

THE ARCHITECTURE OF PUBLIC BUILDINGS AS TRANSFORMATIVE MODEL TOWARDS SUSTAINABILITY

DOI: https://doi.org/10.18485/arh_pt.2024.8.ch75

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ABSTRACT

Problem Statement: After the era of socialist modernism in Macedonia, the transition process of the newly independent state inevitably affected and still transforms the architectural heritage. The monumentality of modern architecture in Yugoslavia was determined by its specific typology and spaciousness. Such characteristics are becoming vulnerable while facing certain challenges between sustainability and the building's formal aspects and appearance. The reflection of these challenges can be observed through the architectural transformation based on heating demands, influenced by social, economic, and digital capitalism. In these processes, the other aspects of architectural physics are often neglected (thermal, acoustic, etc), which becomes an issue in terms of the building's performance and sustainability, and the building's energy efficiency implementation in its entirety. The problematic area of this research is the redefining approach of the architectural practice which strives toward sustainability. Moreover, there is a lack of approaches based on a joint strategy between architecture transformations and architecture physics in a holistic manner. **Purpose of Study:** The main aim is to understand the transformation process, from the architecture of monumentality to the architecture of segregation, where energy consumption is the driving factor and is directly related to the economy market. Therefore, the purpose of this paper is to investigate the interrelation between the architectural transformation process and the discipline of building physics reflected in the energy efficiency strategies. **Methods:** The research is focused on public buildings, built in the period of social modernism in Yugoslavia, that have transformed their phenomenology (building's skin) and materialization. This study investigated the reasons that drive the transformation processes. In that direction, the research method covers chronological data of the energy efficiency strategies by discussing their plans and actions and uses an analytical approach that recognizes the transformed models into sustainable architecture as evidence of the tendencies toward a sustainable economy of the built environment. **Findings and Results:** The expected results of the research will determine the main driving economic and social factors of the transformative processes and will elaborate on the transformed model's sustainability. **Conclusions and Recommendations:** The research will conclude the necessity of collaboration between architecture transformation and building physics, which indicates the architectural characteristics of sustainability.

KEYWORDS _ *Airbnb, Housing market, House prices, Rental values, Supply shortage*

INTRODUCTION

The architectural heritage from the period of Socialist Yugoslavia is facing certain challenges toward sustainability. Energy efficiency strategies are the main driving factors for the transformation of these public buildings, by implementing approaches that often don't take into consideration the building's physics which indicates the architectural characteristics of sustainability. The reflection of these challenges is observed through the architectural transformation on the building's skin based on heating demands, influenced by the need for energy sustainability and economic benefits.

In the following, this paper conducts research on the transformative processes toward sustainability of three public buildings in Skopje: The Youth Cultural Center and both high schools "Orce Nikolov" and "Josip Broz Tito". By recognizing these transformations through an analytical approach, the research determines the factors that drive them and have a decisive influence in terms of the building's performance and sustainability.

In the first part of the research, an overview is made of the energy efficiency strategies in North Macedonia, and the conducted measures and activities of their realization. This part demonstrates the methods that triggered the transformative processes from existing to new architectural appearances. The second part of the research makes an overview of the building's transformations and demonstrates the partial interventions toward sustainability, where architecture is presented as the phenomenon of the problem. The conclusion is the last part, in which the final observations are given.

ECONOMY OF THE BUILT ENVIRONMENT

The main goal in the energy efficiency strategies of the Macedonian municipalities is the reduction of electricity costs, primarily through interventions in public buildings. That goal is driven by the idea of reducing costs in order to improve services and quality of life.

According to the strategies the potential for increasing energy efficiency is through the reduction of costs and energy consumption by improving the internal conditions in the buildings. These measures are applied through interventions on the buildings, mostly aimed at the building's skin, that is, through full or partial reconstruction (Energy agency of the R.N. Macedonia, 2019). However, such processes are not always implemented successfully, due to institutional, legal, and economic barriers (MACEF Energy efficiency program, 2018, 2022). Moreover, the interventions on the built facilities encourage transformations that are not always aligned with the architectural physics of the objects, that is, they neglect the architectural characteristics for sustainability.

The reasons why the implementation of energy efficiency strategies for existing public buildings is incomplete are related to financing or to the source of finance. Furthermore, are the high interest rates of the development projects and the property legal status of the facilities. The legal and economic parts of energy efficiency strategies prevail, but the qualities related to architecture are missing. No strategy so far has included in its program these qualities and the way in which they would affect the architecture of public facilities.

Skopje's strategies for energy efficiency

The strategies of the city of Skopje for promoting and encouraging energy efficiency are aimed at the facilities under the jurisdiction of the city, moreover, facilities belonging to the education sector, public enterprises, fire protection facilities, and cultural facilities. More specifically, these strategies include the buildings that are elaborated on as a case study, such are: The Youth Cultural Center (MKC), and both high schools "Orce Nikolov" and "Josip Brzo Tito" (MACEF Energy efficiency program, 2012, 2018, 2022).

Regarding the energy consumption of these buildings, strategies for partial interventions have been established that will improve the conditions of energy efficiency. The improvement of energy efficiency is perceived through the prism of energy saving with the following characteristics:

- financing and savings;
- social and health benefits;
- following European norms and European standards;
- enabling comfort;
- health and airflow.

The tendency is to reduce energy consumption and the costs of its use in order to achieve economic benefits, through measures distributed in action plans that will take place each year separately. The measures refer to interventions such as replacement of windows, insulation of the floor, wall, roof, installation of heating pumps, installation of photovoltaic collectors, etc. (MACEF Energy efficiency program, 2022).

The focus of this research is on the buildings that are subject to the strategies of the City of Skopje, which at the same time stand out as an architectural heritage built in the period of social modernism in Yugoslavia. These facilities have already gone through transformations and interventions aimed at improving their functionality and energy efficiency and are still the subject of future strategies to increase their energy sustainability.

Transformative processes

The chapter is focused on public buildings, built in the period of social modernism in Yugoslavia, that have gone through transformation in the past 30 years, affecting their phenomenology (building's skin), and materialization.

The reasons that drive these transformations are part of the strategies for energy efficiency that have been implemented for the last 20 years. These strategies are coming up with the budget requirements and in the context of the strategic plans of the Government of the Republic of Macedonia and the Ministry of Economy dealing with issues related to energy, energy efficiency, and the use of renewable energy sources (Energy agency of the R.N. Macedonia, 2019). The transformation processes recognized here represent transformed models as evidence of the tendencies toward a sustainable economy of the built environment.

In following are three cases of transformations, showing the redefinition of the role of architectural practice in the strategies for energy efficiency, where the building is a product that is used specifically for economic income-generating purposes.

Youth Cultural Center Skopje (MKC) was built in the period between 1970 and 1972, as a facility for the promotion of culture, cultural and scientific achievements of young people. The facility has been operating successfully over the years, with a rich program of cultural and scientific activities. The building belongs to late modern architecture in Yugoslavia, with a refined functional plan and basic materials such as concrete, which emphasize its natural form. Its purpose primarily contains a strong social component. The building will undergo several transformations in terms of its appearance, but the most significant is its reconstruction in 2011, which will also experience a makeover of its stylistic expression (Youth Cultural Center, 2014). The reconstruction is aimed at improving the functionality of the building, but also increasing its energy efficiency through interventions such as: an energy-efficient facade, new audio and lighting equipment, renovation of the domes and interior of the Planetarium, replaced roof, floors, doors, windows, and radiators (Figure 1 and 2).



Figure 1 (left): Youth Cultural Center – original façade, source: <https://marh.mk/mkc-skopje/> ;
Figure 2 (right): Youth Cultural Center – reconstructed, source: <https://frontline.mk/>

High School “Orce Nikolov” was built in the period between 1969 and 1971 and is an educational facility. The building belongs to the post-earthquake reconstruction of Skopje and represents one of the symbols of modern architecture in Yugoslavia. Its appearance has strong architectural characteristics under the influence of brutalism, reflecting as well the Macedonian regional modernism. The building’s materialization is characterized with concrete in combination with facade brick.

In 2016, the building was reconstructed with the aim of improving energy efficiency by up to 30% (MACEF Energy efficiency program, 2012). The interventions refer to the replacement of doors and windows, repair and insulation of the roof, insulation of the facade walls from the inside, as well as insulation of the porch ceilings. In 2018, new interventions were noted, such as energy improvement of the building within the Program for Energy Efficiency of City Institutions 2018-2020 (City of Skopje, 2018). In this process, insulation (styrofoam) was applied, but only on the constructive elements, which at the same time represented the characteristic architectural appearance of the concrete facade (Figure 3 and 4).



Figure 3 (left): High School “Orce Nikolov”– original façade, source: <https://marh.mk/>;
Figure 4 (right): High School “Orce Nikolov”– reconstruction, source: <https://marh.mk/>

The facility “Josip Broz Tito” High School was built in the period from 1970 to 1971, with stylistic expressions strongly influenced by brutalism. Materials such as concrete and facade brick prevail in the materialization of the building. The first reconstruction of the building was done in 2012, according to the Energy Efficiency Study, with the aim of saving energy and funds, as well as minimal emission of CO₂ into the atmosphere (MACEF Energy efficiency program, 2012). The interventions refer to covering the building’s facade with insulation (styrofoam), installing new PVC windows, and insulating the roof. The next interventions were made in 2018, within the 2018-2020 Program for Energy Efficiency of City Institutions, with the reconstruction of the facade and external windows. The floors, classroom doors, and parts of the atrium have been renovated (City of Skopje, 2018). (Figure 5 and 6).



Figure 5 (left): High School "Josip Broz-Tito" original façade, source:<https://josipbroztito.edu.mk>;
Figure 6 (right): High School "Josip Broz-Tito" reconstruction, source:<https://josipbroztito.edu.mk>

From the elaborated cases, several problematic areas are noted in the past and current strategies for energy efficiency. These issues refer to an obvious and direct reflection of strategies through transformativeness, an approach with partial solutions and short-term measures. With these approaches, as well occurs the dispersion of consumer entities. In addition to the problem areas that appear in a general framework, issues related to architectural physics are also visible, such as:

- The air humidity and reflection on the wall diffusion resistance and roof surfaces (inappropriate installation of thermal insulation leads to problems related to humidity)
- Solving problems only concerning heating (in heat and thermal aspects) involves problems related to sound and acoustics in the transmission of sound through air environments and transmission of sound through construction surfaces. ,
- Disciplinary problem - architectural physics perceived only through energy issues related to heat. The problem of solving only one segment (heat) entails problems with the whole (sound, humidity, light, cooling, etc.)

Building physics as a discipline is vital in defining the formal, technical (Yu, 2014), and technological (Schittich,2006) aspects of the building's skin development. To understand it better, one needs to understand the means by which it occurs. The building skin characterizes the material, functional, and structural aspects of architecture. Building's skin rests on functional grounds such as: passive, active, cooling, and ventilated (Herzog et al., 2017). Furthermore, the building skin entails two functions: protective and regulatory. The protective function represents the resistance to weather conditions, while the regulatory function refers to the regulation of the internal climatic conditions. The structural narrative on the other hand is associated with the technical and technological characteristics. It specifies the gradation in structure in the building skin by separating the primary, and secondary. At that stage, the development of the architectural detail plays a crucial part in the performativity of the building. Connections and joints are also significant in the detailed development of building skin (Meijs and Knaack, 2009). Besides the functional and structural, materialization is also considered an integral part of the process. Building physics as a discipline and architectural detail as a tool combined represent a unified approach in the development process. Accordingly, heat, light, sound, and humidity as aspects of building physics are an integral part of the development process.

Therefore, the necessity of collaboration between architectural transformation and building physics is increasing, which will provide the architectural characteristics of sustainability.

CONCLUSIONS

Progress toward sustainability, and performance is fundamental in architecture. The environment and the effects it brings are visible in the technical, technological, and tectonic characteristics of the building's skin. Therefore, should be developed better approaches, where issues related to

energy efficiency must be perceived architecturally. Furthermore, is necessary to point out the need to understand the cultural development of humanity, which is part of the energy consumption and benefits, and to include the cultural consequences of development ideas. Decapitalization of culture through the built environment would be a solution resulting from the shortcomings of initial ideas related to financing and savings.

These approaches will include cultural interests, as opposed to the current legal and economic ones. It will enable an integrated approach to solving problems related to the physics of existing architectural buildings.

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