

SUSTAINABILITY IN CONSTRUCTION

Simona STANCA

Technical University of Cluj-Napoca, Buildings and Management Department, Romania
 e-mail: simona.stanca@ccm.utcluj.ro

ABSTRACT

The main theme of this work is the sustainability of buildings and their relevance for sustainable development in Romania and Europe in the current context of orientation towards sustainable augmentation, minimizing the negative impact on the environment.

A sustainable building must be designed to use the necessary resources: energy, water, and materials in a more efficient way while aiming at reducing the impact that the construction itself has on the health of the occupants but also on the environment.

As it is known, human activity in the last few centuries has led to the consumption of resources and the spread of pollutants in the environment.

According to statistics, over time it has been proven that the construction sector is one of the most active contemporary polluters. The largest amount of greenhouse gas emissions from the building sector results from the use of energy (e.g., for heating, lighting, etc.). Thus, it is demonstrated the need to decrease energy consumption for the use of buildings, but also for their construction and recycling.

KEYWORDS: building materials, natural resources, sustainable development

1. Introduction

Sustainability in construction refers to the design, construction, and maintenance of buildings and infrastructure in an environmentally responsible manner, with the goal of reducing their negative

impact on the environment and preserving resources for future generations. This includes using energy-efficient materials and systems, reducing waste and emissions, preserving natural resources, and promoting healthy indoor environments.

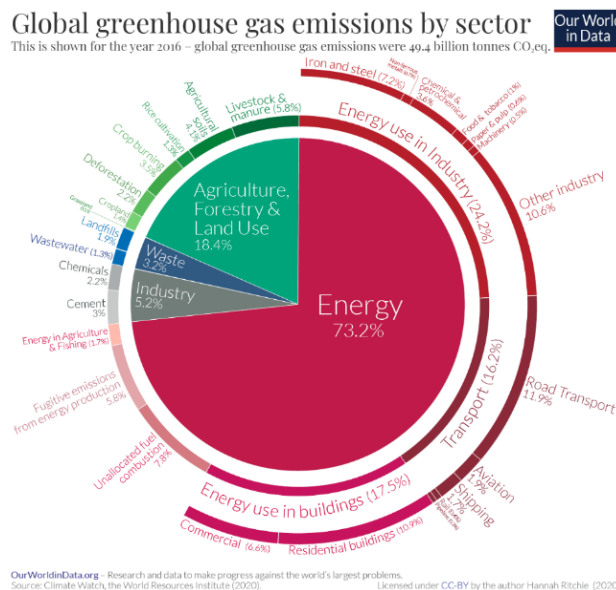


Fig. 1. Global greenhouse gas emission by sectors [11]

Sustainability in the construction sector is important both in terms of energy used in construction and in terms of CO₂ emissions (Fig. 1) [11].

Carbon dioxide emissions are the primary cause of global climate change and if humanity wants to avoid the most severe effects of it, we must reduce these emissions.

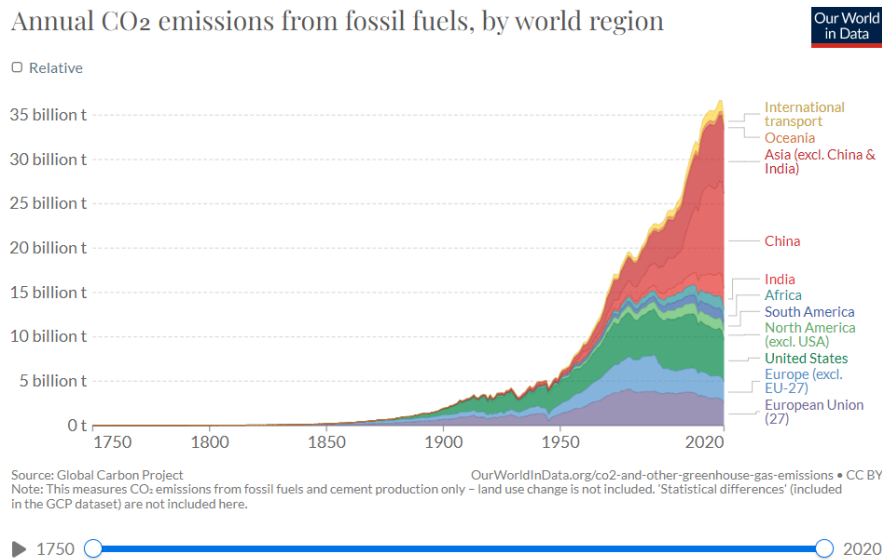
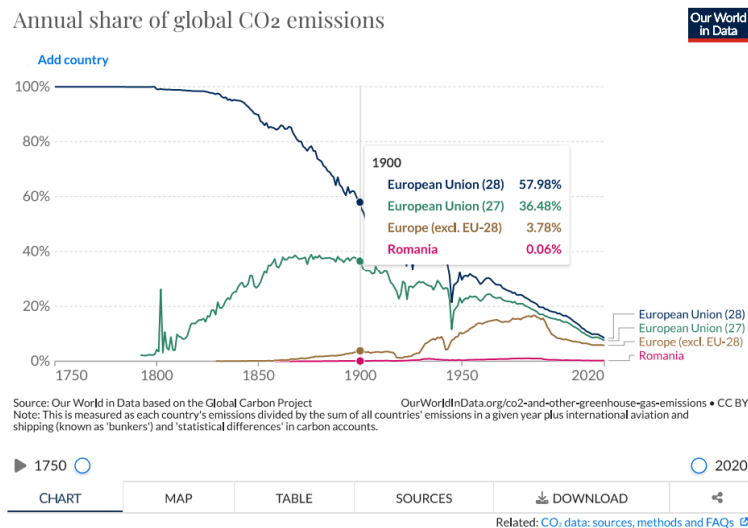


Fig. 2. Annual CO₂ emissions from fossil fuels, by world region [12]

In the twentieth century, Europe and the United States were responsible for the majority of global emissions, with over 90% of emissions coming from these two regions in 1900 and more than 85% in 1950 (Fig. 2) [12].

human welfare when considering CO₂ emissions, as both have a direct impact on the living conditions of generations to come. We must work together to develop a sustainable future that offers a high quality of life for everyone (Fig. 3) [13], (Fig. 4) [14].

As we look to the future, it is critical to recognize the need to balance environmental and



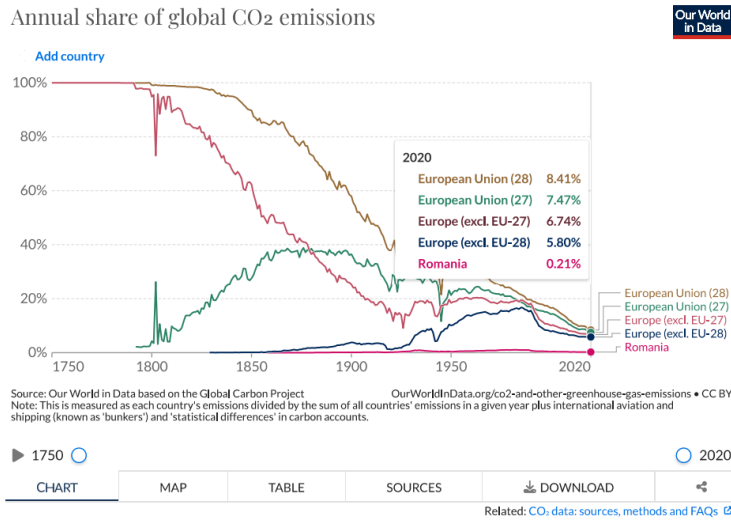


Fig. 3. The total amount of carbon dioxide released into the atmosphere in Europe each year, 1900/2020 [13]

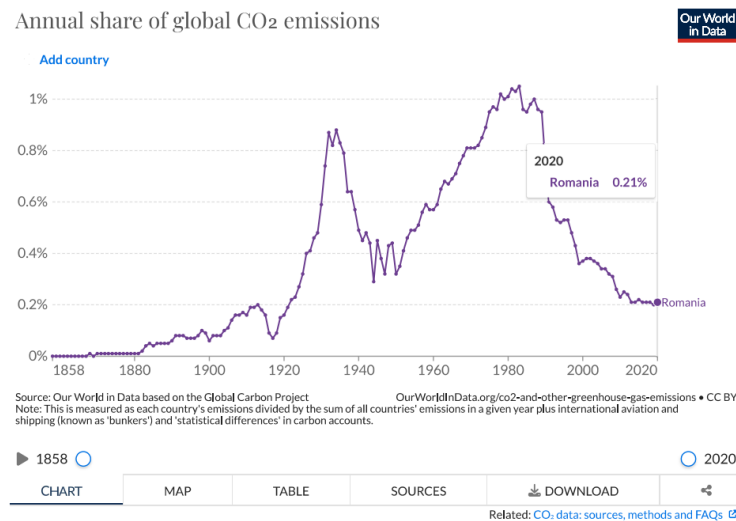
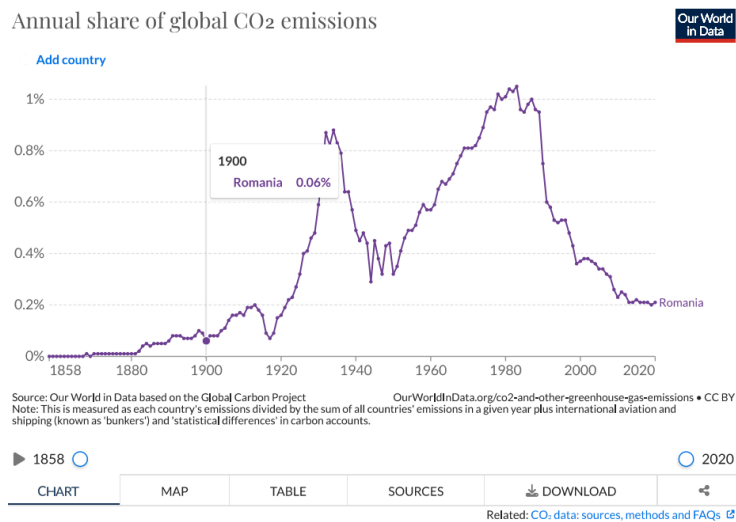


Fig. 4. The quantity of carbon dioxide released into the atmosphere in Romania over the course of a year, 1900/2020 [14]

2. Sustainability in building development

The construction industry is one of the largest users of natural resources while being one of the most dynamic sectors worldwide [1].

Sustainability in the development of buildings refers to the implementation of measures that allow their sustainable execution, measures that ensure a long-term existence of the building, without affecting the environment and respecting economic principles.

Given the global scarcity of natural resources, the main challenge for producers and consumers is ‘to achieve more by consuming fewer resources’ [7].

Given the limited nature of these resources, the adoption of sustainable construction methods and the use of renewable and recyclable materials, as well as the reduction of energy consumption and waste, over time, will have a direct effect in reducing the impact on the environment while providing a healthier and more comfortable lifestyle [2].

Sustainability in the development of buildings is a vast and complex subject, which must be considered from the design stage because the potential impact on the environment is significant (Fig. 5) [4].

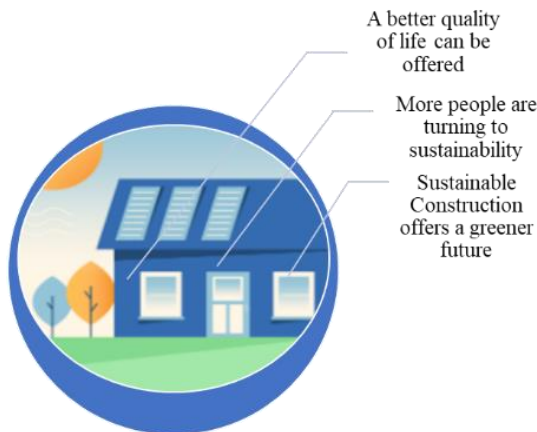


Fig. 5. The importance of sustainability in construction

Sustainable building incorporates the concept of creating a healthy environment with consideration for ecological principles. Professor Charles J. Kibert states that sustainable construction is based on six principles: conservation, reuse, recycling/renewal, nature protection, and the production of non-toxic and high-quality materials [4].

According to the European Commission, the construction sector produces about 1/3 of the total waste. As a global industry, it contributes 11% of greenhouse gas emissions, and its current volume of use of natural resources is unsustainable and substantially compromises the environment for the purpose of its development [16].

The aim is to reduce the environmental impact of the industry by using sustainable development practices, energy efficiency, and harnessing green technology.

Sustainable construction considers the use of resources (energy, natural resources), their impact on the environment, and specific risks to human safety [3].

The moderate use of locally available building materials and compliant, energy-efficient but also sustainable technologies have become a major topic of policymaking, research, and innovation at a global level [8].

3. Durable building materials

In order for construction to be considered sustainable, building materials should be chosen based on their ability to reduce the carbon footprint of a building and their durability. Durable materials should come from a local source, be recyclable, be produced in a sustainable way, and be made from materials that can be recycled. Using these criteria, materials such as concrete, steel, plastic, wood, and bricks can all be used in the construction of sustainable buildings [4, 5, 9].

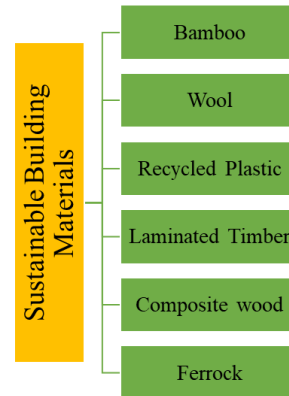


Fig. 6. Sustainable building materials

Types of durable building materials (Fig. 6) [9]:

- straw bale;
- wool;
- recycled steel;
- recycled plastic;
- beaten earth;
- processed wood (composite wood);
- bamboo, etc.

4. The advantages of using sustainable construction materials

Sustainable construction is not just about using the latest materials. It is also about the use of

construction methods and technologies that increase renewable and sustainable efforts [2].

Advantages of using sustainable building materials (Fig. 7) [9]:

- waste reduction;
- low emissions;
- lower costs.



Fig. 7. Benefits of sustainable materials

As the dangers of climate change become more and more apparent, the need for sustainable construction grows. Despite the challenges that come along with it, sustainable construction has the potential to create a cleaner, greener future for us all. The demand for sustainable construction is rising, and the benefits it brings are becoming more and more evident. (Fig. 8) [10, 15], (Fig. 9) [6].



Fig. 8. The benefits of sustainable construction [10, 15]



Fig. 9. Sustainable construction methods, benefits and challenge [6]

5. Conclusions

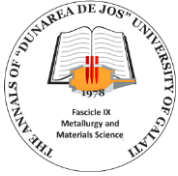
The evolution of human society has always produced a major impact on the development of buildings, which constantly evolve with humanity, according to needs and requirements.

Given the current ecological context, climate change, and the high and growing consumption of non-renewable resources, it is important to find alternative, sustainable, renewable, recyclable, and efficient solutions in the construction field.

The ultimate goal of creating sustainable buildings is to reduce the negative impact of the built environment on both human health and the surroundings. This is done by improving energy efficiency, conserving natural resources, protecting occupants' health, and minimizing waste, pollution, and environmental degradation. To achieve this, new technologies are continually being developed to supplement existing practices.

References

- [1]. Maier A., Molnar L. Monica, Stanca S., *Challenges regarding sustainable development from building materials perspective*, International Conference Interdisciplinarity in Engineering, 38th IBIMA Conference, Seville, Spain, ISBN: 978-0-9998551-7-1, 23-24 November 2021.
- [2]. Stanca S., *Refurbishment of Decommissioned Buildings in the Context of Sustainable Development*, Bul. Inst. Polit. Iași, 62 (66), 1, p. 61-71, ISSN: 1224-3884 (p), ISSN: 2068-4762 (e), 2016.
- [3]. ***, https://www.activesustainability.com/construction-and-urban-development/sustainable-building-materials/?_adin=01833301559, accessed on 2.11.2022.
- [4]. ***, <https://www.bigrentz.com/blog/sustainable-construction>, accessed on 2.11.2022.
- [5]. ***, <https://www.bigrentz.com/blog/the-future-of-building-materials>, accessed on 4.11.2022.



- [6]. ***, <https://engg.dypvp.edu.in/blogs/sustainable-construction-methods-benefits-and-challenges>, accessed on 4.11.2022.
- [7]. ***, <https://www.europarl.europa.eu/factsheets/ro/sheet/77/consumul-si-productia-durabile>, accessed on 5.11.2022.
- [8]. ***, <https://www.frontiersin.org/research-topics/33008/construction-materials-and-technologies-a-sustainable-approach>, accessed on 12.11.2022.
- [9]. ***, <https://mtcopeland.com/blog/a-guide-to-sustainable-building-materials/>, accessed on 14.11.2022.
- [10]. ***, <https://nestcon.com/sustainable-construction-methods-and-benefits/>, accessed on 21.11.2022.
- [11]. ***, <https://ourworldindata.org/emissions-by-sector>, accessed on 9.12.2022.
- [12]. ***, <https://ourworldindata.org/grapher/annual-co-emissions-by-region>, accessed on 9.12.2022.
- [13]. ***, <https://ourworldindata.org/grapher/annual-share-of-co2-emissions?country=European+Union+%2827%29~ROU~Europe+%28excl.+EU-28%29~European+Union+%2828%29>, accessed on 9.12.2022.
- [14]. ***, <https://ourworldindata.org/grapher/annual-share-of-co2-emissions?country=~ROU>, accessed on 9.12.2022.
- [15]. ***, <https://www.renewablesinafrica.com/africas-increasing-investment-in-sustainable-construction/>, accessed in 17.01.2023.
- [16]. ***, <https://www.rockwool.com/ro/despre-noi/filozofia-noastra/blog/importanta-sustenabilitatii-in-constructii/>, accessed on 26.01.2023.