

Energy Management of Historic Buildings

A Tokarčík¹ and M Rovňák¹

¹Department of Environmental management, Faculty of Management, PU, Konštantínova 16, 080 01 Prešov, Slovakia

E-mail: martin.rovnak@unipo.sk

Abstract. The paper is focused on solving problems of design of energy management model in the context of historical buildings and monuments. The main goal of the energy management is to find solutions that preserve the historical heritage while not damaging the uniqueness of the buildings in question and their surroundings. The paper proposes a scheme of activities of energy management of historical monuments in the implementation of energy-efficient measures.

1. Introduction

Building an energy management system using energy management in historic buildings and monuments is a strategic tool for an efficient energy management system. In essence, it is the introduction of a control activity that relies on data from extensive monitoring of energy consumption and ways of losing it [1].

The subsequent estimate of energy consumption, based on data from previous periods, then clearly defines the requirements for managers. Restricting the analysis to specific places where building elements of historic architecture are sufficiently homogeneous is necessary for the development of technical guidelines for energy efficiency [2].

2. Specification of basic tasks of energy management

To optimize the use of energy in historic buildings in a particular area, managers must also look for solutions that preserve historical heritage while not damaging the uniqueness of the buildings in question and their surroundings. Only a well-designed grouping of professionals who know the specifics of the environment is a guarantee of introducing an alternative energy management solution to increase energy efficiency at all levels of consumption while maintaining historical values for future generations. If there is to be a creative environment that brings innovations in the energy management environment while taking into account the environmental demands of society, then it is a necessary requirement to build an energy management that can improve the energy efficiency of the environment and increase its energy efficiency on the basis of its own know-how.

However, such an energy management must find a suitable form of cooperation between experts from both the internal and the external environment, which, through a suitable combination of the performance of individual group members, can optimize the technical, technological and management activities and at the same time bring the requirements of the landowners into conformity [4].

The analysis of historical buildings and monuments consists of the audit and standardization of heat consumption data according to standardized weather conditions, structural damage to historic



buildings according to normal structural damage, preliminary assessment of technical condition and detailed assessment of damage of the building covering [3].

The basic prerequisite for the conscious protection of the monuments is not only their awareness but, above all, their preservation for other generations. An indicator that best describes the care for preserving the cultural monuments and historic buildings is the observation of their construction and technical condition. The biggest challenge in building an energy management system is (in the framework of the priorities) to bring energy-saving rescuing of monuments, restoration of monuments and securing the financing of their renewal. Because of the specific building and restoration procedures required to restore historic monuments, this process is costly. The recovery priority is saving the historical original, not replacing it with a new, often cheaper elements. However, long periods of neglected maintenance or inappropriate pre-recovery procedures require complete and fundamental solutions. Through in-depth energy audits, simulations, and performance enhancement applications, representative constructions can also be defined as design models useful for identifying energy efficiency measures that are customizable for the particular building [2].

The restoration of the cultural monument is any intervention in the monument, which also includes activities that are otherwise called maintenance or repair - new interior painting or painting of facades, replacement of windows and doors, plaster repair, realization of new wiring, etc. It follows that not only the total renovation and reconstruction of the monuments, but also those partial activities, are subject to a decision or a binding opinion by the competent monuments office.

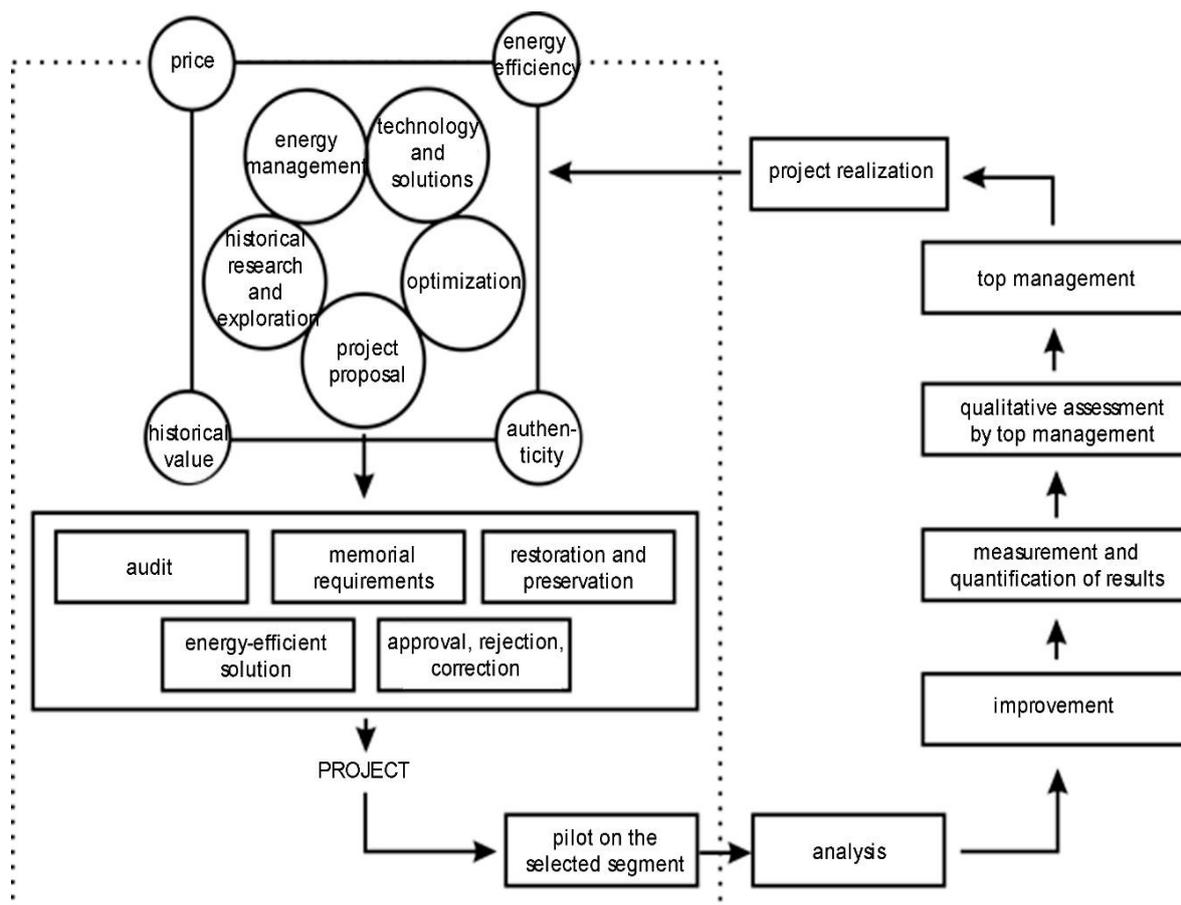


Figure 1. The proposed scheme of energy management activities historic sites, the implementation of energy efficiency measures.

The recovery process also includes the processing of specialized preparatory and project documentation and the execution of construction or restoration work. The main prerequisite for the

preparation of professional and quality renovation of the building cultural monument is its knowledge. For buildings that are several centuries old, it is necessary to specify the construction and development stages, to evaluate the suitability of previous building interventions and modifications. Lastly, it is necessary to process the Framework Restoration Proposal itself, which takes into account the energy intensity of its operation and long-term sustainability. From the point of view of energy management, it is therefore necessary to have experts who are able to carry out a probing monumental architectural-historical and artistic-historical research. Another team of experts who coordinate the energy management system is the restoration team. Their task is to focus on defining the original color and visual solution of the exterior and interior plaster surfaces, specifying their technical state and proposing ways of their renovation, taking into account new technical solutions and results of the research, development and innovation. This expert background can identify unrecognized paintings and surface details that have long been covered with layers of secondary plasters or paints. The subsequent group of experts is represented by managers in the field of energy, technology, projections, audits, energy purchasers and other related professions, including the academic community. All these activities should be carried out by a group of experts, which we can call the energy management of historical monuments (figure 1). If we can activate the required group of market professionals, we will build the core framework of the operating system.

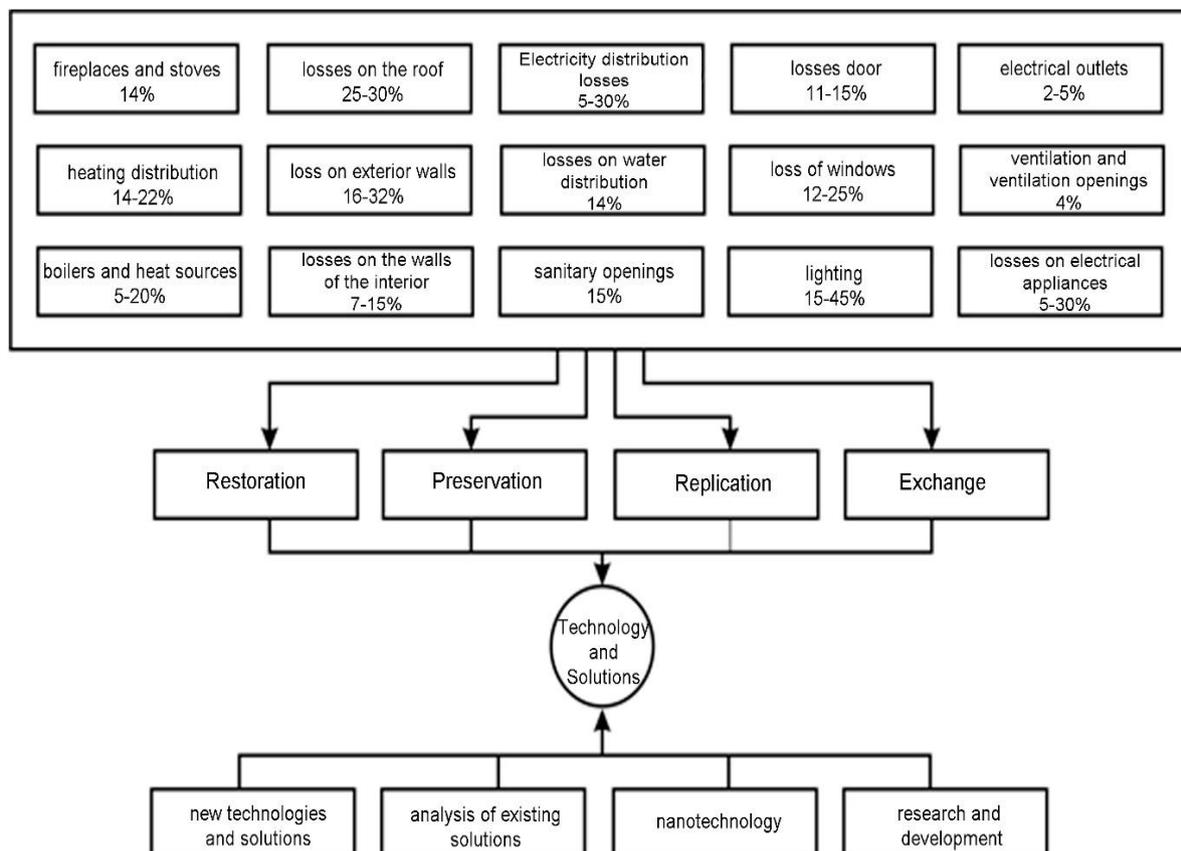


Figure 2. The proposed scheme for the implementation of energy management requirements for the selection of technological solutions for monuments and historical buildings.

From an energy point of view, energy management of historic sites should concentrate on the amount of energy needed to meet all the energy needs associated with the normal use of the building, in particular the amount of energy needed for heating, hot water, cooling, ventilation and lighting [1].

When determining it, it relies on calculations or calculations using measured energy consumption. In terms of numerical indicators, its demands express the need for energy and primary energy in the

historic building. In order to collect heat and hydrometer data on traditional materials and techniques of the architectural heritage analyzed, the calculations based on typical packaging compositions are compared with laboratory results as well as the on-site test data [2].

3. Possibilities to increase the energy efficiency of buildings using the energy management of historic buildings

The potential sources of energy leakage in buildings are: roof, foundations, walls, windows, doors, floors, thermal bridges. For a complex solution of the building, it is also necessary to focus on insulating the floors, windows, doors, pipes, external joints, thermal bridges inside the building, in the areas of the contact between the roof and the building elements of the masonry and removing visible cracks or holes. Figure 2 shows the proposed scheme for the implementation of energy management requirements for the selection of technological solutions for monuments and historic buildings.

With exemplary design solutions of the constructions, it is possible to thoroughly analyze the relevant aspects such as, for example, the construction and conditions of its protection, including its impact on energy improvements. In addition, further relevant research developments in the area concerned, namely the economic feasibility and environmental impact of measures to modernize the historic building through representative buildings, need to be examined. In monumental architecture, the significance of particular features of individual constructions limits the suitability of the proposed approach compared to standard buildings where the repeating characteristics are more pronounced. Nevertheless, there are serious difficulties in balancing the energy efficiency target with the need to preserve the heritage [2].

There is a relationship between the technical state of buildings and energy consumption in buildings for space heating. Although this relationship is unambiguous, it appears that the technical state of buildings must be taken into account when assessing the potential of buildings for their modernization [3].

4. Conclusions

The introduced models accumulate people who have the technical ability and high working knowledge of historic buildings, a prerequisite for proper system maintenance and adaptation in energy efficiency processes. Their advice can thus prevent damage, inappropriate costs and defects while preserving the historical heritage. Only an appropriate balance in the design process and the subsequent qualitative consultation between the interested parties is the guarantee of improving the energy conservation of the historic buildings and monuments.

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