METHOD FOR INTEGRATED STRATEGIC HEATING AND COOLING PLANNING ON REGIONAL LEVEL – THE CASE OF BRASOV

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Overview

Decarbonising the heating sector is essential to reach the climate goals agreed on 2015 United Nations Climate Change Conference held in Paris (COP21). Because heating and cooling cannot be transported over too long distances its issues mainly appear on local and regional level. In former times there was no planning effort given to heating and cooling supply and the sector developed according to pure economics, availability and outdated technology preferences without taking into account climate targets and long-term issues. To exploit the decarbonisation potential of the heating and cooling sector, integrated methods are needed on how to perform strategic heating and cooling planning on local and regional level.

This planning process should include long term targets and the assessment of different heat saving and heat supply options accompanied by intensive and target-group oriented information campaigns and involvement of all stakeholders in order to ensure the achievement of the desired objectives. For example, district heating (DH) in general is seen as an important technology to decarbonise the heating sector especially in urban areas. Especially this technology needs an integrated planning approach to include development of heat demand into the assessment and to ensure a certain heat density by ensuring enough consumers making DH an economic effective solution.

In this paper, the method and the results of an integrated strategic heating and cooling planning process performed for the case of Brasov is shown.

Method

The method for integrated strategic heating and cooling planning presented in this paper is based on the case study of the municipality of Brasov, located in the centre of Romania. The overall method to assess very different local case studies spread across Europe was developed within the Horizon 2020 project progRESsHEAT[1] and then a specific methodology was adapted to the different case studies. The performed steps include:

(1) Calculation of costs and potentials for decreasing thermal losses through the building envelope (heat savings) for ten different building types with three different construction periods with the Invert/EE-Lab model [1]. (2) Calculation of costs for heat supply with five different individual heating technologies for the before mentioned buildings. (3) Modelling of existing district heating system and possible alternative supply portfolios for the future of the district heating system in energyPRO [2] to obtain the district heating generation costs and the sensitivity of the costs to disconnection or to additional costumers. (4) GIS based analysis to divide the municipality into four different types of areas according to the availability of a current district heating network or the feasibility and costs of expanding the network into adjacent areas. The so-called district heating area is the area within 50 m of the current distribution network. In this area, it is assumed that additional buildings can be connected to district heating without further expansion of network but by investing only in connecting pipes and heat exchangers. The so-called next-to-district heating area is the area within 1 000 m of the current transport network. In this area, it is assumed that further buildings can be connected by additionally investing into the current distribution network. The individual area is defined as the area outside the next-to-DH areas. The individual area is not supplied by district heating and is not sharing a border with existing district heating area. For the buildings located in Individual areas, it is necessary to invest in transmission pipes, distribution pipes, connecting pipes and heat exchangers to be able to connect to district heating. The expansion of district heating to scattered buildings, which are spread across the municipality and are not close enough to other buildings, is not considered to be an alternative. (5) For all building classes and all areas within the municipality the cheapest combination of heat saving level and the supply with district heating or individual technologies is calculated. This is done for a reference scenario and for a technical alternative scenario depicting a

[1] http://www.progressheat.eu/Project.html

desirable future regarding the heat supply portfolio of the district heating system and for different interest rates and energy tax assumptions. Indicators like total system costs, total CO_2 emissions, share of renewables etc. are calculated both for the reference and for the alternative scenario to analyse the economic efficiency as well as the CO_2 reduction potentials of various options to save heat and supply heat in the buildings

Results

The results of the assessment show that at least a certain amount of heat savings, if performed when maintenance work is needed anyhow, is cheaper than all assessed heat supply options for all building categories also in absence of energy taxes and with low interest rates. This applies especially for an old building stock but also for newer buildings with construction period between 1995 and 2008.

In course of the heat supply options chosen in combination with the most economic heat saving the situation looks different for the future scenario: When not taking into account energy taxes and assuming depreciation times in the range of the lifetime of the supply systems, the cheapest combination with heat savings are natural gas boiler followed by air source heat pumps (assuming a COP of 2.8). When taking into account energy taxes and shorter depreciation times, biomass boilers are the cheapest supply option in combination with heat savings followed by air-source heat pumps. Nevertheless, heat pumps and biomass boilers have heat generation costs close to each other and their economic feasibility depends on assumed taxes on energy carriers. However, in densely populated areas the potential for individual biomass boiler and air source heat pumps may be limited which again would make individual natural gas boiler the cheapest option. Therefore, in some parts district heating may be the only option to decarbonise substantially although the results also show that in the future scenarios district heating is not the most economical alternative per se in the assessed case study.

This shows the importance of integrated strategic heating and cooling planning which can set the framework conditions so that favourable technologies can be privileged against fossil technologies leading to an overall benefit.

Conclusions

The presented method for integrated strategic heating and cooling planning can be adapted to a wide range of different regions. The respective results of the cheapest combination of heat savings and heat supply for the different buildings highly depend on the individual local conditions. Therefore good data availability is essential to obtain meaningful results. As the method aggregates different building groups in different areas relative to existing infrastructure it is not capable of giving detailed results on the buildings level.

References

[1] Mueller A., Energy Demand Assessment for Space Conditioning and Domestic Hot Water: A Case Study for the Austrian Building Stock, PhD Thesis, TU Wien, Vienna 2015. http://www.invert.at/

[2] EnergyPRO, EMD International, http://www.emd.dk/energypro/