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ENERGY MANAGEMENT FOR MAKING MORE EFFICIENT THE ENERGY CONSUMPTION FOR HOUSE HEATING

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Abstract: *Buildings heating during the cold season had become a real issue in Europe. Giving that we are depending on natural gas and its price is increasing, the specialists are forced to come with alternative methods for reducing both consumption and costs. Our challenge was to reduce the heating costs for an apartment building cluster nearby waste water treatment plant in Pitesti Romania. Because the cluster is heated by a few fairly new heating plants and changing this would have been expensive, our idea was to supply the heating plants with warm water (40 – 45 degrees). Warming the water will be done using a mix of technologies which will lead to a significant cost reduction and a world première.*
Key words: *heating, saving, technology, waste, co-generation*

1. INTRODUCTION

The article is based on an application designed for a certain usage in Romania. The article is highly applicative and is based on the mix of several technical solution in order to achieve the necessary output and performances.

The challenge was based on the necessity of using a mix of heat generating technologies able to adapt to existing preconditions with optimal outcome. The selected apartment building cluster is nearby the city waste water treatment plant. Thus, the location is featuring:

a. high quantity of waste water discharge (700 l/s) with an yearly average temperature of 7 degrees

b. solid waste as an outcome of waste water clarification process and filtering process in the treatment plant

c. sufficient land for implementing the new technologies

d. existing prerequisite for implementing the project

In designing the solution we have started with the idea of not replacing the existing fairly new and modern gas burning heating plan due to the costs. The optimal solution was to supply the heating plant with warm water with the input temperature of 40-45 degrees, thus reducing the selling price at the final consumer. We have decided to use the following technologies in order to have a cheap warm water supply:

a. Therm Liner technology for capturing the heat of the waste water in sewage. This technology consists in placing heat exchanger on the bottom of the sewage pipe, over a length of 201 meters (see figure 1, 2, 3).

The heat exchangers will circulate the heat exchanging liquid which will capture the heat and will transport the heat to a heat pump system. The heat, then, will be transported to a heating plant.

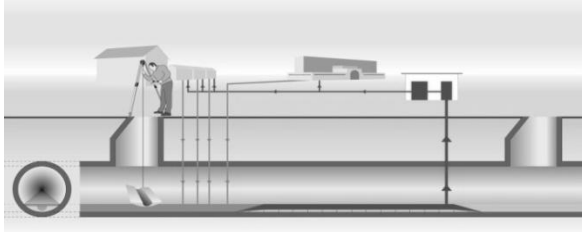

Fig. 1. How to place Thermliner

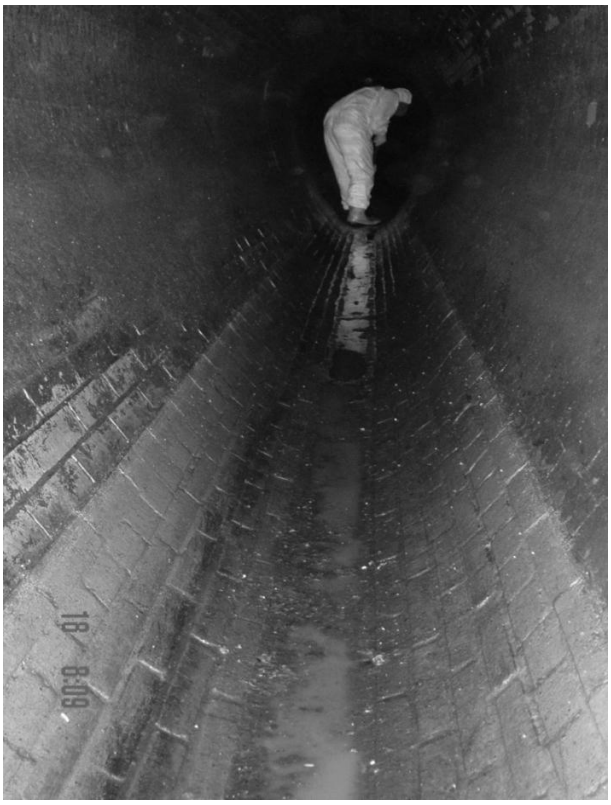

Fig. 2. Sewage without Therm Liner

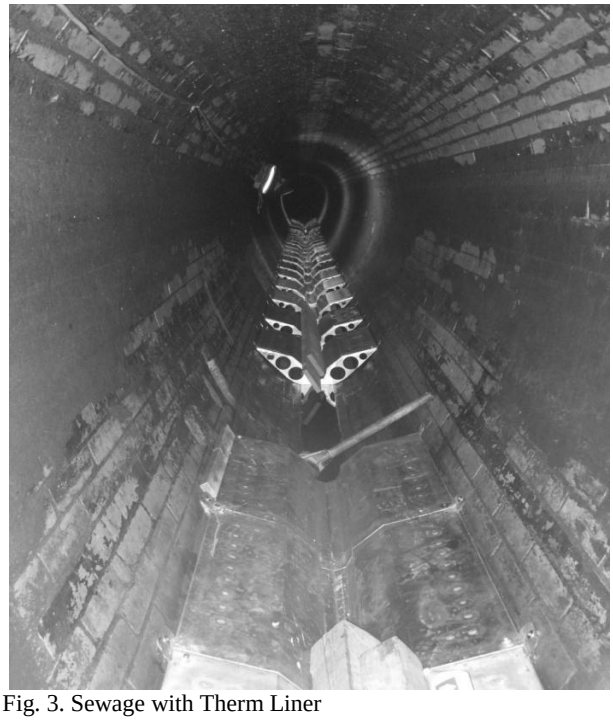

Fig. 3. Sewage with Therm Liner

b. High efficiency co-generation is the technique of burning a fuel (natural gas or biogas) using engines with the output of electricity and burned gases with a temperature of 550-560 degrees. The gases will going to be circulated inside of a heat exchangers and will supply warm water to the heating plant.
c. For the second stage, we proposed that all the solid waste produced by the waste water treatment plant to be processed in the sludge digestion process in order to produce biogas. Until this stage will be implemented, the co-generation plant will burn natural gas
Thus, the area of the waste water treatment plant will become energy self sustained and will provide pre worm water for heating the apartment building cluster.

2. FUNCTIONING PRINCIPLES AND METHODS EFFICIENCY

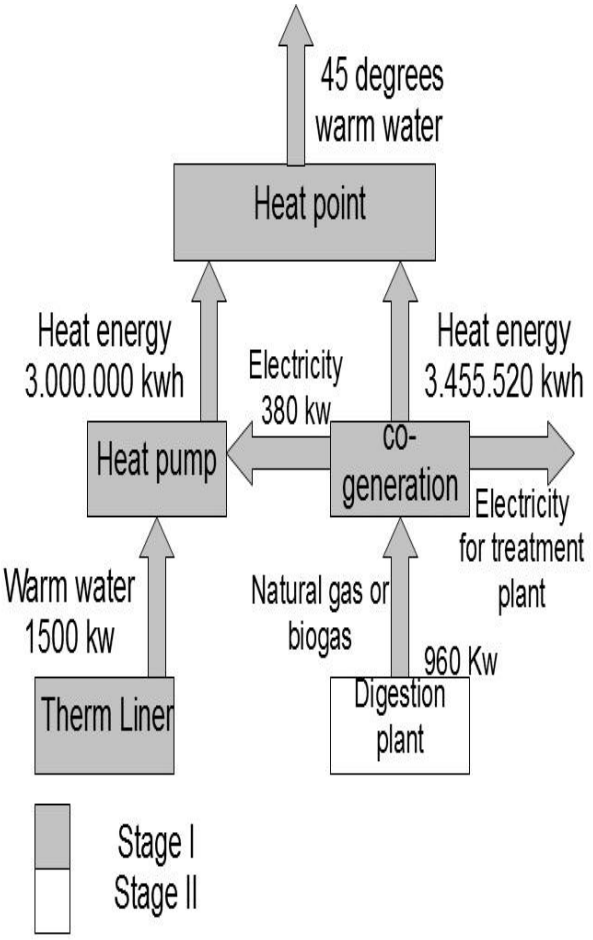

Fig. 4 Installation working chart

Using this mix will generate a fusion of classic and green technologies, as foreseen by the Uhrig team and the team of the 1 Decembrie 1918 University in Alba Iulia. The system functioning is based on the interdependence of the component as follows:
a. Therm Liner will need electricity for the heat pump. The electricity will not come from the national energy system but will be provided by the co-generation engines.
b. The co-generation engines will burn natural gas and will provide heat to the heating plant. Also, the same engines will provide electricity to the heat pump and to the waste water treatment plant, making them energy autonomous.
c. for the second stage, when we going to when the biogas plant will be operational, the co-generation plant will burn biogas and become energy independent and the cost of heat and electricity will be 10 to 12 times lower.
d. finally, the heating energy generated by the co-generation plant and by the Therm liner system will be transported to the heating plant. This area (known as heat point) will have the purpose of generating and providing warm water up to 40-45 degrees using a mix of heat exchangers and blenders and to supply the warm water to the heating plant of the building cluster. The cluster is 800 meters away from the waste water treatment plant area.

Advantages quantified:
a. electricity provided by co-generation – 228.318,2 Euro/year
b. heat provided by co-generation – 116.470,59 Euro/year
c. heat provided by Therm liner – 134.155,48 Euro/year
d. total – 478.155,27 Euro/year
Costs
a. natural gas - 228.064,32 Euro/year
b. maintenance – 60.183,64 Euro/year
c. total costs - 288.247,96 Euro/year
Profit with natural gas technology – 190.696,31 Euro/year
Profit with biogas technology – 395.165,2 Euro/year

Pricing for Therm Liner and co-generation mix
a. Therm Liner – 280.000 euro
b. co-generation plant – 265.000 Euro
c. heat pumps (2 pieces) - 130.000 Euro
d. furniture for heating point – 25.000 Euro
e. feasibility study and technical drawings – 70.000 Euro
f. project management and financing due diligence – 63.000 Euro
g. works – 93.000 Euro
h. total – 873.000 Euro

Amortization – natural gas option – 4, 5 years
Amortization – biogas option – 2, 2 years

3. CONCLUSIONS

We have to conclude that in some cases is useful to mix both classic and modern technologies. The final outcome we are interested for is a cheap heating able to solve the necessity of citizens.
The proposed solution is not eliminating the CO2 emissions but is reducing the emissions with 25-30%. Also, the waste water was discharged in the river with a fairly high temperature, altering the ecosystems.
The waste water treatment plant is generating a solid residuum that needs to be deposited. By digesting process, the residuum is reduced to 10 % and it can be used as fertiliser due to its chemical composition.
The system, augmented with the biogas generating plant is fully independent and provides worm water, electricity and fertilisers.

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