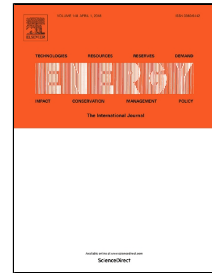


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District heating in cities as a part of low-carbon energy system

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ABSTRACT

In this paper, district heating scenarios towards carbon neutral district heat production in 2050 were formed for Helsinki region, Warsaw and Kaunas based on the plans and goals of the studied cities and the companies supplying district heat in these regions. It was found that increased use of biomass and waste as well as utilization of geothermal and waste heat could be expected in the studied regions in the future. Increased energy efficiency and carbon capture and storage technologies could also be utilized. According to the results, the annual emissions in Helsinki region could be cut by 90% by 2050 compared to the reference case and the average heat production costs increase only by 16%. In Warsaw, emissions were cut by 75% by 2050 but the heat production costs increased by 40%. In Kaunas, emissions can be cut from 0.102 to 0.087 million tonnes of carbon dioxide by 2050 with modest cost increase (29%). Yet, if the emissions are cut to zero, the marginal heat production costs increase by 55%. The cost increase thus depends strongly on the case and in order to limit the increase of heating costs and energy poverty, diversified use of different technologies should be considered.

KEYWORDS

District heat, energy poverty, CO₂ emissions, district heating scenarios, cities, carbon neutrality

HIGHLIGHTS

- Scenarios towards carbon neutral district heat production in 2050 were formed
- Case studies of Helsinki region, Warsaw and Kaunas were performed
- Scenarios include increased use of biofuels, waste, geothermal and excess heat
- There is rather large variation in the cost increase between the studied regions

1 INTRODUCTION

Reducing emissions in the energy sector is essential for climate change mitigation and for meeting EU's emission objectives. Study by Connolly et al. [1] suggests that district heating

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