

From Nuisance to Nurture

Using Residual Heat for Low-Temperature Local Heating Systems in Cities

Van Den Dobbelaars, A.; Chen, H.C.; Dang, M.; Voskuilen, P.

Publication date

2023

Document Version

Final published version

Published in

18th Conference on Sustainable Development of Energy, Water and Environment Systems

Citation (APA)

Van Den Dobbelaars, A., Chen, H. C., Dang, M., & Voskuilen, P. (2023). From Nuisance to Nurture: Using Residual Heat for Low-Temperature Local Heating Systems in Cities. In M. Ban, N. Duić, D. R. Schneider, D. Astiaso Garcia, G. Barone, S. Boldyryev, A. Buonomano, F. Calise, P. Colbertaldo, & More Editors (Eds.), *18th Conference on Sustainable Development of Energy, Water and Environment Systems: Book of Abstracts* (pp. 615). Article 830 (Digital Proceedings). University of Zagreb.

Important note

To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

**18TH CONFERENCE ON
SUSTAINABLE DEVELOPMENT
OF ENERGY, WATER AND
ENVIRONMENT SYSTEMS**

 **18th
sdewes
Conference
DUBROVNIK
2023**



**SEPTEMBER 24–29, 2023
DUBROVNIK, CROATIA**

BOOK OF ABSTRACTS

Edited by:

Marko Ban, Neven Duić, Daniel Rolph Schneider, Davide Astiaso García, Giovanni Barone, Stanislav Boldyryev, Annamaria Buonomano, Francesco Calise, Paolo Colbertaldo, Neven Duić, Yee Van Fan, Cesare Forzano, Marta Gandiglio, Tomás Gómez-Navarro, Daniele Groppi, Małgorzata Kacprzak, Soteris Kalogirou, Damian Kasperczyk, Goran Krajačić, Flavio Manenti, Luis Javier Miguel González, Hrvoje Mikulčić, Carla Montagud Montalvá, Benedetto Nastasi, Adolfo Palombo, Nikola Rajakovic, Alessandro Romagnoli, Tine Seljak, Alessio Tafone, Marian Trafczynski, Laura Vanoli, Petar Sabev Varbanov, Constantinos Vassiliades, Maria Vicidomini, Milan Vujanović

Local Organizing Committee

Prof. Neven Duic, University of Zagreb, CHAIR
Prof. Goran Krajačić, University of Zagreb, CO-CHAIR

Prof. Zvonimir Guzović, University of Zagreb,
Conference secretary

Dr. Marko Ban, SDEWES Centre
Ms. Ana-Marija Ljubanović, SDEWES Centre
Ms. Andreja Biskup Lazanin, SDEWES Centre
Dr. Tomislav Pukšec, University of Zagreb
Ms. Doris Beljan, University of Zagreb
Dr. Tibor Bešenić, University of Zagreb
Mr. Francisco Flores, Pontificia Universidad
Católica de Valparaíso

Mr. Luka Herc, University of Zagreb
Mr. Filip Jurić, University of Zagreb
Ms. Ana Kodba, University of Zagreb
Mr. Marijan Marković, University of Zagreb
Mr. Josip Miškić, University of Zagreb
Ms. Zvezdana Nađ Dujmović, SDEWES
Centre
Mr. Antun Pfeifer, University of Zagreb
Mr. Goran Stunjek, University of Zagreb

Publisher Faculty of Mechanical Engineering and Naval Architecture, Zagreb

ISSN – 2706-3690 (digital proceedings)

Editors

Marko Ban
Neven Duić
Daniel Rolph Schneider
Davide Astiaso Garcia
Giovanni Barone
Stanislav Boldyryev
Annamaria Buonomano
Francesco Calise
Paolo Colbertaldo
Neven Duić
Yee Van Fan
Cesare Forzano

Marta Gandiglio
Tomás Gómez-Navarro
Daniele Groppi
Małgorzata Kacprzak
Soteris Kalogirou
Damian Kasperczyk
Goran Krajačić
Flavio Manenti
Luis Javier Miguel González
Hrvoje Mikulčić
Carla Montagud Montalvá
Benedetto Nastasi

Adolfo Palombo
Nikola Rajakovic
Alessandro Romagnoli
Tine Seljak
Alessio Tafone
Marian Trafczynski
Laura Vanoli
Petar Sabev Varbanov
Constantinos Vassiliades
Maria Vicidomini
Milan Vujanović

Technical Editors Aleksandra Mudrovčić, Marko Ban

SDEWES2023.0830

From Nuisance to Nurture – Using Residual Heat for Low-Temperature Local Heating Systems in Cities

A. Van Den Dobbelsteen^{*1}, H.C. Chen², M. Dang¹, P. Voskuilen³

¹Delft University of Technology, Netherlands; ²TU Delft / AMS Institute, Netherlands;

³AMS Institute, Netherlands (*A.A.J.F.vandenDobbelsteen@tudelft.nl)

Abstract

According to the Paris Agreement, cities need to be carbon neutral by 2050. This entails a dramatic transition from a fossil fuel based built environment to one entirely running on renewable energy. In many European cities this means moving away from natural gas as prime source. At present, three options are generally considered as alternatives to a fossil energy system: (1) all-electric, using solar or wind power and solar heat or heat pump systems, (2) district heating, using high-temperature industrial waste heat or geothermal heat, (3) green gas, which can be biogas or synthetic gases as green hydrogen or synthetic methane. In addition, hybrid solutions are also an option.

Which of the sustainable alternatives is most suited strongly depends on the urban plan, building typology and technology used so far. Districts with a great extent of repetition can be easier renovated to a net zero-energy plan than an area with a great variety of building types. High-density districts are suited for relatively expensive district heating. Districts that are neither are usually designated for a green gas-based system. The problem however is that few cities can produce sufficient biogas or do not have a renewable power over-production to generate synthetic gases. This in particular applies to historic city centres.

The 17th-century inner city of Amsterdam is facing a similar problem. The municipality decided to keep this part of the Dutch capital connected to the gas grid, but under the condition that the demand for gas would be reduced by 70%, as to enable usage of locally produced green gas. However, with a great share of listed buildings – a large part of the inner city of Amsterdam is Unesco World Heritage – such a reduction in heat demand is virtually impossible. Or is it?

From various studies it is known that the old city centre has considerable sources of renewable heat, among which residual heat from cooling processes and exhaust air. This heat is now released into the air, disturbing the temperature in the city and getting lost for other purposed. In the research project presented, sources of renewable heat and residual heat were investigated, quantified and proposed as feed-in for a low-temperature heat (and cold) network, including seasonal storage. The full paper will discuss this study relevant to many cities across the continent.