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Specifics of using RES in Apartment Buildings

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ABSTRACT

The use of renewable energy sources is already becoming a common part of construction and renewal of family houses. For apartment buildings, the use of RES is determined by various factors, which are moreover very difficult to generalize. Therefore, when considering the owners or managers of apartment buildings on the installation of renewable energy technologies in the energy system of the house, it is best to give concrete examples and possibilities of such devices. In their presentation, it is necessary to point out all aspects of the impact of the given technology on the operation of the house - both positive and negative. But we do not have to look for inspiration only at domestic ground.

KEYWORDS : RES, apartment building, RES technologies, consumption profile,

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I. RESIDENTIAL HOUSES AND RES

Energy is constantly developing dynamically. The global disproportion between energy production and consumption is increasing objectively and Europe's dependence on imports of raw materials energy increases significantly. Increasingly, the need to change the energy system in virtually any sector of the economy is being discussed. There is a growing demand for the use of alternative and renewable energy sources, which entails efforts to rationally manage energy and increase the efficiency of energy installations. In the case of heating and DHW, this means that it is not enough to use a highly efficient energy source, but it is necessary to reduce the heat loss of the building and to make the heat distribution system more efficient. There is no doubt that due to the irreversible rise in energy prices and the requirement to minimize the negative impact of human activity on the environment, the interest in the issue of efficient heating and preparation of TV using renewable energy sources will continue to grow. When choosing a suitable heat supply method, the first thing to do is to find a trade-off between cost and user comfort. Reduction of heat production and distribution costs can be achieved either by reducing energy consumption by replacing the old source with a more modern one, or by completely changing the heat source, without necessarily deteriorating thermal comfort. Modern methods of heating and preparation of DHW allow choice based on individual needs and economic possibilities. However, it is always necessary to respect the requirements of environmental protection.

II. RES TECHNOLOGIES APPROPRIATE FOR RH

Residential buildings represent a specificity in terms of RES utilization. This is primarily due to the way the building is owned and the way energy costs are budgeted. These two factors significantly influence the decision on the type of renewable resource to be used in a residential building. In most cases, the heat is supplied centrally to the house, so as a renewable source for heat production, there is a solar system for DHW and heating support, a heat pump and, in very specific cases, wood fuel boilers (pellets, wood chips).

The other mentioned source should be considered very carefully and professionally, as such small sources of solid fuel heat significantly deteriorate the ambient air quality despite the high technology used in combustion. In a typical housing estate development, this solution is rather an exception, so I will not address it in the paper.

In general, solar systems and heat pumps are suitable for the production of heat for residential buildings from renewable sources. Even with these sources it is possible to mention certain basic characteristics determining their installation.

The solar system should be dimensioned as a support source to provide heat for DHW. It is very important to have a sampling profile of the house to avoid over-dimensioning the system. In the summer months, it is a common phenomenon to reduce the consumption of TV due to holidays, so I recommend to underestimate the solar system rather than vice versa. You should also keep in mind at least two important facts:

a) The efficiency of the solar system increases with the volume of heated water (heat transfer medium). This means that you must have sufficient space to install solar tanks. It is advisable to use at least two storage tanks for the purpose of solar energy. In addition, these areas must be within reach of a primary or backup heat source.

b) DH! At present, legislation in Slovakia is not in favor of reducing heat consumption from district heating. Fortunately, RES has an exception in this case, but it is necessary to comply with the statutory amount of support for heat production from RES. In particular, a customer can only disconnect from a SCZT, which is a renewable energy source, if it supplies its source with heat produced from renewable energy sources in a proportion 20% higher than the current heat supplier. If the current supplier has a share of RES in the heat production even higher than 60%, disconnection from SCZT is possible only if the customer ensures the entire heat supply from the RES production. In addition, in the case of interest in the subsidy, it is only the apartment house that is not connected to central heating that can receive support from the state. In addition, it is being examined whether such a CPM network is nearby and can be connected to it. Only if the network cannot be connected can it succeed in applying for state aid.

c) Calculating the cost of preparing a TV - without prior agreement on the rules for charging for the consumption of TV, you will not have a problem! It is probably not efficient to install special TV consumption meters so that it is clear whether the water used has been heated by a solar or other source. It is therefore advisable to agree on a pro rata 'distribution of savings' from the solar system.

Fortunately, even in Slovakia, thanks to subsidies and despite the more complicated fitting process, the solar system is becoming a common part of the complex renovation of apartment buildings, as evidenced by many examples.

Solar system in RH in Dudince. One of the first systems involved in operation monitoring has been operating since 2009. During the first year of operation, the system covered on average 37% of the heat demand for DHW, while in summer it was 72% and in winter only 6%. The payback period is 9 years. Data resourced from SIEA.

Source: SIEA / ERDF. The material was developed as part of a project of free energy consultancy LIVE BY ENERGY provided by SIEA thanks to financial support from the European Regional Development Fund.

Solar system in RH in Michalovce has 526 housing units and daily water consumption is about 4 850 l / day. The solar system consists of 25 solar collectors and three storage tanks with a total volume of 2475 liters (3 x 825 l). Operation of the system confirmed that the system is able to deliver on average 34% of the energy needed to produce DHW, which means savings for the population of € 3,800 per year. With a total investment of € 43,000, the return was set at 11 years for prices valid in 2012 (€ 0.0943 / kWh).

The solar system in RH in Detva was installed by THERMO | SOLAR in July and August 2017. The owners included a solar system with 35 collectors and four 1,000 l storage tanks worth € 54,000 in the bank loan for roof reconstruction.

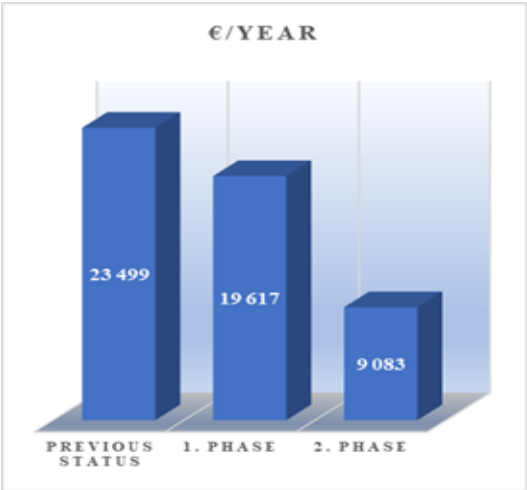
When saving min. 50% of the annual cost is estimated to be 10 years. The total installation and commissioning of the solar system took approximately three weeks. During this time residents suffered 1 day work with heavy equipment in front of the apartment building (crane and trucks with material), 1.5 working day increased noise when passing holes through the floors and max. half day of hot water shutdown during system connection.

Another suitable renewable energy source for heat production in apartment buildings is the energy of the surroundings. It can utilize the heat pump. The use of the heat pump is still laced with various myths. From glorification in the form of permanent COP from 4 up to rejection due to unbearable costs of drilling or ground meander. Of course, when considering a heat pump to provide heat for an apartment building, it is necessary to bear in mind the extremes mentioned, but it is advisable to look at the houses in operation and take an example or lesson from them.

A great advantage of heat pumps is the fact that even in our climatic conditions the air-water heat pump can operate from an outside temperature of -20 ° C. This is practically the lowest temperature in the Slovak towns in a few days a year. So there is no need to worry about the cost of earthworks despite the reduced efficiency of such a system.

It is not suitable to use the heat pump as a replacement of the original source in a non-renewed apartment building! It is strongly recommended to consider this heat source when planning a comprehensive renovation already when designing thermal insulation and heating system control. This will significantly improve the parameters of the operation of such a renovated apartment building.

An example is an apartment building on Michalovská Street in Košice. It is a detached nine-storey apartment building implemented in the construction system T 06 B with 32 housing units. At the time of considering a complete renovation, the cost of heating the house was around € 25,000 per year. Measures to reduce energy consumption were implemented non-standardly in the order of thermoregulation - insulation + doregulation. The realization of both phases of the project brought savings of approximately € 13,000, ie more than half of the original costs.



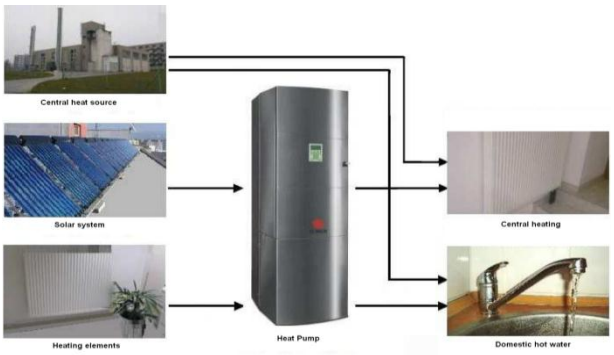
This fact encouraged the inhabitants of the house to decide to use the new technology in the area of heat pump - gas heat pump. The clear advantage of a gas heat pump is a more even course of the COP during the whole period of operation, ie a lower dependence on outdoor low temperatures. In addition, a comprehensive renovation of the heating system was included in the renovation project, in which not only the heat distribution system but also the heating elements were replaced. The cost of the entire heating system with heat pump was about € 170,000. Cost savings account for more than 50% and, with energy prices in 2011, the return was estimated at 15 years.

This RH was also the winner of the Best Renewed Apartment Building 2012 competition, organized by PSS in cooperation with the Association for the Support of Apartment Building Renewal and with the publishing house V.O.Č. Slovakia. Part of the project preparations was also realized in the framework of the thesis of Ing. Jánošíková at FBERG TU in Košice in 2011.

In the same period, the air-water heat pump was also installed on the RH in Zvolen, J. Kozaček 12 street. This was also a comprehensive renovation in two stages - reducing the energy consumption of the house and replacing the heat source. The renovation of the house reduced the consumption of heat for heating by more than 53%, which in financial terms amounted to almost € 7,000 per year. As part of the heat source replacement, the entire heating system and the DHW system were reconstructed. The heat sources are 3 heat pumps with a total output of 79.38 kW, backup heat sources in the form of two gas wall boilers, an accumulation vessel and water tanks with a volume of 2 x 1,000 liters. The system was put into operation in February 2012 and despite the winter season, energy costs dropped by 50% compared to consumption in December and January!

An interesting advantage of modern heat pumps is the possibility to use the accumulated heat in the house during summer days and its use for the preparation of hot water. This makes it possible to cool the interior of the house! Since 2005, the manufacturer of TC MACH has registered this option as a utility model at the patent office. This is a solution where the water-to-water heat pump uses the heat accumulated in the flats during the summer to prepare the hot water. The heat is extracted from the apartments very easily - from the radiators in the apartments! The COP in this case is at the level of 4.4 - 4.6, the temperature of the radiators is kept above the dew point temperature.

Such a solution is built in RH in Prague and Kralice nad Oslavou, Czech Republic.

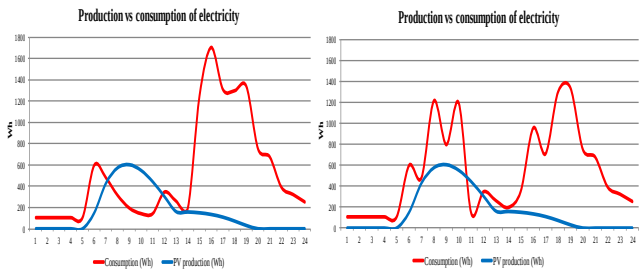


Electricity from RES

Electricity is a specific problem for the supply of energy from RES. This can be produced within the possibilities of apartment buildings either by wind units or photovoltaic systems. Wind turbines are currently designed to accommodate residential buildings only in development alternatives. In contrast, PV plants are also becoming a common part of BD façades and roofs. Again, it is necessary to consider the specific nature of several consumers and the way in which savings are budgeted.

In the case of a problematic agreement between apartment owners, it is possible to consider the alternative of separate residential PV plants. Such solutions are technically undemanding, the installation of the equipment is usually realized on balcony railings or as a shading roof within individual housing units.

In the case of using a "plug-in" system using micro-converters, such a device can be plugged into the socket in the apartment and the electricity produced from the PV is supplied to the home network. The condition is the installation of electricity overflow protection into the DS on the home meter using the "Grid-Free" system. In addition, the user must determine the consumption profile very precisely so that he can immediately consume the electricity produced by the PV plant.



Another variant of PV utilization is direct production of heat from electricity. Currently, there are various systems on the market enabling such use, in Slovakia, for example, the Logitex system is known. Implementation of such a system in a residential building is possible in three basic ways:

a) If the heat supplier agrees, PV water heating can be done in the form of cold water preheating. The cold water inlet to the heat exchanger station is fitted with a water tank powered by the PV plant. Solution suitable for RH with own KOST.

b) Connect the tank with PV water heating to the return flow. For this connection, the apartment owners do not need the consent of the supplier, as they connect to the technological part of the TV preparation that is in their possession. In this way, the circulation does not absorb any or only a small part of the energy from the heat exchanger station and supplies the DHW distribution. Indirect heat supply to the distribution network. This alternative can be used in cases where the measurement of the inlet and outlet temperature of water from an apartment building is ensured.

c) Place the tank for PV water heating in front of the TV outlet from the building. After heating, there is a smaller difference between the measurement of input and output of TV and thus financial savings.

The first variant - a combination of PV preheating and KOST - was considered for a sample calculation of the use of PV heating for a specific RH in Košice. A six-storey RH with three entrances and a total of 36 flats consumes about 103 MWh of heat per year to produce DHW for the price of € 9,660. A 12 kW PV system of 48 PV modules, 2 storage tanks with a capacity of 500 l each are designed for water preheating. The total cost of the installation is 11 400 €.The proposed PV plant can produce 12.5 MWh of energy per year, which, after recalculation for heat production, saves about € 1,180 per year. The return on the whole system is thus ten years. Considering the ease of installation as well as operation, it is certainly advisable to have an offer to prepare a TV for such a system when planning a RH recovery.

Energy Sources For RH And Democracy

III. CONCLUSION

As per the article, when planning a comprehensive renovation of an apartment building, it is certainly advisable to incorporate the use of renewable sources to secure or support heat supply into the project preparations. The return on such systems ranges from 10 to 15 years, which is also the normal period for home renovation loans. In addition, the prices of renewable energy technologies are falling sharply, in contrast to the ever-increasing heat and energy prices on global markets.

IV. LITERATURE

[1] **Jánošíková, D.:** Komplexné riešenie vykurovania bytového domu s využitím OZE, Diplomová práca, TU v Košiciach, FBERG, 2011

[2] **Šomodský, D.:** Potenciál využitia OZE pre bytový dom v Košiciach, Diplomová práca, TU v Košiciach, FBERG, 2017

[3] https://www.asb.sk/tzb/tepelne-cerpadla/uplatnenie-tepelnych-cerpadiel-v-bytovom-dome

[4] https://www.solarneslovensko.sk/solarny-ohrev-vody/slnecne-kolektory-bytove-domy.php

[5] https://www.asb.sk/tzb/solarne-kolektory/solarny-system-v-bytovom-dome

[6] http://www.solarenergy.sk/sk/stranka/tepelne-cerpadla/tc-pre-bytove-domy

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