresh air [4]

Target	Motivation	Typology of building	Project phases			Implementation phases		
			Criteria formulation	Reference document	Target parameters	Criteria formulation	Reference document	Target parameters
The aim is to ensure a healthy indoor environment without pollutants in the air	There is almost no uncontrolled air exchange in buildings with tight windows / doors. This is beneficial for saving heat / cold, but for the building occupants it is necessary to provide fresh air to breathe, concentrate. At the same time, it is necessary to remove pollutants, odors, excess moisture from the building. Opening windows manually for this problem is not a solution - ventilation is sometimes intense, sometimes not at all, causing thermal discomfort in winter and increasing heat / cold consumption. Hybrid or even pressure forced ventilation systems are the solution.	Family house Apartment building Accommodation services	The building must be provided with ventilation according to the reference document. Opening the windows manually is not sufficient to fulfill the requirement. The requirement does not apply to rooms with the location of combustion equipment with open combustion - suction of combustion air from the room.	ČSN EN 15665 Z1 Design vaue according to ČSN EN 15251 2nd class	Ventilation system specified in ČSN EN 15665 Z1 Design values according to ČSN EN 15251 2nd class	Performing ppm CO2 measurements in characteristic rooms for at least 1 day at design occupancy rates and usage patterns. The measurement must meet the target value in all time readings for a maximum of 15 minutes. Measurements shall be made in the presence of independent third party supervision.	Outside Prague: Decree 268/2009 Coll. Prague: Regulation No. 11/2014 Coll. of the capital city of Prague	Residential rooms below 1500 ppm CO2
		Schools		Spaces for children and adolescents: Decree 410/2005 Coll. Other work areas for employees: Government Regulation No. 361/2007 Coll.	Minimum values			
		Office building Cultural facilities		Government Regulation No. 361/2007 Coll.	Minimum values			

3.1.4 Summary and critical analysis

As mentioned above, conditions for public procurement are very similar. The targeted removal of barriers between EU Member States makes their public procurement laws very similar. Construction contracts with a value of more than EUR 5 548 000 must even be carried out solely on the basis of common European law.

While each country (VL & CZ) has more public procurement procedures, most of them are not new special procedures, but more detailed European ones. Beyond the EU procedures, both countries deal with concessions in their public procurement laws. Flemish law, as opposed to Czech, contains 2 other special procedures – Social housing procedure and Working competition. Both of these procedures can have great potential for GPP of building. Social housing covers one of the inherent pillars of sustainable development - the social aspect. [9] Working competition helps in the preparation of alternative delivery systems. This can influence the resulting effectiveness of the criteria at the time of building use. [35] In addition to these two special Flemish procedures, Competitive dialogue, Innovation partnership and Design contest also have great potential for GPP of building. All of these three procedures can result in new proven environmental friendly practices. Innovation partnership makes it possible to find new, more efficient design solutions - especially for buildings with complex technologies. Design contest encourages applicants to create a highly sophisticated and high-quality design that is assessed by experts in the fields. In addition to seeking a more efficient proposal than the competition, the competitive dialogue also exploits the synergy of the ideas of the candidates involved.

Apart from various procedures, the Czech Republic differs from Flanders in that it has already started to use **model contracts** in general. Three important public employers (Directorate of Roads and Motorways, Railway Infrastructure Administration and Waterways Directorate of the Czech Republic) commonly use FIDIC contracts as standard. [34] As FIDIC is a French company, in Belgium its model contracts are used in Wallonia, but no Flemish or federal contracting authority uses FIDIC as a standard. [32, 41] Model contracts can be potential for improvement. It would be of great benefit if there was a model (at least framework) contract for green construction contracts. It would also help if all EU Member States had identical model contracts. If the whole EU used FIDIC contracts or its own model contracts, competition from abroad would increase. Increased competition can lead to better products and foreign companies can bring new ideas.

Although suggestions for improvement have been outlined here, Belgium and the Czechia are average in terms of **public procurement** quality **compared to other European countries**. In

the Single Market Scoreboard (for 2018), both countries are among the best in the Award criteria indicator. Quality award criteria are a good prerequisite for awarding a good Environmentally Friendly Public Procurement. [38]

In the comparison of both countries in terms of **Circularity** in construction industry they are very similar. Both the Kingdom of Belgium and the Czech Republic are above the EU average in the recycling of construction waste. [39] Recycling is certainly a good thing, but if more than 90 % is achieved in the recycling of construction waste, the second step should be a strengthening trend in the design and construction of buildings that will be circular. Buildings made of environmentally friendly materials, parts of them can be easily remanufactured and will not pollute the environment during disposal.

In principle, the selection criteria may be the same for both countries as they are most influenced by the characteristics of the construction. The differences in the criteria can be estimated pursuant the national environment. For example, the likelihood of using seashells as hydro-isolation for building foundations is higher in the coastal Belgium than in the inland Czechia.

However, there are differences in the treatment of criteria. Compared to the Czech Republic, there is Kruispunt Bank – database of subjects with their data in Belgium. These data also include data to determine whether a subject meets the **selection criteria**. For the needs of GPP it would be good to include information about the sustainability of the company in this database. Some sort of score displaying how ecologically the company is managed, what experience it has with GPP, how it handles waste, etc. On the other hand, it is necessary to consider whether this marking would have any practical effect at all. Perhaps it would only burden companies and complicate the system.

Both countries also differ in submitting **Technical specification** and **Award criteria** for the Green Building. **Flanders** has only one government-wide website, so all regional assets or their links are in one place. The GPP manual can be found easily and in many ways on their website. This government manual is of high quality and provides good readership with GPP, but unfortunately it is quite general and for more specific documents (for example, according to the product purchased), the GPP website clearly refers to European more detailed documents.

In the Czech Republic, GPP is the responsibility of the Ministry of the Environment. Its website also links to her government manual, but it is not publicly available – hyperlink does not work. The Department of the Environment website is not the only source of information for GPP of

building. The Czech Green Building Council can be found through the Ministry of Industry and Trade. CZGBC has produced a high-quality handbook for contracting authorities. [4] This example points to the fact that the ministries do not communicate with the public and are not linked. On the other hand, it is good that the foundation for GPP for buildings was created by a separate non-profit organization that is very specialized. In contrast to the CZGBC Handbook, the government manual is only very generally applicable to buildings. It is possible that there is also a Flemish document similar to the CZGBC Contracting Authority's Guide, but the author of this thesis did not find any such background. However, according to the World Green Building Council, there is no member of this world council in Belgium. [45] The author of this thesis discovered the Belgian Sustainable Building Council (BSBC) but does not seem to operate any activity. Its website consists of only a logo and two contacts. No one responded to the messages which author sent.

Analysis of the **CZGBC handbook** has not found any major faults or inconsistencies. There is no GPP for the demolition phase of the project. The advantages and disadvantages of supply systems listed in the document are for the builder only, not for the environment. The socio-cultural criteria only take into account hygiene and ethics towards the users of the building. Criteria considering societal impacts are not considered. For example, the inclusion of excluded people (mentally disabled, drug addicts, prisoners, etc.) in the construction may be the case. Another social aspect may be the provision of facilities for educational purposes (excursions for students of civil engineering, etc.).

3.2 Real application of GPP in practice

This chapter presents Czech and Belgian examples of public green buildings and should serve as inspiration for future public building projects. Although these projects are described only to illustrate the above noticed, the NKÚ project is described in more detail. It is a project that comprehensively solves many challenges from different branches and will have a great impact on the Czech construction industry, in which the author of the thesis will move after finishing university.

3.2.1 Czech green projects

Petr Zahradník – project manager of Czech Green Building Council – recommended and willingly described several current GPP projects. Three of them were selected for this thesis:

- Supreme Audit Office (NKÚ) in Holešovice town - Prague
- Depository of the East Bohemian Museum in Pardubice
- Forests of Czech Republic – new headquarters in Hradec Králové

The **Supreme Audit Office** (Nejvyšší kontrolní úřad – hereinafter NKÚ) is a supervisory institution whose mission is to control the economy of the state - its revenues and expenditures. As given by Czech constitution, this organ is supposed to be independent. To ensure that, it needed to be moved from rented offices to its own building. These are two buildings with an area of 5000 m2 and an expected price of approx. 37 million EUR (940 million CZK) incl. VAT, which will be built in Holešovice town in Prague. At the time of submission of the thesis runs the competition period for the selection of the contractor.

As the NKÚ controls even the most complex investments, it has decided to set an example by choosing several objectives that are hardly ever seen in practice. These include, for example, the Building Information Modelling (BIM) technical requirement or the Life Cycle Cost (LCC) Assessment as one of Award criterion. [46] The award criteria consist of:

- A. Offer price incl. VAT (Value Added Tax) - scale 55 %
- B. Operating and renewal costs for 30 years (LCC) - scale 30 %
- C. Qualification and experience of realization team - scale 15 % [47]

The NKÚ asked the Department of Construction Management and Economics to develop a LCC methodology as neither the Ministry for Regional Development nor the professional associations addressed. This methodology deals with LCC for 30 years. This means that, in this case, the total life cycle (ended by disposal) is not assessed but is assessed only for the duration of the economic life. [47, 48] Structure of LCC consists from sum of two indicators are:

- B.1. operating costs (energy costs, excluding VAT, over a period of 30 years),
- B.2. repairs and replacements building interior installation (note for Czech reader - TZB), all excluding VAT, over a period of 30 years. [48]

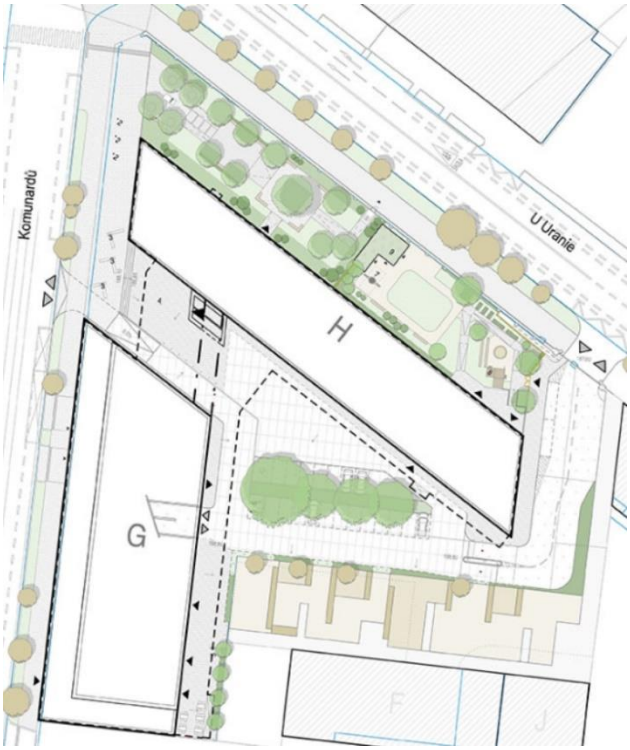
These costs are expressed using an Excel LCC calculation file and then are converted to the net present value (NPV) for the whole period of 30 years (2022-2052) to reflect the time value of money. [48]

Operating costs (**B.1.**) are set by National Calculation Tool. Key parameters of the building envelope and Key parameters of the technical systems parameters that are decisive for the evaluation of the energy performance of the building - given in the calculation file. **B.2.** is divided into renewal costs for 13 components and maintenance costs for 4 components. Their maintenance costs per year, the cost of the component (both excluding VAT) and the service life are filled in by the contender in the Excel file. This Excel for LCC calculation is available to every candidate. [48]

It can be assumed that in the future BIM will be a great help in determining more accurate LCC values.

Another innovative step that is not common with public contracting authorities for contracts of building (not traffic constructions) is the use of the international contractual standard FIDIC. Based on the risk analysis, the **yellow book FIDIC** (Design-Build method) was chosen. [47] At first the architectural design contractor was competed, who elaborated the project documentation into the state for the building permit. Award criteria for this design were judged 50 % by price and 50 % by design quality. This general documentation was the basis for the selection of the contractor, which detailed the design documentation (Design) and offered the amount for the delivery of the building (Build). [46] Nowadays the latest design is at the building permit level. The ground plan view is shown in the Pic. 15, the visualization in the Pic. 16.

Pic. 15: Ground plan – NKÚ [46]

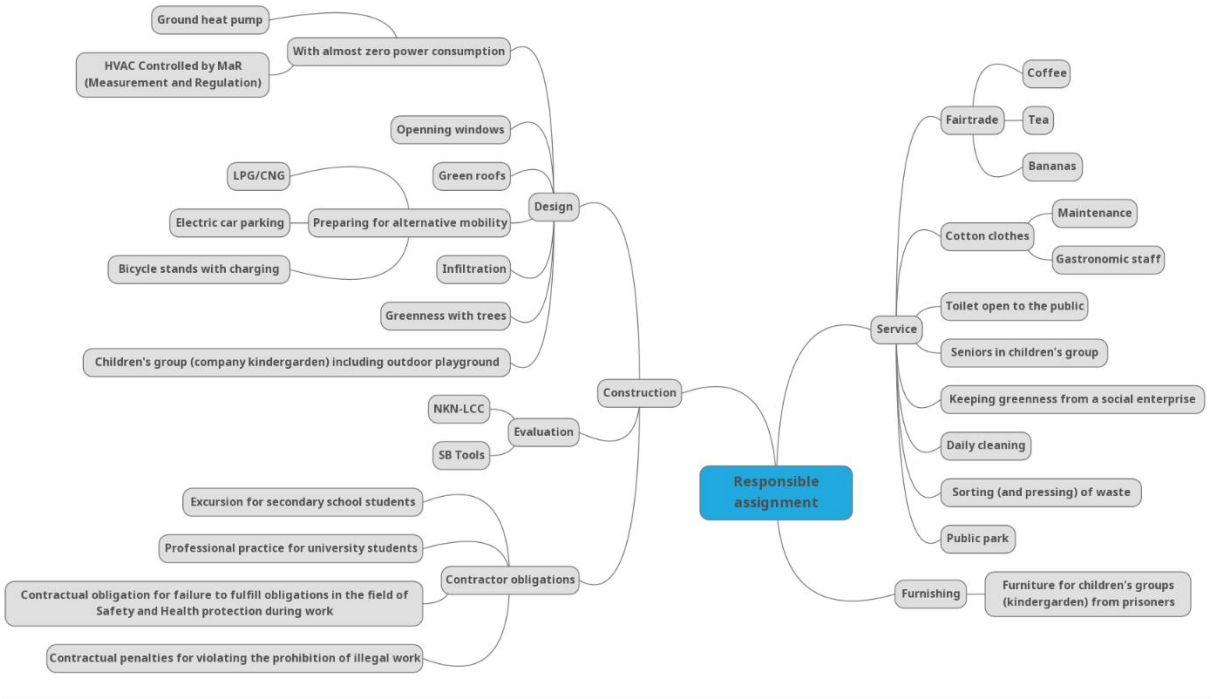


Pic. 16: Visualization – NKÚ [46]

In addition to the above, NKÚ has set many **Technical specifications**. As for the sustainability factor, NKÚ requires SBToolCZ certification (in bronze level), which is composed of 50 % **environmental aspects**. In addition to a renewable energy source for heating and hot water, the project will also apply energy optimization of resources. Moreover, intelligent lighting, a green roof, environmentally friendly ventilation system that emits minimum heat to the surroundings, ground heat pump or the use of captured rain-water for watering is designed. More requirements can be seen in the English translated mind map – see in the Pic. 17.

Sustainability requirements include **social criteria**. During construction, these are fair wage requirements for all workers, including subcontractors, or penalties for failure to comply with Safety and Health protection. Two children groups (kindergartens) will be set up during the use of the building and fair-trade products will be used in operation.

Pic. 17: Responsible assignment – Mind map [47, own processing]



The **Depository of the East Bohemian Museum** in Pardubice is specialized building for work with historical artefacts and for their professional storage. The new building (completed in 2019) is extremely energy efficient. It uses modern technologies such as heat recovery and a heat pump located on a green extensive retention roof. This project also uses the principle of circularity. The main materials represented in the largest quantities are concrete recycled and unburnt brick. [49]

Pic. 18: Museum depository [50]

There was an old building on the site of the depository, which had to be demolished. **Concrete recyclate** with this old building was used to increase the bearing capacity of the soil under the foundation slab instead of aggregate. A total of approx. 1,000 tons of recycled material was used for 800 mm thick layer under the whole building. A big benefit is also that the recycled material did not have to be transported from far away, thus avoiding the generation of exhaust emissions. [49]

The **unburnt brick** forms the inner layer of the cladding. The brick itself is made of mud or clay with admixture of sand. It is therefore very simple as a material and can be used on site. It does not need to be burned or treated, only air-dried for about 50 hours. As a result, the energy required to produce it is minimal, unlike conventional bricks that must be burned. The project of the depository for the East Bohemian Museum involved about 350 tons of material. The same case is the plaster, which is also clay. Another advantage of unburnt clay in the interior is that it helps naturally maintain the indoor climate. Climate stability is very important for maintaining good condition of the exhibits. [49]

For good heat accumulation, reinforced concrete is used as the main supporting structure. [49] There may be room for improvement. ERC-Tech specialists have developed a process that allows the use of construction debris in concrete mixes instead of aggregates. Ercconcrete® = Concrete made of 100% recycled material. [51]

Forests of Czech Republic – new headquarters is a project of the public organization Forests of Czerch Republic (Lesy ČR – hereinafter LČR), which takes care of the state-owned forests. The existing building of the company headquarters does not have sufficient capacity, is unsatisfactory and its reconstruction would be less advantageous than the construction of a new building. When preparing the contract, LČR set 4 basic requirements:

- adherence to the principles of sustainable development in the construction and operation of buildings,
- fulfilment of energy management requirements for the energy performance of nearly zero energy buildings,
- minimizing restrictions on proper operation of the Directorate during construction,
- using as much wood as possible to promote it as a suitable building material. [52]

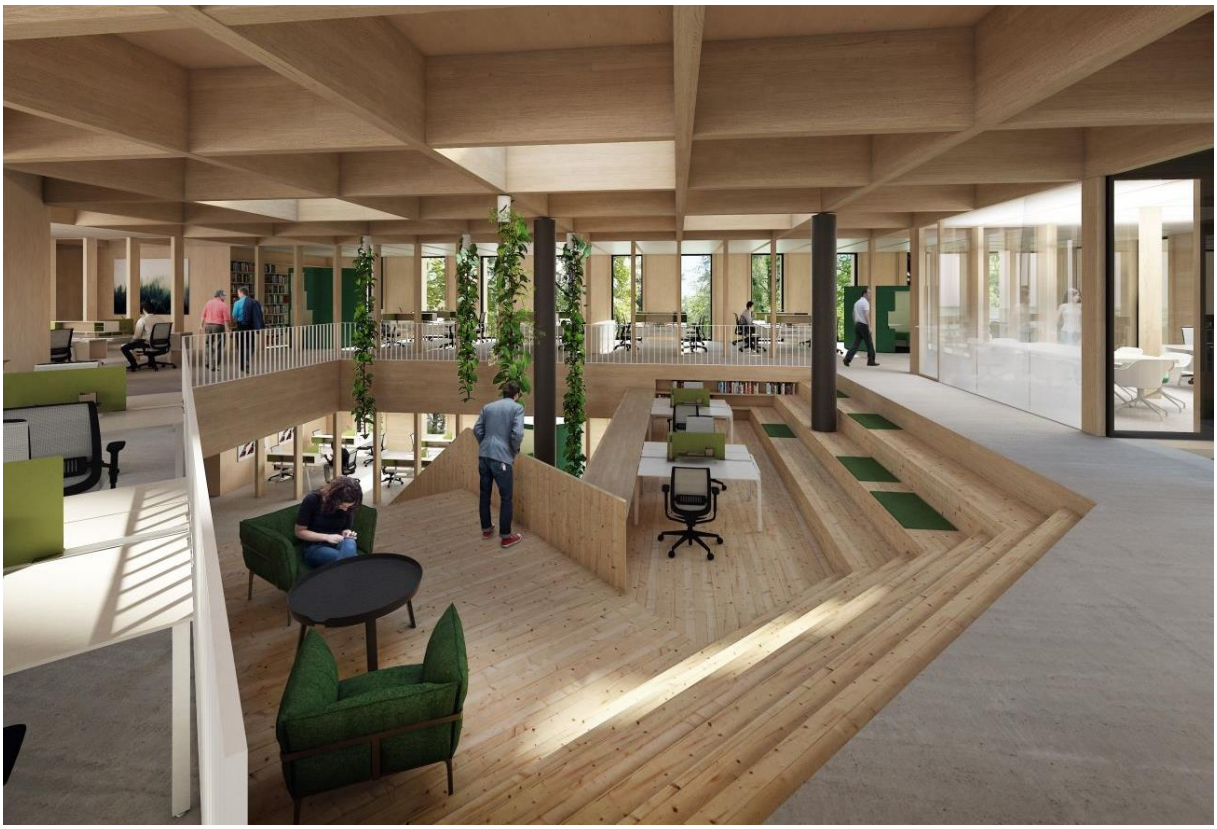
The project is managed by the DBB method, the public anonymous two-round architectural competition procedure was used to select the design - the quality of the designs was expertly evaluated. In addition to the four general requirements mentioned above, great emphasis is placed on tender documentation:

- the use of renewable energy sources,
- construction materials must be used efficiently
    - saving non-renewable resources,
    - long-lasting construction,
    - materials of local origin are preferred,
- the solution must use water efficiently, drinking water must be used with maximum efficiency,
- creating a new area for the public around the building. [53]

The project is located in the brownfield, so the construction of the headquarters will lead to reclamation of the neglected environment. The winning design with a tree-shape ground plan meets all the requirements. Its visualization can be seen in Pic. 19 and Pic. 20. Today, the project is in the phase of obtaining a building permit. [52]

Pic. 19: LČR headquarters - exterior [52]

Pic. 20: LČR headquarters - interior [52]



3.2.2 Belgian green projects

Thanks to Alexis Versele and Lode Lefevre - the Belgian supervisors of this thesis - the background materials for three inspirational projects are available. Two are purely Flemish, while the third building is on the territory of Belgium, but its importance is pan-European:

- 't Centrum of KAMPC in Westerlo
- Daycare center Wiegelied in Oostende
- Façade of New headquarters of the Council of the EU in Brussels

The **KAMP C** is the center for sustainability and innovation in construction managed by the province of Antwerp (corresponds to the Czech regions = "hejtmanství kraje" – note for Czech reader). It is located in a former military complex in Westerlo, Antwerp Province, Flemish Region. This project includes Renovation coach (consulting - review which works are priority and help implement a step-by-step plan), 3D printing in construction, Circular construction and GEWOONtebreker (research on achieving a pleasant and varied environment for living in today's fast-changing times.). [54]

KEMP C, together with other partners, has prepared **'t Centrum** building project for its purposes that is fully circular. The construction of the **first circular building in Belgium** should start already in 2020. *"This pilot project will provide insights into the obstacles and solutions and thus accelerate the much-needed circular transition in the construction sector."* This project includes a total of 7 aspects as 7 pillars of circular construction:

- Circular **area development**
  = divide an area on the basis of available material, residual, waste or energy flows so that surpluses or waste from one serves as a raw material for the other;
- Circular **designs**
  = designing building elements in such a way that the building is dynamic, changeable, removable and modular and functions as a temporary storage of materials;
- Circular **financing**
  = forms of financing via total cost of ownership, LCC, investments that are paid for by savings or earnings in time, deposit on materials and leasing formulas;
- Circular **work**
  = offer workspace as a service. The office is open and dynamic with high-tech support. Communication and connection with other employees and companies are central;
- Circular **materials**
  = materials that can be re-grown, reusable, recycled or recycled, so that they remain in the cycle for as long as possible;

- Circular **business model**
  = purchase products as a service whereby the producer remains the owner and is responsible for maintenance and return;
- Circular **procurement**
  = a package of openly formulated ambitions with a fixed budget challenges the market to form a consortium and to come up with innovative building solutions itself. [54]

Design meets green requirements such as energy-positive building, surrounded by greenery, with lots of light, modular office design and adaptable workplaces. The design allows easy future building modifications without much energy. All design is required in BIM. *"The Center will also test new business models. For example, light can be leased from suppliers. This will encourage them to make sustainable products. The result: much lower energy consumption, a longer service life, easy maintenance and the possibility of reuse."* [54] No visualization of the prepared building is not available.

Daycare center Wiegelied is a construction investment of the Oostende city. It is a kindergarten with a capacity for 72 children, which was supplied by the Design-Build delivery system. [55]

Pic. 21: Front view of Daycare center Wiegelied [55]

A special feature of this building is the use of hemp as a building material. The supporting part consists of prefabricated wooden boxes, which are filled with chopped and dried hemp stems in the factory. If hemp filler needs to be keeping shape - to be self-supporting - lime is added to the hemp straw. Pic. 22 shows a cross-section of a box filled with lime hemp. The prefabricated boxes are brought to the site and settled by crane. In the Pic. 23 is a view of the construction works of the perimeter structure of the Wiegelied Daycare Center. [55]

Pic. 22: Box cross-section [own photo]

The use of hemp straw was determined as a requirement of the Technical Specification. Furthermore, the selection criteria include the obligation to have a reference to experience with building straw. Other selection criteria were: Extract from the criminal record, at least 1 experience building a nursery school and Certificate that (according to KRUISPUNT BANK) falls into category D and the building cost class. [56]

Hemp or lime-hemp can be also used for in-site building. First, it is necessary to create a wooden frame that is closed with boards, then it is filled with blown hemp straw.

Using a hemp-in-a-box building system has many advantages. First, it fits the idea of a circular economy. Renewable materials are used for the construction and can be easily recycled with minimal environmental impact. Since it is a prefabricated building, any conversion or repair is easier than, for example, monolithic structures. Another favourable aspect of hemp straw in buildings is maintaining a good indoor climate. A healthy living environment in building is especially important for children, as they are more susceptible to disease.

Pic. 23: Assembly of panel boxes filled with hemp [55]

New headquarters of the Council of the EU is a building in Brussels, which is the seat of one of the most important institutions of the European Union. Due to the arrival of new members since 2004 and the growing bureaucracy, additional space had to be provided to the European Commission. The Belgian State offered the Council to cede block A from the complex "Residence Palace", but it had to be reconstructed and adapted to the needs of the EU Commission. The architectural company Samyn & partners, who is the author of the reconstruction design, has designed a façade that will impress everybody at first sight with its new façade. This façade protects from the urban dust the yard, which was only half-covered by an L-shaped building before the reconstruction. It creates a new glass atrium and covers the principal entrance as well as a new lantern-shaped volume incorporating the conference rooms. [57]

The peculiarity of the facade is that it consists of *"a harmonized patchwork of re-used windows with simple crystal like single glazing (from different European countries) providing the necessary acoustic barrier from the traffic noise and it also offers first thermal insulation for the inner space."* Following to EU recommendations about energy savings, over the next few years, many old houses will be reconstructed and replaced by more cost-effective windows.

The use of old windows demonstrates the effort to re-use old but still usable components for a new purpose. [57]

On the other hand, it should be pointed out that the air has been polluted by exhaust gases due to the import of windows from all EU Member States. The facade is therefore more important for the promotion of philosophy than for its own ecological impact. Each contracting authority should choose the objectives and evaluate the opportunities of the new building.

3.2.3 Summary and critical analysis

Just like increasing demands for materials and resources ecology, GPP is expected to become crucial part of each construction project. In order to be able to correctly asses all possibilities, public owners should be at least knowledgeable in GPP.

There is certainly room for improvement and many possible challenges for construction industry, such as using the new concrete type with recycled concrete as an aggregate. The new headquarters of **Forests of Czech Republic** and the **Day-care center in Oostende** are good examples of challenge to use renewable materials as much as possible. The **KEMP C** circular building is an important milestone in supporting the circular economy. It is therefore necessary to promote this project as widely as possible to the general public. On the other hand, the facade of the seat of the **EU Commission** has more marketing than functional purpose. While pointing out the need to reuse old products, it should use local resources that are not transported across the continent.

As the **NKÚ** project evaluation of bids have been described in more detail, a critical reflection is appropriate. Although the NKÚ's project is very ambitious and innovative, it would be much more interesting from the GPP point of view to assess LCC over its entire life cycle, including demolition. If demolition costs were included in the LCC, contractors would have to design more circular buildings. An even greater challenge would be to count the cost of environment deterioration into the LCC (eg all CO2 production caused by the building's entire life cycle).

3.3 Deficiencies and their improvements

The area of green buildings is a rapidly developing field and therefore naturally has several pitfalls. Many of them were criticized in partial summaries at the end of important chapters. In this chapter are mentioned those, which the author considers as the most pressing problem.

3.3.1 Insufficient interest of contracting authorities in GPP

During the consultation of the author with Petr Zahradník (project manager of the CZGBC) in the summer of 2019, Mr. Zahradník mentioned that there should be more green public procurement on the Czech market. Although it is natural that a CZGBC representative would ideally see all public procurement for buildings as environmental friendly, it is worth considering seriously how to increase the aspects of sustainable development in public procurement of buildings.

The biggest problem can be considered fear of contracting authorities that they will increase risks and complicate the contract process with green criteria. As ignorance is very often a source of fear, it is necessary to disseminate GPP awareness among contracting authorities and make it as easy as possible for them. There is great room for improvement when it comes to cooperation between Czech ministries involved in construction industry. On the other hand, cooperation with and support of experts from specialized non-profit organizations proved to be a step in the right direction – CZGBC has created very useful documents.

In addition to supporting GPP by available service of experts, two other tools can be used that can be controlled directly by the government - **Incentives** (subsidies) and **regulations**. Already today there are many successful grant programs for environmental protection. In the Czech Republic for example programs Dešťovka (rainwater management) or Nová zelená úsporám (energy savings in family houses and apartment buildings). The problem of the redistribution of money, and hence of subsidies, is that it must be strictly controlled for abuse. For example, many mayors are already reluctant to apply for subsidies because they are afraid of making a mistake and being tried in court. [58] Instead of subsidizing, VAT reduction in case of purchasing a building with a certain green standard is a viable alternative. Instead of spending money through multiple accounts, only the resulting green building cost is reduced.

Even more attention is required for **regulations** and mandatory requirements. If such regulation arises, it must always be supported by the agreement of a wide range of experts and a detailed feasibility study assessing the benefits, their costs and risks.

On the other hand, the above-mentioned examples of good practice in Chapter 3.2 or above-average recycling of building materials from both countries show that Belgium and the Czech Republic are on track. It is necessary to maintain a high level of expertise, to seek new opportunities, to cooperate and improve GPP materials and, above all, to spread the idea of GPP. This thesis should help to this.

3.3.2 Responsibility for entire LC

Another important issue is the difference between real results and design. The author of the work has experience from his job where a private client had an administrative building with a LEED certificate built and already during the building realization it was clear that some of the evaluated components would not be paid off financially and would not be used them in practice. The client just wanted to receive the certification for making the project attractive, not for sustainable development support.

It can be assumed that if the designer and the contractor are responsible for the final functioning of the building, they will submit better processed offers with higher efficiency. Alternative delivery methods can offer a good background for this. The **Design-Build** method is a good step because it promotes greater collaboration between the designer and the construction realization team. This kind of collaboration decreases risk of misunderstandings and errors, which could potentially reduce final product quality. The actual practical use of the building exists up to the **EPC in turnkey** method. Based on this method, a contractor is obliged to demonstrate a correct technology functioning during commissioning. However, the supplier is responsible for the proper functioning only for a short time at the use-phase beginning.

The **Design-Build-Finance-Operate** method has great potential for motivating the design and delivery of quality and efficient construction. If a contractor designs and delivers a poor quality environmental element that does not meet the prescribed results, it will be paid a reduced or no amount. The quality is also motivated by the supplier to avoid high maintenance costs, which he runs as a part of the service. However, DBFO is used more for PPP transport projects, as their handling is less complicated than building projects. The environmental elements of the buildings are very different from each other and experts are needed in the field to operate them.

The general contractor for services is likely to hire specialist subcontractors, it is preferable to use DBFO with CMaR for building projects. Construction Management at Risk method can divided building parts, which have environmental impact and need to be operated. These parts would be designed according to the DBFO method, the remaining parts of the building (supporting structure, foundations, ...) would be supplied by a traditional system or DB system.

The difficulty of this delivery system is the complicated measurement and proving of unfulfilled criteria. For example, if the lighting supplier began to reduce his energy costs by reducing the required lux values, users may not notice this. Accidental inspections are an additional cost and stable measuring instruments can be influenced by the supplier. A similar principle is used in the project ’t Centrum, where they call it "purchasing products as a service".

4. Conclusion

This Master thesis has two main objectives - to inform and inspire a potential contracting authority about GPP and to be a good basis for a professional discussion that would lead to a better GPP.

The first objective is fulfilled by describing the basic terms related to GPP and proposing procedures for setting green criteria. Thesis also refers to important organizations and documents and provides that can be another important assistant for GPP preparation. The most valuable documents for GPP of buildings are the Green Public Procurement Criteria for Office Building Design, Construction and Management, prepared by the European Commission and the Green Building Procurement Guide of CZGBC, whose criteria-recommendations were also translated to English for non-Czech readers.

The second objective is also met by penetrating different groups of experts and synergistically pooling their expertise. This also fulfills the instruction of the thesis supervisor to perform a comparative analysis of approaches to GPP of both countries. The intersection of different expertise is a good basis for defining deficiencies and, in particular, suggestions for their improvement. The most distinctive groups of experts are the two university departments shielding this thesis - Department of Sustainable Buildings (KU Leuven) and Department of Construction Management and Economics (CTU). In addition to these groups, information from architects, specialists in HVAC, energy, environment, administration, etc. is used.

While this thesis includes fairly complete overview of GPP, there is still plenty research topics for future researchers. These topics include:

- Creating a manual for GPP of buildings with recommended green criteria in Dutch;
- Creating uniform EU-wide model contracts or promoting the use of FIDIC contracts. All European public employers could benefit from these single contracts;
- Implement similar PP procedures in Czech law as the Flemish Social Housing Procedure and Working Competition to support sustainable projects;
- Supporting LCC for the whole life cycle (including demolition) as Award criterion;
- Supporting LCC including environmental costs as Award criterion;
- Raise GPP awareness among the general public;
- Service as a product delivering.

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List of attachments

1. A list of activities for public work contracts
2. A list of priority sectors for GPP criteria
3. CBE website cutout with data from the construction company Artes Depret
4. Summary criteria for architectural competition or study
5. Social-cultural and functional criteria
6. Economical criteria
7. Procedural criteria
8. Environmental criteria

Annex No. 1: A list of activities for public work contracts

ANNEX II

LIST OF THE ACTIVITIES REFERRED TO IN POINT (6)(a) OF ARTICLE 2(1)

In the event of any difference of interpretation between the CPV and the NACE, the CPV nomenclature will apply.

NACE Rev. 1 [1]					CPV code
SECTION F			CONSTRUCTION		
Division	Group	Class	Subject	Notes	
45			Construction	This division includes: — construction of new buildings and works, restoring and common repairs.	45000000
	45.1		Site preparation		45100000
		45.11	Demolition and wrecking of buildings; earth moving	This class includes: — demolition of buildings and other structures, — clearing of building sites, — earth moving: excavation, landfill, levelling and grading of construction sites, trench digging, rock removal, blasting, etc. — site preparation for mining: — overburden removal and other development and preparation of mineral properties and sites. This class also includes: — building site drainage. — drainage of agricultural or forestry land.	45110000
		45.12	Test drilling and boring	This class includes: — test drilling, test boring and core sampling for construction, geophysical, geological or similar purposes. This class excludes: — drilling of production oil or gas wells, see 11.20. — water well drilling, see 45.25, — shaft sinking, see 45.25, — oil and gas field exploration, geophysical, geological and seismic surveying, see 74.20.	45120000
	45.2		Building of complete constructions or parts thereof; civil engineering		45200000

NACE Rev. 1 (1)					CPV code
SECTION F			CONSTRUCTION		
Division	Group	Class	Subject	Notes	
		45.21	General construction of buildings and civil engineering works	This class includes: — construction of all types of buildings construction of civil engineering constructions, — bridges, including those for elevated highways, viaducts, tunnels and subways, — long-distance pipelines, communication and power lines, — urban pipelines, urban communication and power lines, — ancillary urban works, — assembly and erection of prefabricated constructions on the site. This class excludes: — service activities incidental to oil and gas extraction, see 11.20, — erection of complete prefabricated constructions from self-manufactured parts not of concrete, see divisions 20, 26 and 28, — construction work, other than buildings, for stadiums, swimming pools, gymnasiums, tennis courts, golf courses and other sports installations, see 45.23, — building installation, see 45.3, — building completion, see 45.4, — architectural and engineering activities, see 74.20, — project management for construction, see 74.20.	45210000 Except: – 45213316 45220000 45231000 45232000
		45.22	Erection of roof covering and frames	This class includes: — erection of roofs, — roof covering, — waterproofing.	45261000
		45.23	Construction of highways, roads, airfields and sport facilities	This class includes: — construction of highways, streets, roads, other vehicular and pedestrian ways, — construction of railways, — construction of airfield runways, — construction work, other than buildings, for stadiums, swimming pools, gymnasiums, tennis courts, golf courses and other sports installations, — painting of markings on road surfaces and car parks. This class excludes: — preliminary earth moving, see 45.11.	45212212 and DA03 45230000 except: – 45231000 – 45232000 – 45234115

NACE Rev. 1 (1)					CPV code
SECTION F			CONSTRUCTION		
Division	Group	Class	Subject	Notes	
		45.24	Construction of water projects	This class includes — construction of: — waterways, harbour and river works, pleasure ports (marinas), locks, etc., — dams and dykes, — dredging, — subsurface work.	45240000
		45.25	Other construction work involving special trades	This class includes: — construction activities specialising in one aspect common to different kinds of structures, requiring specialised skill or equipment, — construction of foundations, including pile driving, — water well drilling and construction, shaft sinking, — erection of non-self-manufactured steel elements, — steel bending, — bricklaying and stone setting, — scaffolds and work platform erecting and dismantling, including renting of scaffolds and work platforms, — erection of chimneys and industrial ovens. This class excludes: — renting of scaffolds without erection and dismantling, see 71.32	45250000 45262000
	45.3		Building installation		45300000

NACE Rev. 1 (1)					CPV code
SECTION F			CONSTRUCTION		
Division	Group	Class	Subject	Notes	
		45.31	Installation of electrical wiring and fittings	This class includes: installation in buildings or other construction projects of: — electrical wiring and fittings, — telecommunications systems, — electrical heating systems, — residential antennas and aerials, — fire alarms, — burglar alarm systems, — lifts and escalators, — lightning conductors, etc.	45213316 45310000 Except: – 45316000
		45.32	Insulation work activities	This class includes: — installation in buildings or other construction projects of thermal, sound or vibration insulation. This class excludes: — waterproofing, see 45.22.	45320000
		45.33	Plumbing	This class includes: — installation in buildings or other construction projects of: — plumbing and sanitary equipment, — gas fittings, — heating, ventilation, refrigeration or air-conditioning equipment and ducts, — sprinkler systems. This class excludes: — installation of electrical heating systems, see 45.31.	45330000
		45.34	Other building installation	This class includes: — installation of illumination and signalling systems for roads, railways, airports and harbours, — installation in buildings or other construction projects of fittings and fixtures n.e.c.	45234115 45316000 45340000
	45.4		Building completion		45400000

NACE Rev. 1 (1)					CPV code
SECTION F			CONSTRUCTION		
Division	Group	Class	Subject	Notes	
		45.41	Plastering	This class includes: — application in buildings or other construction projects of interior and exterior plaster or stucco, including related lathing materials.	45410000
		45.42	Joinery installation	This class includes: — installation of not self-manufactured doors, windows, door and window frames, fitted kitchens, staircases, shop fittings and the like, of wood or other materials, — interior completion such as ceilings, wooden wall coverings, movable partitions, etc. This class excludes: — laying of parquet and other wood floor coverings, see 45.43.	45420000
		45.43	Floor and wall covering	This class includes: — laying, tiling, hanging or fitting in buildings or other construction projects of: — ceramic, concrete or cut stone wall or floor tiles, — parquet and other wood floor coverings carpets and linoleum floor coverings, — including of rubber or plastic, — terrazzo, marble, granite or slate floor or wall coverings, — wallpaper.	45430000
		45.44	Painting and glazing	This class includes: — interior and exterior painting of buildings, — painting of civil engineering structures, — installation of glass, mirrors, etc. This class excludes: — installation of windows, see 45.42,	45440000

NACE Rev. 1 [1]					CPV code
SECTION F			CONSTRUCTION		
Division	Group	Class	Subject	Notes	
		45.45	Other building completion	This class includes: — installation of private swimming pools, — steam cleaning, sand blasting and similar activities for building exteriors, — other building completion and finishing work n.e.c. This class excludes: — interior cleaning of buildings and other structures, see 74.70.	45212212 and DA04 45450000
	45.5		Renting of construction or demolition equipment with operator		45500000
		45.50	Renting of construction or demolition equipment with operator	This class excludes: — renting of construction or demolition machinery and equipment without operators, see 71.32.	45500000

[1] Council Regulation (EEC) No 3037/90 of 9 October 1990 on the statistical classification of economic activities in the European Community (OJ L 293, 24.10.1990, p. 1).

Annex No. 2: A list of priority sectors for GPP criteria

Cleaning products and services

- Technical background report
- EU GPP criteria (published in 2018)

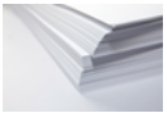
bg cs es da de et el en fr fi it lt lv hr hu mt nl pl pt ro sk sl sv

Computer and monitors

- Technical Background Report
- EU GPP criteria (published in 2016)

bg cs es da de et el en fr fi it lt lv hr hu mt nl pl pt ro sk sl sv

Copying and graphic paper



- Technical background report
- EU GPP criteria (published in 2008)

bg cs es da de et el en fr it lt lv hu mt nl pl pt ro sk sl fi sv

Electrical and Electronic Equipment used in the Health Care Sector

- Technical Background Report
- EU GPP criteria (published in 2014)

bg cs es da de et el en fr hr it lt lv hu mt nl pl pt ro sk sl fi sv

Electricity

- Technical background report
- EU GPP criteria (published in 2012)

bg cs es da de et el en fr it lt lv hu mt nl pl pt ro sk sl fi sv

NEW Food Catering services and vending machines

- Technical Background Report
- EU GPP criteria (published in 2019)

bg cs es da de et el fr it lt lv hr hu mt nl pl pt ro sk sl fi sv

Furniture

- Technical background report
- EU GPP criteria (published in 2017)

bg cs es da de et el en fr it lt lv hu mt nl pl pt ro sk sl fi sv

NEW Public Space Maintenance

- Technical Background Report
- EU GPP criteria (published in 2019)

Imaging Equipment

- Technical Background Report
- EU GPP criteria (published in 2014)

bg cs es da de et el en fr it lt lv hu mt nl pl pt ro sk sl fi sv

Office Building Design, Construction and Management

- Technical Background Report
- EU GPP criteria (published in 2016)
- Procurement practice guidance document

bg cs es da de et el en fr it lt lv hr hu mt nl pl pt ro sk sl fi sv

Paints, varnishes and road markings

- Technical Background Report
- EU GPP criteria (published in 2018)

bg cs es da de et el en fr it
lt lv hu mt nl pl pt ro sk sl fi sv

Road Design, Construction and Maintenance

- Technical Background Report
- EU GPP criteria (published in 2016)
- Procurement practice guidance document

bg cs es da de et el en fr it lt lv hu hr mt nl
pl pt ro sk sl fi sv

Sanitary Tapware

- Technical Background Report
- EU GPP criteria (published in 2013)

bg cs es da de et el en fr it
lt lv hu mt nl pl pt ro sk sl fi sv

Road lighting and traffic signals

- Technical Background Report
- EU GPP criteria (published in 2018)
- Procurement practice guidance document

bg cs es da de et el en fr fi it lt lv hr
hu mt nl pl pt ro sk sl sv

Textiles

- Technical background report
- EU GPP criteria (published in 2017)

bg cs es da de et el en fr it
lt lv hu hr mt nl pl pt ro sk sl fi sv

Toilets and Urinals

- Technical Background Report
- EU GPP criteria (published in 2013)

bg cs es da de et el en fr hr
it lt lv hu mt nl pl pt ro sk sl fi sv

NEW Road Transport

- Technical Background Report
- EU GPP criteria (published in 2019)

bg cs es da de et el en fr it lt lv hr hu
mt nl pl pt ro sk sl fi sv

Waste Water Infrastructure

- Technical Background Report
- EU GPP criteria (published in 2013). Available in different EU languages here

Water-based Heaters

- Technical Background Report
- EU GPP criteria (published in 2014)

bg cs es da de et el en fr hr
it lt lv hu mt nl pl pt ro sk
sl fi sv

Annex No. 3: CBE website cutout with data from the construction company Artes Depret

Registered entity data

In general	
Enterprise number:	0400.082.042
Status:	**Active**
Legal situation:	**Normal situation** Since October 16, 1941
Start date:	October 16, 1941
Name:	Artes Depret Name in Dutch, since March 22, 2013
Registered seat's address:	Rederskaai 61 box 301 8380 Brugge Since May 22, 2018
Phone number:	No data included in CBE.
Fax:	No data included in CBE.
Email address:	No data included in CBE.
Web Address:	No data included in CBE.
Entity type:	Legal person
Legal form:	Public limited company Since March 31, 1983
Number of establishment units (EU):	1 Information and activities for each establishment unit

Functions		
Board member	0542.722.423	Since January 1, 2014
Board member	Hoornaert , Robert	Since January 1, 2000
Board member	Plasschaert , Paul	Since May 26, 2010
Permanent representative	Ockier , Marc (0542.722.423)	Since January 1, 2014
Managing Director	Hoornaert , Robert	Since January 1, 2000

Proof of professional skills and basic knowledge of enterprise governance
Joiner - carpenter contractor Since January 1, 1984
Central heating installer Since January 1, 1984
Plasterer - cement contractor Since January 1, 1984
Masonry and concrete works contractor Since January 1, 1984
Tiling contractor Since January 1, 1984
Electrician installation Since January 1, 1984
Glazing contractor Since January 1, 1984
Sanitary facilities installer and plumbing Since January 1, 1984
Individual gas heating appliance installer Since January 1, 1984
Contractor zinc works and metal roofs Since January 1, 1984
Contractor construction non-metal roofs Since January 1, 1984
Refrigeration contractor Since January 1, 1984
Manufacturer - installer neon signs Since January 1, 1984
Contractor weatherproofing of structures Since January 1, 1984
Demolition works contractor Since January 1, 1984
Knowledge of basic management Since January 1, 1984

Annex No. 4: Summary criteria for architectural competition or study [4]

Criterion name	Target	Motivation	Typology of building	Formulace kritéria	Reference document	Target parameters
Building energy concept including natural ventilation	To create a specific part of the architectural study / contest for motivation for thinking + documentation for energy performance evaluation of the tender building	The energy intensity of the building and the possibility of using alternative and renewable resources is largely determined by the architectural arrangement of the masses and functions of the building, the solution of the building envelope. At the same time it is the architectural-construction part that decides on the use, respectively. non-utilization of the positive properties of the building, such as thermal accumulation, shielding, natural cross and chimney ventilation, the possibility of heat recovery, natural dampening etc. The good energy concept of the building is thus the cornerstone for the final good result.	All types of buildings (new or significant change)	Energy concept as part of the outcome of the competition / study taking into account at least the following: • Energy operation diagrams of the building (heating, cooling, ventilation, humidification / dehumidification, hot water preparation, lighting) in the winter, summer, transition period + night and day regime with preference for using natural principles and energy around the building • Location / location of renewable energy sources • Architectural-building and technological measures of shielding, solar heat gain, thermal buffer, thermal accumulation, thermal recovery, natural dampening / cooling		Part of the drawing and descriptive documentation devoted to the energy concept.
Evaluation of alternative energy sources within the Building Energy Performance Certificate	Assessment of the statutory obligation to prepare an energy assessment, or, as the case may be, a framework assessment within Energy Performance Certificate in the early conceptual phase of the project, when it is appropriate and possible to make a decision on this analysis.	The energy performance of the building and the possibility of using alternative and renewable resources is largely determined by the architectural arrangement of the masses and building functions, the solution of the building envelope. At the same time it is the architectural-construction part that decides on the use, respectively. non-utilization of the positive properties of the building, such as thermal accumulation, shielding, natural cross and chimney ventilation, the possibility of heat recovery, natural dampening etc. The good energy concept of the building is thus the cornerstone for the final good result.	All types of buildings (new or significant change)	Carry out legislation assessing alternative energy sources and produce a report on the results.	Decree 78/2013 Coll. Decree 480/2012 Coll.	Report of evaluation of alternative sources in the work of the study / competition documentation.
Water management concept	To create a specific part of the architectural study / contest to motivate thinking + documentation for the evaluation of the water consumption of the tender building	As well as the energy of the building and water management on the land is largely determined by the building's framework architecture, the building's mass, the solution of paved areas and the roof, the solving of natural or artificial water holding capacities. It is therefore essential to address this issue at the beginning of the project proposal. The concept of drinking water management contributes to more economical use of the less and less available quality drinking water, solves the protection of the environment and the sewer system from intense rain.	All types of buildings (new or significant change)	The concept of drinking water management taking into account at least the following: • Schemes for collecting and managing rainwater or other wastewater, such as gray water, process waste water within the technology		Part of the drawing and descriptive documentation devoted to the concept of water management.
Alternative transport support concept	To create a specific part of the architectural study / contest to motivate thinking + documentation for assessing the friendliness of the design to support alternative transport	The ecological footprint and energy consumption of transport from and to the building is also a crucial factor, which is not only influenced by the location of the building, but also by its own design. The building is supposed to have a safe background and preference for walking, cycling, alternative and gentle car drives.	All types of buildings (new or significant change)	The concept of alternative transport support, taking into account at least the following: • Safe and preferential access for pedestrians in conjunction with the surrounding environment • Safe / reserved access for cyclists with a connection to the surrounding environment, facilities for safe storage and locking of the bike for both visitors and permanent users of the building, changing rooms and showers • Background and preferences of alternative and friendly transport		The part of drawing and descriptive documentation devoted to the concept of alternative transport support.
Ecological building concept	To create a specific part of the documentation of the architectural study / competition to motivate thinking + to the documents for assessing the ecological impact of selected materials and promoting ecology and biodiversity in the territory.	Another very important part of the design of the building, which is more difficult to evaluate, is the raw material intensity of the building materials and their associated ecological footprint. Especially for energy-efficient buildings, this “initiation” footprint is of comparable importance to the entire operation of the building. Another aspect is the ecological quality support and diversity of the territory, the choice of natural elements outside but also inside the building.	All types of buildings (new or significant change)	The ecological concept of the building taking into account at least the following: • Minimization of the ecological footprint of selected building materials, durability of selected materials, use of materials on a natural renewable basis • Measures to preserve / promote the ecological quality of the area, to promote species diversity and local fauna and flora species		Part of the drawing and descriptive documentation devoted to the ecological concept of the building.
Public discussion of construction	The intention of the construction should be discussed with local associations / residents, as well as with relevant industry associations according to the nature of the construction, eg association for protection of local environment, association for support of local culture, social services etc.					

Annex No. 5: Social-cultural and functional criteria [4]

Criterion name	Target	Motivation	Typology of building	Project phases			Implementation phases		
				Criteria formulation	Reference document	Target parameters	Criteria formulation	Reference document	Target parameters
Amount of fresh air	The aim is to ensure a healthy indoor environment without pollutants in the air	There is almost no uncontrolled air exchange in buildings with tight windows / doors. This is beneficial for saving heat / cold, but for the building occupants it is necessary to provide fresh air to breathe, concentrate. At the same time, it is necessary to remove pollutants, odors, excess moisture from the building. Opening windows manually for this problem is not a solution - ventilation is sometimes intense, sometimes not at all, causing thermal discomfort in winter and increasing heat / cold consumption. Hybrid or even pressure forced ventilation systems are the solution.	Family house Apartment building Accommodation services	The building must be provided with ventilation according to the reference document. Opening the windows manually is not sufficient to fulfill the requirement. The requirement does not apply to rooms with the location of combustion equipment with open combustion - suction of combustion air from the room.	ČSN EN 15665 Z1 Design vaue according to ČSN EN 15251 2nd class	Ventilation system specified in ČSN EN 15665 Z1 Design values according to ČSN EN 15251 2nd class	Performing ppm CO2 measurements in characteristic rooms for at least 1 day at design occupancy rates and usage patterns. The measurement must meet the target value in all time readings for a maximum of 15 minutes. Measurements shall be made in the presence of independent third party supervision.	Outside Prague: Decree 268/2009 Coll. Prague: Regulation No. 11/2014 Coll. of the capital city of Prague	Residential rooms below 1500 ppm CO2
			Schools		Spaces for children and adolescents: Decree 410/2005 Coll. Other work areas for employees: Government Regulation No. 361/2007 Coll.	Minimum values			
			Office building Cultural facilities		Government Regulation No. 361/2007 Coll.	Minimum values			
Indoor air free of harmful volatile substances	The aim is to ensure the selection of low emission materials of volatile substances and formaldehyde.	Building materials often contain pollutants such as volatile substances (TVOC) or formaldehyde (HCHO), which can have a major negative impact on human health. These are often floor coverings; paints, coatings, mordants; sealants and binders; board materials internally bonded to partitions, soffits, floors and furniture; internally bonded insulating materials; and more. The requirement helps to select so-called low-emission materials, ie a material with a gentle binder with a significantly lower content of harmful substances, which are released into the interior of the building during life.	All types of buildings	The design specification for each product type is traceable in particular in the BREEAM certification, but the specification for the public body is too complex. It is recommended to target the successful measurement of pollutants (similar to the tightness measurement by the Blower Door Test).			Measurement of hourly concentration of nitrogen dioxide, benzene, ethylbenzene, sum of xylenes, styrene, formaldehyde, trichlorethylene, tetrachlorethylene in characteristic rooms for at least 1 hour with a design number of occupancy and use of the room. Measurements shall be made in the presence of independent third party supervision.	Decree 6/2003 Coll. binding, inter alia, for education and training facilities, accommodation facilities, buildings for trade, buildings for gathering more people. However, the requirement may also be made mandatory for other types of buildings.	Annex 2 Limit Values (Note - not attached in this Thesis)
Visual comfort and daylight	Forward-looking ratios are important, but their method of evaluation / control is complicated for these purposes. Sufficient access of daylight and sunlight is solved by ČSN 73 0580 in the legislative obligation to General technical requirements for construction.								
Acoustic comfort	It is solved by the standard ČSN 73 0532, it is relatively also applied in practice, and the legislative binding to the General technical requirements for construction is accepted.								
User influence on comfort	The goal is to allow building users to influence personal comfort with manually operated elements.	The criterion takes into account the individual needs of the building users to influence in their residence. The following essential elements have been selected: ventilation, glare protection. It is provable that everyone has the need for manual control, fully automated systems are not comfortable for the user.	All types of buildings	Individually controlled: • natural ventilation elements with an effective ventilation area of at least 5% of the floor area of the room • protection against glare with at least the possibility of shielding a part of direct sunlight		• natural ventilation elements for 80% of the rooms located at the exterior façade • anti-glare protection for 80% of the rooms located at the exterior façade			
Inclusive access and facilities of the building	The goal is to allow building users to influence personal comfort with manually operated elements.	The criterion ensures equal accessibility to and use of the building for people who have mobility, visual, hearing or mental disabilities. At the same time, for example for the elderly, pregnant women, people with children.	All types of buildings	Beyond the strict implementation of Decree 398/2009 Coll. and further: • access to the building without steps and leveling steps or a barrier-free ramp, as well as natural or artificial guide lines, must be within the main entrance of the building • measures designed to comply with the Decree do not mean inferior or inferior use of the building compared to use by persons without any handicap	Vyhláška č. 398/2009 Sb.	Consistent fulfillment of the decree with supplementary fulfillment according to the criterion description.			

Annex No. 6: Economical criteria [4]

Criterion name	Target	Motivation	Typology of building	Project phases			Implementation phases		
				Criteria formulation	Reference document	Target parameters	Criteria formulation	Reference document	Target parameters
Life Cycle Costing	So far there is not enough experience in the Czech Republic to specify clear criteria for fair competition without the possibility of cheating. The criterion is essential in the future, and we will address it in the following versions of the technical criteria.								
EPC – Energy Performance Contracting	Enable the realization of truly economically returnable energy saving measures with guaranteed savings. To also allow non-governmental funding of such public sector measures.	It is a financial model of performing renovation (mostly parts of building technology) in the form of third-party financing, ie without a single crown of state money. The provided investment is repaid on an ongoing basis after the realization of the realized savings, which is, however, guaranteed by the investor. After several years of installments, the overall savings are due to the building owner, ie public budgets. The model eliminates the risks of poor design, management, implementation and operation of an energy-saving measure on a building, which is particularly crucial in a not entirely effective way of awarding public contracts.	Types of buildings with significant energy consumption, obsolete technologies (especially building changes).	In order to organize the EPC tender, it is necessary to contact a professional company. Criteria, deep details on how to proceed can be found on the website of the Association of Energy Service Providers - www.apes.cz	www.apes.cz	www.apes.cz	www.apes.cz	www.apes.cz	www.apes.cz

Annex No. 7: Procedural criteria [4]

Criterion name	Target	Motivation	Typology of building	Project phases			Implementation phases		
				Criteria formulation	Reference document	Target parameters	Criteria formulation	Reference document	Target parameters
Commissioning, specialized investors technical Supervision (ITS)	functional and energy-efficient energy consumption technologies, mainly building systems	Every building, especially more complex buildings, needs not only high-quality design, but also high-quality and functional commissioning of energy systems of heating, cooling, ventilation, hot water preparation, dampening, lighting and interconnected building automation. By default, ITS does not specifically address the building's indoor environment technologies. The criterion targets a specialist on the investor's side to supervise the correct installation and testing of the operating modes of all HVAC.	All types of buildings (new or significant change)	ITS will check the implementation project documentation from the point of view of compliance of the HVAC project with the assignment.		Checking the project documentation of TDI, drawing up the TDI report on the necessity and form of correction of project documentation	Heating: Adjustment of system flows according to the design of the thermohydraulic setting of the heating system. The correctness of the adjustment will be checked at random by the ITS. Cooling: Adjusting the system flow according to the design of the thermohydraulic adjustment of the cooling system. The correctness of the adjustment will be checked at random by the ITS.	Heating and cooling: Decree 193/2007 Coll .; ČSN 14336; ČSN 060310 Ventilation: ČSN EN 12599 Hot water: ČSN 73 6660; CSN 73 6670; CSN 75 5911 Mar / BMS: CSN EN 50090	Testing and adjustment process according to the cited documents.
Building Information Modelling	Procurement of building projects with investment savings, eliminating uncontrolled extra costs and project and construction conflicts to support building management through BIM	The condition of project / project management / building management in the process standard Building Information Modeling is an obligatory part of public tenders, eg government buildings in the UK.	All types of buildings (new or significant change)	For the correct listing of tender criteria see www.czbim.org	www.czbim.org	www.czbim.org	www.czbim.org	www.czbim.org	www.czbim.org

Annex No. 8: Environmental criteria [4]

Criterion name	Target	Motivation	Typology of building	Project phases			Implementation phases		
				Criteria formulation	Reference document	Target parameters	Criteria formulation	Reference document	Target parameters
The quality of the building envelope against the reference building	Reduced heat and cooling energy requirements due to the thermo-technical quality of walls, roof, floor and hole fillings: windows and doors.	Criterion easy to assess and control. At the same time, it is very flexible for different functional arrangement of buildings (different design temperatures), as well as for shape design and consistent assessment of new buildings and renovated buildings. The building envelope, unlike technology, has a long renewal cycle, often 30-40 years, so it makes sense to focus on the quality of the building envelope separately as it affects buildings for decades. At the same time, compared to the requirements for individual sub-structures, it allows for a certain technical and architectural freedom of design.	Family house Schools	U_{em} - The average heat transfer coefficient of the building envelope (for changes in existing buildings, the percentage reduction of the U_{em} state proposed compared to the current one)	ČSN 730540-2: 2012 Decree 78/2013 Coll. Nová zelená úsporám (New green savings program)	≤ 0,5 | ≤ 0,75 x Uem, R			
						≤ 0,85 | ≤ 0.75 Uem, R + ≥ 50 % | ≥ 60 % Uem reduction			
			Apartment building Accommodation services	U_{em} - The average heat transfer coefficient of a building envelope for new buildings; Uem - Percentage reduction of the U_{em} status proposed compared to the current change of buildings		≤ 0,6 | ≤ 0,75 x Uem, R			
						≥ 50 % ≥ 60 % Uem reduction The parameter affects the size of the house, the limiting conditions of the street facade, etc. This must always be taken into account for the location. The potential is very individual.			
			Office building Cultural facilities	U_{em} - Percentage reduction of the Uem status proposed compared to the current change of buildings		≥ X % Uem reduction The parameter affects many different factors. It is necessary to set the requirement individually according to the intention of the extent of the building reconstruction and according to the current state.			
Flexible reaction and reduction of energy losses of the heating system	Ensuring the system's regulatory capacity to respond to reduced energy needs.	The criterion identifies the necessity of concurrent provision of automatic regulation on heating and / or heating. cooling system with measures on the building envelope. If the thermal system cannot respond flexibly to natural gains, the quality of the building envelope will not be effective. This is especially a problem with renovation of buildings.	Family house (especially for building changes)	Design / embodiment suitable for insulation of heat distribution systems, fittings and flanges Equithermal regulation of heat energy source	Decree 193/2007 Coll. Act No. 406/2000 Coll.	Mentioned requirements of the Decree for new buildings or newly established facilities			
				Individual automatic control system for individual heating appliances (eg thermoregulators)	Decree 194/2007 Coll. Act No. 406/2000 Coll.	Mentioned compliant description of the decree			
			Residential building Accommodation services Schools (especially for building changes)	Identical to family houses Stepless or three-stage automatic regulation of the circulating pump of the heating system Project of a new thermohydraulic setting of the heating system according to better parameters of the building envelope	Decree 193/2007 Coll. Act No. 406/2000 Coll.	Mentioned requirements of the Decree for new buildings or newly established facilities	Adjustment of system flow rates according to the project of thermohydraulic adjustment of the heating system. The adjustment will be checked at random by an independent third party.	Decree 193/2007 Coll.; ČSN 060310	Protocol of adjustment according to the requirements of the decree and standard
				Individual automatic control system for individual heating appliances (eg thermoregulators)	Decree 194/2007 Coll. Act No. 406/2000 Coll.	Mentioned compliant description of the decree			
			Administration building, Cultural facilities (especially for building changes)	Design suitable for insulation of heat and cold distribution systems, fittings and flanges Equithermal regulation of thermal energy source, automatic attenuation regulation of the cold in dependence on the determinant Stepless or three-stage automatic regulation of the circulating pump of the heating system Project of a new thermohydraulic setting of the heating system according to better parameters of the building envelope	Decree 193/2007 Coll. Act No. 406/2000 Coll.	Mentioned requirements of the Decree for new buildings or newly established facilities	Adjustment of system flow rates according to the project of thermohydraulic adjustment of the heating system. The adjustment will be checked at random by an independent third party.	Decree 193/2007 Coll.; ČSN 060310	Family houses, apartment buildings: n50 = 0,6 Other buildings: n50 = 1,0
				Individual automatic control system for individual heating appliances (eg thermoregulators)	Decree 194/2007 Coll. Act No. 406/2000 Coll.	Mentioned compliant description of the decree			
Airtightness of building envelope	Ensure quality airtight construction.	The criterion places a condition on the nearly airtight envelope of the building. Airtightness is often problematic especially in details of joints of structures such as: window-wall, wall-roof, ceiling mounting on the wall. Airtightness is important for the elimination of uncontrolled heat loss, but also as a prevention against degradation of constructions by condensate and against mold formation in the interior.	All types of buildings (new buildings)				Detached house: Measurement of airtightness of a building according to ČSN EN 13829: 2000 Other buildings of larger extent: Measurement of airtightness of characteristic parts of the building (eg apartment, office module) according to ČSN EN 13829: 2000	ČSN EN 13829: 2000 Guideline Nová zelená úsporám (New green savings program)	Family houses, apartment buildings: n50 = 0,6 Other buildings: n50 = 1,0

Criterion name	Target	Motivation	Typology of building	Project phases		
				Criteria formulation	Reference document	Target parameters
Specific energy demand for heating	Reduced thermal energy demand due to building envelope quality, orientation and degree of glazing to cardinal points and heat recovery.	The criterion evaluates not only the degree of "insulation" of the building envelope, but also the quality of the whole architecture and the whole building aspect of the building. The quality of the building envelope is given 30-40 years in advance. The orientation and functional division of the building, as well as the degree of glazing to the cardinal points, are often intended for the whole life cycle of the building. Therefore, it makes sense to consider this fixed state separately. However, the criterion is less controllable than Uem and allows for more targeted manipulation. The criterion is meaningful especially for new buildings, where the design is not bound by the current state. At the same time, due to the accuracy of the calculation, it can be used only for buildings with a predominant heat and cold demand.	Family house (new buildings)	Design calculated heat demand for heating	ČSN 730540-2: 2012 Decree 78/2013 Coll. Boundary conditions TNI 730331 Nová zelená úsporám instrucion (New green savings)	≤ 20 kWh/(m2.year)
			Apartment building Accommodation services (new buildings)			≤ 15 kWh/(m2.year)
			Schools (new buildings)			≤ 20 kWh/(m2.year)
Power consumption against reference building	Intentionally omitted, the criterion does not say anything too reasonable to the foregoing. Much more relevant to environmental impact is specific non-renewable primary energy.					
Consumption of non-renewable primary energy	Reducing the environmental impact of building energy systems (heating, cooling, ventilation, dampening, lighting).	The criterion evaluates the environmental impact of the building operation in terms of pumping primary raw materials in comparison with the reference building. The reference building is designed as a building of the same shape, identical function and use, with standard energy-saving technologies. The criterion in its indicator includes both the impact of design quality and technological quality. The criterion also includes the positive impact of the use of renewable resources on the building or land. For more complex building functions such as office buildings, cultural facilities with variable number of users, the need for cold, damp / dehumidification, the criterion specifies advanced assessment of the criterion in the form of a dynamic energy model. The proposed procedure is maximally based on the Decree, but it provides some areas not fixed by legislation. The selected calculation method is the only one with a more accurate and meaningful value than the standard method of the static monthly method contained in the Building Energy Performance Certificate (BEPC). BEPC is an inappropriate tool for these more complex buildings.	Family house (new buildings)	Specific non-renewable primary energy	ČSN 730540-2: 2012 Decree 78/2013 Coll. Boundary conditions according to TNI 730331 New green savings	≤90 (without OZE) | ≤60 (with OZE) kWh/(m2.year)
			Apartment building Accommodation services (new buildings)			≤80 (without OZE) | ≤50 (with OZE) kWh/(m2.year)
			Schools (new buildings)			≤120 (without OZE) | ≤100 (with OZE) kWh/(m2.year)
			Family house Apartment building Accommodation services Schools (changes of buildings)	Change in the specific non-renewable primary energy state before and after the measure		≥X % reduction The parameter is influenced by many different factors. It is necessary to set the requirement individually according to the intention of the extent of the building reconstruction and according to the current state.
			Office building Cultural facilities	Percentage reduction of non-renewable primary energy set for the reference building by X%. The reduction is demonstrated using a dynamic computational model with a minimum hourly calculation in ANSI / ASHRAE Standard 140 (BESTEST) or VDI 6020 or VDI 6007 Blatt2 or EN 15265 or EN 15255 certified software. The percentage reduction will be the result of comparing the consumption of the reference and rated buildings. Both calculations will be performed in the same software, with identical settings of the boundary conditions of indoor use (time profiles, indoor gains, targeted thermal and humidity comfort) and outdoor climate database. The evaluated building will then be set according to the actual designed solution. The outdoor climate database will be based on measured data.	ČSN 730540-2: 2012 Decree 78/2013 Coll. Boundary conditions according to TNI 730331	≥X % reduction The parameter is influenced by many different factors. It is necessary to set the requirement individually according to the intention of the extent of the building reconstruction and according to the current state.
Environmental cycle criteria: Global warming potential; Environmental acidification potential; Potential of eutrophication of the environment; Ozone depletion potential; Potential of ground-level ozone formation	No legislative support; There is also a lack of existence and experience with target / reference values. It is certainly a future, but it would now be irresponsible to propose this for state tenders.					

Criterion name	Target	Motivation	Typology of building	Project phases		
				Criteria formulation	Reference document	Target parameters
Elimination of the influence of the thermal island of cities - roofs	Support of thermal reflective materials or natural surfaces to eliminate the effect of thermal overheating of urban units compared to the undeveloped landscape.	Overheating of cities causes unnatural environment, causes discomfort of urban units in summer.	All types of buildings	Percentage of non-heat-absorbing roof of the total relevant area. The relevant roof area is read from above, including the protruding parts of the awnings / terraces. The roof area also includes terrain structures. Functional parts are deducted from the area such as: area coverage of renewable energy technologies, usable areas for pedestrians, playgrounds. The following are considered to be non-thermally absorptive roof layers: green roof, material with reflectance index (SRI) ≥ 82.		≥ 90 % | ≥ 50 % of the relevant roof area The parameter affects the size of the house, limiting the conditions of the street facade, etc. This must always be taken into account for the given location. The potential is very individual.
Elimination of the influence of the thermal island of cities - outside the roof	Generalizing as a mandatory criterion is problematic. Possible inspiration is possible in the LEED certificate, if it should be included.					
Drinking water consumption	Reduce the need for drinking water during building operation and thus reduce the risk of water scarcity (lack).	Drinking water is used for many purposes where it can be replaced with water of lower quality. At the same time, there are many energy-saving technologies that make it possible to maintain user comfort while significantly reducing the need for drinking water. The criterion has no legislative methodological support and standard setting, but it will clearly lead to the installation of energy-saving technologies.	All types of buildings	Percentage reduction of drinking water needs assessed against reference building. Drinking water consumption is calculated only for basic valves. Consumption is always based on the anticipated number and duration of use x flow rate of the fitting / flushing quantity. The assumed number and duration of use are considered in the same way for the reference and rated buildings. The reference building considers the following values: WC - small and large flushing at 6 l / flush; urinal 4 l / flush; washbasin fitting 2 l / min .; shower 9.5 l / min .; kitchen washbasin fitting 8.5 l / min. The use of non-drinking water on relevant valves, eg gray and rainwater, is considered to be a saving against the reference building. The criterion must be supported by calculation.	EU Ecolabel for toilets and urinals	≥ 30-35 % (no need for gray / rain water) | ≥ 45–50 % (with the use of gray / rainwater) saving drinking water compared to the reference building The parameter affects the size of the house, limiting the conditions of the street facade, etc. This must always be taken into account for the given location. The potential is very individual.
Choice of building materials with respect to the environment	The aim is to reduce the demand for construction of primary raw materials and sustainable economy. The aim is to promote recycled materials and to develop the market for credible certification systems that allow a comprehensive assessment of the environmental performance of a construction product.	• High recycling materials: Supports the selection of high recycled products as feedstock. It leads to the development of the market for such products and to the lower demand of the construction industry for pumping primary raw materials. However, proving the origin of raw materials from manufacturers is time consuming. • Environmental Product Declaration (EPD): The criterion can be used to optimize the environmental impact of building materials, from building load-bearing structures to secondary structures and finishing. At present, there is a lack of comprehensive data on building materials. • Sustainable forestry and timber processing: Support for FSC certifications leads to environmentally friendly, environmentally friendly forest management, with limits on harvesting to maintain the area and quality of forests. • Naturally Renewable Building Materials: Support for materials that do not affect the extraction of non-renewable raw materials has a natural recovery cycle of up to 10 years in nature. Such materials include, for example, fast-growing wood and timber products, marmoleum, bamboo, sheep and hemp wool, straw products, and the like. • In all areas relevant to the criterion are those materials that are firmly attached to the building.	All types of buildings	• Support for materials with a high recycling rate: The weight / volume ratio of recycled raw materials in building materials to the total weight of the building. • Environmental Product Declaration: Inclusion of X different building materials with Environmental Product Declaration (EPD). EPD is directed to a specific construction product from a specific manufacturing site, independently verified by a third party, complies with ISO 14025, 14040, 14044 and EN 15804 or ISO 21930. • Wood-based materials with FSC: X% of the volume of all wood-based materials must prove FSC's origin and woodworking certification. • Wood-based furniture with FSC: Specification of FSC-certified furniture types. • Quickly Renewable Materials: Including X different building materials with a natural renewal cycle (life cycle) of less than 10 years.	ISO 14025, 14040, 14044 and EN 15804 or ISO 21930. FSC	Recycled content: 20% by weight of recycled materials to the total weight of building materials fixed to the EPD: inclusion of 5 different EPD building materials as required FSC CoC: 50 | 70 | 90% by volume of FSC or PEFC-certified wood-based materials. FSC furniture: an example of office cabinets / tables with FSC Rapidly renewable materials: the inclusion of 3 different types of quickly renewable materials

Criterion name	Target	Motivation	Typology of building	Project phases		
				Criteria formulation	Reference document	Target parameters
Prevention of floods and load for the sewer system during heavy rainfall	The aim is that the construction does not negatively affect the subsidies of the surrounding natural waterways and the sewerage system during intensive rainfall.	Urban units often have paved areas that have only a limited ability to naturally catch intense rains. The construction often leads to an increase in the flood subsidy and burden for the drainage system. The criterion supports the fact that the construction does not change the runoff conditions from the territory. The criterion is supported, inter alia, by green roofs, permeable paved areas with infiltration capability, as well as building or natural retention devices for catching and gradual however or draining of extreme rains. The criterion further supports the use of catching and use of rainwater in the building for instance for irrigation or flushing of toilets.	All types of buildings	• Maximum flow rate from the site: The flow rate of rainwater from the area must not be increased compared to the state before the exhibition. Rated for 1-year and 100-year rain. • Outflow volume from the plot: The construction of the building under assessment shall not increase the runoff volume of rainwater from the plot during a 100-year rain for 6 hours compared to the situation in the territory before construction. • Calculations will be performed in accordance with the standard.	ČSN 75 9010	The maximum flow rate and runoff volume of rainwater from the plot is not higher than before construction
Background of the building and surroundings for alternative transport	The aim is to build a background for an alternative, more environmentally friendly choice of transport than an individual's car. The aim is to reduce tied transport emissions when traveling to and from the building.	Cycling facilities: A fully-fledged alternative on the way to the building is provided when building a safe arrival, safely storing your bike against theft, changing clothes and hygiene. Electric vehicle charging facilities: Electric vehicles are clean in operation. With the development of renewable electricity production, they will also become environmentally friendly in terms of fuel consumption. Parking facilities for CNG vehicles: Gas is an environmentally friendly fuel than petrol / diesel. In the case of underground stalls, however, special measures are required for air conditioning and fire safety of the building.	All types of buildings	• Building a safe driveway (dedicated lane, limited speed up to 40 km / h) to store bicycles in a cycle / lane connection, build safe X bikes storage for both regular building occupants and visitors under lock or security camera; available showers for all types of permanent occupants of the building along with a place for changing. • Construction of X rechargeable dedicated car parking spaces. • Creating facilities for X underground parking spaces for CNG-powered cars.		Facilities for X bikes according to the criterion description Facilities for X charging points for electric vehicles Facilities for X underground parking for CNG
Separate waste management in the building	The aim is to create sufficient facilities for sorted waste.	If the building is not properly designed and operated, it may be difficult for users to separate waste. The design of the building should, on the contrary, motivate it to be sorted.	All types of buildings	• Properly available waste collection bins in the following range: paper, plastic, glass, biowaste at a maximum distance of: 100 m for non-residential buildings / within buildings for residential buildings from permanent residences. • Central waste collection point in or near the building accessible for collection service		Background of collection containers and central collection point for sorted waste according to the criterion description