

ENERGY EXIGENCY OF BUILDINGS - THE SECOND GREATEST SAVINGS POTENTIAL IN THE NATIONAL ECONOMY

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1. Introduction

The exigency of buildings on energy represents the second greatest savings potential in the balance of demand and consumption within the fuel and energy systems of the national economy in any developed country. Their complex energy exigency is the summary of total investment inputs used for ensuring the heat protection and of the annual operational demands of the separate building energetic systems during its life cycle.

At present times, characterised by the transition from the planed type of economy to the market economy, the new tendencies even in the sphere of so called buildings power engineering are arisen step by step. Although the number of various building types is enormous, and the range of their usage is very broad as well, it may be stated that the energy in buildings is used predominantly in form of the heat, less in form of the electric energy. Otherwise said: the energies – especially the heat energy, are becoming goods, still more and more, having their price, but also their consumer.

The purpose of this report is to point out the fact that the buildings being the second greatest energy consumer within the balances of the world developed countries, are, at the same time, the consumers disposing with large possibilities of energy saving. There are right these rationalisation measures intended both for the building constructions and for their operational energetic systems that are the subject-matter of this report.

2. Territorial energy consumption in the world

The global issues of the energy consumption in the world are the subject-matter of the World Energy Council analysis. It is evident that the strong disequilibrium between the increase in population (3 – 4 times) and energy consumption (more than 10 times) occurred during the last century. Actually, they are not the developed industrial countries that must face the greatest problems related to the energy supply, but first of all, just the underdeveloped countries. While in 1990 about 75 % of population in the developing countries used about 33 % of the world energy consumption, it is expected that in the year 2020 they will need even 55 % thereof, at the population growth reaching 85 %.

It is evident that the distribution of the world energy consumption is very uneven. While the consumption in the North America is 7,82 toe per capita, in the East European state 5,01 toe, in West Europe 3,22 toe, the Pacific region shows just 1,2 toe per capita. The world mean value is 1,66 toe per capita. The given situation is also in contradiction with the state of fuel and energy resources; the North America is participating on these resources approximately by 20 %, the former states of Soviet Union by more than 40 % and the Europe by 2 % roughly. The above mentioned data show that the "scissors" are largest especially in our territory, and thus the only way to solve this situation, is the reasonable saving of all the energy resources.

Thus, taking into account the actual situation, Slovakia is a typical example of a country dependent on the import of fuel sources (90 %), while 10 % of the domestic resources are represented by the solid fuels, that are the least energetic effective and the least suitable from the ecological aspect. In addition to it, the import is unidirectional, till now undiversified and performed on the market principles, i.e. for the world prices.

3. Fuels – energy structure in the world

Similarly to the uneven energy consumption from the territorial point of view, also the fuel and energy structure is diversified. In addition, the energy resources, especially the fossil fuels are unevenly scattered, and the costs for their mining, transport and their processing in order to get various forms of energy differ from case to case substantially.

Nowadays, the standard fossil fuels provide us with more than $\frac{3}{4}$ of the total energy consumption. The share of the traditional and partial non commercial fuels is 11 % (biomass, excrements...), nuclear energy – 5 %, water energy - 6 %, and so called "new" renewable energy resources – only 2 %. The oil with its portion of 31,8 % continues still to prevail among the fossil fuels, surpassing the coal – 26,1 % and natural gas – 19,3 %; the part of solid fuels in the consumption is considered still high, taking into account the actual world environmental situation.

The very unfavourable fuel and energy structure of the Slovak economy is persisting; about 50 % of heat production is based on the solid fuels, having an extremely harmful impact on the environment, requiring inevitable technical measures in the sphere of the air protection technique, or financial penalties, but said again, accompanied by the negative influence on the prices of the produced heat power.

4. Energetic exigency of buildings

The priority purposes of the energy consumption in the buildings are directed to ensure the user's comfort, or in case of production buildings, to guarantee the adequate technological conditions. The optimum state of temperature inside the heated buildings cannot be circumvented or camouflaged in any way; it is just necessary for ensuring of heat, comfort, productivity of the subjects in a building – persons, animals, and equipment.

Consequently, the energy balance between the exposed subject and heated interior is the principal question, it means the heat flows as losses or gains that, from the user's viewpoint should be considered as the essential fact quantifying the inevitable demand on heat in form of the heat output provided by the installed heaters and heated surfaces, as the basis for determination of the actually consumed heat energy. And this is the point where the basic contradiction arises, defined as the difference between the actually produced and actually consumed heat energy. Theoretically, this difference may vary from 0 up to 50 – 60 %, depending on the fuel basis, production methods and heat distribution.

The heat related technical quality of buildings and building objects is another question to be considered. In view of the character of the construction and its time history we are sorry just to state that even up to the first half of 90th years there were constructed buildings demonstrating, even in the phase of design and preparation, the specific energy consumption 2 up to 3 time higher than those designed in the climatically comparable countries. Such values, as 200 kWh/m² up to 800 kWh/m² necessary for heating the dwelling or industrial buildings are not exceptional cases, but the actual reality. In these cases the separate streamlining measures are of no help; it is necessary to carry out the energy audit, as a measure of an overall technical and economic assessment of the complex system of more energy saving technical solutions, including the adequate operational regime and consumers behaviour.

5. Energy saving measures in buildings

The energy saving measures are presenting a complex of rationalising steps that may be classified, according to the various approaches to them, into the following groups:

- a) building constructions and energy systems,
- b) energy conveyers (electric energy, gas, oil...),
- c) type of energy.

Nevertheless the final energy saving measures are performed especially in the sphere of buildings and technology equipment, and thus they are concentrated on the so called buildings heat protection and on the optimum run of the buildings energetic systems.

5.1 Building constructions

There exist the energy saving measures suitable for the building constructions, whether covering or separating, opaque or separating, or the joints and gaps; the purpose of all these forms is the improvement of buildings heat protection, while the required hygienic inevitable parameters of interior must be guaranteed. It may be

achieved whether by the higher thermal resistance of the building construction, or by the lower coefficient of heat penetration, by the influencing the energy gains of the solar radiation by means of transparent constructions, by improvement of the heat accumulation capability of the jointing constructions, and by lowering the fresh air infiltration to the hygienically necessary level.

5.2 Heating

The economical measures are carried out within the complex cycle : production – distribution, consumption, expressed otherwise – within the whole heating system starting from the heat source and ending at the heater, not excluding the measuring, regulatory and controlling technical equipment. In principle, it is the question of better energy efficiency in all the stages, whether of energy change or its conveying. To say it more specifically: it concerns the issue of the enhancement of the combustion process efficiency in the heat resources, including the further gaining of heat from the escaping combustion products. The lowering the losses at minimum during the heat distribution by means of pipelines, and the optimisation of the heating systems operation as far as time, place and individual consumers requirements are concerned, by using the self-acting equipment, that is another subject-matter to be solved.

5.3 Hot supply water preparation

Likewise in case of heating, the rationalisation measures are taken also within the cycle production – distribution –delivery of hot supply water, naturally, depending on its character (local, central). In addition, these measures are related to the aim to achieve the higher heat resource efficiency, the minimum heat losses in the distribution system, especially in those without circulation. In addition, it is the issue of installing the water discharge appliances saving both the energy and liquid, equipped with electronic timing regulation or batching unit. Simultaneously, the temperature parameters of hot supply water must be observed; the temperature should not be too high, but not too low that would allow the proliferation of bacteria legionela.

5.4 Ventilation and air-conditioning

Despite the fact that the ventilation, air-conditioning and cooling systems are not dominant in our climatic regions, they are becoming to be more frequent accessory systems of buildings. Although their operation time is substantially shorter than that of heating systems, their energy exigency is considerable high, in case, we want ensure the required indoor climate especially in summertime. Thus, within the framework of the economical procedures saving the energy, it is the question of optimum air delivery by using the automatic technical equipment related to time and space, but first of all it is the problem of repeated utilisation of the heat obtained from the vented air, as far as permitted by the hygienic requirements. In addition to it, the regular maintenance of the individual parts of system, strainers, exchangers, but also the maintenance of air-conditioning system pipelines and outlets must be kept in mind as by far not inconsiderable issue.

5.5 Pumps / ventilators

The heating and air systems for delivery of heat conveying / cooling medium need to be equipped with pumps or ventilators that are exigent on the electric energy too. The electric energy consumption may be reduced especially by bringing their operational time to an optimum level, it means the time regulation, or use of multistep controlled electric motors, or possibly the installation of frequency transducers enabling the continuous motor speed control. Naturally, these measures should become the part of a larger superior regulation system of heating, hot supply water production, or air conditioning.

5.6 Lighting

If saving the electric energy within lighting systems, the use of energy saving lamps, the application of controlling system permitting the consideration of time and space related requirements on artificial lighting of both the indoor and outdoor spaces of a building are recommended.

6. Conclusion

It is evident that the energy consumption of buildings became the second most important possibility to achieve certain savings within the economies of the developed countries; it is of great importance especially in Europe, proving the

greatest difference between the fuel and energy resources situation and the energy consumption. Nevertheless, it is pleasant to observe that there exist numerous rationalisation, energy saving measures providing us with practical possibilities to enhance the energy efficiency within the complex cycle: production – distribution – consumption. However, these solutions require the complex technical and economic assessment in form of an energy audit of a building that would give us the actual results and that would state the priority hierarchy for application of separate measures.

7. Bibliography

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