Development Plan

MPEC Ostróda

Who am I and who is Artelia?

- **Mathias V. Steenstrup**
  Engineer and project manager
  District heating

- **Artelia**
  Independent multi-disciplinary engineering & project management company

- **5 main markets/fields**
  - Energy ← District Heating
  - Industry
  - Buildings
  - Mobility
  - Water

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10,000+
employees

€983 M
2023
turnover

100%
Employee owned

40
countries

100 years
of experience

Projects in countries
100

Agenda/journey

MPEC Ostróda (2025)

Aims

Strategy

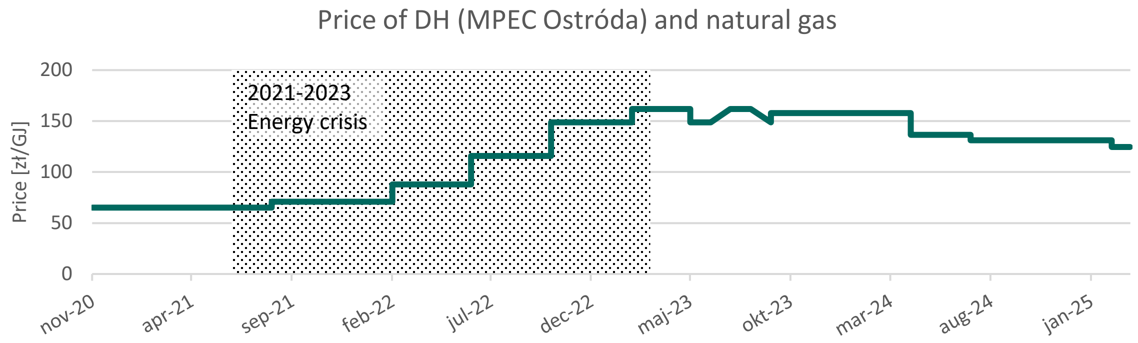
Techno-economic analysis

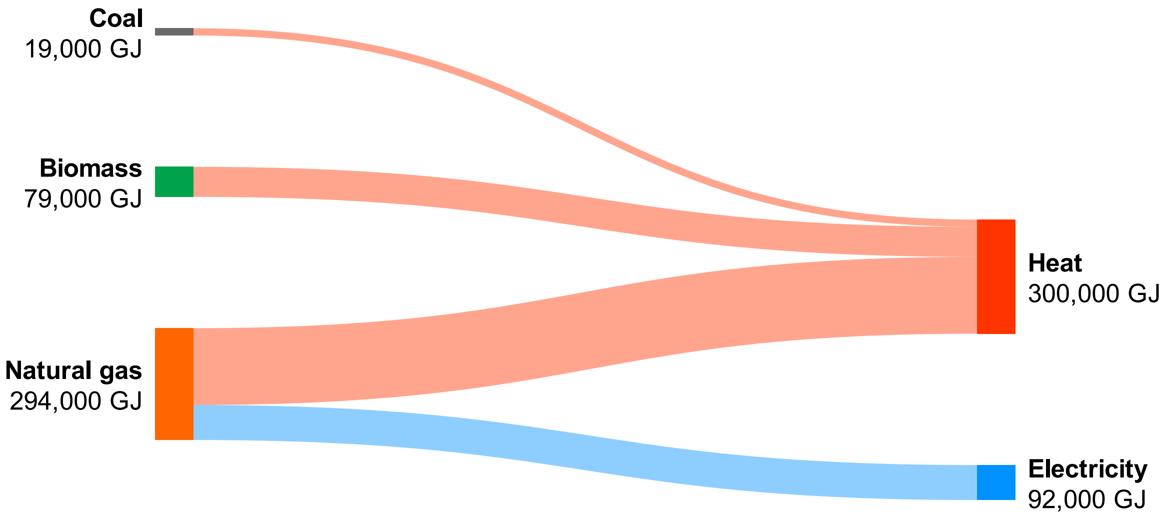
Results

Roadmap 2030 and beyond

MPEC Ostróda 2025

- MPEC Ostróda were formerly dependent on coal
- Today heat (and electricity) is produced from a mix of natural gas, biomass and coal
- The price of heat has been highly influenced by the energy crisis from 2021-2023, but since then MPEC Ostróda has managed to lower the price by 18%





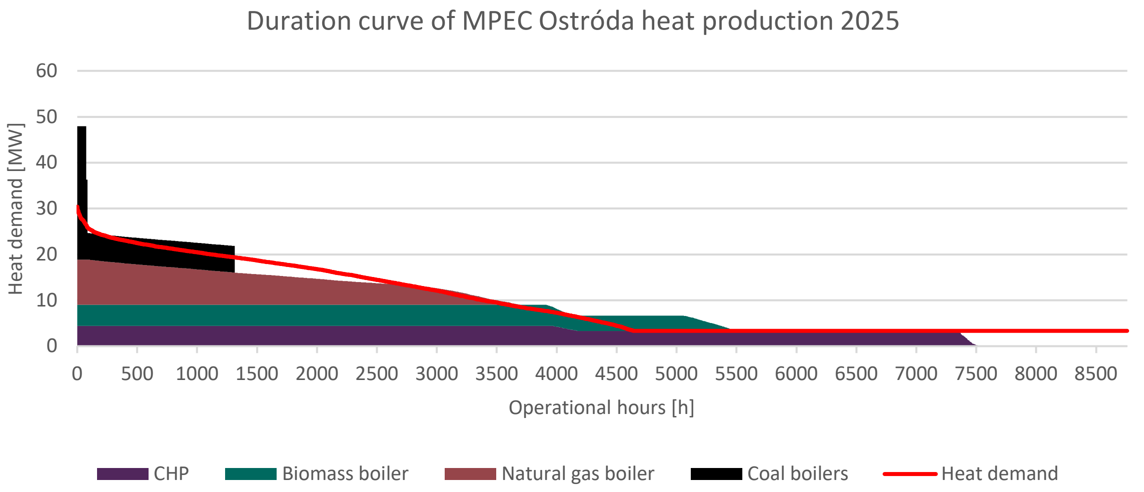
MPEC Ostróda 2025

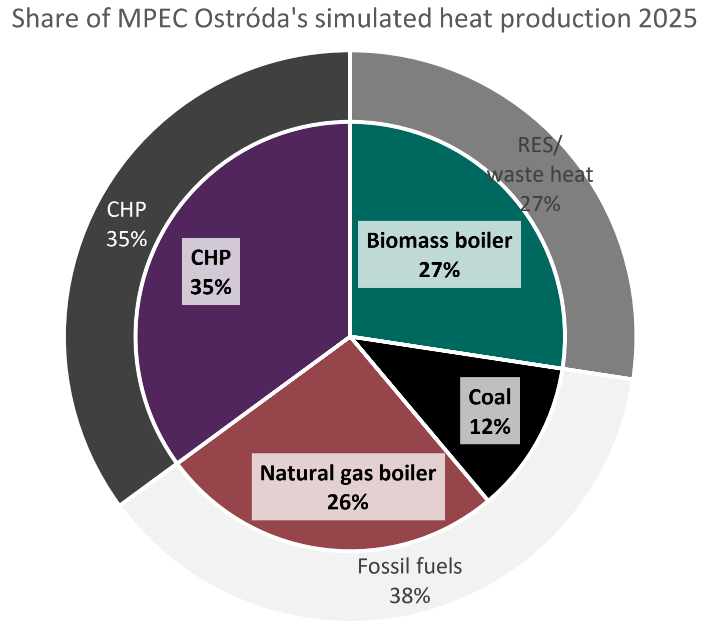
- MPEC Ostróda were formerly dependent on coal
- Today heat (and electricity) is produced from a mix of natural gas, biomass and coal

- A calibrated simulation model of MPEC Ostróda's production is made to simulate future scenarios
  - Simulation tool: EnergyPRO

- Baseload is covered by CHP, biomass boiler and natural gas boiler while the peak load is covered by coal boilers

- The share of RES is 27 % and fossil fuels 38 %
- The remaining 35 % is CHP





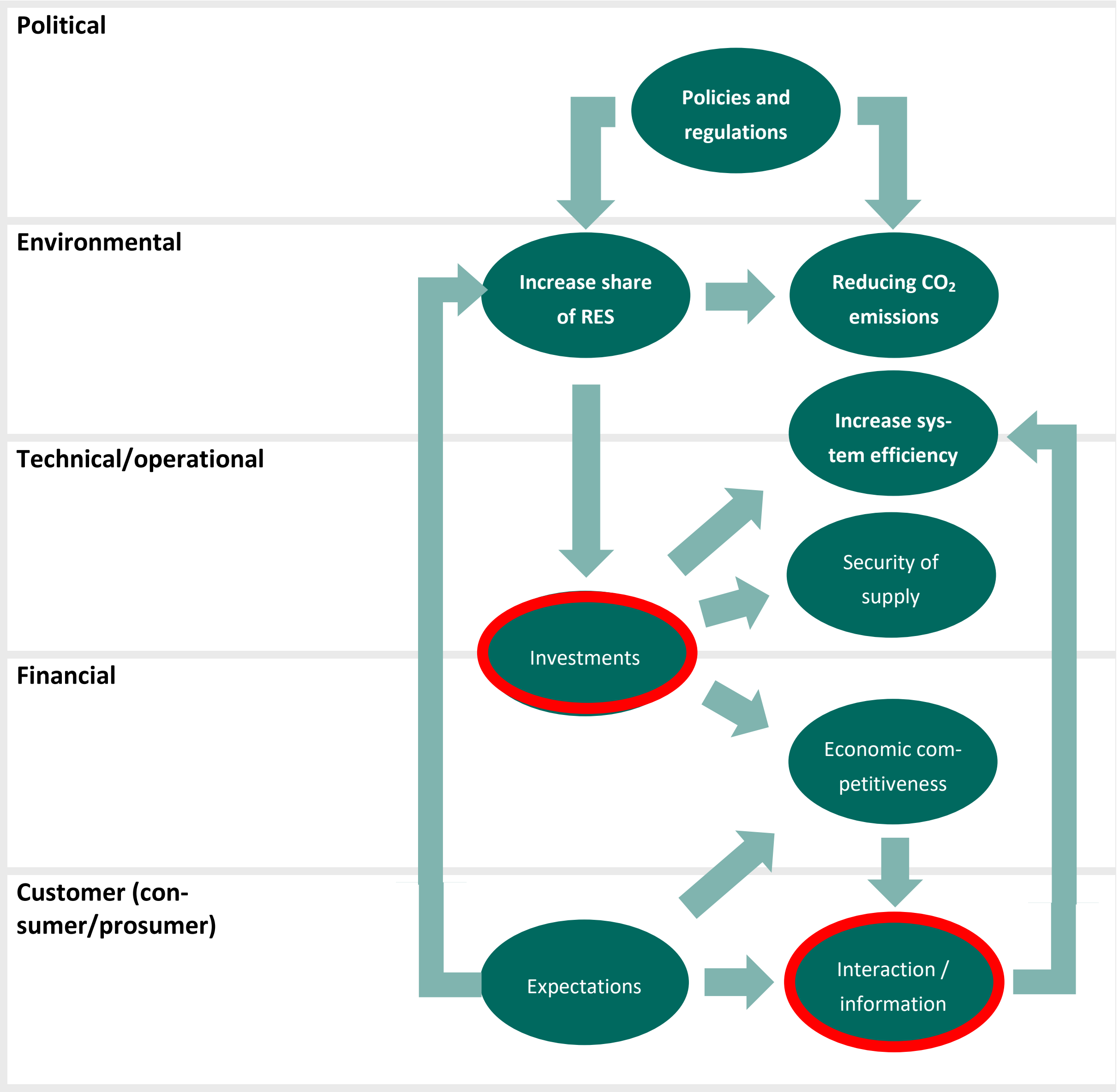
Aims

- EU Energy Efficiency Directive (EU/2023/1791)
  - MPEC Ostróda meets the criteria of 2027 by having 62 % combined RES and CHP
  - The criteria of 2028 can be obtained by meeting the criteria of “high-efficiency CHP”
    - >10 % Primary Energy Saving (PES)
    - <270 gCO_2 per 1 $kWh_{heating+cooling}$
  - Criteria of 2035 are applied for this project
- Local aims
  - …

Time	Criteria	
≤ 31 December 2027	either	Min. 50 % of RES
		Min. 50 % of waste heat
		Min. 75 % of CHP
		Min. 50 % of a combination (RES, waste heat and/or CHP)
≥ 1 January 2028	either	Min. 50 % of RES
		Min. 50 % of waste heat
		Min. 50 % of RES and waste heat
		Min. 80 % of high-efficiency CHP
		Min. 50 % of a combination (RES, waste heat and high-efficiency CHP) and min. 5 % RES
≥ 1 January 2035	either	Min. 50 % of RES
		Min. 50 % of waste heat
		Min. 50 % of a combination (RES and waste heat)
		Min. 80 % of a combination (RES, waste heat and/or high-efficiency CHP and min. 35 % RES
≥ 1 January 2040	either	75 % of RES
		75 % of waste heat
		75 % of a combination (RES and waste heat)
		Min. 95 % of a combination (RES, waste heat and/or high-efficiency CHP and min. 35 % RES
≥ 1 January 2045	either	Min. 75 % of RES
		Min. 75 % of waste heat
		75 % of a combination (RES and waste heat)
≥ 1 January 2050	either	100 % of RES
		100 % of waste heat
		100 % of a combination (RES and waste heat)

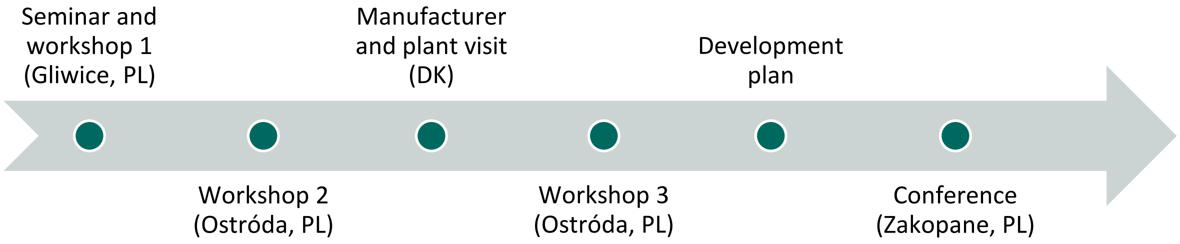
Strategy

- Meet these aims through investments and consumer interaction/information
  - Investments must seek to **increase system efficiency**, **increase security of supply** and **increase the economic competitiveness** by lower heating prices
  - Through consumer interaction/information, the **system efficiency can be increased** by e.g. lower return temperatures and **expectations can be met**



Strategy

- SWOT analysis
  - Obtain knowledge and experiences with RES
  - Seek sources of heat/fuels that increase flexibility (and security of supply) while lower fuel dependency
  - Utilize and further develop on the already well-established infrastructure
  - Seek state-of-the-art technologies at low investment cost by e.g. economic support schemes



Strengths

Well developed infrastructure

Experience

Loyal customers

Environmental benefits

Flexibility (multiple fuel sources)

Weaknesses

High modernization/investment costs

Traditional energy source dependence

Heat sources/fuels may limit feasibility of certain technologies

Lack of experience with RES

Opportunities

Government and EU support

Acquiring new customers + new urban areas

Increasing demand for RES

Excess heat usage

Choice awareness

Threats

Changing regulations

Customer attrition

Households not prioritizing the environment

Choice awareness

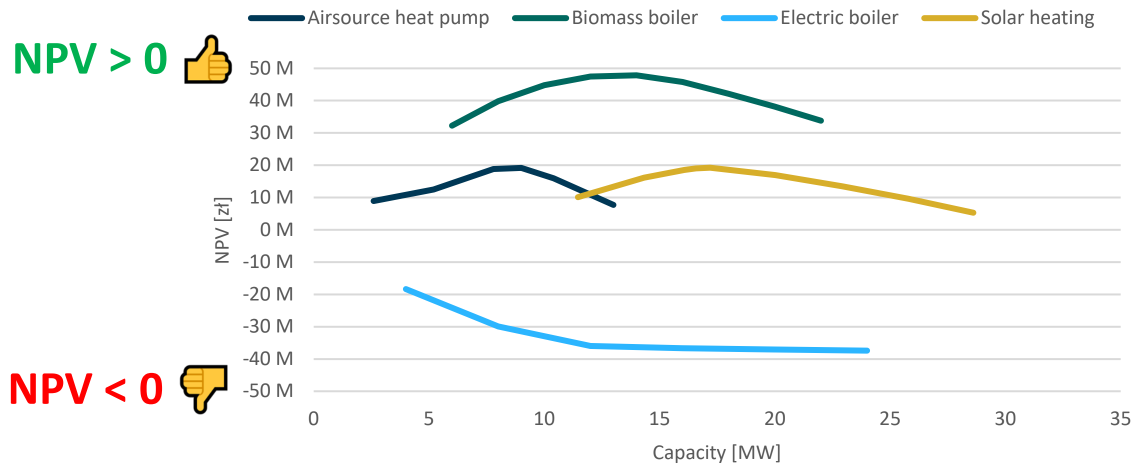
Local opposition

Insulation improvements (lowers demand)

Techno-economic analysis

- Model
  - All productions units (capacity, efficiency etc.)
  - Economic (fuel costs, taxes and tariffs, O&M, incomes etc.)
  - Local conditions (ambient temperatures, solar radiation etc.)
- Hourly simulation of annual production and costs
  - Optimizes production based on the hourly price of each production unit
  - Annual report of **production** and **finance**
- Investment costs
  - Based upon actual and comparable projects
- NPV
  - Combining the investment with the annual operational costs, a net present value can be calculated an compared for each investment

Net Present Value (NPV) is the sum of all future cash flows discounted to present value, used to assess investment profitability.



Techno-economic analysis

- Technology catalogue
  - Heat pumps
  - Electric boiler
  - Biomass boiler and CHP
  - Solar thermal collectors
  - Geothermal energy
  - Excess heat

  - Thermal energy storage

Electricity

RES

Waste heat

Capacity

Investment costs

O&M costs

Operation time

Efficiency

Fuel costs

Net Present Value (NPV)

Evaluation and simulation

Site area

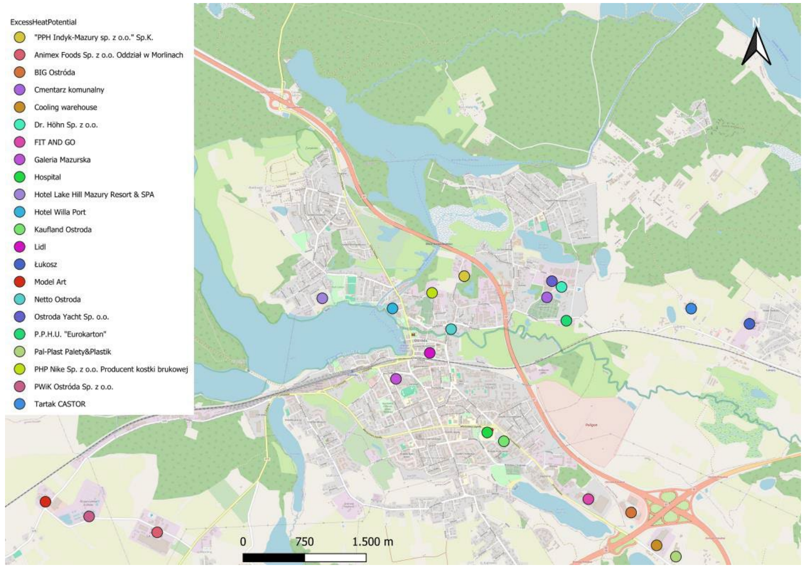
Availability

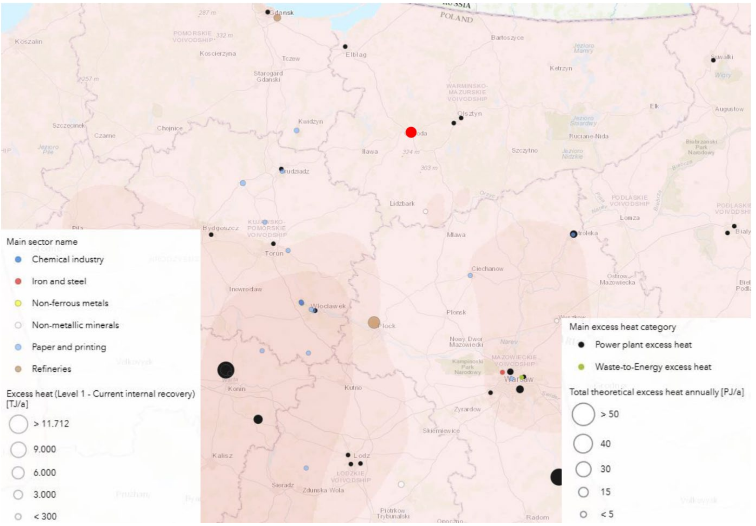
Sustainability

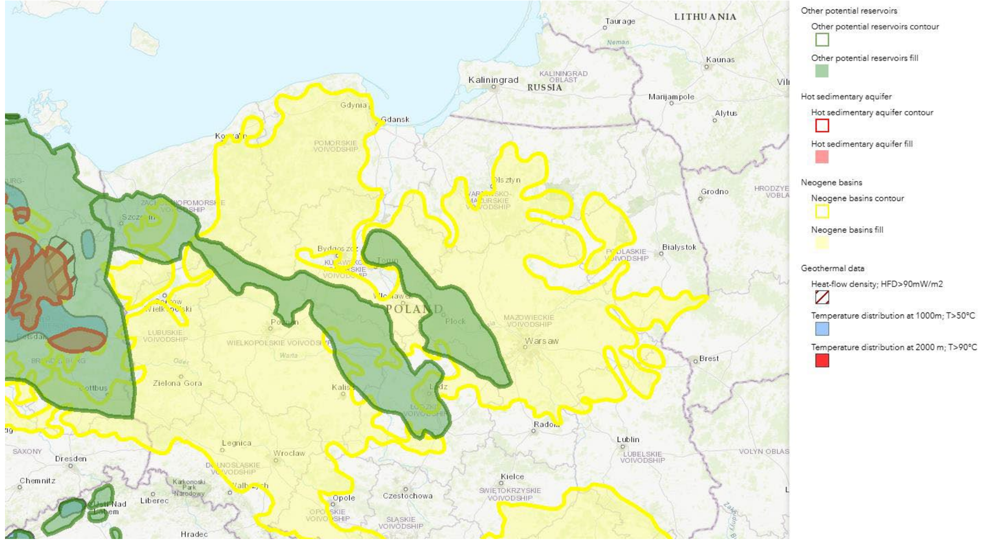
Flexibility/ security of supply

Techno-economic analysis

- Mapping of excess/waste heat
  - Third-party maps
  - Self-produced map
- Low and high temperature sources
  - Higher temperatures are preferred
  - Lower temperatures can be utilized through heat pumps
- Low and high capacity
  - Capacity should be of a certain size for it to be feasible
- Mapping can also be used for other sources of heat such as geothermal energy







Results

Heat Pump
10 MW_{heat}
Air/water
Natural refrigerant

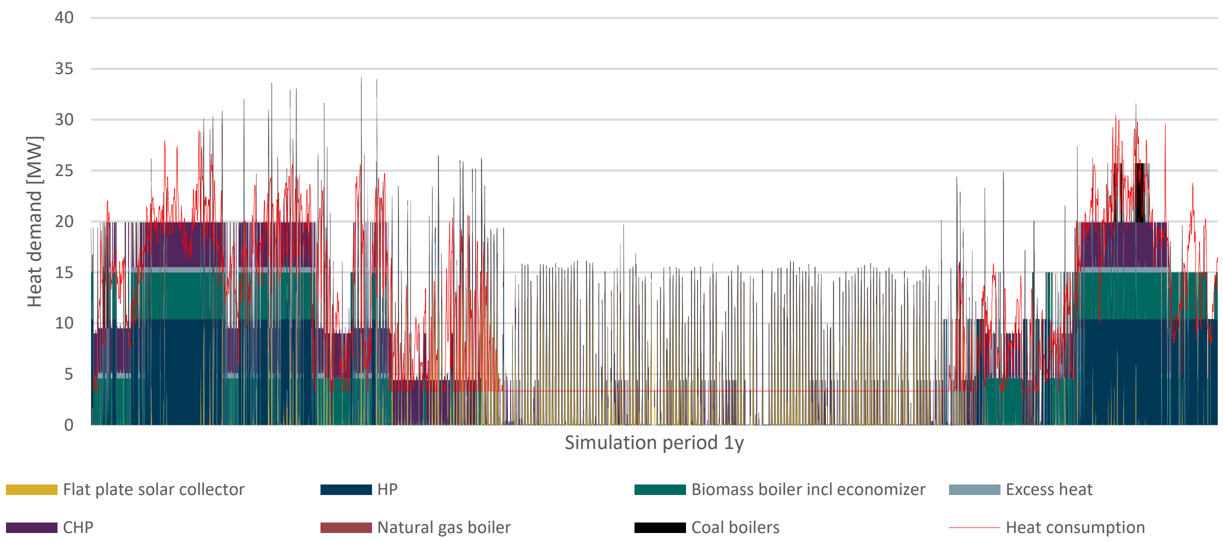
Excess/waste heat
0,5 MW
Further investigated for more capacity…

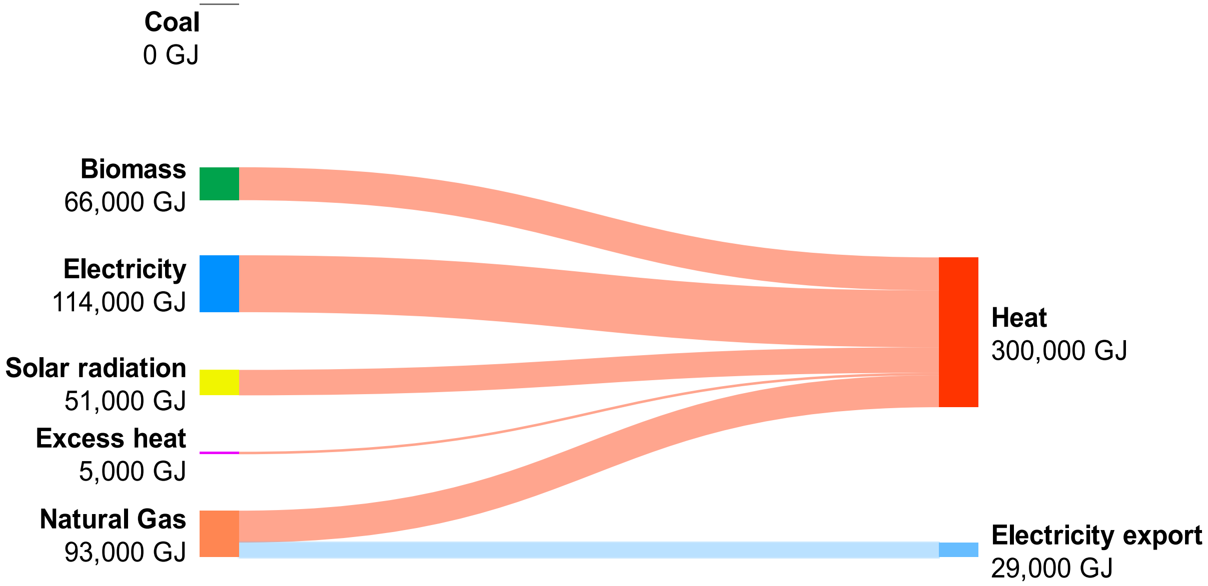
Solar thermal collectors
23,850 m^2 effective solar panel area
10 ha of land area

Thermal storage
4,000 m^3 (CHP, HP and biomass)
4,500 m^3 (Solar thermal collectors)

Results

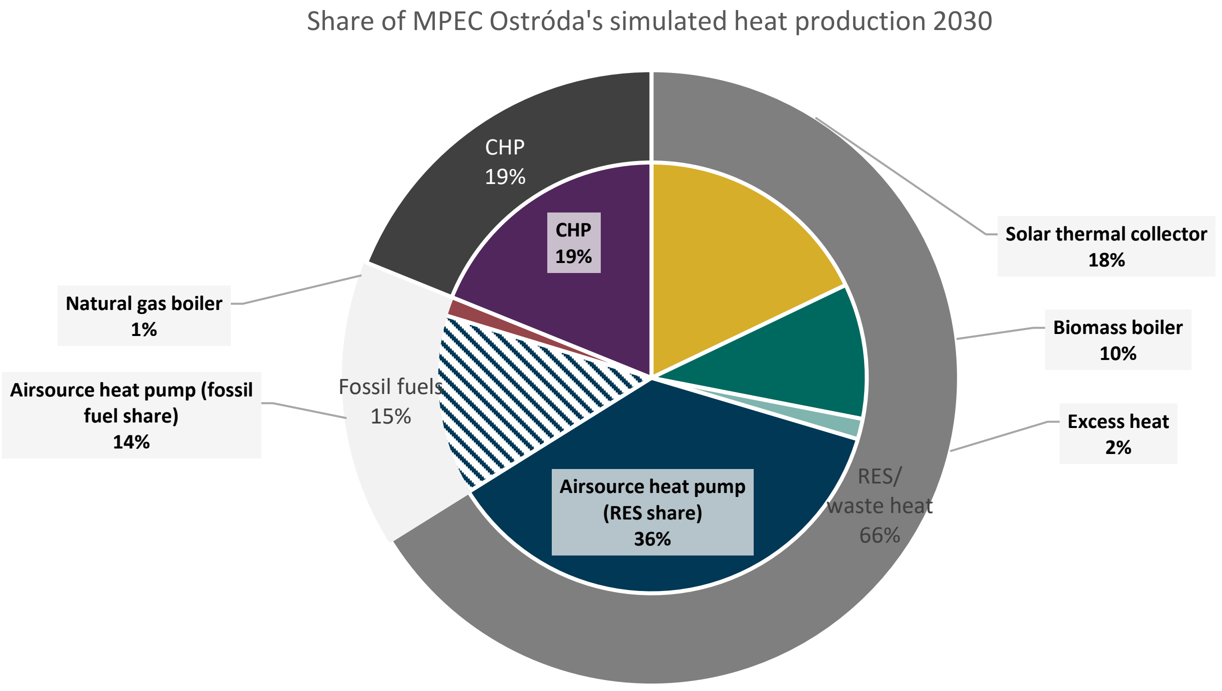
- Model simulation of 2030
  - Technical results
    - Productions shares
    - Fuel consumption
    - Emissions
- All technologies are producing a significant shares of the overall heat production
- Coal is completely phased out
- Electricity is produced in the hours where it is profitable to operate the CHP
  - Cheaper alternatives will decrease the number of hours
- Solar heat will produce all the heat needed during the summer

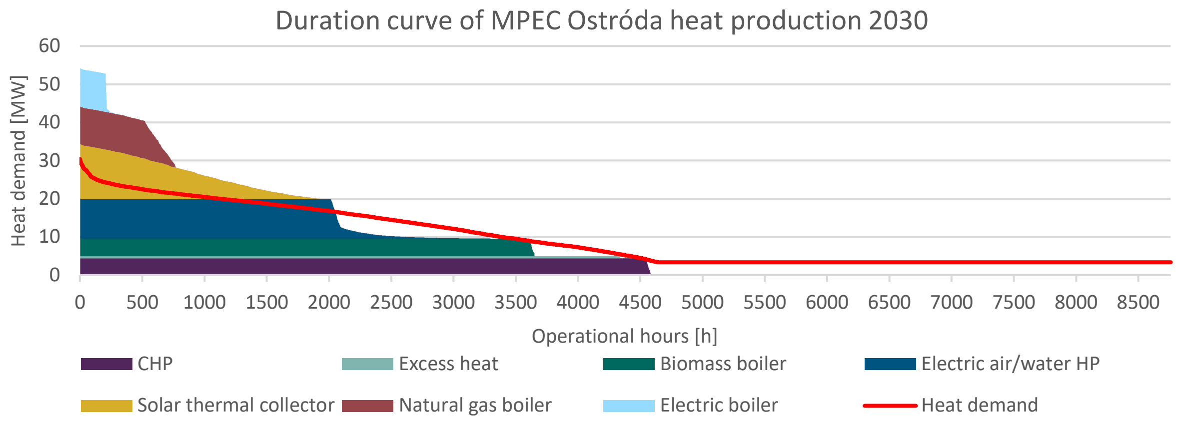




Results

- The 2035 requirements of the EU EED is fulfilled
  - RES > 50 % (66 %)
  - RES & high efficiency CHP > 80 % (85 %)
- Baseload will be covered by the biomass boiler, CHP and heat pump except for the summer where the solar thermal collectors will cover the heat demand
- The wide range of fuels will increase **security of supply**, and provides flexibility regarding fuel prices
- Thermal storages will increase flexibility even more
- The solar thermal collectors will make MPEC Ostróda independent of fuels during the summer period





Roadmap 2030 and beyond

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- Investments are spread across the next 5 years
  - 2026:
    5 MW of heat pump capacity and 4,000 m^3 thermal storage will provide enough for the last coal to be phased out
  - 2027-2028:
    Additional 5 MW heat pump based on the initial experiences of heat pump investment
  - 2029-2030:
    Solar thermal collectors are installed
- Development plan should be revised with regular intervals (e.g. every second year) as prerequisites will change over time
  - It is believed that the heat demand will increase in the future

2025
- 1 MW Solar PV
- 0.5 MW excess heat

2026
- 5 MW Airsource HP (prepared for additionally 5 MW, see 2027-2028)
- 4,000 m^3 thermal storage

2027-2028
- 5 MW Airsource HP

2029-2030
- 23,850 m^2 (17.2 MW) solar thermal collectors
- 4,500 m^3 thermal storage

>2030

?