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The business case for ULTDH using the RELaTED concept – Residential & commercial customers, and heat producers

Introduction

The RELaTED project assessed the business case for ULTDH using a decentralized approach to heat production, i.e. heat can be collected from multiple points within the district heating (DH) network, not just one location. This assessment was applied to the DH customer case for residential and non-residential buildings, and heat producers (DH company). For DH customers, the use of building integrated solar panels, heat pumps, and triple function substations were applied to the DH networks of Belgrade, Serbia, and Tartu, Estonia. For Heat producers, a business model was developed to assess the feasibility of incorporating new sources of heat into the DH network; this was also applied to Belgrade and Tartu.

Residential & commercial customers

In the eyes of a DH company, there is little difference between how residential and non-residential buildings are treated as customers; both customer segments pay for the heat they consume. But there are a few factors that can determine the demand for heat which can impact the cost. For example, if a building has been renovated to reduce heat loss – insulated walls, thermally efficient windows, doors, and roofs – then they will cost less to heat. There are also differences that can arise from the size of buildings – i.e., an apartment complex with 32 apartments might have a similar heat demand compared to an office building of a similar size. On the other hand, an individual home would have a much different heat demand and consumption compared to an office building or school.

To account for these differences, the RELaTED concept and cost assessment were applied to buildings of a comparable size and heat consumption profile. In this case, apartment buildings (residential) in Tartu and Belgrade and non-residential buildings - an office building (Belgrade) and grocery store (Tartu) – were compared. The findings can be observed in table on the next page.

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		LCoE (c€/kWh for 15 years)	Payback period (years)	Savings on energy bill (€/building/year)
Belgrade	Residential	8.8	15	8,845
	Non-residential	8.5	6	6,000* - 22,000*
Tartu	Residential	10.7	32	5,545
	Non-residential	9.8	27	5,194

Savings are highly dependent on electricity and heat price. The high range represents the best case scenario but slight changes in these prices can drastically change the savings.

Table1. Levelized cost of energy and payback period for the scenarios assessed. *The table shows what the expected pay paypack period will be to integrate solar thermal energy, heat pumps, and triple function substation at the building level. Levelized cost of energy refers to the average net present cost of electricty over a 15 year period. If the payback is longer than 15 years, then the use of the RELaTED concept is not feasible.*

Conclusion

The results are much more favourable for Belgrade compared to Tartu. In Belgrade, the use of the RELaTED concept is a promising solution that can be applied for residential and non-residential buildings in climates similar to Belgrade. This is because the solar irradiation availability is sufficient to warrant the use of solar panels throughout the year. In Tartu, low irradiation levels and cold outdoor temperatures makes it not suitable for this heat configuration and is not an economically viable solution.

Heat producer case

The business case for heat producers should be based on a heat price that ensures a fair ROI for integrating low grades sources such as waste heat and solar thermal energy into a ULTDH network. The main heat producers involved in such investments are (1) DH companies who manage combined heat and power (CHP) plants and heat pumps (HP), (2) and heat producers of waste heat or solar thermal energy who can be the building or company owner from where these heat sources are being produced.

To assess competing heat production technologies for DH networks and the potential of RES/waste heat for DH heat production, an economic model is proposed to simulate the potential cashflow of the heat producer to support the investment into new heating installations. The model focuses on the energetic and economic effects based on the variable-flows that are represented in next figure. The parameters for the economic model are shown in the schematic below. The figure is divided into the operator (left side) and the user (right side):

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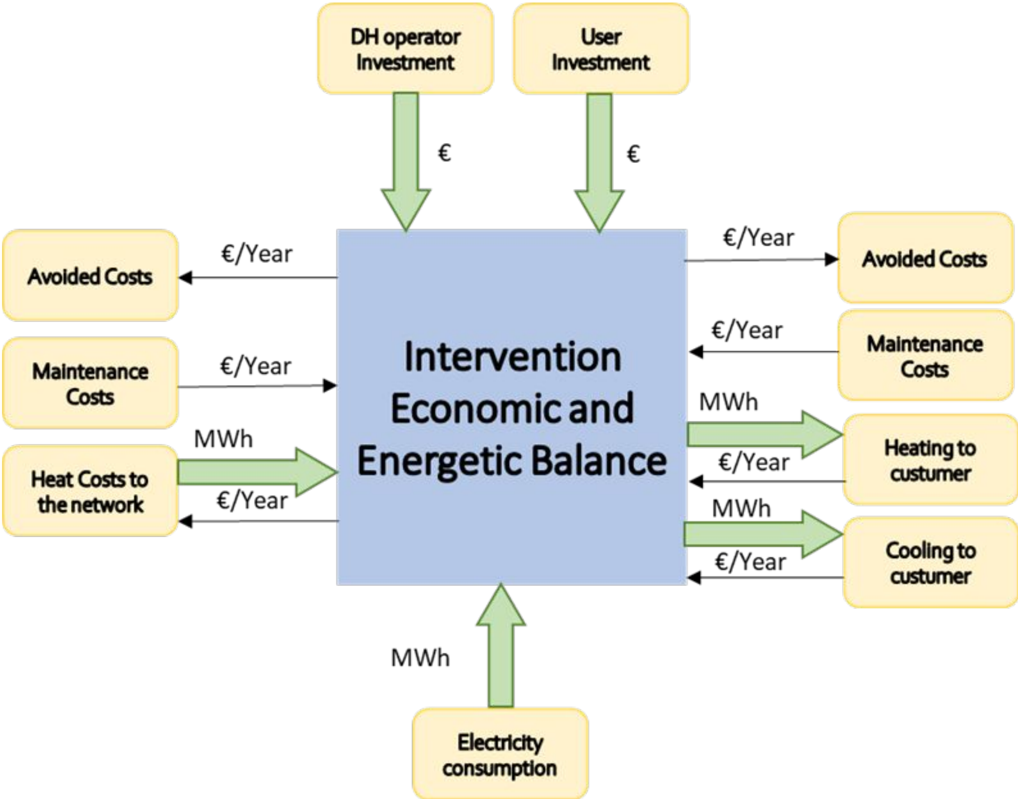

Figure 1. Intervention Economic and Energetic Balance model:

Economic inputs: The economic inputs include the capital and operational costs that are non-energy related for the new installations. These inputs can be divided as operator investment and maintenance costs and the user investment and operator costs.

Economic figures related with energy flows: This includes energy costs, such as service costs, paid by users in the new installations.

Economic outputs: These terms include the simulated economic output of avoided costs due to efficiency improvements in the new installations. It is not a real economic flux, but a simulated figure used to represent the improvement on operational costs due to the increase of efficiency. The terms include DH avoided costs and user avoided costs.

Conclusion

The use of ULTDH network in combination with CHP, reversible heat pumps for heating & cooling, solar systems, and waste heat increases the energy performance in every case. For the waste heat recovery case (Tartu), it was found that the source temperature and the cost to recover the heat, i.e. through new installations, was crucial to determining whether waste heat recover was a feasible option in that DHN. For the solar thermal case (Belgrade), it was found that the investments needed in relation to the size of the ST field was an important factor in determining the feasibility of using ST energy in the DHN. Investment costs for the ST plants increased with the size of the solar field which can impact the payback time and overall cost for the ST plant.

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