

THE ROLE OF EXCESS HEAT FOR THE FUTURE SUPPLY OF DISTRICT HEAT IN LARGE CITIES: THE CASE OF FRANKFURT AM MAIN

Jeton HASANI¹, Marcus HUMMEL², Paul FAY³

Introduction

Heating and cooling (H&C) accounts for around 50% of energy demand in the EU. Thus, H&C plays an important role in decarbonising the energy systems. In large cities the use of various different types of excess heat could play an important role in the decarbonisation of H&C: dense population makes district heating more economically attractive compared to rural areas, the amounts of regional biomass sources are very limited, and several potential sources of excess heat might be available in or nearby the city. In this contribution we aim at analysing the role of different sources of excess heat for the future heat supply in the city of Frankfurt. Hereby the influence of different input parameters should be identified including the temperatures of the district heating systems.

Methodology

For the analysis we use a dispatch model that calculates the heat supply from various technologies in the district heating system at each hour of the year. The objective function is to minimize the running costs of the heat supply. Clearly, the heat demand has to be satisfied at each hour of the year.

With the dispatch model we analyse various different supply portfolios containing different capacities of heat pumps using different sources of excess heat. The basis for setting the capacities is a study on available excess heat source in the city done for the city authority. The portfolios include excess heat from waste water, from river water, from data centres and from different industrial facilities. We calculate various sensitivities of the dispatch and the resulting supply costs due to temperatures in the district heating systems, hourly electricity wholesale prices and savings in space heating demand due to renovation measures in the buildings of the city.

Results

The results show that the temperature of the heat distribution has a remarkable influence on the efficiency of the heat pumps needed for using most of the excess heat sources. However, also the influence of future electricity wholesale prices is high and in the same order of magnitude.

In the long version of the paper we are going to present quantitative results of the analysis and draw conclusions on meaningful portfolios for future low carbon heat supply portfolios for large cities like Frankfurt am Main.

¹ TU Wien- EEG, Gußhausstraße 25 29, <https://eeg.tuwien.ac.at/>

² e-think (Zentrum f. Energiewirtschaft und Umwelt), Argentinierstrasse 18/10, www.e-think.ac.at

³ Energiereferat Stadt Frankfurt am Main, Adam-Riese-Straße 25, www.energiereferat.stadtfrankfurt.de/