7th International Conference on Smart Energy Systems
21-22 September 2021
#SESAAU2021

CO_2 emission intensity of Estonian district heating sector

Eduard Latõšov[1], Anna Volkova[1], Siim Umbleja[2]
[1]Department of Energy Technology, Tallinn University of Technology, Tallinn, Estonia
[2]Estonian Power and Heat Association, Tallinn, Estonia

Powered by

Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463

Introduction 1/2

The EU aims to be climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions.

To track changes in district heating sector the CO_2 specific emission factor can be used.

Factor indicates the energy efficiency and renewable energy intensity of a given network and the CO_2 reduction potential.

Powered by

Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463

Introduction 2/2

The main objectives of this article are to:

- perform CO_2 specific emission factor calculations for the Estonian district heating sector based on real data from district heating systems in 2020 (calculations for each DH area and DH sector).
- analyse calculation limitations, to provide guidance on improving the transparency and accuracy of the calculation methodology,
- analyse the results.

Powered by

reINVEST sEEnergies GRUNDFOS HOFOR kamstrup LOGSTOR
Innovation Fund Denmark
Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463
INNARGI Vestas ENGINEERING TOMORROW Danfoss

Materials and methods 1/3

In previous studies „power bonus“ method was used.
Calculations based on data from Statistics Estonia.

In this study:
Two methods have been applied/analysed:

- "power bonus" method,
- proportional allocation of CO_2 emissions between electricity and heat.

Real data from DH companies as a basis.

Powered by

reINVEST
sEEnergies
Innovation Fund Denmark
Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463
GRUNDFOS
HOFOR
kamstrup
LOGSTOR
INNARGI
Vestas
ENGINEERING TOMORROW
Danfoss

Materials and methods 2/3

The **weighting factors (specific emission factors)** of fuels and energies have a major role in calculations.

The values of specific emission factors for most fuels proposed in the Regulation "Methods for the calculation of carbon dioxide emissions into the atmosphere".

Exceptions that are not directly covered by the legislation and need to be dealt with separately are:

- shale gas, manufactures gas and coke oven gas,
- municipal and industrial waste,
- electricity,
- waste heat.

Powered by

reINVEST sEEnergies GRUNDFOS HOFOR kamstrup LOGSTOR

Innovation Fund Denmark

Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463

INNARGI Vestas ENGINEERING TOMORROW Danfoss

AALBORG UNIVERSITY
DENMARK

7th International Conference on Smart Energy Systems
21-22 September 2021
#SESAAU2021

energy CLUSTER DENMARK

INPUTS AND OUTPUTS

SIMPLE CASE

Source: https://www.utilitas.ee/en/rl_gallery/utilitas-eesti-boiler-plants/

INPUTS:

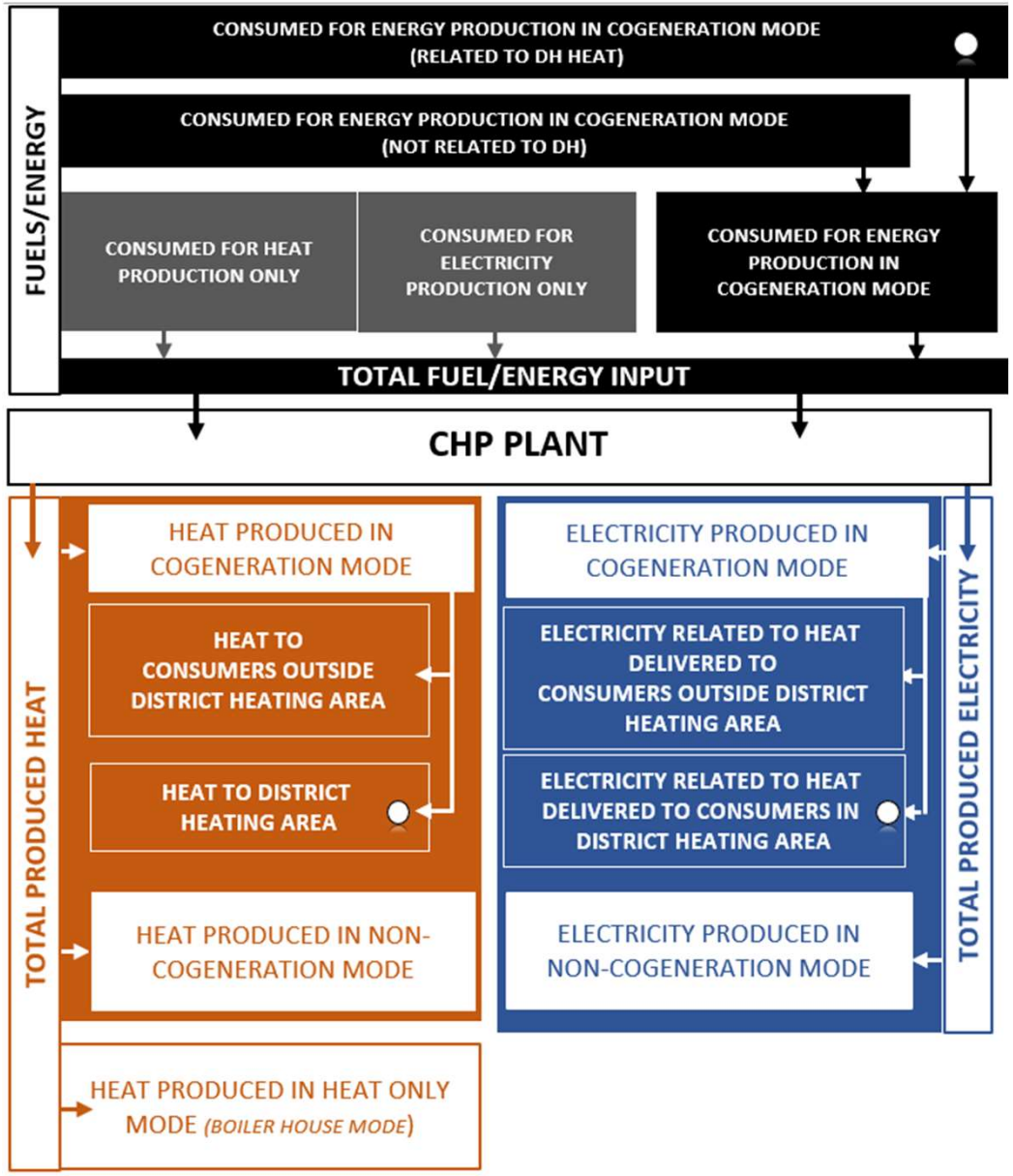
1. Fuels used for heat production, MWh
2. CO_2 emision factors for used fuels
3. Heat consumed in DH area

Powered by

reINVEST
sEEnergies
Innovation Fund Denmark

Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463

GRUNDFOS
HOFOR
kamstrup
LOGSTOR
INNARGI
Vestas
ENGINEERING TOMORROW
Danfoss



Materials and methods 3/3

COMPLICATED CASE

The scheme is applied when the useful energy produced in the cogeneration plant is sold outside the district heating network and part of the energy is not produced in the cogeneration process.

(data needed marked with white circles).

According to **EN 15316-4-5:2017**, the assessment of the electricity generation mode (whether the CHP plant is operating in CHP mode or not at certain times) is based on a comparison of the total efficiency of a real CHP plant with reference values. This approach is in line with the solution proposed in Directive 2008/952/EC.

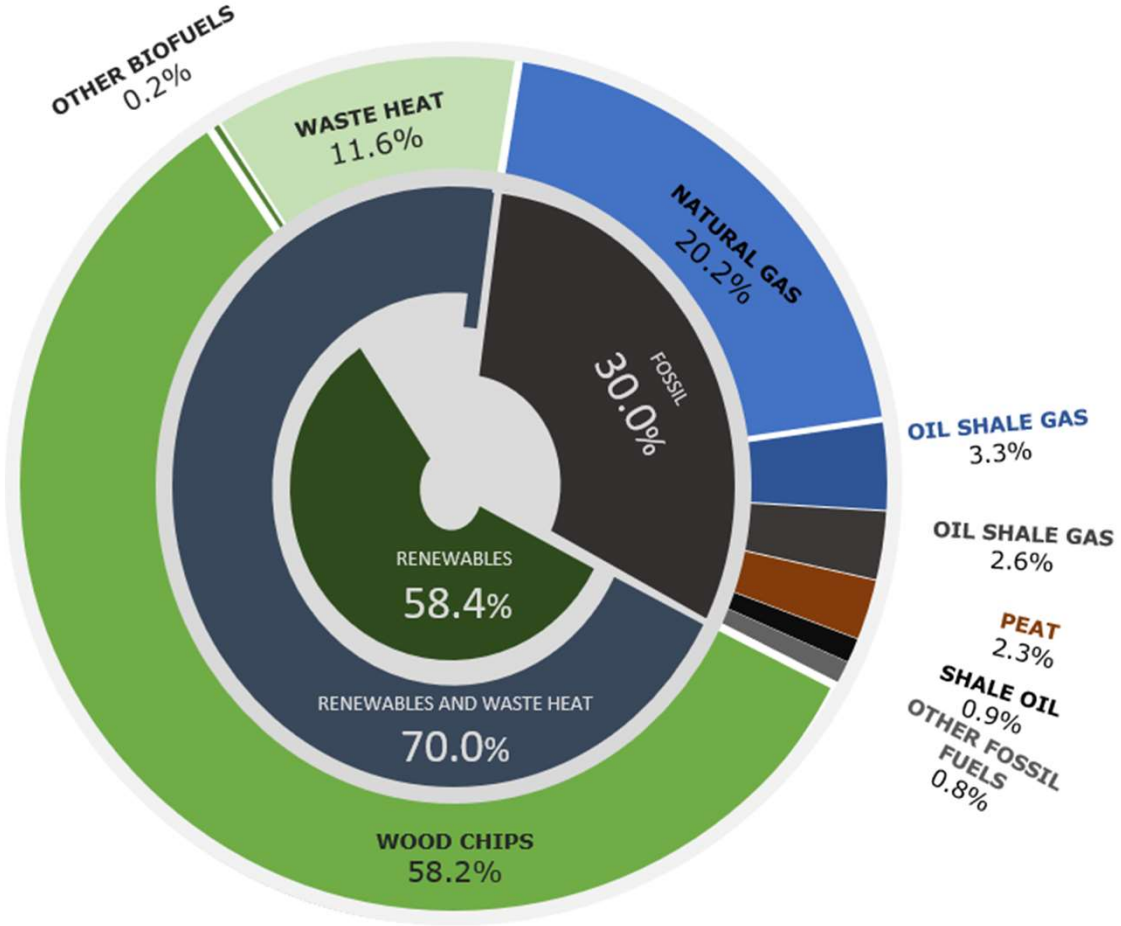
AALBORG UNIVERSITY
DENMARK

7th International Conference on Smart Energy Systems
21-22 September 2021
#SESAAU2021

energy CLUSTER DENMARK

DH SECTOR IN ESTONIA. 2020

Results 1/3



COGENERATED HEAT

42%

reINVEST
sEEnergies
Innovation Fund Denmark
Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463
GRUNDFOS
HOFOR
kamstrup
LOGSTOR
INNARGI
Vestas
ENGINEERING TOMORROW
Danfoss

AALBORG UNIVERSITY
DENMARK

7th International Conference on Smart Energy Systems
21-22 September 2021
#SESAAU2021

energy CLUSTER DENMARK

Results 2/3

CALCULATION METHOD	According to 2020 data	
	DH heat delivered, MWh	CO_2 specific emission factor, $kgCO_2/MWh_{heat}$
"power bonus"	3,673,820	-19.8
proportional allocation		85.9

Local heat production with natural gas boiler about 200 $kgCO_2/MWh_{heat}$

Powered by

reINVEST sEEnergies GRUNDFOS HOFOR kamstrup LOGSTOR

Innovation Fund Denmark

Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463

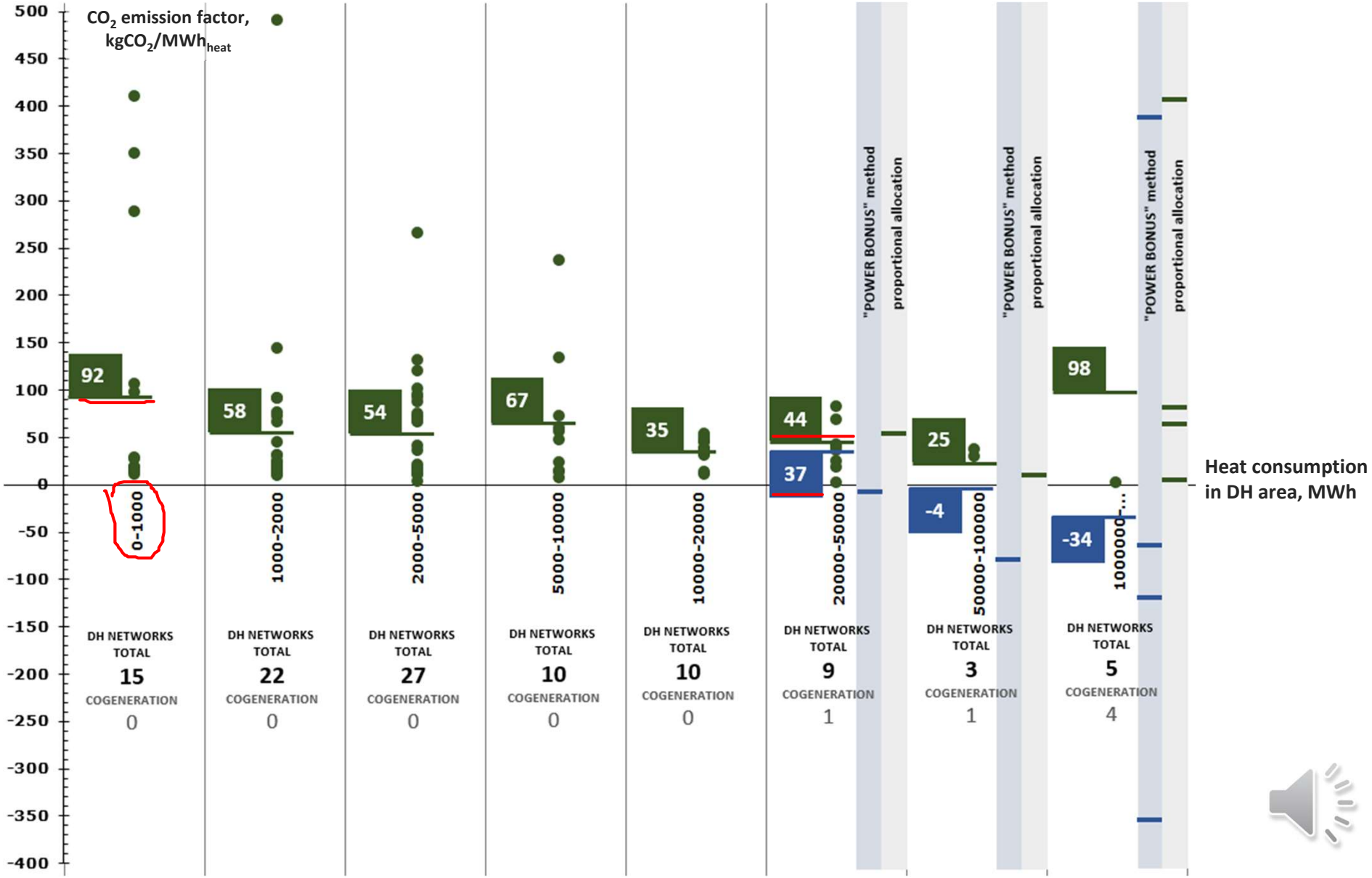
INNARGI Vestas ENGINEERING TOMORROW Danfoss

AALBORG UNIVERSITY
DENMARK

7th International Conference on Smart Energy Systems
21-22 September 2021
#SESAAU2021

energy CLUSTER DENMARK

Results 3/3



Discussion and conclusions

There is no consistent and clear definition of waste energy (waste heat and waste cooling) in the Estonian regulatory documents.

The overall efficiencies of some cogeneration CHP units in district heating areas with cogeneration were below the reference values from standard EN 15316-4-5:2017. Reasonable to improve the way of accounting.

It is reasonable to select one method for calculations to avoid unclear/misundestooding results.

Powered by

reINVEST
sEEnergies
Innovation Fund Denmark
Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463
GRUNDFOS
HOFOR
kamstrup
LOGSTOR
INNARGI
Vestas
ENGINEERING TOMORROW
Danfoss

AALBORG UNIVERSITY
DENMARK

7th International Conference on Smart Energy Systems
21-22 September 2021
#SESAAU2021

energy CLUSTER DENMARK

THANK YOU

Eduard Latõšov
Associate professor, PhD, EUR ING
Programme Director (Energy Technology and Thermal Engineering)
Department of Energy Technology
Tallinn University of Technology
Tel +372 620 3908, Mobile +372 5335 9298
eduard.latosov@taltech.ee
www.taltech.ee

TAL TECH

Powered by

reINVEST

sEEnergies

Innovation Fund Denmark

Funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463

GRUNDFOS

HOFOR

kamstrup

LOGSTOR

INNARGI

Vestas

ENGINEERING TOMORROW

Danfoss