

Reducing the energy consumption through friendly sun buildings in Jiu Valley region

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Abstract. The work highlights the possibility of reducing electricity consumption by building homes, offices, production spaces, etc., by placing them in such a way that the sunlight is used instead of artificial light. The placement of constructions in the Jiu Valley in order to benefit from the sunlight from sunrise to sunset is more difficult due to the depression and the height of the mountains that surround the region. A monitoring of the incidence of sunlight over a period of time can generate economic aspects by reducing the consumption of electricity, consumed by the maintenance of artificial lighting. This can also play an important role in combating climate change and promoting sustainable development.

Keywords: *electricity consumption, sunlight, green buildings, efficiency.*

Introduction

Jiu Valley is a region located in the Jiu Valley in Romania. It is known for its picturesque landscapes, including mountains, forests, and the Jiu River that flows through the valley. The region is also historically significant, as it was an important coal mining area during the industrialization of Romania.

Mining in the Jiu Valley was one of the oldest and most important economic activities in this region of Romania. The Jiu Valley was known for its rich coal reserves, which has been mined since the 19th century. Mining has been the most important of the area's economic development, providing jobs for thousands of people and helping to raise the community's standard of living. However, with the changes in the energy market and the reduction in demand for coal, the mining industry in Jiu Valley began to decline.[5]

In our area, the problem of ecological balance and climate change are big challenges because massive deforestation, pollution and excessive exploitation of natural resources have affected ecosystems and biodiversity. To solve these problems, we need to reduce greenhouse gas emissions, protect forests and water resources, promote renewable energies and a sustainable lifestyle.

Built Environment

The buildings and construction sector are vital in combating climate change due to its significant greenhouse gas emissions. Sustainable practices, energy-efficient design, and green building standards can reduce environmental impact. Retrofitting existing buildings for energy efficiency and investing in renewable energy sources like solar panels can further decrease the sector's carbon footprint. Ultimately,

the sector has a responsibility to adopt sustainable practices to mitigate climate change effects and promote a greener future.[1]

According to the studies carried out, the building and construction sector is a very important point in the fight against climate change because 36% of the global final energy consumption and 39% of the total carbon dioxide (CO₂) emissions were obtained from this sector.[6]

Thus, in order to achieve a sustainable environment, we need practices and technologies that ensure the construction and use of buildings in a way that minimizes the impact on the environment. It is necessary to design and construct buildings in an ecologically sustainable way, using materials and techniques which reduce resource consumption and carbon emissions.

The natural environment with varied climate is not suitable for the human lifestyle, he always tries to transform the surrounding natural environment so that he can carry out his activities. A built environment must bring benefits in terms of people's health and well-being, protecting the environment and contributing to the formation of sustainable and pleasant communities. It can also play an important role in combating climate change and promoting sustainable development.

Building a house from a climate point of view refers to the design and construction according to the specific climatic conditions of the regions in which it is located.[3]

Our area has a climate that can be considered typical mountain, with significant temperature variations between seasons and a predisposition to extreme weather phenomena. During summer, average temperatures can vary between 15°C and 25°C, and winters can be quite cold, with average temperatures below zero degrees Celsius and precipitation in the form of snow.

From the climate point of view, some important considerations that are taken into account for the buildings in Jiu Valley are:

-Adequate thermal insulation that maintains an optimal level of thermal comfort during the cold season, because it is important that buildings are well thermally insulated to reduce heat loss.

A protection against frost and snow as the region can have long and cold winters means that buildings must be constructed with frost and snow resistant materials to cope with harsh weather conditions.

-Effective ventilation because due to the variety of climatic conditions in the Jiu Valley, adequate ventilation inside the buildings contributes to maintaining a healthy and comfortable environment for the occupants.

-Use of renewable energy sources as climate change and environmental concerns increase, the integration of renewable energy sources such as solar panels or wind power into the construction and operation of buildings helps to reduce the region's carbon footprint.

By approaching a sustainable design and construction that takes into account the climatic specificities of the area, the buildings in Jiu Valley could be more energy efficient, more resistant to climate change and more comfortable for the occupants.

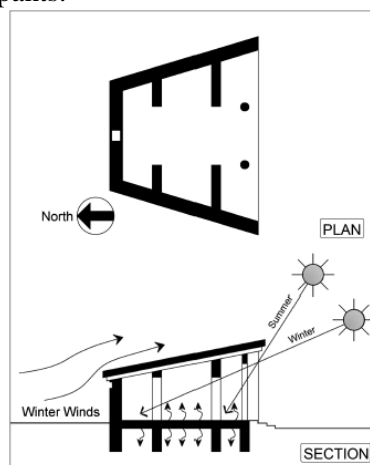


Figure1. The incidence of the sun's rays

In our area, the design of buildings so that they correspond to the climatic conditions was achieved based on the optimization of energy efficiency, personal comfort and the durability of the constructions. This approach takes into account factors such as temperature, humidity, solar radiation, wind patterns and precipitation levels and is in continuous development (Fig.1). The aim is to create ecological, energy-efficient and comfortable spaces adapted to the local climate, contributing to a more sustainable and resilient built environment. High-performance buildings are often characterized by their ability to optimize resource use, reduce energy consumption, minimize environmental impacts, enhance indoor air quality, and provide superior levels of comfort and productivity for occupants. These buildings often incorporate advanced technologies, innovative design strategies, and sustainable materials to achieve high levels of performance in a variety of areas. Overall, high-performance buildings are designed to deliver superior outcomes in terms of energy efficiency, environmental sustainability, occupant health and wellbeing, and overall building performance.

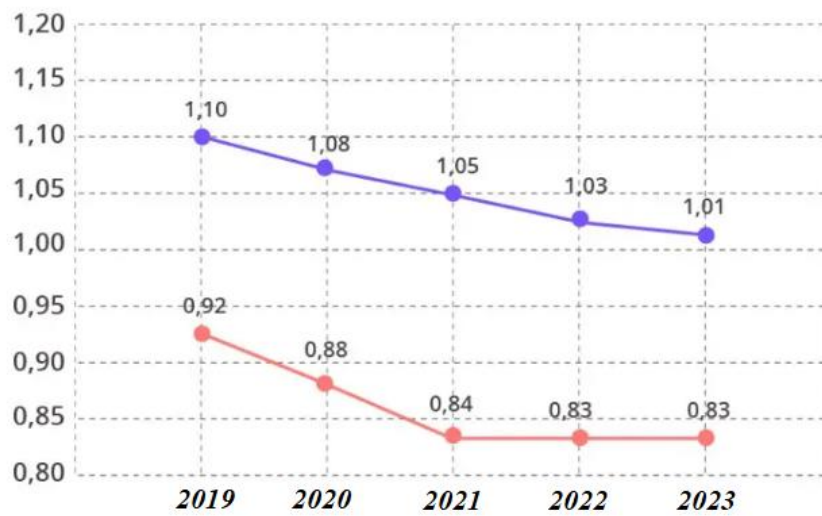


Figure 2. The difference with climate correction and without climate correction

Following the studies carried out on the buildings in our area, it was found that their modernization taking into account aspects such as thermal insulation, the use of renewable energy sources, the installation of efficient ventilation and lighting systems, as well as the use of durable and friendly construction materials with the environment, the implementation of smart technologies and temperature and lighting control systems based on sensors has significantly contributed to reducing energy consumption and increasing the energy efficiency of buildings. Thus, as can be seen in figure number 2, energy consumption in a rehabilitated house is much more efficient than in non-rehabilitated buildings.

Rehabilitating buildings to improve energy efficiency can bring significant benefits such as reducing energy consumption for heating, cooling, and lighting, leading to lower utility bills. Proper thermal insulation, efficient ventilation systems, renewable energy sources, and LED lighting can all contribute to energy savings. Furthermore, building rehabilitation can have a positive impact on the environment by reducing greenhouse gas emissions and conserving natural resources.

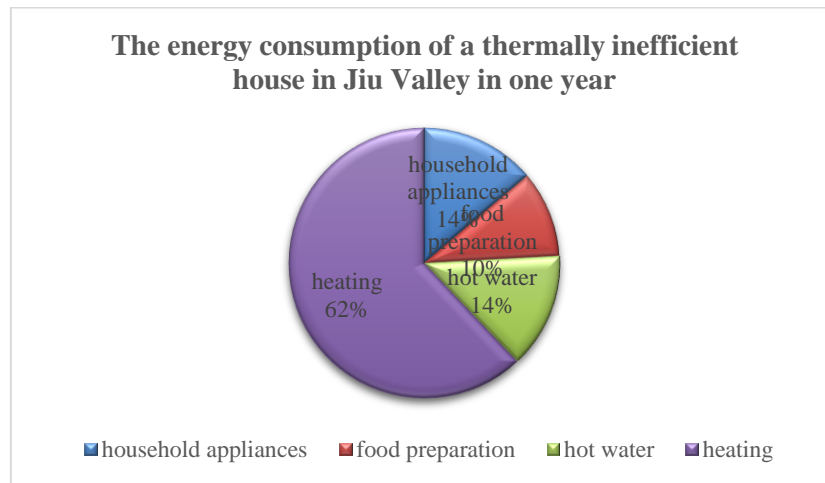


Figure 3. The energy consumption of a thermally inefficient house in Jiu Valley in one year

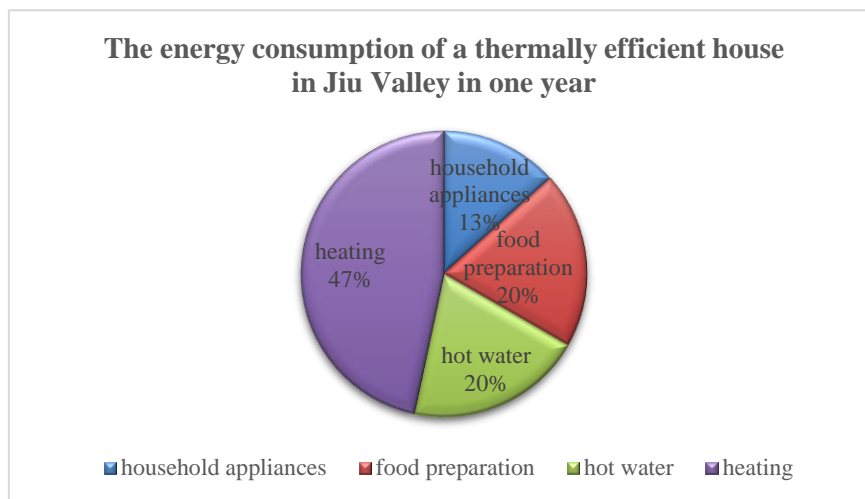


Figure 4. The energy consumption of a thermally efficient house in Jiu Valley in one year

As can be seen in the graphs above, the energy consumption for heating the dwellings is much lower in the energy-rehabilitated ones, compared to the buildings built in the 1990s.

We find that heat loss in buildings is determined by factors such as inadequate insulation, air infiltration, inadequate heating system, building wear and climatic factors.

Conclusion

Energy efficiency consists of measures and practices that reduce energy consumption and optimize the use of available energy resources. This process involves identifying and eliminating energy losses, increasing the efficiency of energy production and use systems, using renewable sources and implementing more energy efficient technologies. Energy efficiency can reduce environmental impact and save energy costs, representing a sustainable solution for managing energy resources and reducing greenhouse gas emissions.

Rehabilitating buildings to make them more energy efficient involves making various upgrades and improvements to the building's infrastructure. This can include installing energy-efficient lighting, HVAC systems, insulation, windows, and appliances, as well as implementing renewable energy sources such as solar panels or geothermal systems. By reducing the energy consumption of buildings, we can contribute to a more sustainable future by decreasing greenhouse gas emissions and minimizing our impact on the environment.

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Acknowledgments

The work underlines the aspects related to the exploitation of the solar potential in order to reduce the consumption of electrical energy through the need to illuminate the different buildings for living or working. Each accumulated energy gain determines a sustainable and accounted gain in energy produced worldwide.