

SOLUTIONS FOR THE MODERNISATION OF COLTERM TIMIȘOARA

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ABSTRACT: District heat is currently providing the cheapest alternative to thermal energy. Of course, this system is facing the challenges of our times – related to the losses in the distribution network, production costs, the possibility of using alternative (renewable) fuels and, not in the last, the customers degree of satisfaction. In our paper we perform a SWOT analysis of the thermal energy distribution system in Romania. The case study will refer to the local district heat company of Timisoara, SC Colterm SA. For this company, its current situation will be analyzed – including the McKinsey matrix, and solution for the modernization will be proposed, directly referring to cogeneration solutions for the thermal energy, losses reduction solutions, pollution reduction solutions.

KEYWORDS: district heating, SWOT analysis, McKinsey matrix, distribution network losses, alternative energy sources

1. INTRODUCTION

Centralized heating or district heating is the technical process by which a large number of non-industrial consumers (residential or commercial, public or private) are supplied from the same source. The key elements of a district heating system are: thermal power plants (plants), heat pump stations, consumers, pipelines between them (thermal networks). [1] The thermal agent may be water, steam or air.

Like any power generation system, district heating systems are subject to the same international regulations on quality, environmental protection and climate change.

1.1 Actual situation in Europe and Romania

At EU level, a set of integrated energy and climate change strategies have been adopted. In 2014, the 2030 Energy and Climate Change Package [2] was launched, which states:

1. Reduce greenhouse gas emissions by at least 20% until 2020 and by 40% until 2030
2. Increase the share of renewable energies in total energy consumption by 20% until 2020 and by 27% until 2030
3. Increase energy efficiency by 20% until 2020 and by 27% until 2030

Modern practices to increase efficiency in district heating originated in the 1980s in Denmark and Sweden. These practices continued in Germany [3]. Currently, the Federal Ministry of Economic Affairs and Energy in Germany finances projects on the integration of solar heating systems in existing district heating systems [4]. Based on an annual statistical assessment, the impact of decentralized

solar thermal input on the system is modelled to increase efficiency in peak periods but also during summer periods when demand for heat is reduced (and is focused on the demand of hot water for domestic use rather than for heating). German studies have shown that the integration of solar energy into the district heating system has the consequence of reducing greenhouse gas emissions, increasing the efficiency of the plant and, together with appropriate policies to support district heating companies, also bring economic benefits.

Following Germany, Poland is the second district heating producer in Europe. However, the Polish district heating system also faces challenges, in particular those related to the EU directives on energy and the reduction of greenhouse gas emissions, but also those related to the moral and technological wear of systems and those related to legislative issues [5].

Unlike in other countries, where district heating refers to both centralized heating and central cooling systems and services in Romania district heating refers only to centralized heating installations.

From the point of view of the existing district heating systems, there are two types of consumers in Romania: those connected to the centralized system and those who are part of the so-called decentralized system - whether they do not have access to the centralized system in their localities or have opted for disconnection from it. The distribution of heating sources in the non-industrial sector in Romania shows a consumer preference for biomass, followed by gas, district heating and electricity.

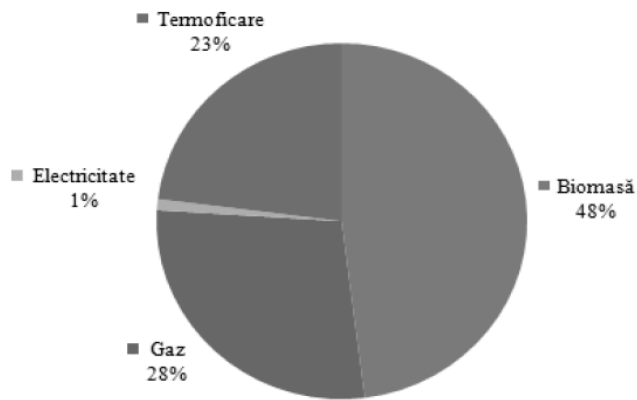


Figure 1. Heating sources in the non-industrial sector in Romania [6]

From the point of view of the types of users, the education sector consumes the most energy,

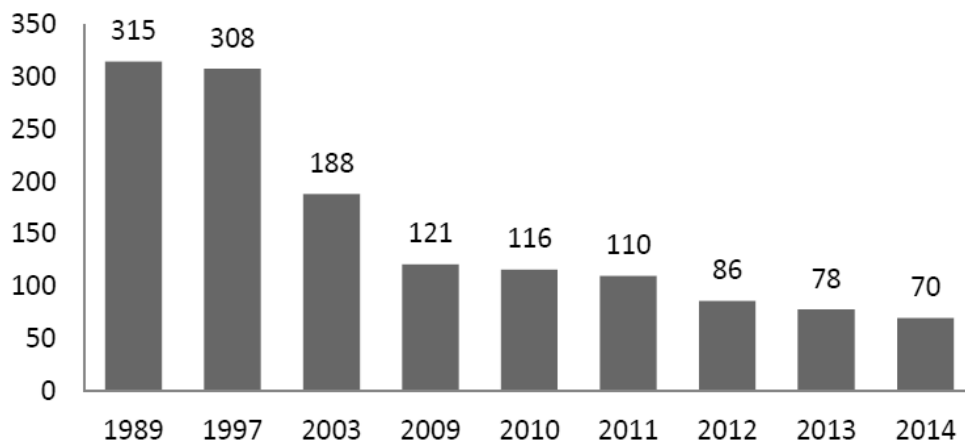


Figure 2. Number of localities in Romania with district heating system [6]

The decrease in the number of localities where centralized district heating systems operate is a consequence of "the wrong economic and energy policy decisions that have affected centralized cogeneration and heating in Romania" [1]. Among these decisions, we mention:

- The lack of a national strategic planning institution after the abolition of the State Council of Planning in 1990 - resulting in the lack of a National Economic Strategy
- The increase in the number of privately owned apartments after 1990, resulting in new responsibilities for owners, such as energy modernization of buildings, which they cannot cope with
- The absence of a national policy in the field of urban energy
- A number of inefficient solutions concerning the thermal energy issue: subsidies, non-uniform social protection measures through the price of energy, etc.
- The competition between cogeneration and natural gas, at the same time with an official

followed by the health and the residential sector. Also, more than 85% of residential buildings were built before 1989, without incorporating energy efficiency growth systems. This is a real problem for both consumers and heating companies.

The current trend in Romania is to disconnect from district heating systems [6], with the number of holdings decreasing from 109,415 in 2008 to 93,558 in 2014. This has also led to a decrease in the number of localities using a centralized district heating system (from 315 in 1989 to 121 in 2009 and 70 in 2014), whereas the total number of cities, municipalities and communes in Romania increased.

encouragement of the sale of individual (apartment) heating systems.

The use of renewable energies in the field of heating involves the use of solar water heating systems, or the use of biogas and biomass fuels, or even the use of household waste for the production of biofuels.

1.2 COLTERM SA – local district heating company

COLTERM SA Timisoara is a company established by the Local Council Decision in 2004, with the reorganization of two existing companies: TERMOCET 2002 (which managed the heating plants and primary distribution network of the thermal agent) and CALOR (which managed the secondary distribution network of the thermal agent, district heating and district heating plants). The company functions under the Local Council of Timisoara, - thus being a state-owned company and not a private one.

Colterm's main activity is the production, transport, distribution and supply of thermal energy [7]. In addition, Colterm also deals with the production and supply of electricity, the operation, maintenance and development of thermal networks and installations

in thermal power stations and plants, cold water hydrophoring, installation and operation of cost-sharing systems and railway transport and maneuvering activities.

The company holds two hot water boilers of 100Gcal / h and three industrial steam boilers of 100 t / h that run on solid fuel with natural gas support. The electrical part is provided by a counter-pressure turbine which is fed by the industrial steam boilers. It also holds a district heating plant with natural gas and oil or light liquid fuel, a hydroelectric power plant on the river Bega, a cogeneration plant with gas-fueled thermal engines, 118 thermal power stations, five block stations, 47 cold water hydrophoring stations. District heating cover 90% of thermal energy needs of the consumers connected to the Colterm distribution system.

2. SWOT ANALYSIS OF COLTERM SA

2.1 Strenghts

- The district heating system is less polluting. Thus, its use leads to an improvement in the quality of life and health of users.
- District heating is attractive compared to other forms of heating, especially in the context of rising energy prices. Thus, currently it is one of the most efficient heating solutions.
- Practically, the repair or service costs of the installations, usually associated with the apartment individual heating systems, are negligible for the consumers.
- The risk of explosion is virtually nullified for consumers and does not affect them.

2.2 Weaknesses

- Most of the energy equipment and technologies are technically and morally obsolete
- The high price of thermal energy and non-unitary social protection measures taken in this respect, as well as the technical, energy and economic losses.
- Energy losses in the distribution network. These losses are felt both at the level of return pipes, but also at residential buildings, which are mostly not upgraded for energetic efficiency and consequently have energy losses in the order of 40-50%. Another factor that directly influences losses is consumer disconnections from the district heating.

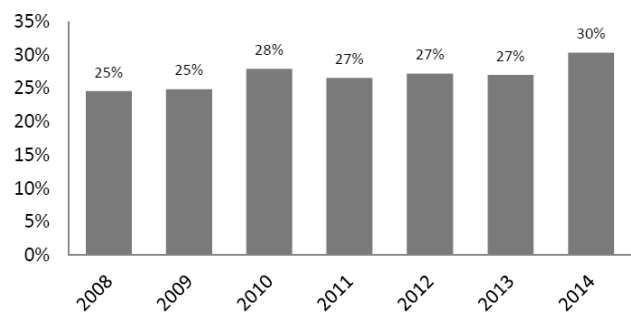


Figure 3. Average heat losses between 2008 and 2014 [6]

- Management of the company is deficient and its negotiation abilities are scanty
- Vertical Metering System for Thermal Energy Consumption.

2.3 Opportunities

- Introducing of the horizontal metering system. This system is designed to integrate indoor heating systems in a horizontal distribution system, providing individual metering of each apartment and has the following advantages: underground heat losses are eliminated, new, lighter, cheaper and more time-resistant materials are used, consumers become practically independent of neighbors, pollution is reduced.
- Using alternative, renewable resources (biofuels, solar energy).
- Using the geothermal potential of the area to achieve energy savings.
- Domestic waste processing, in partnership with the local sanitation company, for the purpose of producing biogas.
- Modernizing and expanding the distribution networks to limit losses.
- Promoting efficient cogeneration.

2.4 Threats

- The increased number of disconnections due to the attractiveness of the individual apartment heating systems
- Lack of a national policy to promote high efficiency cogeneration and a lack of differentiation of fuel prices between industrial and individual consumers.
- Difficulties in the payment of internal and external credits, which leads to the impossibility of obtaining new grants and credits for development.

3. SOLUTIONS FOR THE MODERNISATION OF COLTERM SA

For the modernization of Colterm the management must rally in the EU's integrated energy and climate change strategies.

Currently, the main energy resources used for heat production in Romania are: natural gas, coal, liquid hydrocarbons (oil), biomass, renewable energies

(solar energy, geothermal energy). By 2030, it is intended to increase the consumption of heat and renewable energies.

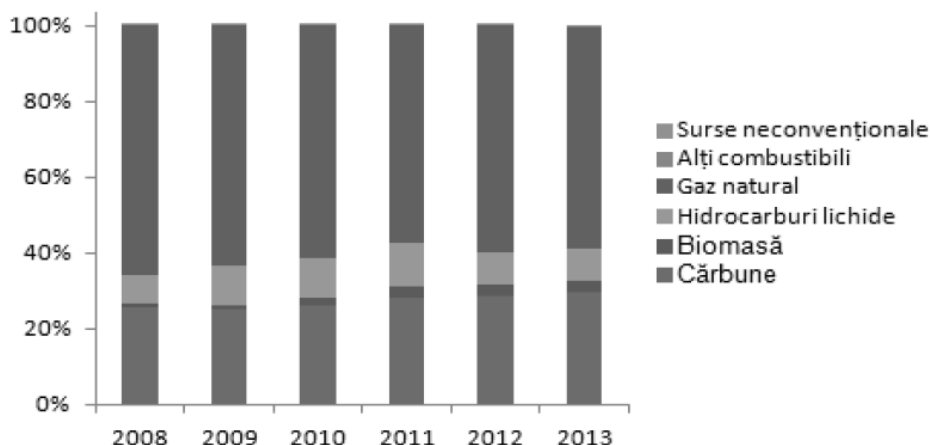


Figure 4. Energy sources used for thermal energy production [6]

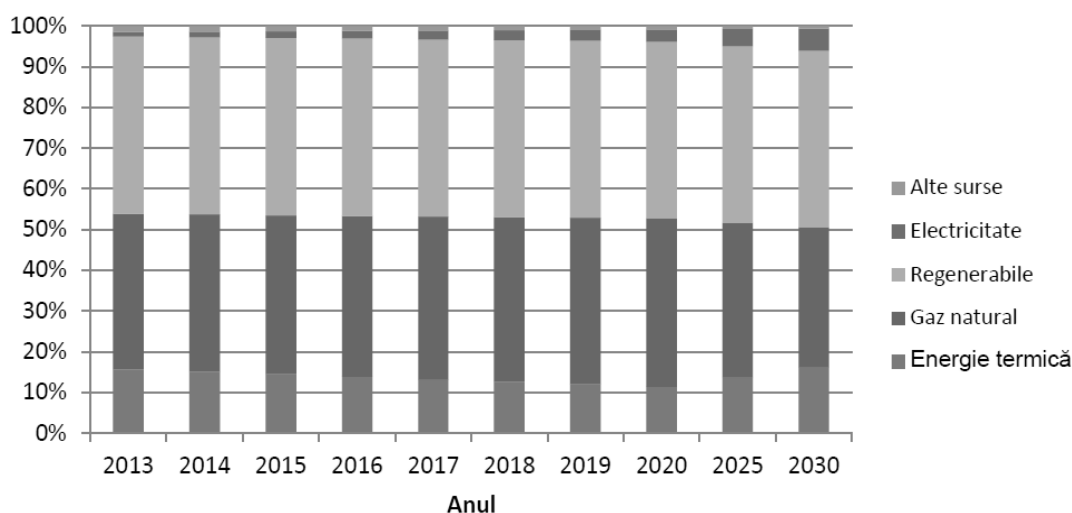


Figure 5. Estimative energy consumption until 2030 [6]

3.1 Measures to reduce greenhouse gas emissions and increase energy efficiency

Measures to reduce greenhouse gas emissions include:

- Using solar heating panels mounted on buildings.
- Waste incineration with heat recovery.
- The use of decentralized, biofuel-based cogeneration plants
- Using local biofuel boilers to cover the load peaks.
- Use of heat pumps and electrical heaters to conserve energy.
- Implementing measures to reduce energy losses, such as thermal rehabilitation of buildings and rehabilitation of the distribution network.

Measures to increase energy efficiency include:

- Energetic modernization and rehabilitation of residential and non-residential buildings. This measure does not necessarily depend on the management of the district heating company, but on local and national strategies to reduce energy losses.
- Replacement of obsolete distribution networks for the transport of primary heat and thermal energy and their resizing as well as reduction of technological losses below 15%. This measure is related to the efficient management of the district heating company.
- Rehabilitation of thermal stations and substations by equipping them with high efficiency heat exchangers, variable speed pumps, complete automation and remote monitoring. This measure is also related to the management of the district heating company and its capability of attracting European funds for modernization.
- Implementation of measuring and control systems along the source-network-consumer energy

chain, in order to highlight the losses as accurately as possible and to draw up the correct energy balances. This measure concerns both the management of the district heating company and the local and national strategies adopted to reduce energy losses.

- Reduction or elimination of secondary distribution networks by installing substations or thermal modules at the building level. This measure can only be implemented by the management of the district heating company.
- Replacement of the distribution networks inside the buildings and their adaptation to the individual metering needs at apartment level (horizontally) of the thermal energy consumption. The implementation of this measure lies with both the district heating company and consumers who choose to disconnect from the centralized system.
- Metering individual heat consumers and installing thermostatic valves on each heating appliance and hot water counters. This measure is being implemented by the district heating company, but more involvement from consumers is needed, which has to accept the installation of individual meters and individual faucets.
- Inform and educate the population about the need to save energy resources, protect the environment and expand the use of renewable energy resources. This measure is implemented by

both the district heating company and local and national public authorities.

- Extension and implementation of the programs for the use of renewable resources and the production in cogeneration of electric and thermal energy, including in rural areas. This measure can be implemented by attracting European funds and is mainly the responsibility of local and national authorities.
- Implementation of public support measures for district heating services. This measure rests solely with national and local authorities.

Therefore, some of these modernization solutions are the responsibility of the management of COLTERM SA and part of them are the responsibility of the local administration or the central administration. But all solutions are feasible, as can be seen from the examples of other European countries.

3.2 McKinsey analysis

In order to prioritize the solutions available, the managers should analyse the McKinsey matrix [8]. This is a nine-box matrix used to determine where is best to invest cash in a decentralized corporation. Each potential investment unit is judged by two factors: its attractiveness of the relevant industry and the unit's competitive strength within that industry.

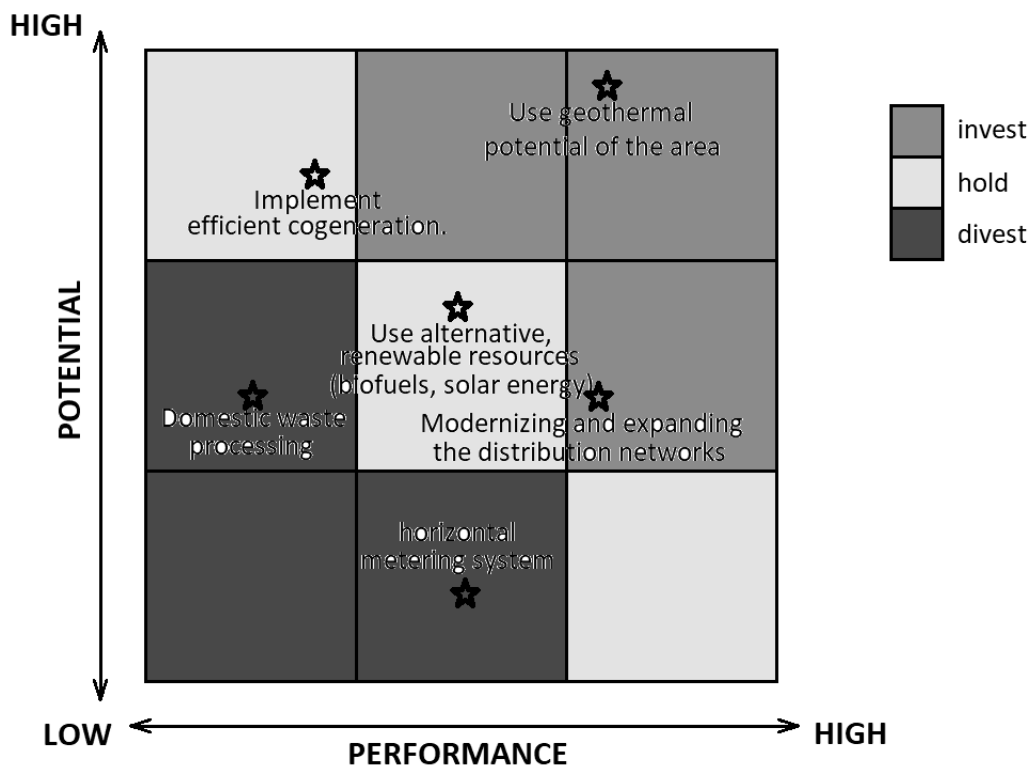


Figure 6. McKinsey analysis for Colterm potential investments (author's own elaboration)

Based on the McKinsey analysis performed by us in the case of Colterm, the best investing potential are the usage of geothermal potential of the area and the implementation of efficient cogeneration. The usage of alternative resources is an investment to hold, and the modernization and expansion of the distribution network are also good choices.

A first step was taken during the period 2013-2016 when, together with the Local Council of Timisoara, they implemented the European project "Rehabilitation of the centralized heating system in Timișoara to comply with the environmental protection standards regarding air pollutant emissions and increase the efficiency of the power supply with urban heat "[9]. During the implementation of this project 8 pumps, 2 hot water boilers, 3 steam boilers were installed and a desulphurisation unit was installed, thus fulfilling the project objective and improving the quality of the environmental factors. The company also strives to rehabilitate the distribution network and thermal points.

4. CONCLUSIONS

In order to meet the EU's requirements for energy and climate change, COLTERM needs to be modernized.

Good management directions are presented based on the McKinsey analysis of the potential investments.

However, during the time, the company focused on implementing a horizontal metering system, modernizing and/or repairing the distribution networks and domestic waste processing. These were not the best investment choices, and the results are in line with them.

As lacking efficiency as they are, the managements' efforts to modernize the company are, however, hampered by the absence of coherent support policies at local and national level.

5. REFERENCES

1. A. Leca, Considerații privind sistemul de alimentare centralizată cu energii termice al Municipiului București, *Conferința anuală a ASTR*, 2014
2. https://ec.europa.eu/clima/policies/strategies/2030_en
3. Winterscheid, C., Holler, S. and Dalenbäck, J.O., 2017. Integration of solar thermal systems into existing district heating systems. *Energy Procedia*, 116, pp.158-169.
4. Heymann, M., Rühling, K. and Felsmann, C., 2017. Integration of Solar Thermal Systems into District Heating–DH System Simulation. *Energy Procedia*, 116, pp.394-402.
5. Wojdyga, K. and Chorzelski, M., 2017. Chances for Polish district heating systems. *Energy Procedia*, 116, pp.106-118.
6. Ministerul Dezvoltării Regionale și Administrației Publice Ministerul Energiei, Raport privind evaluarea potențialului național de punere în aplicare a cogenerării de înaltă eficiență și a termoficării și răcirii centralizate eficiente, 2015
7. <https://www.colterm.ro/despre-noi/prezentarea-societatii>
8. <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/enduring-ideas-the-ge-and-mckinsey-nine-box-matrix>
9. <https://www.colterm.ro/despre-noi/programe-europene>