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Official Event of the Austrian Presidency of the Council of the European Union

Renewable Heating and Cooling in Integrated Urban and Industrial Energy Systems

3 – 5 October 2018
Congress Graz
Austria

Proceedings

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

Richard Büchele, Lukas Kranzl, Marcus Hummel
Institute of Energy Systems and Electrical Drives
Gusshausstr. 25-29/370-3, 1040 Wien, Austria
Phone: +43-1-58801 / 370 368
E-Mail: buechele@eeg.tuwien.ac.at

SUMMARY

In this work a method for integrated strategic heating and cooling planning on regional level is presented which is applied for the case study city of Brasov. The overall methodology comprises the calculation of the cost-optimal combination of heat savings with either district heating or individual supply technologies for different building groups located in different areas according to the availability of a current district heating network and the calculation of different indicators like total system costs, total CO2 emissions, share of renewables etc. for different scenarios and for different interest rates and energy tax assumptions to analyse the economic efficiency as well as the CO2 reduction potentials of various options to save heat and supply heat in the buildings. The results of the assessment show that at least a certain amount of heat savings is cheaper than all assessed heat supply options for all building groups but that renewable supply options are not the most economical alternatives per se in the assessed case study under current conditions.

INTRODUCTION

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effort given to heating and cooling supply and the sector developed according to pure economics, availability and outdated technology preferences without taking into account climate targets and long-term issues. But 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 relevant 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 but especially this technology needs an integrated planning approach to include future development of heat demand into the assessment and to ensure a sufficient heat density with enough customers making DH an economic effective solution. Therefore 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 integrated strategic heating and cooling planning process presented in this paper was developed within the Horizon 2020 project progRESsHEAT and then the methodology was adapted to the case study municipality of Brasov, located in the centre of Romania.

The overall methodology comprises the calculation of the cost-optimal combination of heat savings with either district heating or individual supply technologies for different building groups located in different areas according to the availability of a current district heating network and included following steps:

(1) Calculation of costs and potentials for heat savings for ten different building types with three different construction periods with the Invert/EE-Lab model (Müller, 2015). (2) Calculation of costs for heat supply with five different individual heating technologies for the before mentioned buildings. (3) Modelling of the existing district heating system and possible alternative supply portfolios for the future of the district heating system in energyPRO (EMD International, n.d.) 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. (5) For all building groups 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 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 CO2 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 CO2 reduction potentials of various options to save heat and supply heat in the buildings. All these steps are carried out along with a wide stakeholder integration process where all the strategic issues and long term targets are discussed to find realistic assumptions and coherent scenarios for the whole heating and cooling planning process.

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 annual 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. In densely populated areas with limited potential for individual biomass boiler and air source heat pumps again individual natural gas boiler are the cheapest option. Nevertheless, all assessed supply technologies have heat generation costs close to each other and their economic feasibility depends on assumed taxes, lifetimes and other framework conditions. Especially the economic efficiency of district heating highly depends on the achieved connection of customers within the network area. This shows the importance of integrated strategic heating and cooling planning to evaluate the needed framework conditions facilitating the implementation of cost optimal combination of heat savings with renewable and low carbon heating technologies.

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CONFERENCE TOPIC

Spatial energy planning with focus on renewable energies