Spread of Innovative Solutions for Sustainable Construction

Handbook

1 The Building and its Environemnt

IS-SusCon

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1 The Building and its Environment

The preparation of the construction starts with the conception of the idea, when the owner(s) decides that they want to build a house. There may be several reasons behind this decision, which cannot be detailed here, in any case, after polishing the sparks of thought and refining the ideas, the basic decisions have to be made at this stage. A design program must be developed, a designer be picked and a decision shall be taken regarding where to build the house. It is recommended to do these three processes parallelly, at the same time, approximately. It is a common case that the construction site is a starting point, however, if it is possible to choose from several plots, it is useful to involve the designer in the process and finalize the planning program together, considering the possible locations. The building site and the design program, which is the basic idea behind the future house, interact closely with each other, just as the designer has a significant impact on both. Unfortunately, it is often neglected, but the designer plays a key role in the whole construction process, so it is highly important to select the right architect and, of course, further specialist designers. The best solution is if they form a team. In order to design an energy- and environment-conscious house, it is essential for the designers to be committed to sustainable construction, as well as they possess qualification and in-depth knowledge in this area. Besides that, of course, the skills and knowledge needed to achieve architectural, construction- and technical quality are essential, as well as a sense of reality and empathy for the builder's budget.

At first glance, it may seem that we have set the bar very high, but we are pleased to announce that there are many designers working in Hungary (and in Europe as well) who meet the conditions described above.

1.1 The environmental load of buildings

The environmental impact of buildings is significant in terms of energy consumption and greenhouse gas emissions, as well as waste generation. This is especially true when looking at the entire life span of a building (from building material production, through construction and use to demolition). (see chapter 2 for Life Cycle Assessment)

Sustainability is difficult to define. It means that we use only the necessary amount of resources. The aim is to protect, maintain the current state and prevent further destruction of air, soil, surface and groundwater, wildlife (plants, animals) and the landscape, as well as the built environment while supporting the health and wellbeing now and in the future.

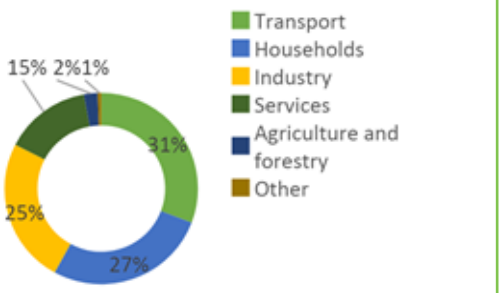

Figure 1: Total energy consumption by sector, 2017[1]

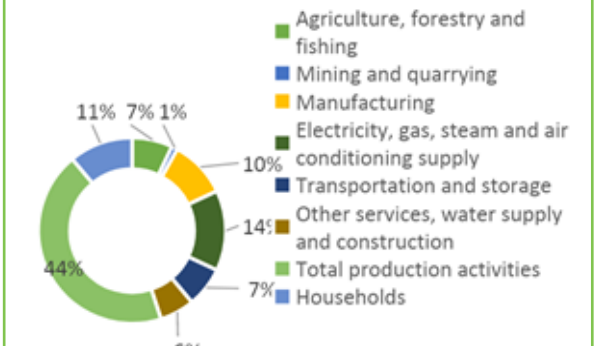

Figure 2: Greenhouse gas emissions by economic activity, 2016[2]

In Europe, the industrial sector accounts for 24.6% of the total energy consumption and 36.4% of waste generation, in which construction plays a significant role. In addition, 27.2% of the total energy consumption, 11% of the greenhouse gas emissions and 8.5% of the waste generation come from households.[3]

1 Source of data: Eurostat Statistical Books Energy, transport and environment statistics, 2019
2 Source of data: Eurostat Statistical Books Energy, transport and environment statistics, 2019
3 Eurostat Statistical Books, Energy, transport and environment statistics, 2019

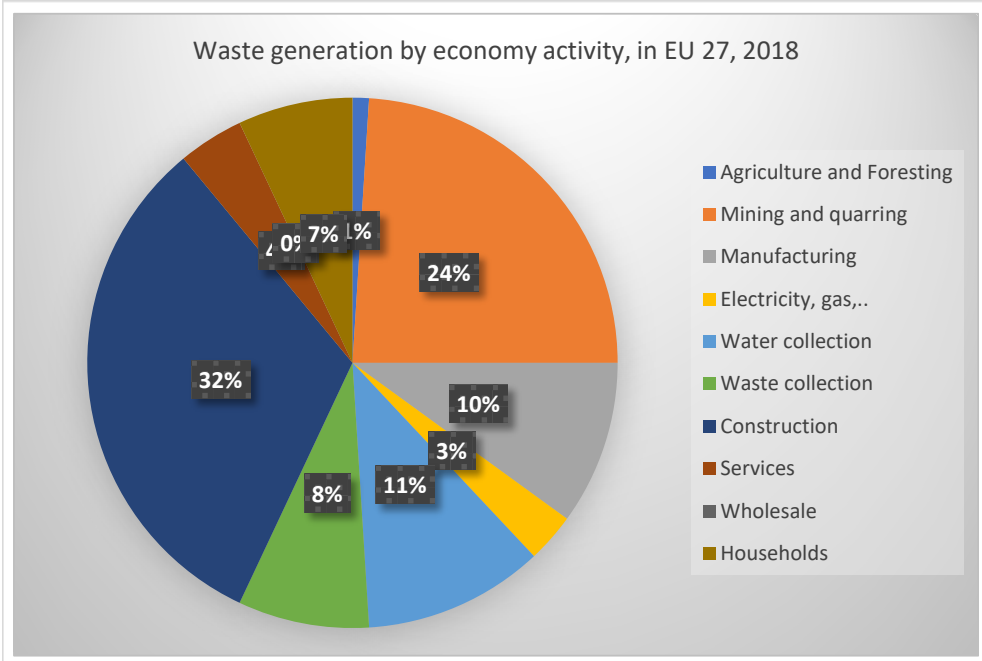

Figure 3 : Waste generation by economic activity, in EU27, 2018[4]

For this reason, it is important to dedicate attention to reducing the environmental impact during both construction and the use of buildings. Looking at the entire life cycle of a building construction accounts for 50-80% of the total environmental load (the ratio depends largely on the energy-related properties of the building, for example thermal insulation, heating system). Most of the energy consumption, on the other hand, occurs during use.

During building use, energy consumption is divided between different functions. In an average European household, 64.1% of total energy consumption is used for heating, 14.8% for hot water production, 14.4% for lighting and other electrical appliances, 0.3% for cooling and 0.9% makes up for other consumers. It can be seen that the most energy-intensive element is heating (although this depends largely on the local climate as well as the characteristics of the buildings). For this reason, during the construction and renovation of buildings, a great emphasis is placed on reducing the need for heating energy (with thermal insulation and efficient cooling systems). But it is not only large-scale interventions that can reduce energy consumption of households.

Figure 4: Energy consumption in EU households[5]

4 Source of data: Eurostat Statistical Books Energy, transport and environment statistics, 2019
5 Source: Eurostat Statistical Books, Energy, transport and environment statistics, 2019

In many cases, smaller investments (e.g. replacing light bulbs with energy-saving ones), as well as changing consumer behaviour (e.g. preferring natural daylight) can also make a significant difference. See Chapter 6 for further suggestions.

However, it matters which source the energy comes from. On one hand, the type of energy (e.g. electricity, heat) is an important environmental aspect, and on the other hand so is the energy source which this energy is produced with (e.g. solar energy, natural gas). It is important to strive to use the given energy carrier in the most efficient way and, in parallel, to produce the required energy with the least environmental load (e.g. natural gas can be used more efficiently for heating than electricity generation, and electricity can be generated with less environmental load with solar panels as a coal-fired power plant). To achieve this, the aspects of environmentally conscious construction must be taken into account during the design of the building, the selection of building materials and building services systems as well.

More specific statistics related to the building sector in terms of waste generation and use of resources are available here:

in English:
https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF

https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_2&format=PDF

in Hungarian:
https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0003.02/DOC_1&format=PDF

https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0003.02/DOC_2&format=PDF

1.2 Sustainable construction

The construction industry is facing new challenges. Sustainability in this case depends on achieving the lowest possible environmental impact, while encouraging social and economic development. Society demands new infrastructure, a reduction in the consumption of energy and resources, and the implementation of sustainable or "green" constructions.

Following the definition provided by Charles J. Kibert, sustainable construction is "the creation and responsible management of a healthy-built environment based on resource efficient and ecological principles".[6] In comparison with the traditional concerns in construction (performance, quality, cost), the criteria of sustainable construction has become resource depletion, environmental degradation and healthy environment and there were also 6 principles set for it:

- Minimise resource consumption (Conserve)
- Maximise resource reuse (Reuse)
- Use renewable or recyclable resources (Renew/Recycle)
- Protect the natural environment (Protect Nature)
- Create a healthy, non-toxic environment (Non-Toxics)
- Pursue quality in creating the built environment (Quality)

From the point of view of **environmental impact**, a sustainable construction involves

- The design and management of built structures, whether at the scale of build ings, infrastructure, or urban agglomerations
- The performance of materials across all scales and throughout their whole use-cycles
- The use of renewable energy resources, as well as their related technologies in building, operation and maintenance to reduce global greenhouse gas emissions.

6 Charles J. Kibert: Sustainable Construction

From the point of view of **economic impact**, sustainable construction involves regarding renewable energy generation, the transition from a linear to a circular economy recycling material and waste, water harvesting and preservation, transferability of technologies, and the adaptability of structures to changes in use; innovative financing models premised on an economy of means that yields more with less; and the reinvestment of returns back into the common domain for collective benefit.

From the point of view of **social impact**, sustainable construction involves adherence to the highest ethical standards in business, as well as to industry practices throughout all project phases; the promotion of socially-viable living and working environments, including occupational health and safety standards for labour forces and users; and the democratization of all processes pertaining to the production and use of the built environment as a commonwealth.

A building finalised by a circular-solution method is built without wasting resources, polluting the environment and damaging the ecosystem, and it can be recycled after use. It is built in an economically responsible way, contributing to the well-being of people and the biosphere. Circular buildings generally have a positive impact on materials, energy, waste, biodiversity, health and well-being, on human culture and society.

Regarding sustainable construction, we have to consider, on one hand the building stock, our built heritage, which we cannot eliminate for technical, cultural or economic reasons, nor can we replace them with new ones, and on the other hand, the limiting factors that frame our ideas when implementing new facilities.

In terms of the built environment, the existing building stock accounts for - by far - the most carbon emissions and where the greatest opportunities for savings can be found.

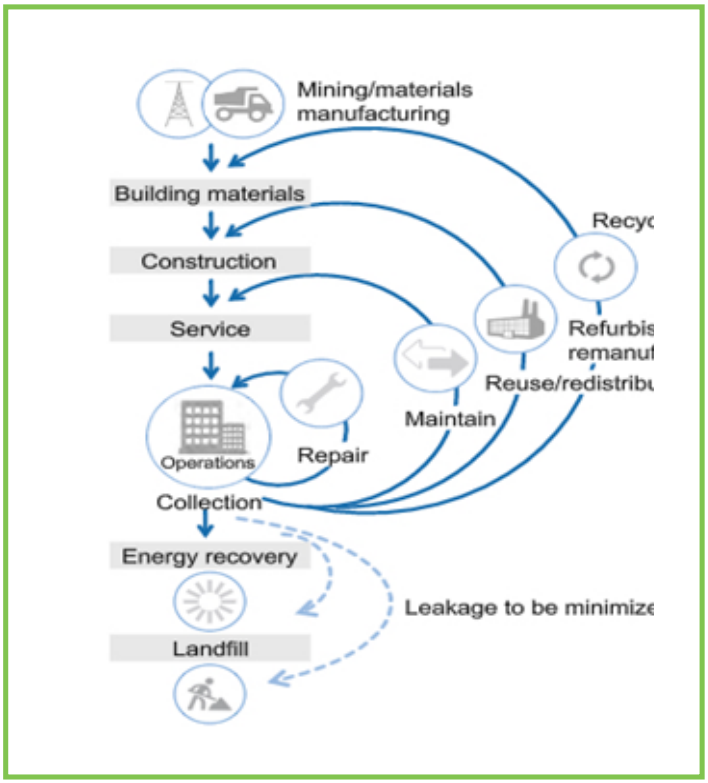

Figure 5: Circularity in building industry[7]

7 Source: Ellen MacArthur Foundation; World Economic Forum; Boston Consulting Group