



## Impact of Building's Thermal Insulation on Increasing Thermal Comfort and Reduction of Electricity Consumption

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### Abstract

Recently, the construction sector in Albania has been developing rapidly when it comes to the variety of construction materials and the most advanced techniques of the time. The challenge for engineers, architects, and builders consists of using and combining them as effectively as possible to ensure maximum comfort at the lowest possible cost. When designing a building, one should bear in mind that the success or failure of the project is based primarily on ensuring internal environmental comfort, as it has been proven that residents who live in an environment that contributes to a healthy and comfortable lifestyle are more satisfied and productive. Unfortunately, this fact is often overlooked, as it is easier to focus on the initial cost of a project rather than to determine the value of the improved health and productivity of the user as well as the reduction of the subsequent costs. Through measurements performed in different seasons and periods, it has been proven that the thermal insulation of a building significantly increases its thermal comfort. Additionally, statistical tables obtained from Electricity Distribution Operator prove that thermal insulation is associated with a significant reduction in electricity consumption, from 15 - 28%, mainly in peak periods. If the Urban Sector of Local Units were to find stimulators, motivating entities to consider the thermal insulation of new buildings, it would make a substantial difference in this regard. The thermal insulation of the existing dwellings' stock, which can be realized through the coordination of the Local Units and the Electricity Distribution Operator policies, would also significantly impact the increase of thermal comfort and the reduction of electricity consumption.

**Keywords:** Thermal insulation of buildings, thermal comfort, reduction of electricity consumption

### 1. Introduction

Albania is a developing country, and traces of the former communist regime are still present in many aspects of life, including the field of construction. This sector has evolved significantly in implementing contemporary materials and techniques, but there is still much work, mainly in the mentality and way of designing and building with foresight. According to many studies, the higher the comfort level in buildings, the healthier, more satisfied, and more efficient the residents are. (The Health and Environment Alliance (HEAL), 2018) So, increasing the comfort level in apartments is the main challenge of designers and builders today.

Moreover, the realization of this challenge should be aimed at the most optimal and efficient cost. On this basis, but also as a need to meet the criteria, in the framework of the aspiration of EU membership, the Parliament of Albania

approved in November 2015 Law 124, on 05.11.2015 "On energy efficiency", later regulated by Law no. 28/2021, for some changes and additions to Law no. 124/2015 "On energy efficiency" amended. According to the data, one of the essential elements of comfort is the thermal one, which is realized mainly through electricity. According to Balkan Green Energy News (2018), for 65% of households in Albania, most of the electricity consumption goes to heating their homes, while for approximately 60%, most of it is spent on cooling (Figure 1). According to the Directive 2010/31 / EC on Energy Performance in Buildings (DPNE), 25% of the total annual energy consumption goes for heating, and 20% goes for cooling.

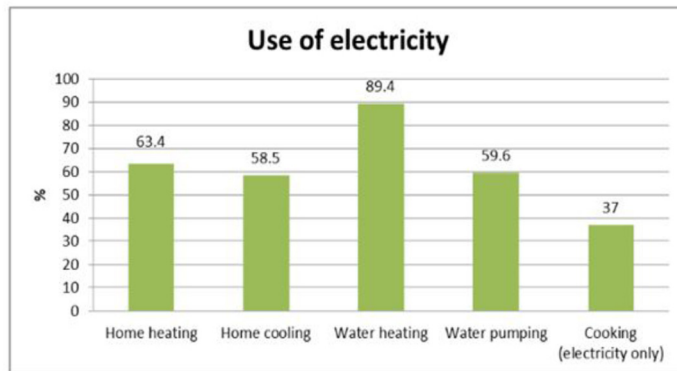


Figure 1: Use of electricity by households

Thermal insulation is the most efficient solution for storing the obtained thermal energy and prevents its transfer from the residential area to the outside environment. The quality of thermal comfort in apartments is mainly conditioned by the quality of masonry, which increases significantly through its thermal insulation. Many people still do not understand the great benefits of thermal insulation due to the lack of accurate and sufficient information. On the other hand, these benefits are neglected by many builders because of the momentary gains, without thinking about saving electricity, as a limited resource, or the increased costs of households that will live in these buildings.

The initiative of thermal insulation should be, in the first place, the responsibility of the Local Authorities, whose contribution makes the process faster and essentially affordable.

The intervention of the Local Authorities should be done in two plans:

1. First plan should be dedicated to new buildings, which is easier to implement, both in terms of technical and legislative sides. With a detailed study based on existing legislation, these authorities can undertake different policies to stimulate builders who apply thermal insulation in their constructions.
2. The second plan should be dedicated to the stock of existing buildings, where the process is a little more complicated but not impossible. In this contingent of housing, the initiative can be taken by the Local Authorities themselves, through the funds at their disposal, but also by individuals who share the same building, if supported by incentive policy, or repayable financial assistance, based on a continuous awareness, on the medium-term benefits of the process.

## 2. Objectives

This research aims to identify the social and economic benefits of thermal insulation in residential buildings, based on the one hand on the actual perception of residents and the other hand in the analysis of technical measurements of electricity consumption. The ultimate objective is to analyze the improvement of the thermal performance of the indoor environment in a residential building, closely related to the need for comfort and reducing the cost of living.

## 3. Research Question

This research focuses on measuring well-being and improving the quality of life because of the thermal insulation of

buildings and is based on the following questions:

- How can we measure the impact of thermal insulation on daily life?
- What is the impact of thermal insulation in reducing the cost of living?

#### 4. Methodology

This research was conducted based on a process extended in several directions. It is based on a good knowledge of the legal framework, daily, continuous, and advanced work towards recognizing contemporary studies related to the requirements for comfort and its impact on daily activity, and a series of field analyses and surveys. Good knowledge of legislation and literature makes it possible for us to understand the directions we need to look for and the spaces where we can move. Analyzing the situation in a global context indeed begins with more straightforward analyses in the local context.

On this basis, the research is composed of a combination of qualitative and quantitative methods to answer optimally the questions that arise during the process.

The qualitative method consists mainly of an active search of statistical data concerning surveys and observations on thermal insulation and the impacts of its application on buildings. The quantitative method involves a survey conducted by interviewing residents in a thermally insulated residential building and extracting data to reach a convincing conclusion.

#### 5. Limitations

Despite all the efforts to be as accurate as possible in determining the reduction of the amount of electricity due to thermal insulation, we find it difficult to be precise because we cannot fully identify the use of alternative sources of heat in certain moments.

Moreover, other minor issues came to the surface as we could not calculate the electricity consumption from newly purchased household appliances during the study period or the savings from replacing an old appliance with a new one with better technical properties. However, relying on professional judgment, these restrictions are not to the extent that they have a significant impact.

##### 5.1 Impact of thermal insulation on the improvement of everyday life quality

A focus group of 6 families was chosen after ensuring they lived in the same building before and after the thermal insulation. A formal survey was conducted and distributed to the families. Families count as a single subject of the survey, making a total amount of 6 subjects. The survey asked the subjects to describe their well-being in everyday life and inside their homes before and after the thermal insulation. They were asked to rate different aspects of their life such as physical well-being (having an excessive feeling of coldness/ warmth during winter/summer), emotional well-being (feeling comfortable and happy inside of home), psychological well-being (possible state of optimism related to the comfort when entering a home or while staying at home). Ratings for each category and a composed rating of all dimensions before and after the insulation are presented below. (Table 1)

Table 1: Presentation of the results from the survey

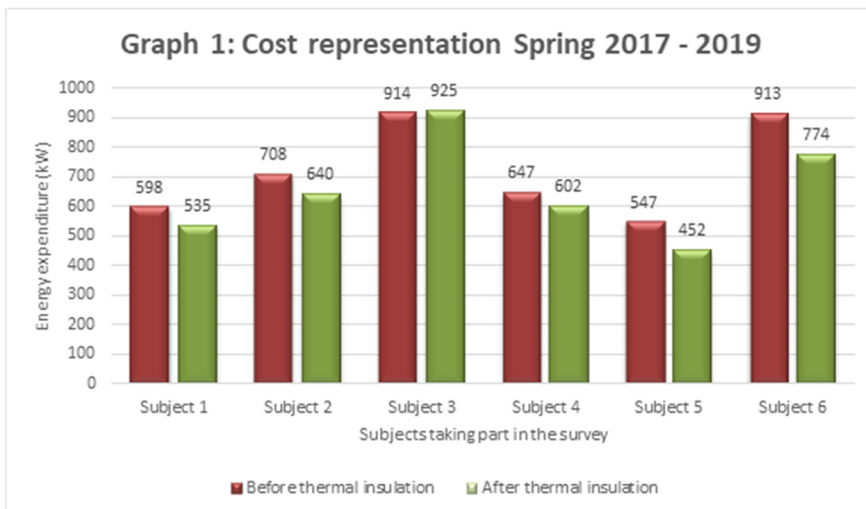
	Physical improvement	Emotional improvement	Psychological improvement	Average of general improvement/subject
Subject 1	4	4	3	3,67
Subject 2	5	3	3	3,67
Subject 3	5	5	4	4,67
Subject 4	3	4	2	3
Subject 5	4	3	2	3
Subject 6	4	4	3	3,67
Average group improvement/ aspect	4,17	3,83	2,83	

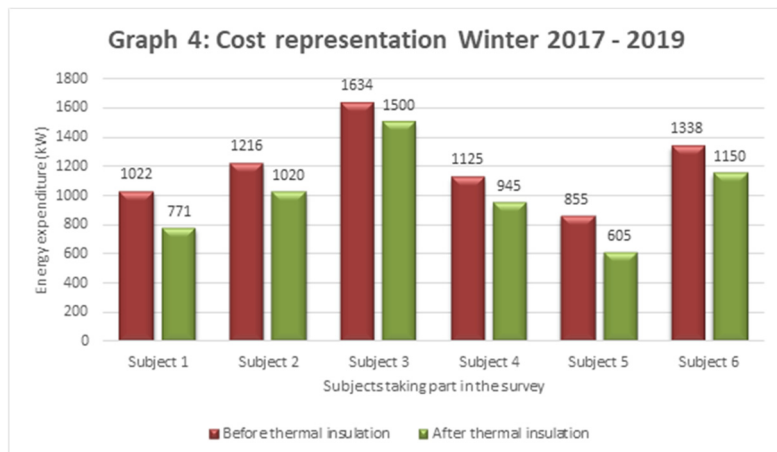
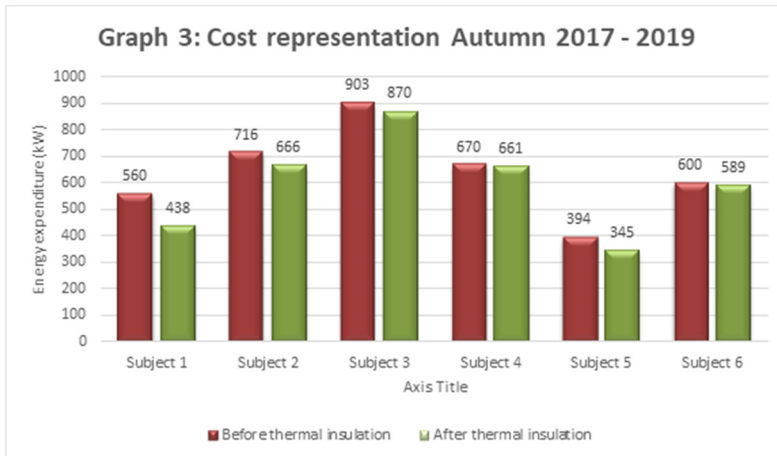
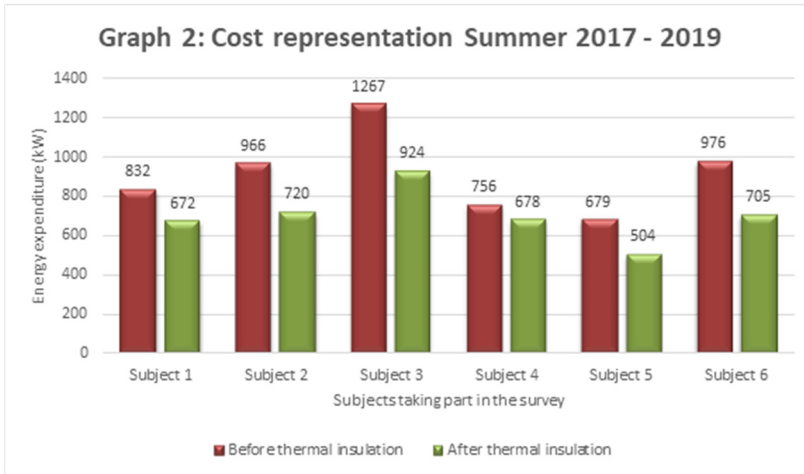
Legend	
Improvement aspect	
Subject	
Subject evaluation	
Evaluation span: 1-5	
-	1-2: little or no improvement
-	2-4: notable improvement
-	4-5: great positive change

The general conclusion from the survey was satisfactory, and the subjective impression was overall positive. Most of the subjects had noted improvements in every aspect. As a result, they considered their life to be improved. Different aspects of well-being were also separately improved as the average ranking by each aspect lay between 2 and 4. It was expected for the subjects not to reach the maximum life improvement level as more factors contributing to the improvement were not studied in this research.

### 5.2 Impact of thermal insulation on electrical energy-related costs

The economic aspect is also crucial in the life of every average household as it heavily impacts the quality of all their daily activities. This paper interprets official data retained from OSHE for the same subjects that collaborated above. The data represent the yearly expenditure on electrical energy, and this research focuses on two critical years, the year before the thermal insulation and the year after. This selection was made to prove the difference in expenditure and, as a result, in cost during this timeframe. Data was compiled and formatted graphically. (See Graph 1-4)





The data in each of the four graphs correspond to each subject's average expenditures for each season. There is a difference between the respective values before and after the thermal insulation works.

From the graphs, it is clear that in spring and autumn, when the need for heating - cooling is very low, the difference between these two values is not very large, although it is present.

When the need for heating - cooling is at the highest levels in the winter and summer periods, the difference between these two values is much more significant.

We also see that the opinions obtained during the interview are in sync with the statistical data presented in the graph.

## **6. Conclusion**

Through this research, certain conclusions were put on evidence. The research subjects felt the impact of thermal insulation in their everyday lives. They were physically feeling an increase in energy and health as having a comfortable interior and avoiding excessive temperatures in both directions, warm and cold, reduced their chances of getting sick and suffering from the seasonal flu and cold. The constant state of health also affected their psychological and emotional state as they were feeling more motivated to stay active during the day and even increased the amount of time they spent at home instead of avoiding it. From the obtained data, it is evident that the economic impact of thermal insulation has a positive impact on the household's savings in energy-related costs.

Furthermore, the investment becomes profitable in a 4–5-year period if the investment was undertaken privately by the inhabitants of the building.

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