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Importance of the consumption profile of a Residential House for RES Designing

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ABSTRACT

The importance of a detailed consumption profile is increasing with the increasing share of the use of renewable energy sources due to their unpredictability. Indeed, it is very important to take into account their volatility with the potential volatility of energy consumption. The same proportion of its importance can be attributed to the size and type of the customer. If we move only at the municipal level, the most problematic is the consumption profile of apartment buildings. It is almost impossible to find two type-identical apartment buildings with identical heat, hot water and electricity consumption profiles. The reason is simple - people. This is the main reason why the design of RES should be based on precisely measured durable consumption values, not standardized energy demand values. It is necessary to get used to the fact that quality measuring systems in a residential building are not a burden, but to help reduce energy costs. Whether by energy management or by using energy that is renewable and clean.

KEYWORDS : Energy demand, energy consumption, consumption profile, RES

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I. INTRODUCTION

In the discussions concerning the energy intensity of housing, the notion of consumption profile has been increasingly becoming more common. Its importance is increasing with the increasing share of the use of renewable energy sources due to their unpredictability. Indeed, it is very important to take into account their volatility with the potential volatility of energy consumption. The same proportion of its importance can be attributed to the size and type of the customer. If we move only at the municipal level, the most problematic is the consumption profile of apartment buildings. It is almost impossible to find two type-identical apartment buildings with identical heat, hot water and electricity consumption profiles. The reason is simple - people.

II. DEMAND VERSUS ENERGY CONSUMPTION IN APARTMENT BUILDINGS

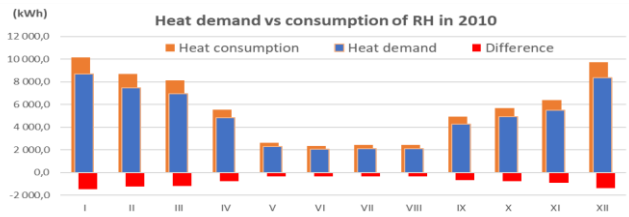
When assessing apartment buildings in terms of their energy performance, two basic procedures are used- standardized vs. operational evaluation. It is also common practice to combine both procedures. The basic difference in energy performance is that while a standardized assessment takes into account mainly technical factors such as:

- Thermal properties of the building envelope,
- Technical parameters of the heat source,
- Floor and utility area of the building,
- The estimated number of users,
- Location, etc.

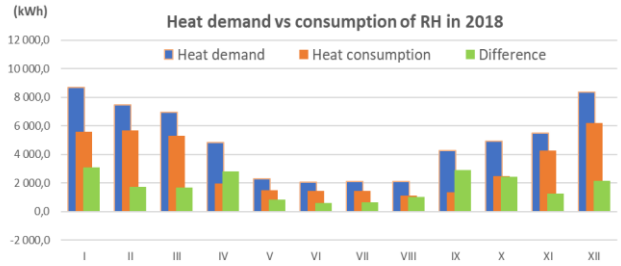
In addition to the above, the following data shall be considered in the operational evaluation:

- Real measured consumption of the house for the longest possible time period,
- Appliances operating time,
- Operating parameters of the heating and DHW systems,
- Consumer behavior and more.

In general, a standardized calculation is used in the design of the energy system of a new house, while the experienced designer will also take into account the experience in the operation of similar buildings. If a "standard" source, ie district heating, boiler, electric heating, etc., is proposed as an energy source, it is not difficult to cover the potential difference between the planned demand and real consumption. These heat sources have a sufficiently large range able to cover the resulting offtake differences, as in the assessed BD in Spišská Nová Ves. The figure below shows the difference between the actual heat consumption and the demand established by the normalized calculation. The differences range from approx. 1,500 kWh / month in winter to approx. 300 kWh / month in summer.

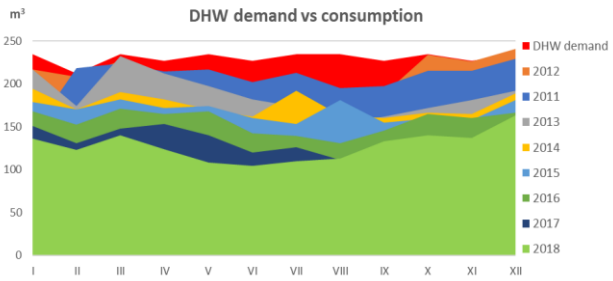


In the case of major differences, caused, for example, by the insulation of the house or the behavior of residents, it is necessary to consider a change, respectively. treatment of the heat source. In this case, the heat consumption has already been reduced by almost 3,000 kWh / month in three months and the year-on-year difference is almost 40 MWh.



It is therefore obvious that knowing heat consumption is important. However, providing heat for heating is more likely to achieve a minimum difference between calculation and measurement than when determining the heat demand for DHW. Although, of course, exceptions confirm the rule. However, hot water consumption is influenced very much by consumer behavior, irrespective of the thermal properties of the building envelope (except in extreme cases). It is virtually impossible to calculate the relatively accurate consumption of DHW in an apartment building, and only a very complex modeling process can be used to make the expected consumption profile seriously. However, even these cannot cope without the values obtained by detailed and long-term measurements.

As it follows from the graphical representation of the hot water consumption in the house under consideration, the differences from the standard values are more pronounced every year, which may be due to more responsible behavior of the population, some weight can be attributed to the modernization of the distribution system in the house.



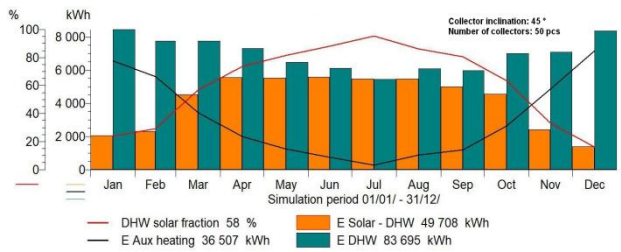
The difference in DHW consumption by more than 55% compared to the normalized demand is already considerable and when planning the use of a renewable energy source, there is a significant difference not only in technology but also in economic terms. While a traditional energy source does not produce or remove excess heat, an unsuitable oversized RES-based energy source produces excess energy irrespective of consumption, making it very easy to put the owner's money into the air in the form of

unused energy. A precise design of a renewable resource is necessary but impossible without knowing the behavior of the population - that is, without a detailed consumption profile. In the case of investing in home renovation and renewable energy, for example in the form of EPC, this is doubly true.

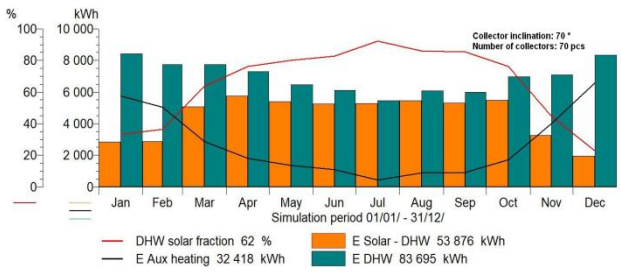
III. CONSUMPTION PROFILE AND FINANCING OF RES IN RH

As RES technologies still represent a significantly higher financial burden than 'standard' energy sources, their design and utilization planning must be solved precisely and always in several variants. Only in this way the future user can choose the one that best suits his needs and the behavior of the occupants of the house. As an example we can mention the BD in Spišská Nová Ves with the average monthly energy consumption for the preparation of DHW in other years at the level of 7000 kWh and the consumption profile according to the graph.

By appropriate dimensioning of the solar system it is possible to ensure coverage of the total heat demand for DHW production at the level of 58%, while in the summer period there is no overproduction of heat despite the lowest monthly consumption. 50 pieces of selected solar collectors are sufficient to cover the consumption. For the sake of simplicity, only the numbers and prices of solar collectors are given, and the corresponding technologies are not quantified. The solar system thus designed already shows a solar heat deficit in March, April and September, October.



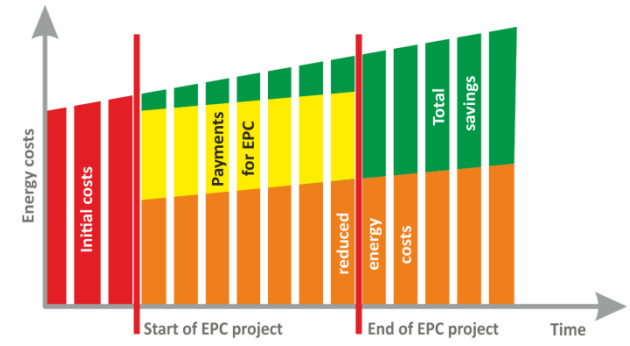
If the user is interested in increasing the solar fraction even in the mentioned problematic months, the solar system can be adapted by increasing the inclination of the collectors and increasing their number. With a 70 ° gradient and the number of collectors 70, the solar share has risen significantly in the required months, and the total solar energy benefit rises to 62%.



However, it is questionable whether an increase in the solar share of 4% represents the same financial benefit for users. At the price of natural gas in the residential house 0,054 € / kWh (for the sake of simplicity it is not considered again with other costs of medical devices) such a solar benefit for the apartment building is an amount of 180, - € per year. At a solar collector cost of € 700, the investment is increased by € 14,000, which is 78 years in simple return!

So if the designer does not have a detailed and stable consumption profile and is based only on standard values, it is possible to oversize the solar system by tens of percent! The heat produced in the summer will not be used and the return on investment may exceed the service life of the system.

A similar situation may arise if apartment owners decide to finance the renovation of the house and new energy-based renewable energy facilities in the form of EPC (Energy Performance Contracting), ie one of the forms of energy guaranteed service. The essence of the EPC is that the financing of home renovation and energy technologies will be provided by the EPC provider itself. The homeowner pays the investment only from the savings made, and the contract is set up so that part of it remains to him.



However, the guaranteed energy service requires a great responsibility of the customer. The precondition for meeting the guaranteed savings is strict adherence to the operation of the building as set in the EPC project. This point is a critical point of apartment buildings, because it is very difficult, if not impossible, to guarantee the operation of energy systems according to rules such as: fixed and maintained temperature of individual premises including apartments, default hot water consumption.

In an apartment building with tens of housing units and hundreds of users, such operations are very difficult to maintain, which is also the reason for the caution of EPC service providers in a residential building. However, as a certain tolerance is set in the definition of energy performance rules, in the case of a sufficiently detailed long-term and stable consumption profile, EPC service providers are willing to discuss the conditions of mutual cooperation with administrators and owners.

IV. CONCLUSION

The conclusion can be summarized in a single sentence - No measurement is no steering! This, slightly non-literary sentence, expresses the essence of the success of any energy project. This is particularly true of the relationship between apartment buildings and renewable energy. Two unpredictable systems are very difficult to match to an optimal system in terms of energy, economy and user-friendliness. It is necessary to get used to the fact that quality measuring systems in a residential building are not a burden, but to help reduce energy costs. Whether by energy management or by using energy that is renewable and clean.

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