

Efficient District Heating and Cooling

Does it promote the 2050 decarbonisation goals?

eceee 2021
Summer Study on energy efficiency

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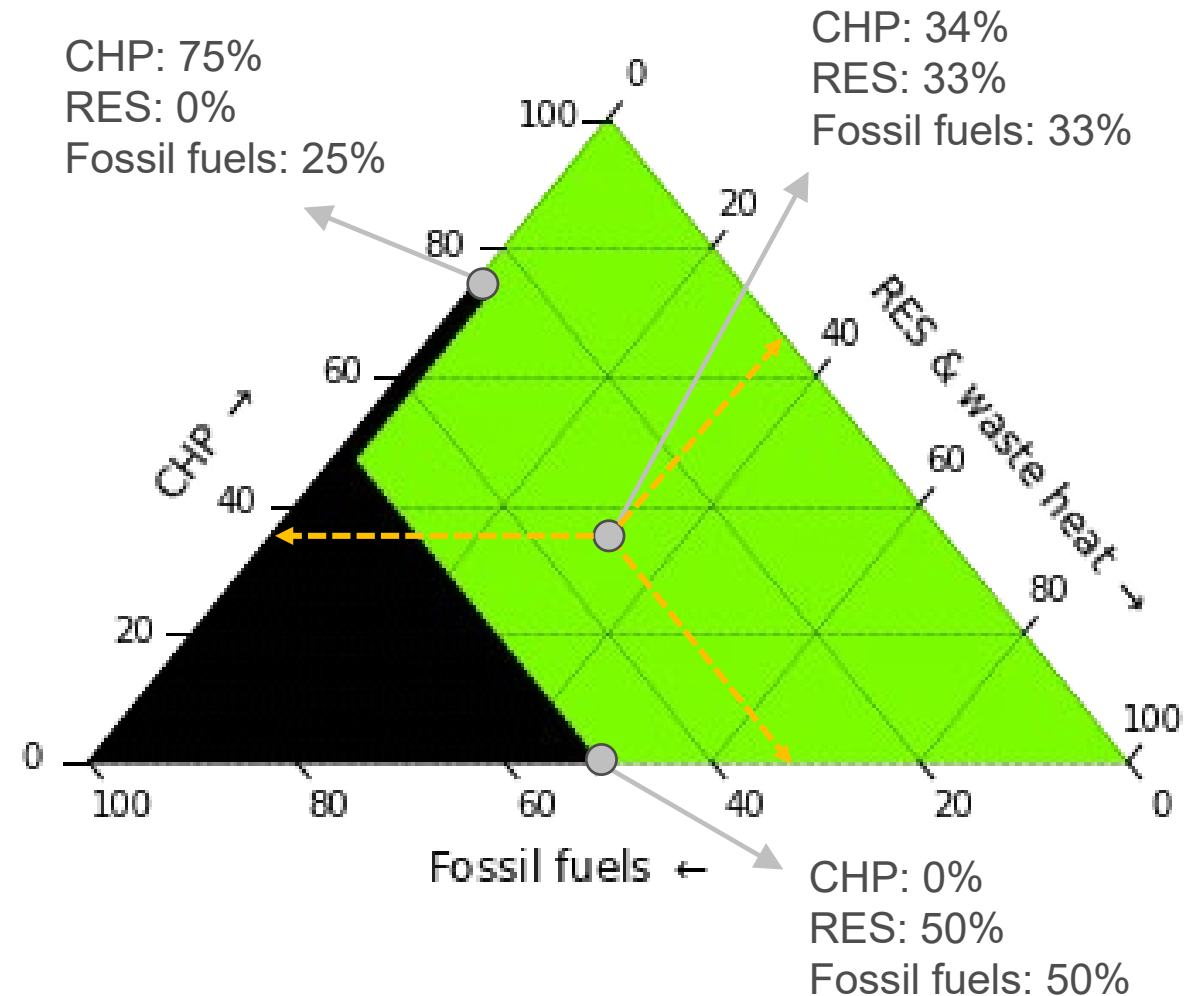
8th June, 2021

Context and Objectives

- Provide background analysis to account and monitor the deployment of efficient district heating and cooling networks for the future recast Energy Efficiency Directive and Renewable Energy Directive
- Interpretation and discussion of the definition of Efficient District heating and cooling and its limitations
- Propose considerations for improving the definition aligned with the ambition to be a net-zero continent by 2050

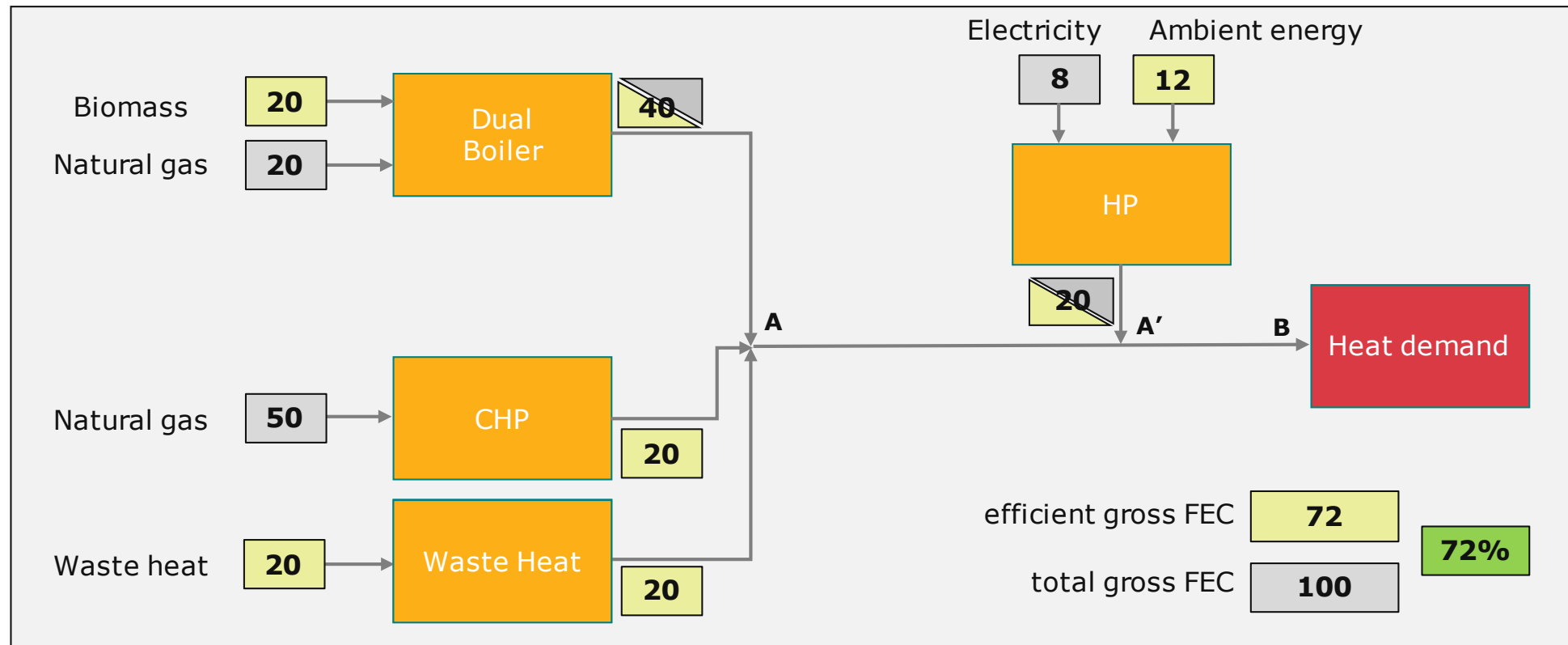
Current definition

‘Efficient district heating and cooling’, as defined first in Article 2(41) of the EED, means a district heating or cooling system using at least **50 % renewable energy, 50 % waste heat, 75 % of cogenerated heat or 50 % of a combination of such energy and heat**’.



Current definition — Interpretation

Energy flows | Thermal losses | Combination of thresholds | The role of CHP

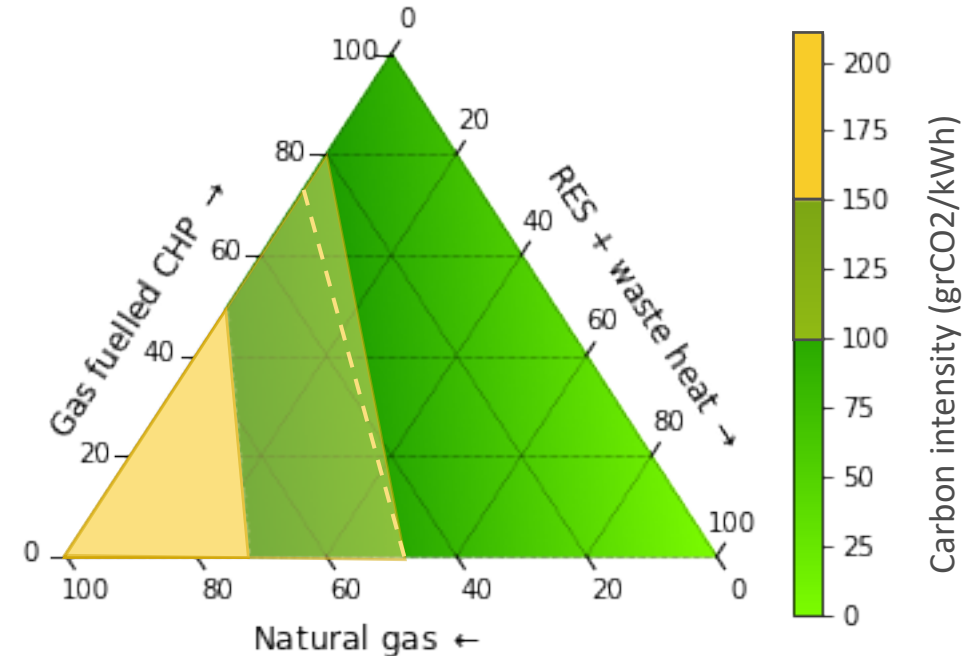
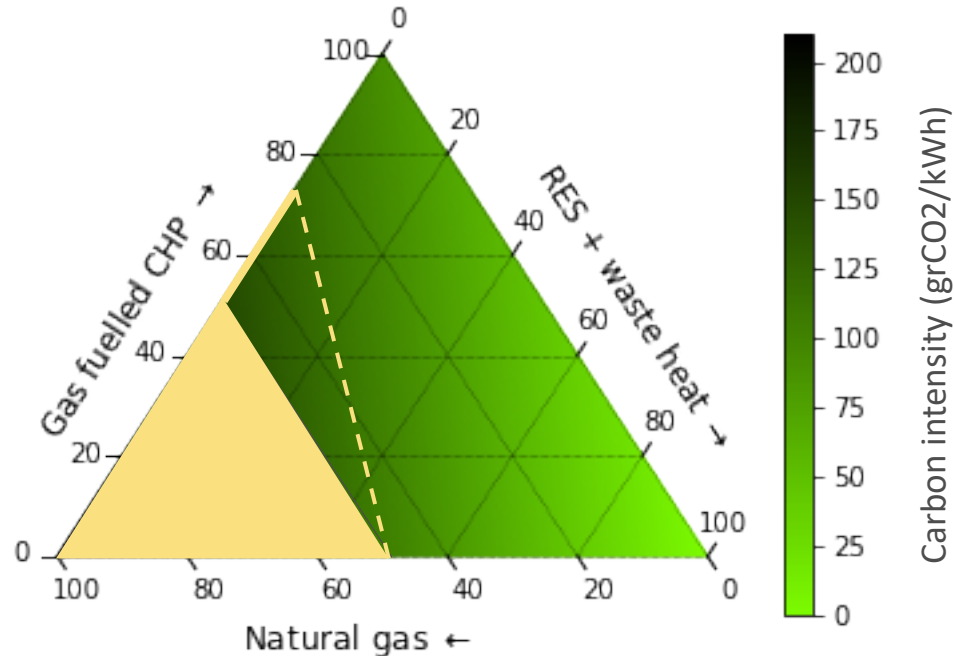


Proposed clarification of current definition – short term

‘Efficient district heating and cooling’, as defined first in Article 2(41) of the EED, means a district heating or cooling system using at least 50 % renewable energy, 50 % waste heat, 75 % of **high-efficiency** cogenerated heat or 50 % of a combination of such **thermal energy going into the network**’.

From Efficient to Clean/Net-zero DHC? (I)

Energy flows | Thermal losses | **Combination of thresholds** | The role of CHP



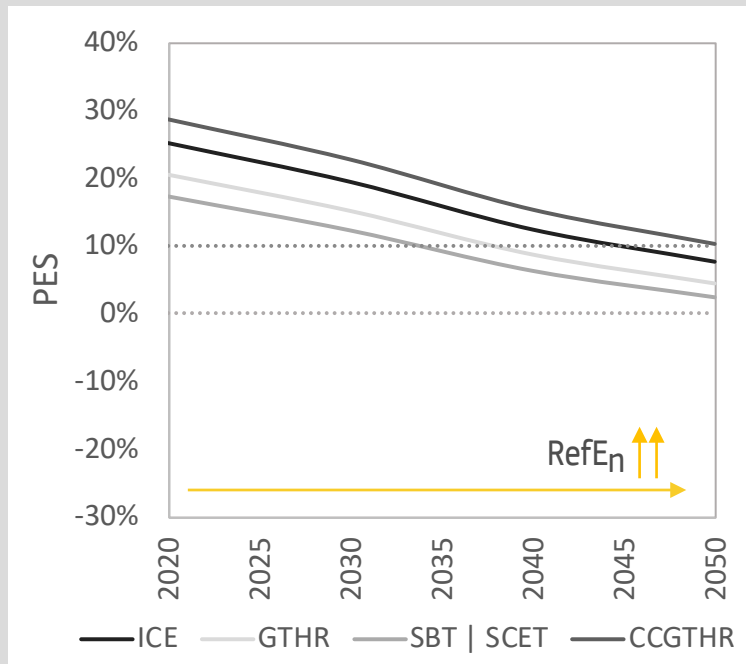
From efficient to Clean/Net-zero DHC? (II)

Energy flows | Thermal losses | Combination of thresholds | **The role of CHP**

Efficient in its traditional form: ration output to input

$$PES = 1 - \frac{1}{\frac{CHPH_n}{RefH_n} + \frac{CHPE_n}{RefE_n}} > 0.1$$

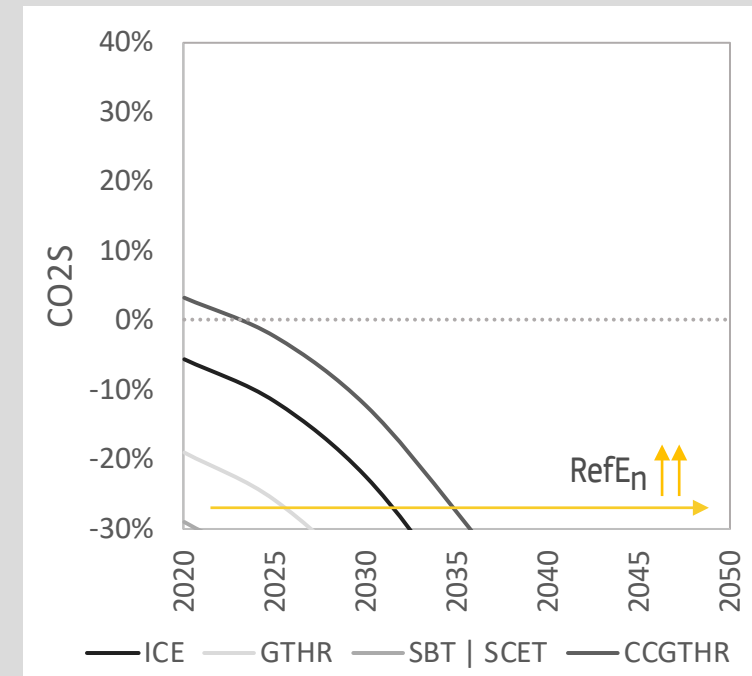
RefH_n = 103%
Condensing gas boiler



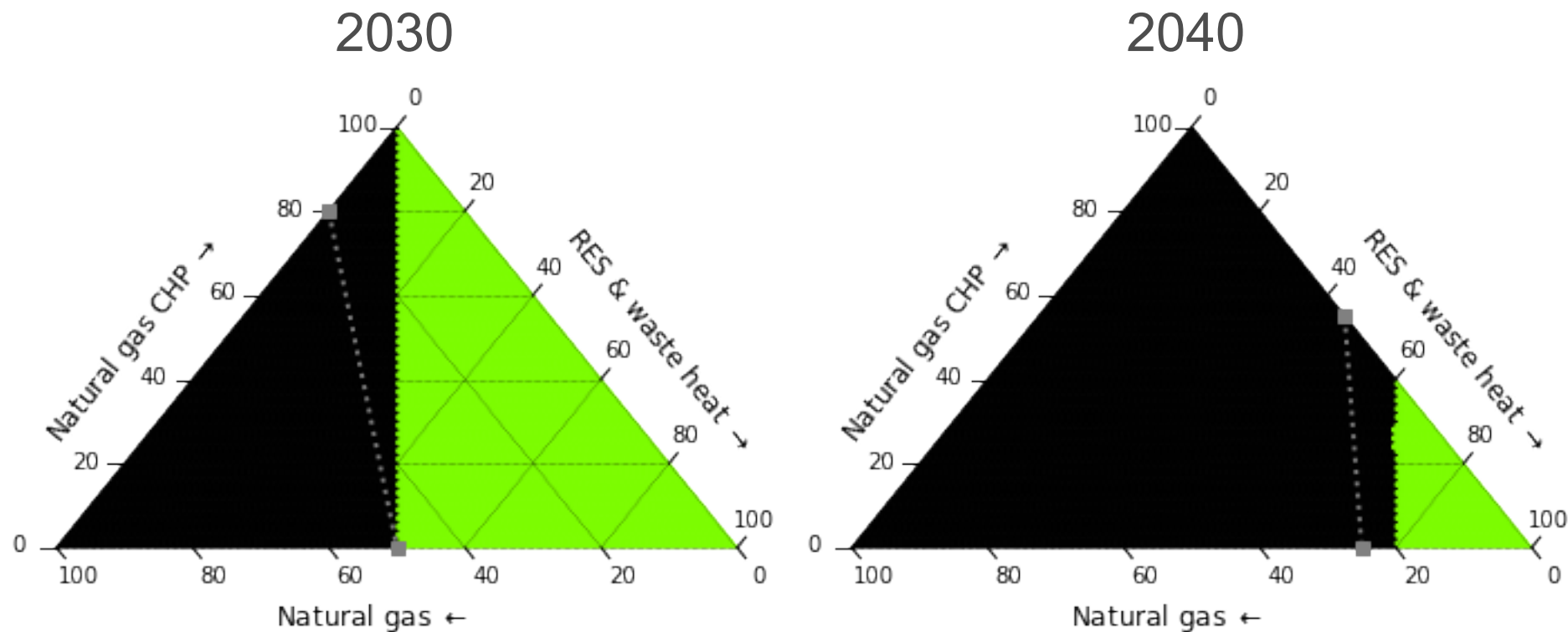
Clean in the form of CO2 emissions

$$CO2S = 1 - \left(\frac{CHP_{ef,h} + CHP_{ef,el}}{Ref_{ef,h} + Ref_{ef,el}} \right)$$

RefH_n = 103%
Condensing gas boiler



Proposed definition for Clean/Net-Zero DHC – long term



Possible directions for an updated definition

By 2030, 'Efficient district heating and cooling', means a district heating or cooling system using always **equal or more** renewable energy technologies than fossil fueled individual generation energy technologies.

By 2040, 'Clean district heating and cooling', means a district heating or cooling system using **always 60 percentage points** more renewable than fossil fuels fueled individual generation energy technologies.

By 2050, 'Clean district heating and cooling', means a district heating or cooling system using **exclusively** a combination of renewable fueled (either individual or combined generation) heat, including solar thermal, geothermal and ambient heat, and waste heat/cold sources.

Thank you

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Based on work done by Jiménez-Navarro, J.P., Filippidou, F., Kavvadias, K., Carlsson, J.



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EDHE tool

EDHE - Efficient District heating evaluation

fill white cells only

Duplicate sheet

Input data

Input data	
Select country	AT
Select year	2050

CO2 intensity of national power m	61.0
National power efficiency (η)	75.3%

Assumptions

Account CHP-electricity?	<input checked="" type="checkbox"/> Mark if Yes
CO2 allocation option for CHP	Exergetic (REDII Annex.VI)
Temperature of heat supply ($^{\circ}\text{C}$)	60
DH Thermal losses (%)	10%

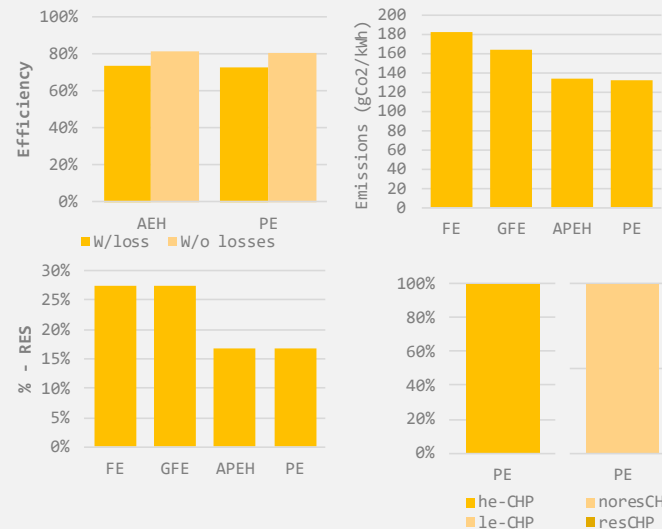
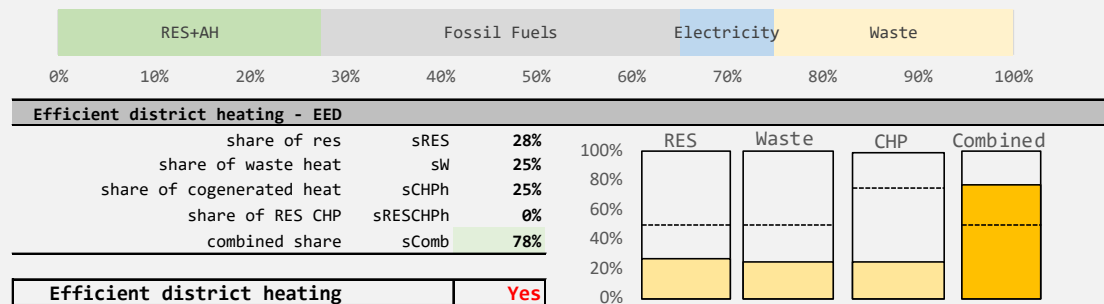
← Click to fill with national average DH losses (EUROSTAT)

Fill the Table below or select a predefined op Default

Technology	Input fuel	Heat capacity	Total		
			MW	TJ	η_{th}
Heat units	Natural gas		5	0.85	0.00
Heat units	Renewable		5	0.85	0.00
CHP	Natural gas		10	0.45	0.40
Heat pumps	Electricity		10	2.50	0.00
Heat recovery units	Waste		10	0.90	0.00
Heat units	Waste		0	0.85	0.00
Heat units	Electricity		0	0.85	0.00
TOTALS			40	1.04	0.40

← Click to fill with default technology efficiencies

Results



Legend

- AEH Available energy for heat
- PE Primary energy
- FE Final Energy
- GFE Gross Final Energy
- he-CHP highly-efficient CHP ($\eta > 85\%$)
- le-CHP low-efficient CHP ($\eta < 85\%$)
- noresCHP non-renewable CHP
- resCHP renewable CHP
- η_{th} thermal efficiency
- η_e electric efficiency
- AH Ambient Heat

Background information

Efficiency evolution for the heat and power sector in the EU.

Source: POTEnCIA

