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THE IMPACT OF THE DECREASING NUMBER OF USERS ON THE EVOLUTION OF A CENTRALIZED HEATING SYSTEM

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INTRODUCTION

The paper describes the involution of a centralized system with district heating plants (DH), powered by natural gas, in order to understand that a periodic diagnosis of the efficiency of the system and a risk analysis that considers the development of competing alternative systems, can avoid huge economic problems for local public administrations which are unfortunately also associated with special social problems.

MATERIALS AND METHODS

The analyzed centralized heating system had 31 heating facilities, with a total installed thermal power of 129 Gcal/h. The distribution pipelines network totalized more than 25 km. The district heating system covered the demand for heat and domestic hot water for 16.635 apartments and 457 economic agents.

The methodology used in this paper was through measurements of different indicators of the DH system, recordings of specific consumptions, analysis of the evolution characteristic curves of the recorder parameters and their framing into mathematical functions. The main indicators followed in our investigation were: the system's production of thermal energy, number of consumers connected to the heating network and efficiency of the system.

RESULTS AND DISCUSSIONS

Thermal energy production of the district heating system

The district heating system produced between 1997 and 2005 a total thermal energy of 129.25 Gcal/h. By 2006, with less consumers connected to the network, the energy production had a significant decrease of 65%, reaching a value of 84.35 Gcal/h.

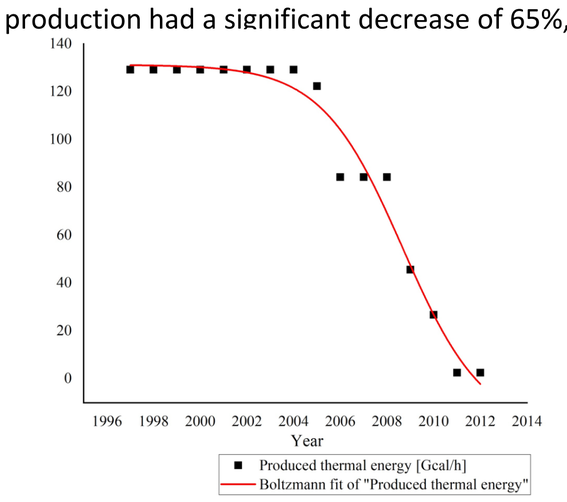

Figure 1. Produced thermal energy by the district heating system

Figure 2. Evolution of residential consumers connected to the DH system

Thermal efficiency of the DH system

The massive disconnections put serious challenges on the district heating system as it was meant to operate an oversized energy supply, with different parameters from its design, but with less demand. The centralized heating system was seriously affected on one hand by the overall thermal efficiency and on the other hand by hydraulic imbalances of the distribution pipeline network. As it can be seen in figure 3 the thermal efficiency of the DH system decreases to the level of not being feasible.

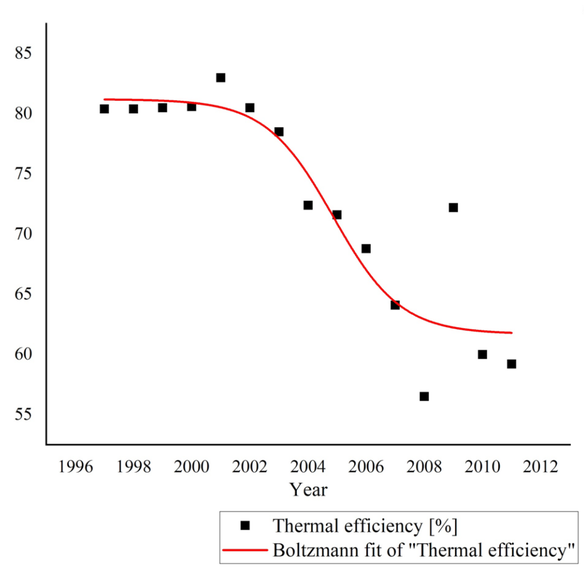

Figure 3. The evolution of system's thermal efficiency

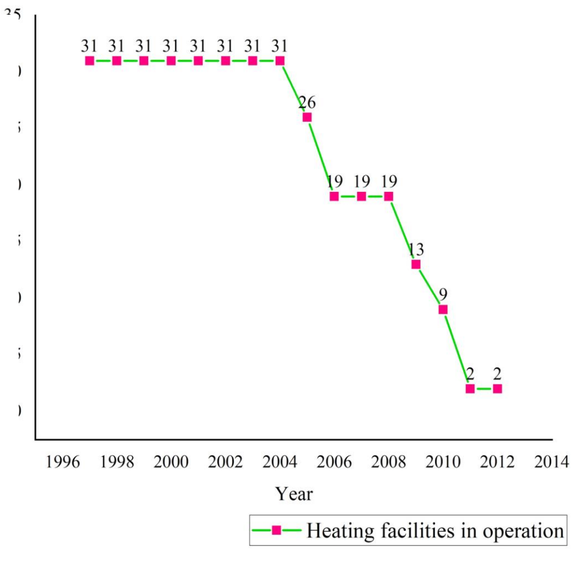

Figure 4. Heating facilities in operation

Thermal energy losses exceeding 30% cannot be tolerated for this type of system (district heating system with combustible natural gas). The lower the thermal (consumer) density determines the lower efficiency of the system. Likewise, the decrease in demand (output reduction) can't be technically diminished with reduction in inputs leading to performance decline due to the partial use of heating facilities.

Given the performance indicators presented on the graphs and the lack of clear regulations in the field, a steeper slope of the graph occurred after the year 2004, meaning after this year the financial balance of the business was broken and the collapse of the system was imminent.

Evolution of system's specific consumptions

One of the main reasons for the accentuated decrease in the overall DH system's thermal efficiency in 2008 (see fig.3), is related to the increase in specific electricity consumption reported to sold thermal energy (see fig.5), reaching a level of 58.3 kWh/Gcal. The specific consumption of natural gas reported to the sold thermal energy follows the same path of the electricity consumption, i.e. an overall increase. If in '97 the amount of natural gas consumed by the DH system on the sold thermal energy was 154.4 [m3/Gcal], in 2004 increased to 171.5[m3/Gcal], reaching a level of 219.7 [m3/Gcal].

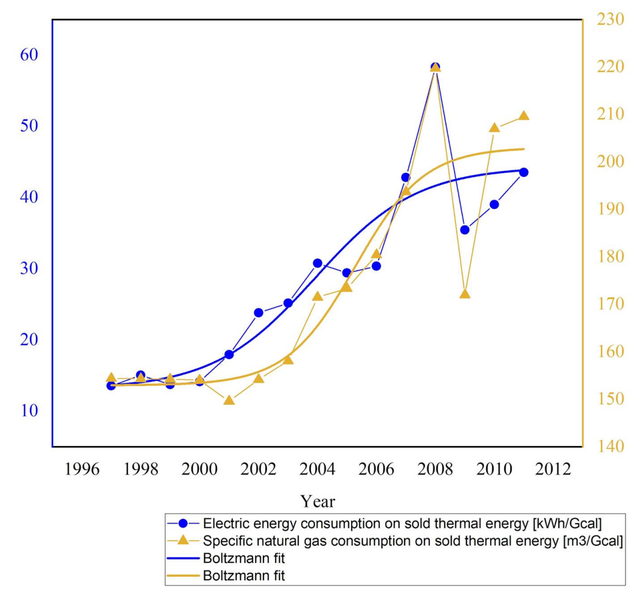

Figure 5. The evolution of the DH system's specific consumptions reported to annual sold thermal energy

Analysis of the main annual indicators in the DH system

We analyzed the evolution of the main annual indicators through an overlap graph that is presented in figure 6. These indicators are the main factors that are considered for the establishment of the DH system's efficiency, i.e. annual produced energy, annual consumption of natural gas and electricity and number of system's employees.

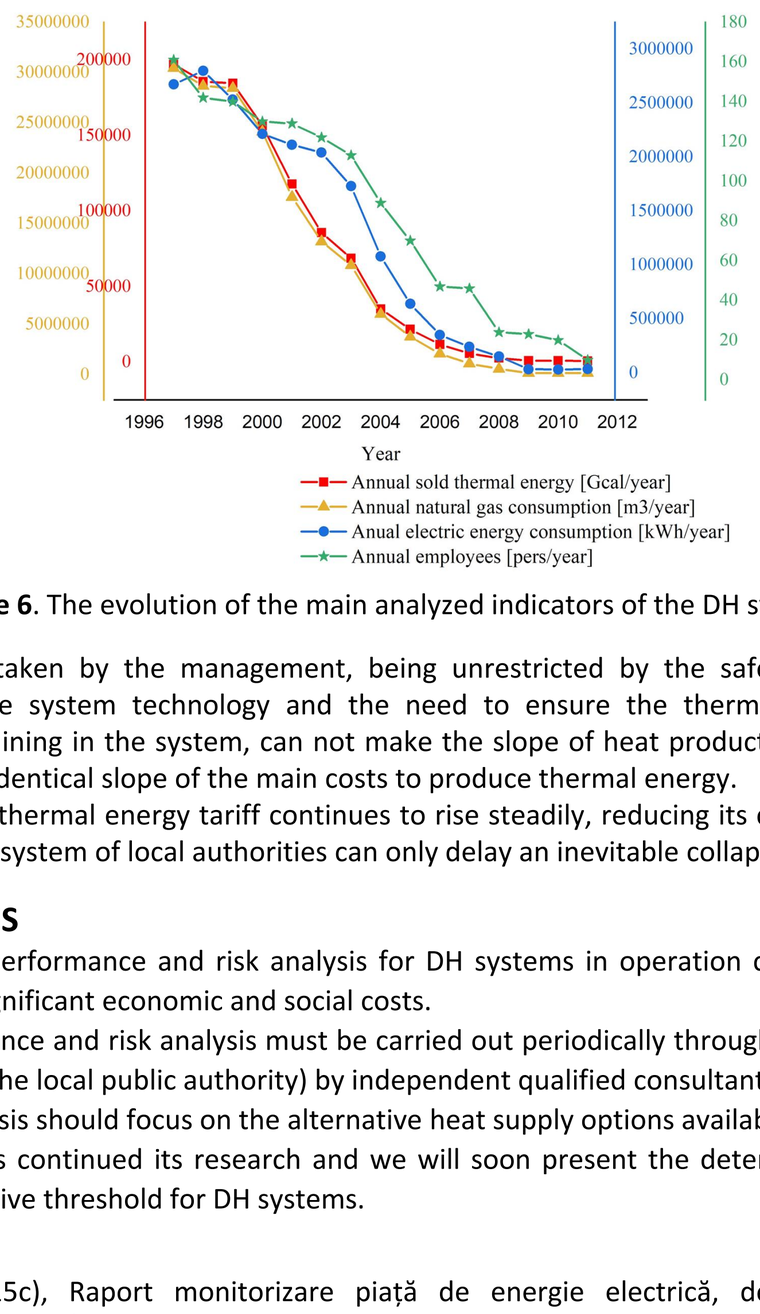

Figure 6. The evolution of the main analyzed indicators of the DH system

The measures taken by the management, being unrestricted by the safety rules of the installations, the system technology and the need to ensure the thermal energy of all customers remaining in the system, can not make the slope of heat production decrease be followed by an identical slope of the main costs to produce thermal energy.
As a result, the thermal energy tariff continues to rise steadily, reducing its competitiveness, and the subsidy system of local authorities can only delay an inevitable collapse.

CONCLUSIONS

1. The lack of performance and risk analysis for DH systems in operation can lead to their collapse with significant economic and social costs.
2. The performance and risk analysis must be carried out periodically through the care of the owner (usually the local public authority) by independent qualified consultants.
3. The risk analysis should focus on the alternative heat supply options available in the area.
4. The team has continued its research and we will soon present the determination of the critical competitive threshold for DH systems.

References:

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