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## SOLUTIONS INFLUENCING THE ENERGETIC BALANCE OF BUILDINGS IN THE ASPECT OF HISTORICAL TOWNS

The factor of energy consumption by buildings becomes more and more significant. If the energy consumption is low, operating costs of building decrease, and the concentration of pollutants in the atmosphere becomes lower. These factors as well as many others encourage us to use the energy in a careful and clever manner. The objective of this paper is to emphasize the possibility of using the energy-saving solutions in historical towns.

### 1. INTRODUCTION

At present a great number of reasons encourage us to use the energy in a clever manner. This is not merely because of our fears that the resources of conventional energy carriers might finally be exhausted, but we are aware of that fact survival of civilisation is under threat and that our environment should be regarded as an integral part of a natural ecosystem [1].

At various stages of man's development we have dealt with different activities allowing us to reduce the energy consumption by buildings. At first the activities were rather intuitive and now we behave in a purposeful way.

The first attempts to reduce the energy consumption were undertaken as early as ca. 5 thousand years ago by the American Indians in North America, and a bit later in Asia [2]. Other good examples of such practices are the Eskimo igloos and the houses of Berbers excavated in Morocco or Tunisia – both solutions adopted in these structures have been effectively used till today.

Nowadays we deal with significant development of various technologies, industry, means of communication and other fields relating to pollutant emission. Under such circumstances our health and the technical condition of buildings can deteriorate.

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Emission of pollutants is particularly hazardous for old, historical towns, where traditional energy sources are notoriously used, which greatly contributes to town degradation.

## 2. REDUCTION IN ENERGY CONSUMPTION AND IN POLLUTION OF THE ENVIRONMENT

It is extremely important to make efforts that allow reduction of civilization threats. There is a necessity of inducing changes in energy production or in erecting energy-saving buildings and also in supporting a mental revolution that leads to environmentally-friendly changes in the life standards. It becomes clear that locating ecological and energy-saving structures on the outskirts of cities is not justified as it entails separation of the place of residence from the place of work – everyday commuting from the place of residence to the place of work and other services steals all the energy savings obtained in the construction stage and causes an increase in the emission of CO<sub>2</sub>. Therefore, city centres with well-developed residential and service functions, with the possibility of providing jobs without the need of the development of individual transport (increasing the emission of CO<sub>2</sub>), may constitute an excellent basis for the development of pro-energetic ideas. Moreover, the use of renewable energy systems and energy-saving solutions on a larger scale, i.e., in urban and architectural complexes, positively increases their efficiency, decreases the implementation and utilization costs, which makes them more attractive also in economic terms. In such systems, an energy-saving building cannot be regarded as a sum of individual solutions, but as an integrated system of co-operating components. Architects need to co-operate with an interdisciplinary team of designers, and their co-operation should be based upon theoretical simulations in the course of designing, as well as upon the research carried out in the erected structures, where there is one additional factor, namely their user with his needs and habits [3].

The simplicity of a solution, leading to an optimal energy balance of buildings and the whole planning concept should be of the prime importance. Therefore, a sensible energy balance should be obtained via simple, commonly known and used assumptions [3]:

1. Compact settlement with the buildings erected according to cardinal points.
2. Energy-saving shape of buildings.
3. High insulating and accumulating power of constructional barriers.
4. Double façades and transparent insulations ensuring natural air circulation.
5. Accumulation and storage of solar energy in constructional barriers.
6. Protecting buildings from over-heating.
7. Window and door woodwork with high energetic quality and selective coatings that increase the efficiency of accumulation of solar energy.
8. Zoning of rooms according to their heat requirement – delineating energetic buf-

fer zones.

9. Use of such facilities as recuperators that enable utilizing the heat in media removed from the buildings, air turbines in which electric energy is produced due to air flow (wind), etc.

10. Wastes and grey water recycling.

11. Providing buildings with intelligent automatic installations with the possibility of individual steering and with energy-efficient household appliances.

A prototype of the solutions suggested is the ZED (zero emission development) building developed due to the initiative taken by the European Union in 1997. In such a building, 30% of the energy consumed is produced by solar cells, and the remaining 70% – by air turbines located in an open core of the building, one over the other, in a main direction of a local wind rose. ECO-settlements [4], [5] being erected, i.e. Solar Village (R. Rogers Partnership, 1994) on Mallorca and Solar City (Norman Foster, Herzog, R. Rogers, 1995) in Austria, can be another examples of the solutions given earlier. Such settlements are almost self-sufficient in respect of energy production. Moreover, in these settlements some elements of the sustainable development have been introduced, e.g., efficient management of energy, the use of renewable energy in hybrid solutions and the wastes and grey water recycling.

### 3. CONCLUSIONS

The aforementioned technical innovations found today in historical towns are associated with certain limitations; however, it is possible to protect our relics of the past and simultaneously to implement a great majority of the innovations, all the more because the energy-beneficial type of construction is compact with energetically balanced proportions of the surface of the external barriers relative to the buildings' curvature. The problem of improving the insulating power of external barriers may be solved by using double façades and transparent insulations which constitute a protective filter of the elevation of buildings both in energetic and acoustic terms. They are also a kind of protection against the pollution of the atmosphere, which is specially essential in the case of historical buildings. Moreover, a compact settlement in the city centre is conducive to the realization of multifunctional passages covered with glass roofs within the quarters, which due to architectural and technological innovations may be energy-friendly. They allow us to reduce heat losses and to recover energy from "the warm island", i.e., the city with its architecture, land development, infrastructure, transportation, industry, etc. They can also be an alternative to large commercial centres located on the outskirts of cities, thus they limit dislocation of clients, which can decrease the pollution of the environment with the carbon dioxide.

These are very crucial issues, especially now, when Poland, as a member of the European Union, is obliged to respect European directives and regulations, including

those controlling the use of energy and pro-ecological solutions in the construction industry. In the near future, the regulations introduced by the European Directive in order to control thermal characteristics of buildings will become valid in Poland. This will oblige us to set an energy standard for buildings designed now as well as the monuments that are renovated and modernized.

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#### ROZWIĄZANIA WPŁYWAJĄCE NA BILANS ENERGETYCZNY BUDYNKÓW W ASPEKCIE MIAST HISTORYCZNYCH

Czynnik energochłonności budynków staje się coraz bardziej istotny. Gdy zużycie energii jest małe, spadają koszty eksploatacji, obniża się stężenie zanieczyszczeń w atmosferze – te czynniki i wiele innych skłaniają do świadomego gospodarowania energią.

Celem artykułu jest podkreślenie, że można stosować rozwiązania energooszczędne w miastach historycznych.