Coal Phase Out & Production of Green Energy in Poland

RE-BUILDING Europe Conference

Jörn Erik Mantz

09-05-2023

District heating chance and challenge for Decarbonising Poland

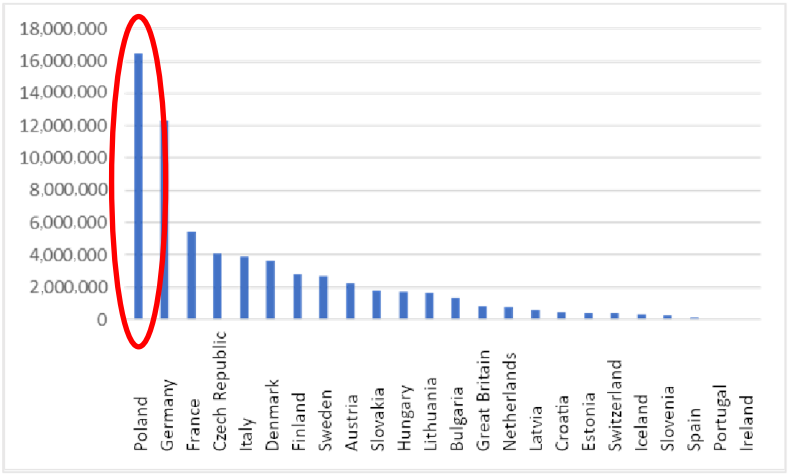


Chart 4: Number of large-scale heat consumers, 2017[17]

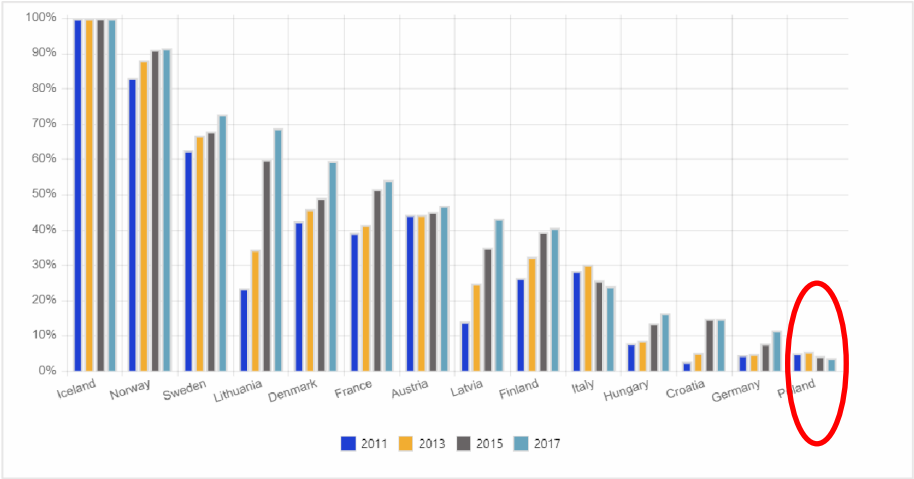
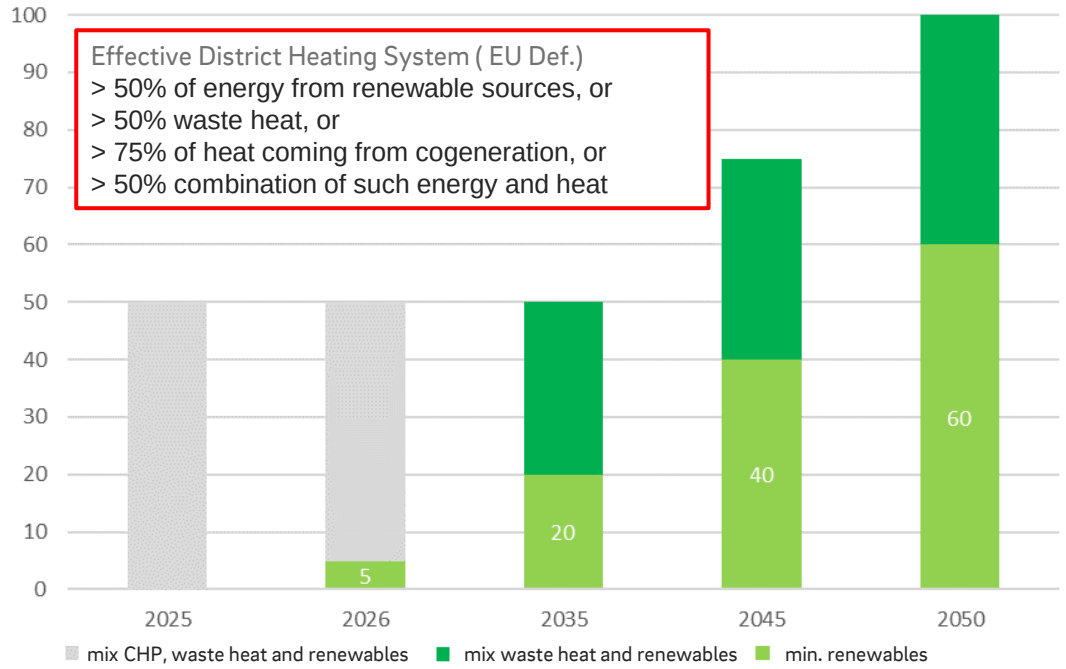


Chart 7: Share of renewable energy in large-scale district heating[20]

387 DH companies supply 16 m customers – 1 of 4 in Europe – DH accounts for > 50 of gross final energy consumption -> less then 10 % from RES resources (2020 Fit for 55 analysis of PTEZ)

“Effective” District Heating Systems a base for EU “Fit for 55” Decarbonisation Programm



Consequences, if DH system does not fulfill criteria

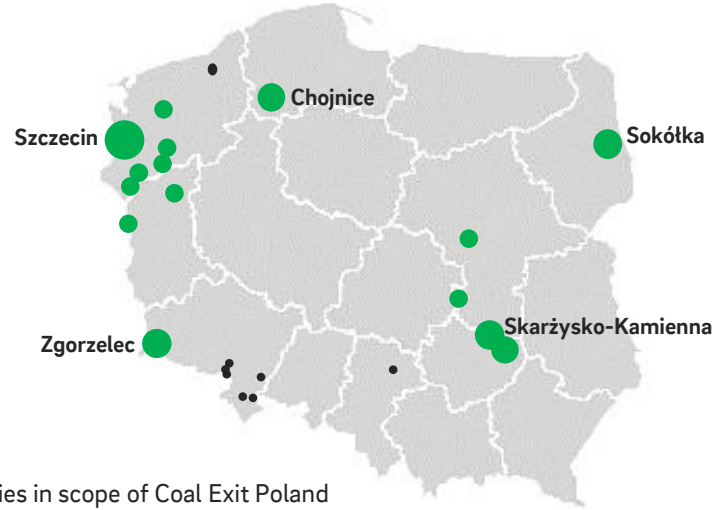
- Limited access to financing options for modernization and maintenance of system
- Mandatory connection of new renewable third party generation
- Customers are allowed to disconnect from DH system
- CAPEX invested in DH system not compliant to EU Taxonomy
- Not allowed to use simplified tariff calculation method

Do we need to change -> With > 60 % heat from coal – Yes we do !

Coal Exit Poland: E.ON position 2023

E.ON DH Portfolio in Poland:

- 535 MWth installed capacity - coal-based (80%))
- 952 GWh/a average heat production - coal-based (94%))
- 23 cities - 15 cities in scope of first decarb. process



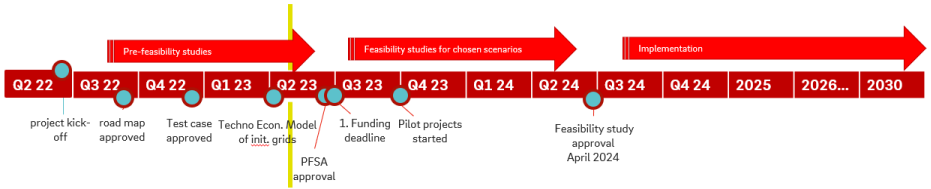
Cities in scope of Coal Exit Poland

Systems not in scope (smaller than 5 MW)

E.ON Goals

1. Replace coal-based generation until 2030
2. Decarbonise to max. extend by 2035
3. Fulfil Polish and EU environmental regulation

What does this mean?



Large variety of alternative technologies exist

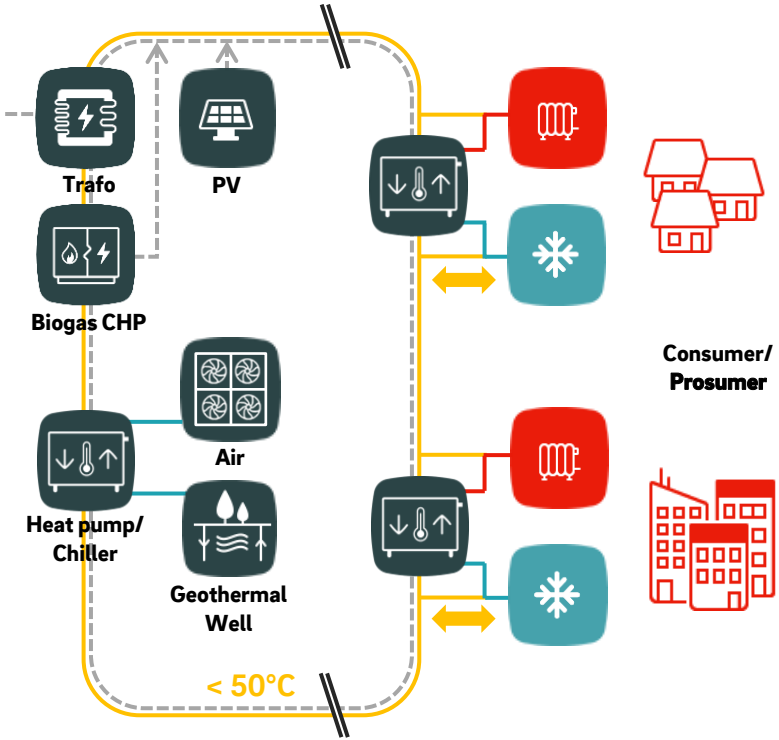
Electricity or Combustion	Technology	Description	Carbon emissions (tCO2e / MWh)	Security of supply	Air Pollutants (Particles, SO2, NOX, CH4, N20)
Electricity based (heat pump coupled)	Geothermal	Subsurface hot water for generating heat for DH network	0	• Stable baseload supply. No seasonality constraints • Not reliant on fuel commodity so stable supply/OPEX price	
	Electric heat pumps	Electricity-based pumps, e.g. air-to-water or water-to-water	0	• Partially dependent on water access • Low functionality in cold temperatures	
	Solar thermal	Solar thermal collectors feeding solar heat into DH networks	0	• Supply reliant on sunlight. Sunlight/heat storage required. • Space constrained for urban environments	
Combustion based with Carbon Capture and Storage (CCS) [1]	Waste + CCS	Burning of waste to generate heat with carbon capture applied	0.05	• Dependent on local resource / transport • No seasonality constraints	
	Coal, Oil, Natural gas + CCS	Burning of coal, natural gas, oil with carbon capture applied	0.05	• Relies on significant and often long fuel transportation • Subject to large price fluctuations	
	Biomass + CCS	Incineration of bio-material with carbon capture applied	0.06	• Dependent on local resource and increasingly on long fuel transportation. • No seasonality constraint for producing heat but future risk on commodity prices.	
Combustion based without CCS	Waste	Burning of waste to generate heat in single combustion of CPH plant	0.32	• Dependent on local resource / transport • No seasonality constraints	
	Coal, Oil, Natural gas	Burning of coal, natural gas, oil to generate heat in single combustion of CPH plant	0.36	• Relies on significant and often long fuel transportation • Subject to large price fluctuations	
	Biomass	Incineration of bio-material e.g. wood pellets, to produce heat	0.41	• Dependent on local resource and increasingly on long fuel transportation. • No seasonality constraint for producing heat but future risk on commodity prices.	
	Hydrogen boilers	Burning of hydrogen gas to generate heat	0	• Very limited expensive fuel supply. Fuel supply targeted for hard to abate industries • No seasonality constraints but subject to large future risk on commodity prices.	
Other	Surplus heat	Use of surplus heat from industrials and urban sources	Depends on specific heat source	• Dep. on local capacity; decreasing with green electrification • No seasonality constraints	Depends on specific heat source

E.ON energy design for the future of Tegel XL

The Project

- Development airport area TXL to Urban Tech Republic
- 1.000 companies (17.500 jobs)
- Relocating of Beuth University (5.000 Studenten)
- 5.000 apartments
- **Sustainable primary energy sources**
- Biogas, geothermal, ambient energy, industrial excess heat, solar energy

LowEx network (40°C winter, 20°C summer)



Significant investment is needed but considerable carbon savings are possible

ITEMS	UNIT	MINIMUM	MAXIMUM
CAPEX (approx.)	[mln €]	200	350
CAPEX netto ex. Sub.	[mln €]	100	310
Avoided CO_2 emissions	[t/a]	120 000	244 000
	%	44	89

Polish tariff system with little incentive to change

- **Polish district heating market is fully regulated for DH systems with ordered capacity > 5 MW.**
- **A tariff validity period set by the President of URE: 1 to 3 years**
- **Heat prices: cost + X[1] approach separately for production and distribution**
- **Cogeneration:**
  - **Simplified heat price tariff calculation is allowed based on published reference prices for different fuel types**
  - **Power sales is not reflected in heat price tariff calculation; pot. to generate additional margin depending on fuel spread**

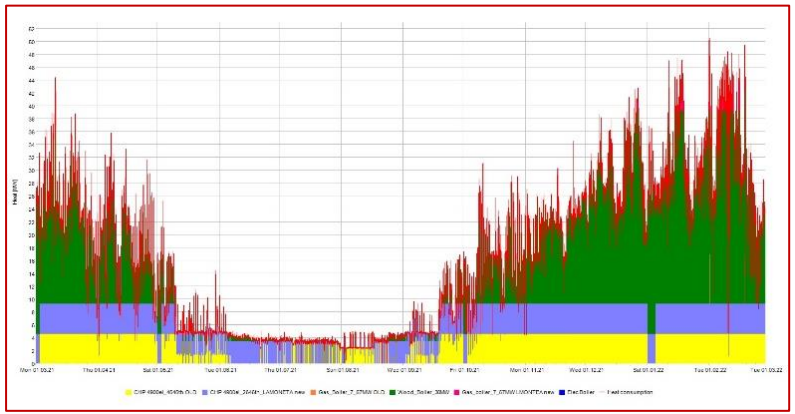
Opportunities to improve return on investment:

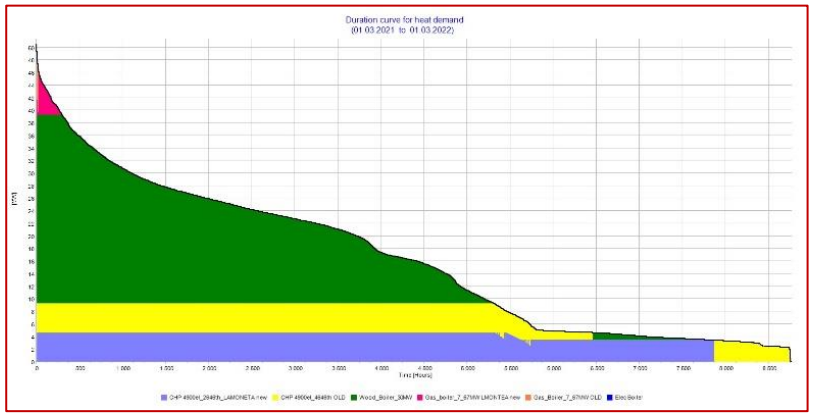
- **One-off bonuses just for one fiscal year:**
  - **for investments reducing CO_2 emissions: WACC increased by 1% for every 25% of CO_2 emissions saved**
  - **for investment intensity: for investments above 50% of depreciation costs plus WACC multiplied by the value of undepreciated assets: 1.5-3.0%**
- **Increase WACC**
  - **By sale of power or Capacity Fee collection -> CHP requiring high temperatures & combustion technologies**

1) X = WACC (set by the Regulator, 6.388%, to be adjusted four times per year) multiplied with the value of undepreciated assets

Runtime is the key challenge for RES resources in conventional DH – a project sample

City of Skarżysko-Kamienna has a population of **43,000**
32 km of district heating network, **540** heat substations.
Consumers structure: multi-family buildings: 61%; public buildings: 21%; industry: 18% (MESCO)
Connection of multi-family buildings to hot water - annually 3-5 buildings
CHP system operational support (guaranteed bonus) until 2035
Heat demand 65 MW (ordered) – Production 470 000 GJ/a

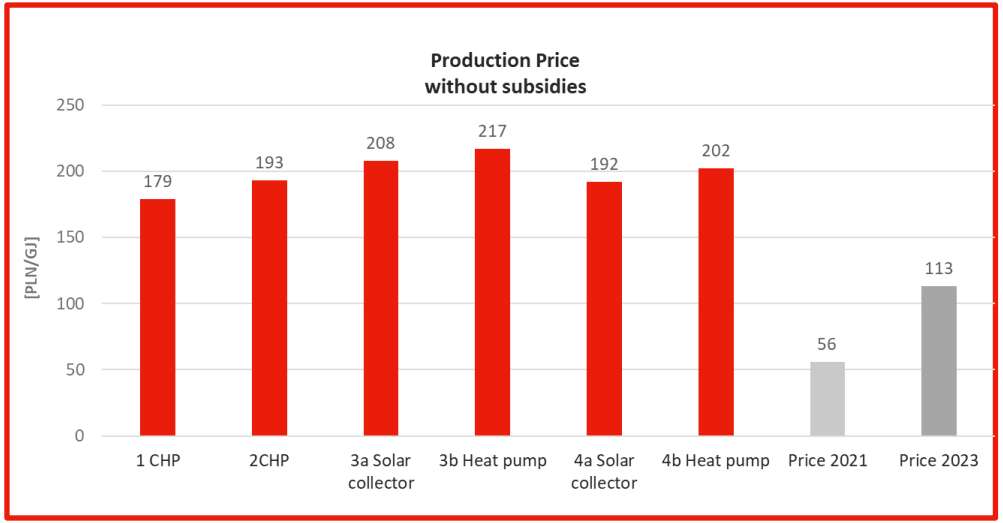




Results Sample Project

Status as of: March 2023

Currently existing production units:
CHP gas 5 MWt
HOB gas 8 MWt



Currently only CHP based solutions allow acceptable returns

Scenario	New production units	CAPEX [mln PLN]	IRR [%]	CO_2 emissions [T/year]	Fit for 55 2026	Fit for 55 2035	Evaluation
1	CHP-HOB_{gas}-$HOB_{Biomass}$-Electrode B.	124	12,4%	33 900	✓	✓	1.31[2]
2	CHP-HOB_{gas}-$HOB_{Biomass}$	140	10,8%	33 900	✓	✓	1.20
3a	Solar collectors-$HOB_{biomass}$	144	6,1%	32 115	✓	✓[1]	0.97
3b	Heat pump-$HOB_{biomass}$	155	6,3%	32 115	✓	✓[1]	0.95
4a	Solar collectors-ORC-$HOB_{biomass}$	171	<%	20 576	✓	✓	0.85
4b	Heat pump-ORC-$HOB_{biomass}$	182	4,2%	20 576	✓	✓	1.00

1) Through production management, it is possible to reach a share of 50% RES in 2035.

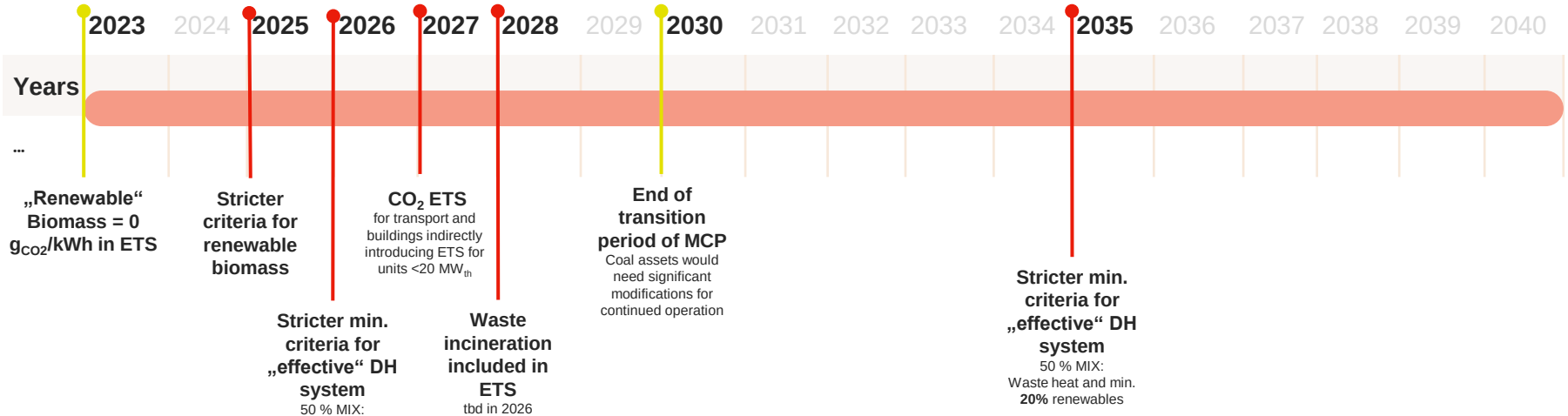
2) The higher the score the better the scenario

Main conclusions

- District Heating is a main source of heat in Poland dominated by carbon intensive fossil fuels and high temperature solutions
- Change is needed to comply with EU “Fit for 55”
- Technologies & concepts for more efficient and low carbon district heating are available
- High investments are required
- Solutions where only heat is produced today achieve an insufficient IRR of 4-5%.
- Aid programs for investment in green sourcescan significantly improve the attractiveness in terms of price for the customer
- Tariff systems need to adapt to
  - A) incentivize efficiency investments
  - B) promote investments in low temp & low carbon solutions not mainly incentivize CHP production

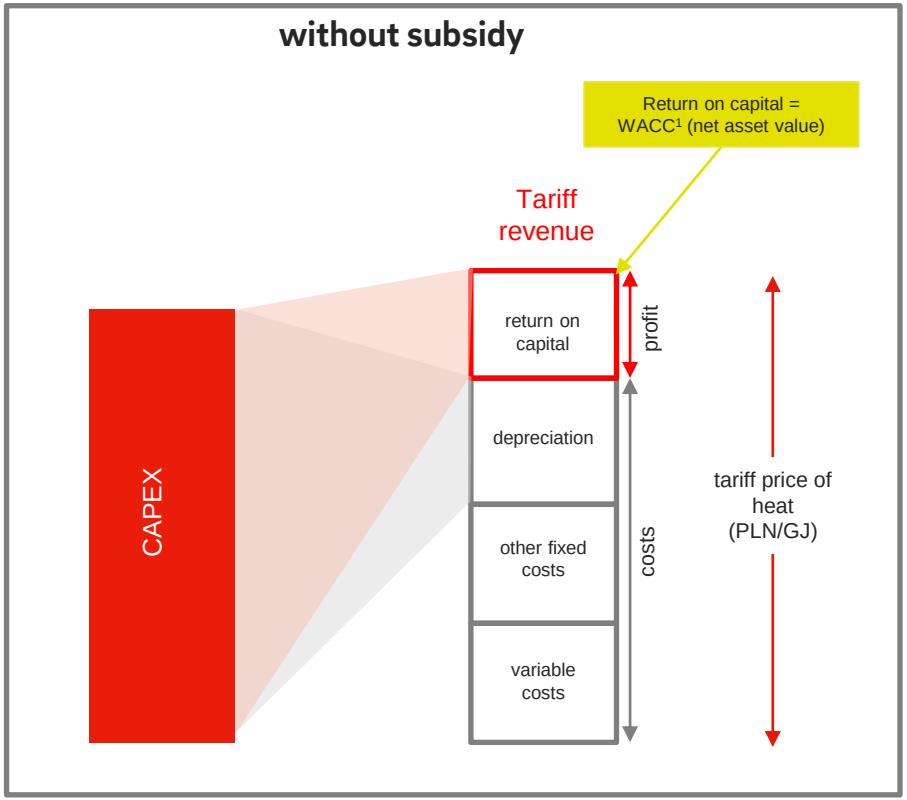
Back Up

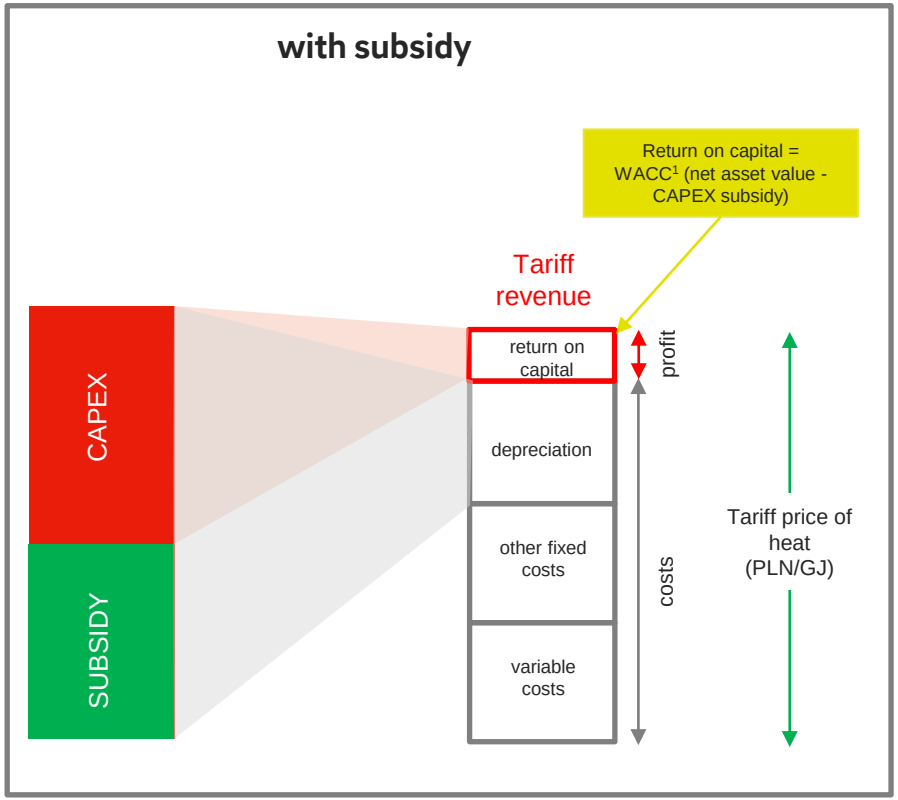
Regulation II: Environmental regulation and outlook



Coal Exit Poland

Impact of subsidies on heat tariff calculation

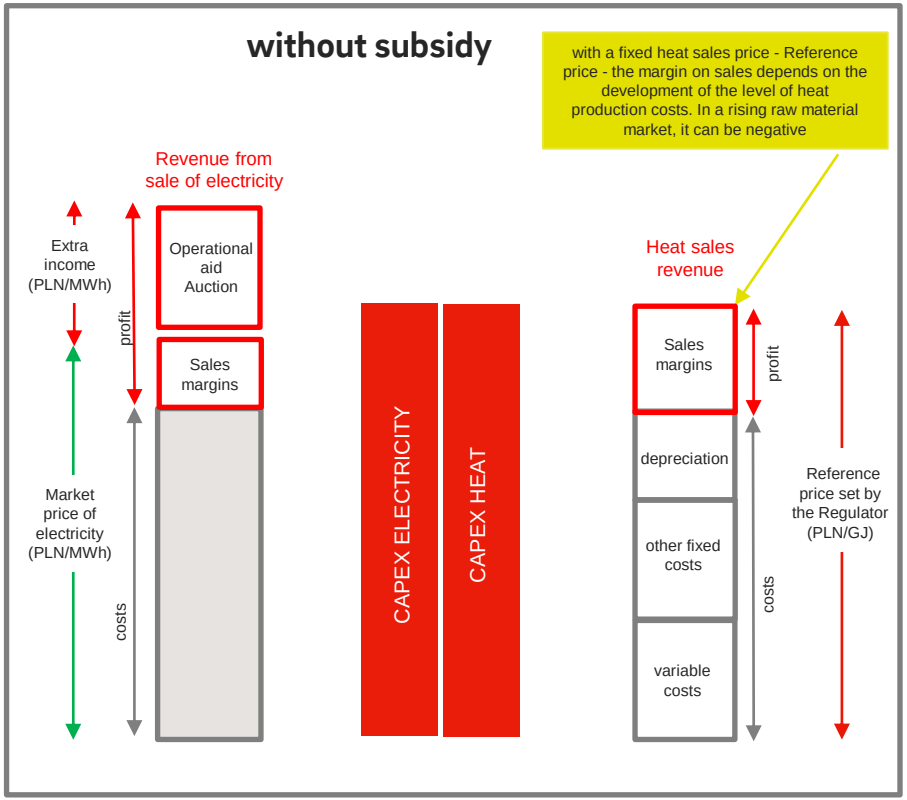


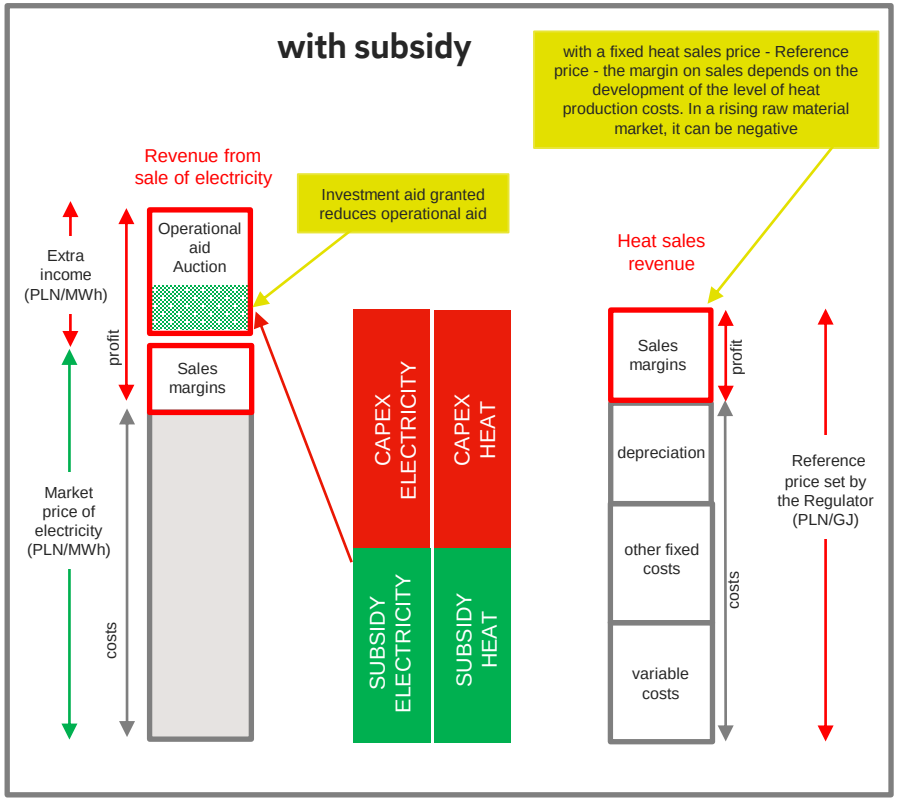


1) WACC (URE) = 6,388%, 1Q 2023

Coal Exit Poland

Impact of subsidies on heat tariff calculation (CHP (gas) >1MW)





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