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

Aira Hast, Sanna Syri, Vidas Lekavičius, Arvydas Galinis

PII: S0360-5442(18)30565-6
DOI: 10.1016/j.energy.2018.03.156
Reference: EGY 12614
To appear in: Energy

Received Date: 03 January 2018
Revised Date: 22 March 2018
Accepted Date: 28 March 2018

Please cite this article as: Aira Hast, Sanna Syri, Vidas Lekavičius, Arvydas Galinis, District heating in cities as a part of low-carbon energy system, Energy (2018), doi: 10.1016/j.energy.2018.03.156

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.
District heating in cities as a part of low-carbon energy system

Aira Hast*1
Department of Mechanical Engineering
Aalto University, Espoo, Finland
e–mail1: aira.hast@aalto.fi

Sanna Syri2, Vidas Lekavičius3, Arvydas Galinis4

a Department of Mechanical Engineering, Aalto University, Finland
e-mail2: sanna.syri@aalto.fi
e-mail3: Vidas.Lekavicius@lei.lt
e-mail4: Arvydas.Galinis@lei.lt

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

* Corresponding author
دریافت فوری

متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات