Case study – Brzeg DH

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European Investment Bank Group

Jaspers
Joint Assistance to Support Projects in European Regions

Background

- EC site visit to Poland on DH, February 2022.
- Initial discussions with Ministry of Climate and DH Chamber of Commerce.
- Preparation of 2 horizontal assignments (large DH > 50 MW > small DH).
- Call for projects.

Objective and scope of the assignment

- Objective:
  - compliance with efficient DH system definition as of 2025,
  - reducing ETS cost and eventually leaving ETS,
  - diversification of supply sources.
- Scope:
  - Multi-criteria analysis of decarbonisation options available:
    - data collection and the analysis of the current situation,
    - identification of decarbonisation options available,
    - selection of the most adequate option.
  - Formulation of conclusions on the key aspects to be faced in the decarbonisation process and dissemination of results.

Decarbonisation objective

Energy sources to achieve EDHC criteria / Periods	Renewable energy	Waste heat	Renewable energy and waste heat	Combined supply from renewables, waste heat and (high-efficiency) cogeneration	(High-efficiency) cogeneration
Until 31.12.2027	50%	50%	50%	50%	50%
1.1.2028 - 31.12.2034	50%	50%	50%	50%[1]	80%[2]
1.1.2035 - 31.12.2039	50%	50%	50%	80%[3]	
1.1.2040 - 31.12.2044	75%	75%	75%	95%[3]	
1.1.2045 - 31.12.2049	75%	75%	75%		
After 1.1.2050	100%	100%	100%		

Notes:

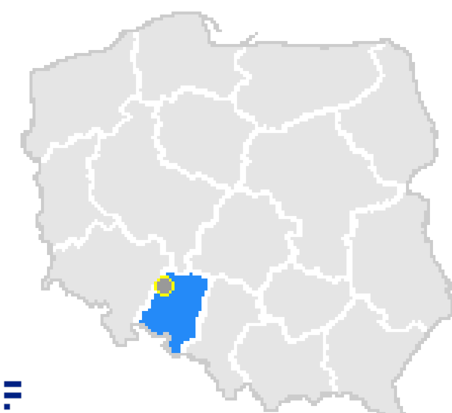
(1) Only high-efficiency cogeneration can be counted towards the threshold. At least 5 % of the heating and cooling supply going into the network should be from renewable energy.

(2) Only high-efficiency cogeneration can be counted towards the threshold.

(3) Only high-efficiency cogeneration can be counted towards the threshold. At least 35 % of the heating and cooling supply going into the network should be from renewable energy or waste heat.

DH system in Brzeg

- Municipality of 35,000 inhabitants in Opolskie Region,
- BPEC – municipal company, 57 staff, regulated,
- 47 MW installed capacity, 4 coal-fired boilers (13.5 MW; 14 MW; 12 MW; 7 MW),
- 6 MW biomass boiler project underway,
- 50 kWp PV plant,
- Network of 33 km, 290 sub-stations,
- Supplies heat to 10,000 inhabitants,
- Sales of around 300 TJ/a, including 18 TJ/a for DHW.



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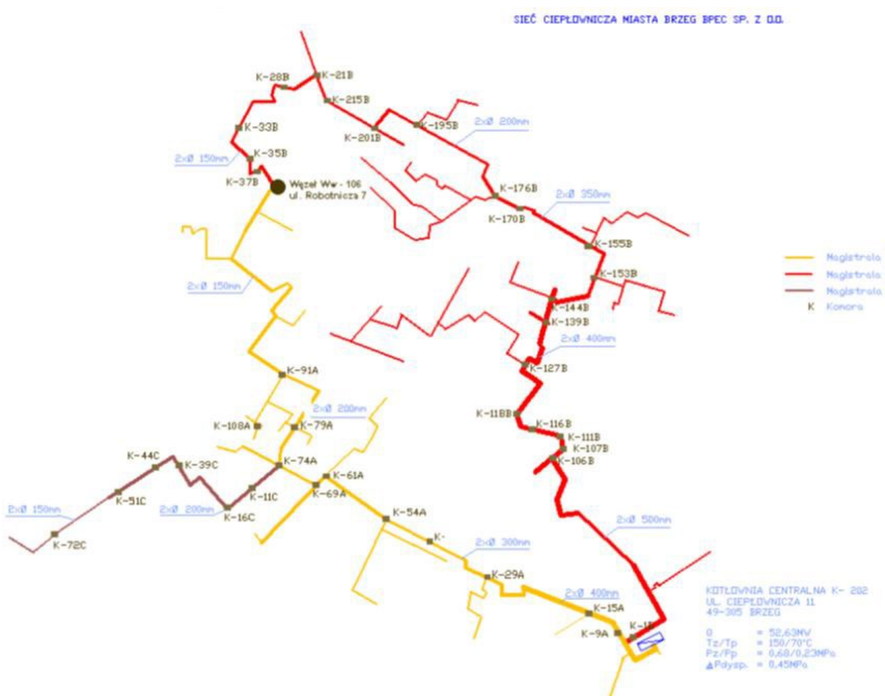
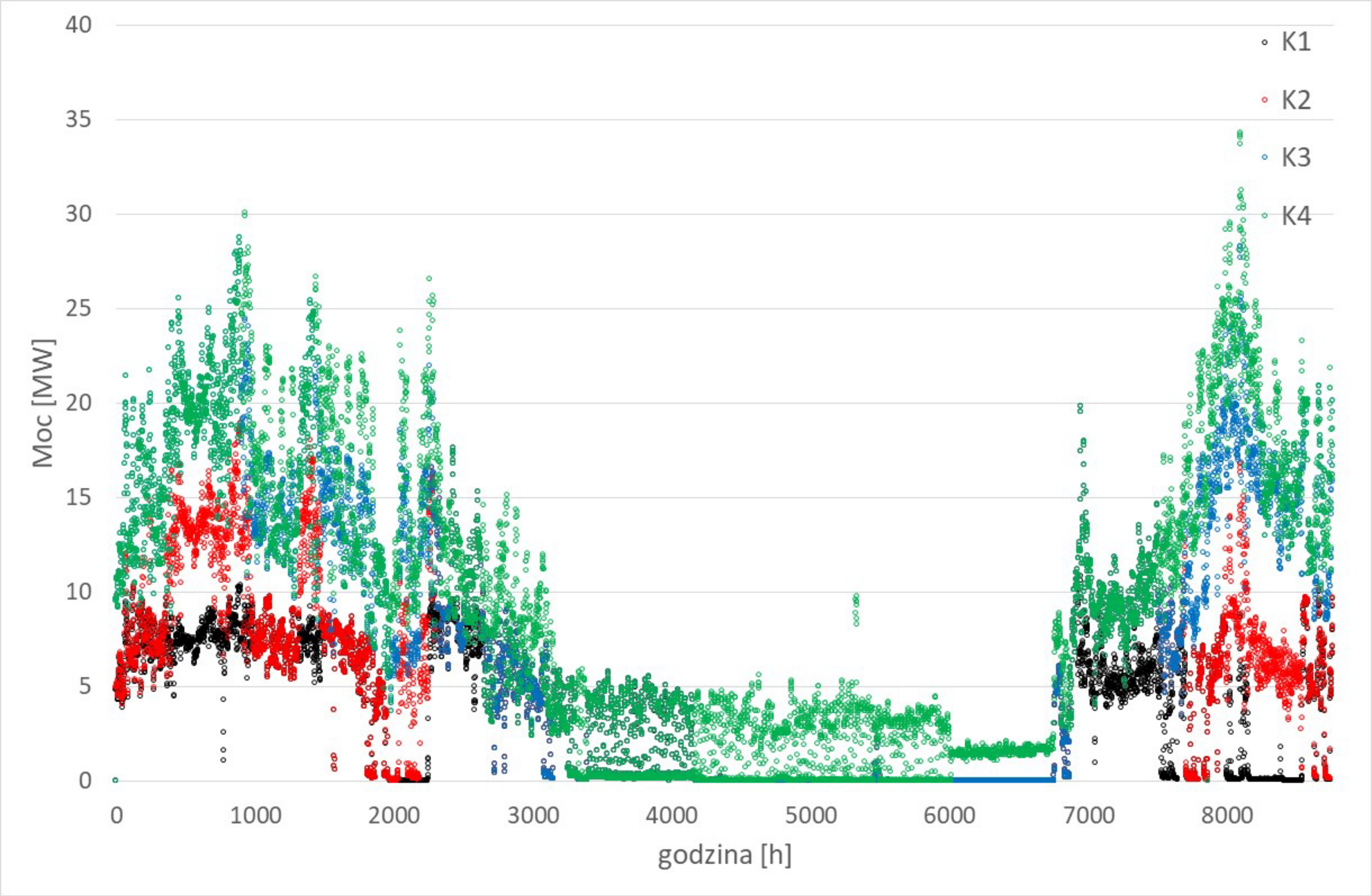


DH system in Brzeg



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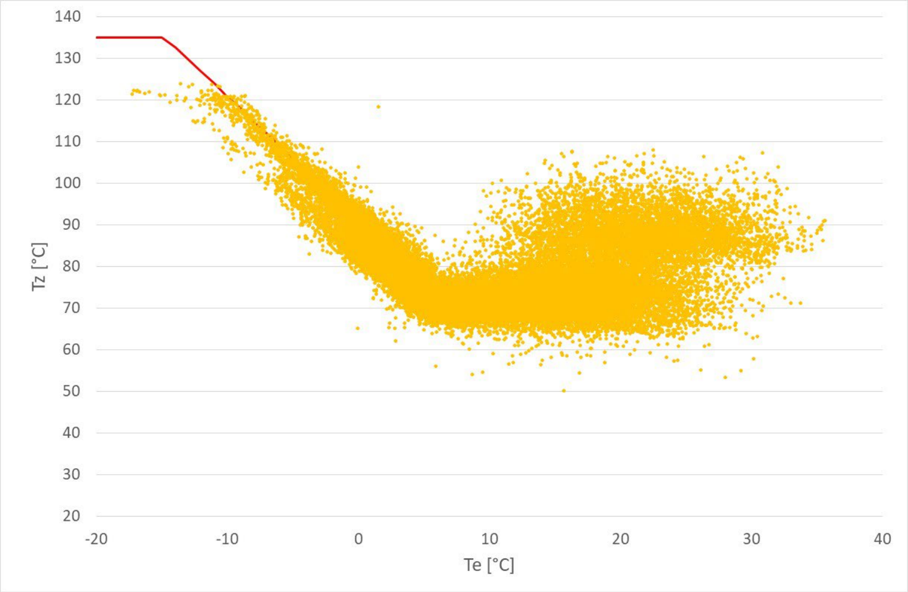
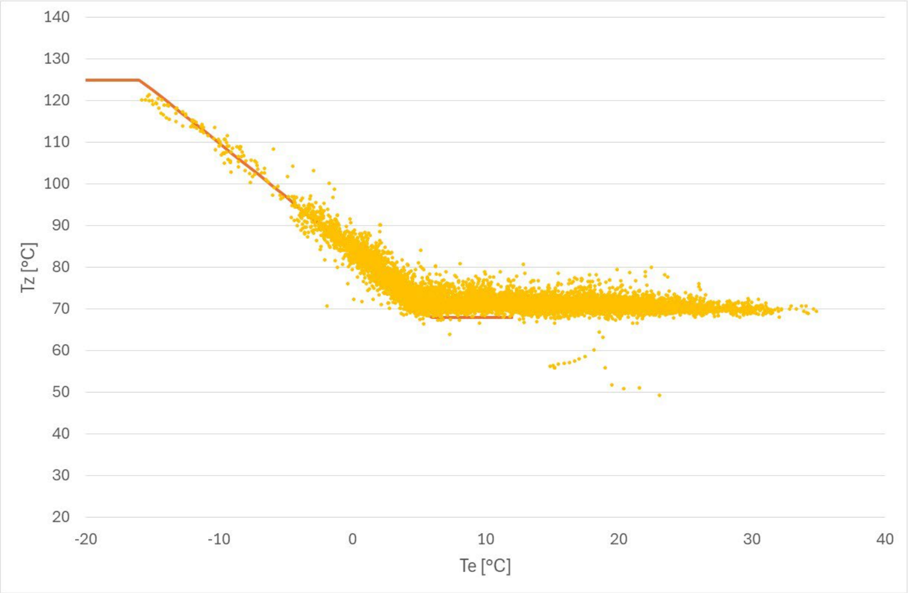
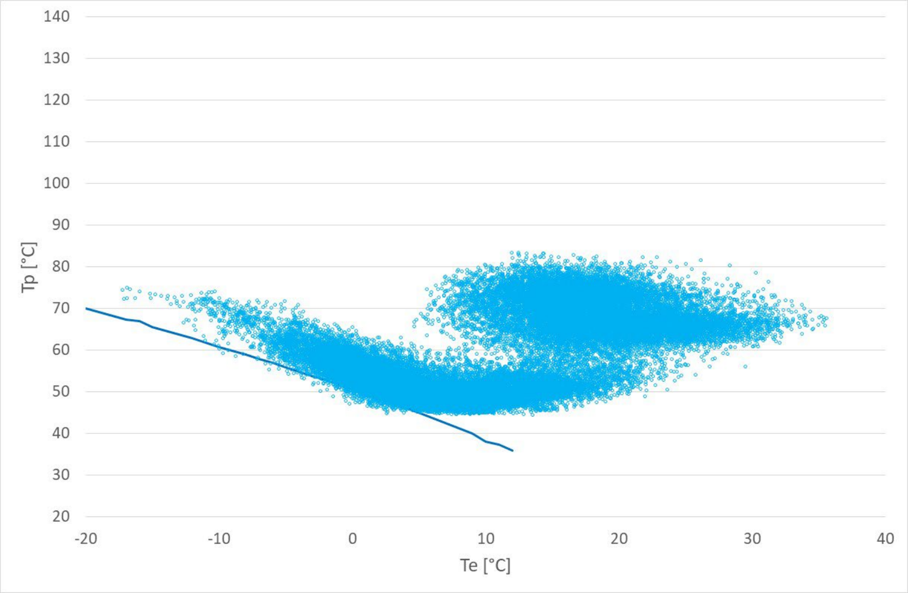
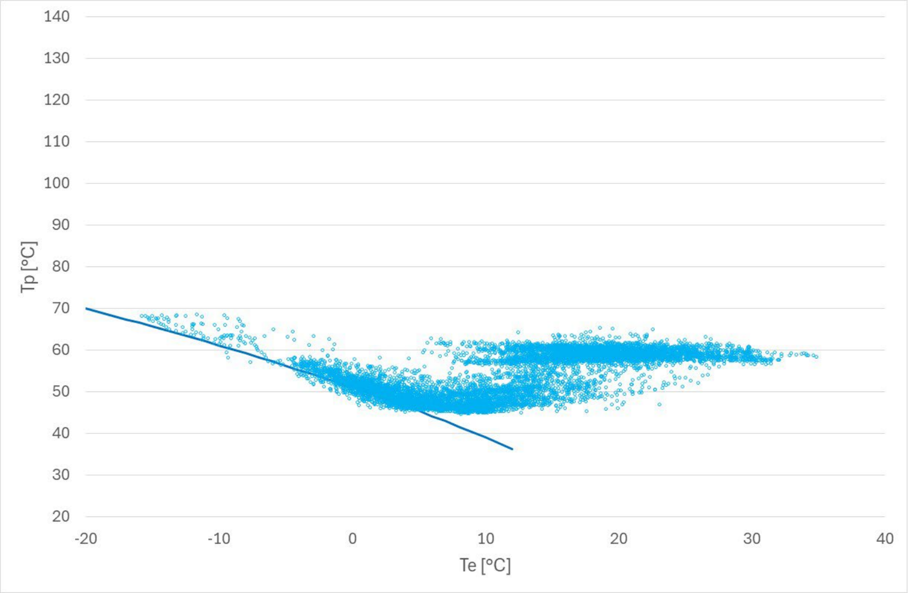




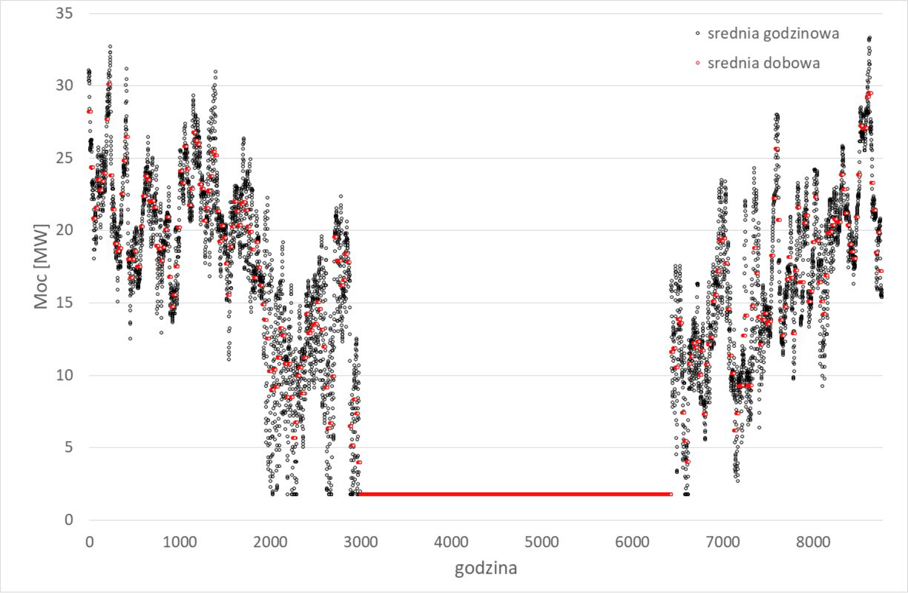


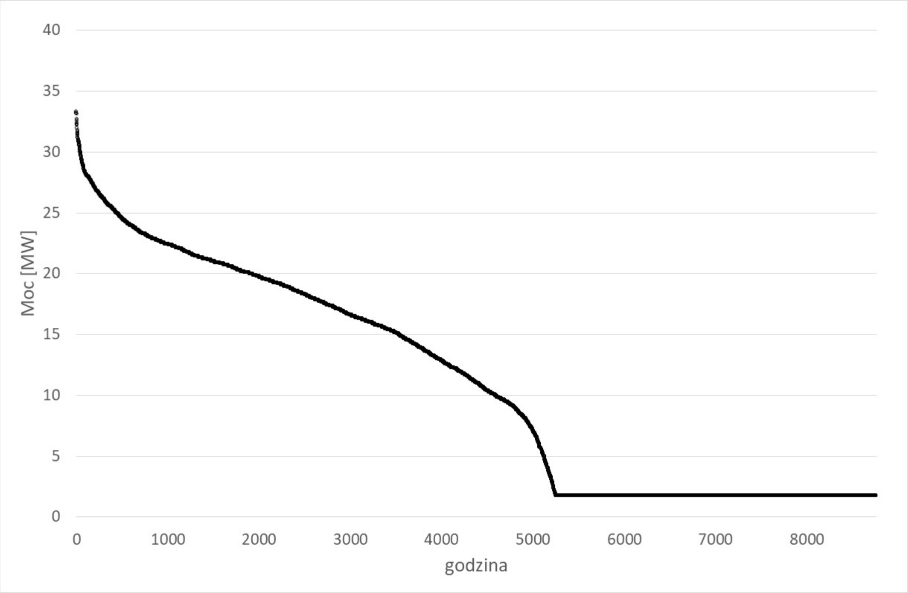


Assessment of existing situation

- Highly carbon intensive, non-compliant with “efficient DH” definition, reliant on coal only.
- Robust equipment.
- 2nd generation DH (125/70°C).
- Inefficient summer operation, somewhat improved recently.
- Ring network mainly using preinsultated pipes with space for further reduction of losses.
- Sound water management.
- Good heat density, good prospects for market development (DHW).
- Sound financial situation with risks ahead (ETS and fuel prices, tariff-setting mechanism).
- Plot of land available for investments, co-financing opportunities.

Demand analysis





Options analysis – qualitative assessment

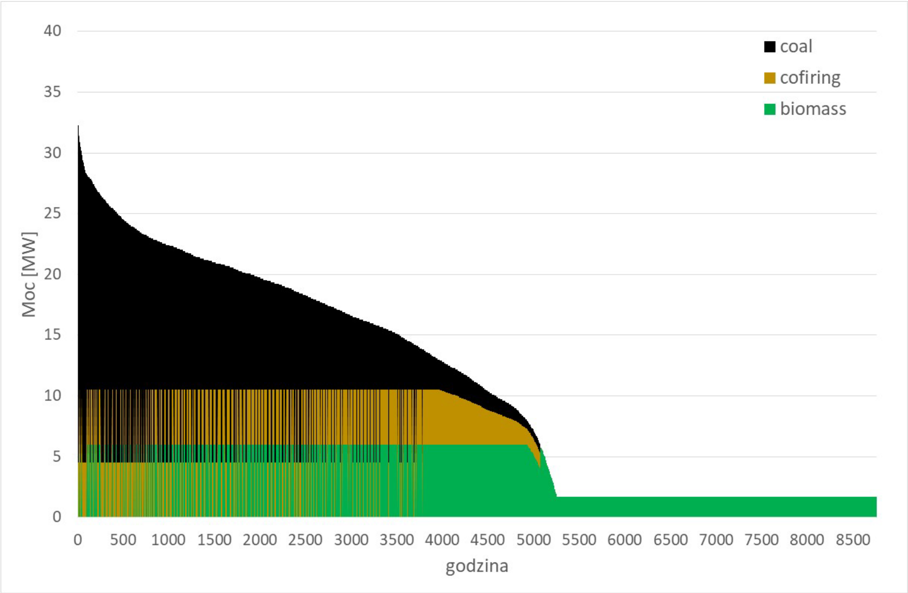
- Modernisation of existing plants:
  - Flue gas condenser for biomass boiler,
  - ORC,
  - Co-firing.
- Storage:
  - Short-term,
  - Long-term.
- New generation sources:
  - WtE,
  - Waste heat,
  - Geothermal,
  - Hydrogen,
  - Biomass boiler,
  - Gas boiler,
  - Fuel oil boiler,
  - Electric boiler,
  - Gas CHP,
  - Heat pumps,
  - Solar thermal,
  - PV.

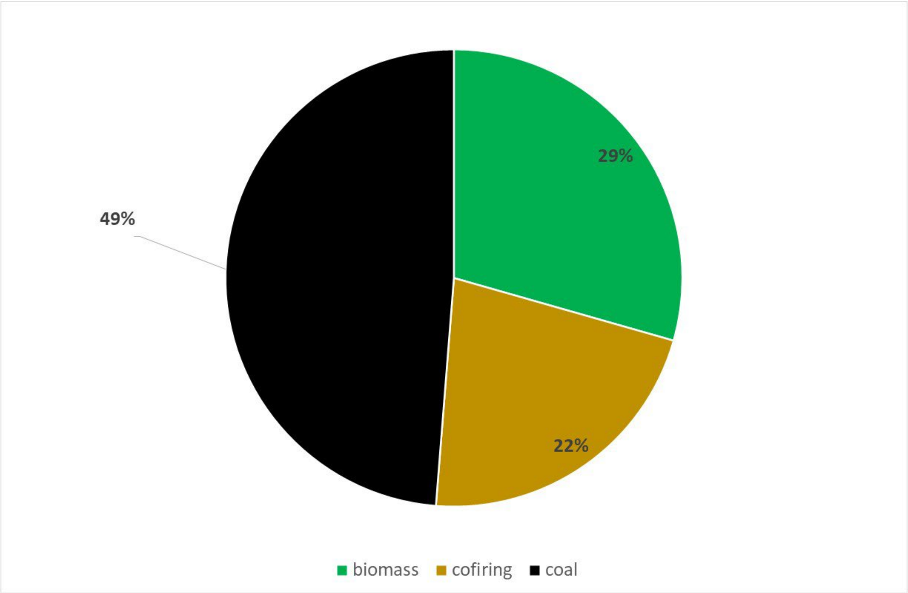
Options analysis – qualitative assessment

- Criteria: security of supply, environmental effect, technical feasibility.
- Options qualified:
    - Co-firing,
    - Waste heat,
    - Biomass boiler,
    - Gas boiler,
    - Electric boiler,
    - Heat pump,
    - Gas CHP,
    - Storage.

Options analysis – phase I

- Phase I: 2025.
- Criteria: LCOH.
- W0 – 6 MW biomass boiler, coal boilers, co-firing.





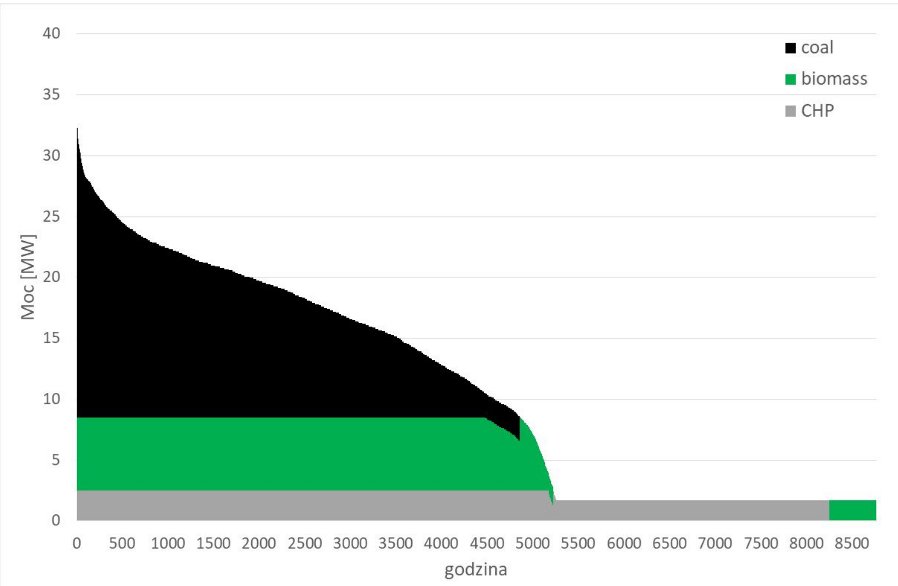
Options analysis – phase II

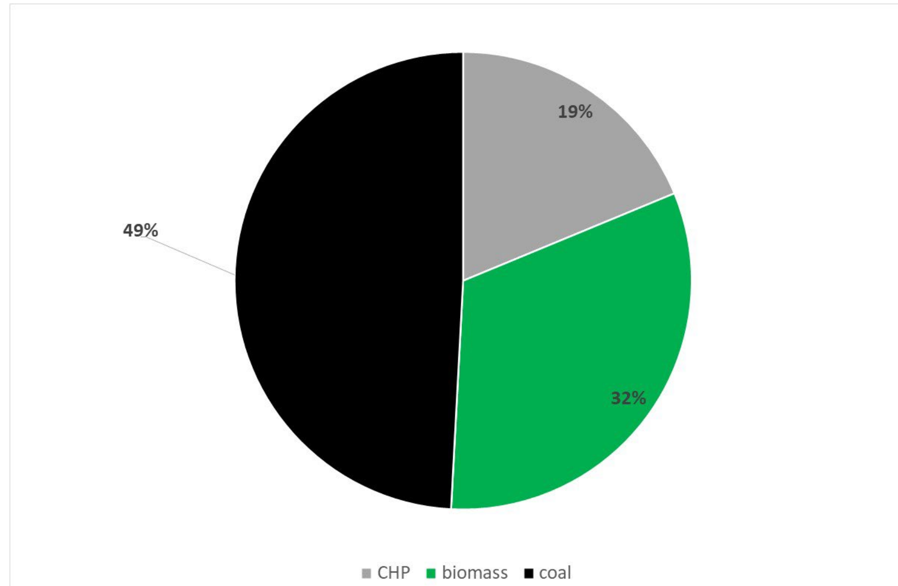
- Phase II: 2026-2030.
- Criteria: LCOH.
- Options considered:
  - W0 – 6 MW biomass boiler, coal boilers, co-firing,
  - W1 – 2.5 MW_t gas CHP,
  - W2 – 2.5 MW_t biomass boiler,
  - W3 – 2.5 MW_t AW heat pump,
  - W3a – 2.5 MW_t AW heat pump with 1 MW_p PV,
  - W4 – 2.5 MW_t AW heat pump and micro-CHP (1 MW_e),
  - W4a – 2.5 MW_t AW heat pump with micro-CHP and 1 MW_p PV,
  - W5 – 2.5 MW_t WW heat pump using waste heat.

Options analysis – phase II

Option	LCOH [PLN/GJ]	LCOH [EUR/GJ]
W1	88.2	20.5
W0	91.2	21.2
W2	91.2	21.2
W4a	92.5	21.5
W4	92.7	21.6
W3a	92.8	21.6
W5	93.1	21.7
W3	95.2	22.1

Options analysis – phase II





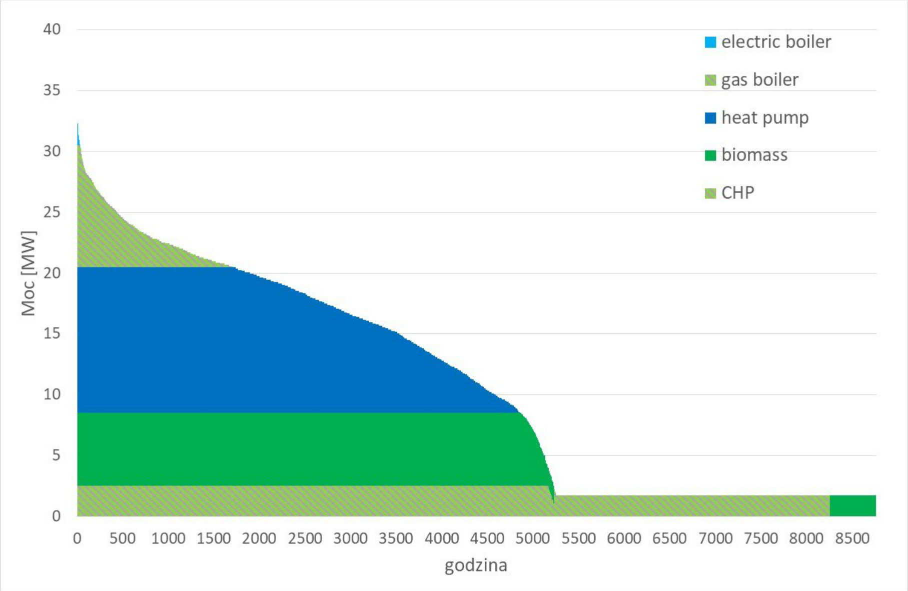
Options analysis – phase III

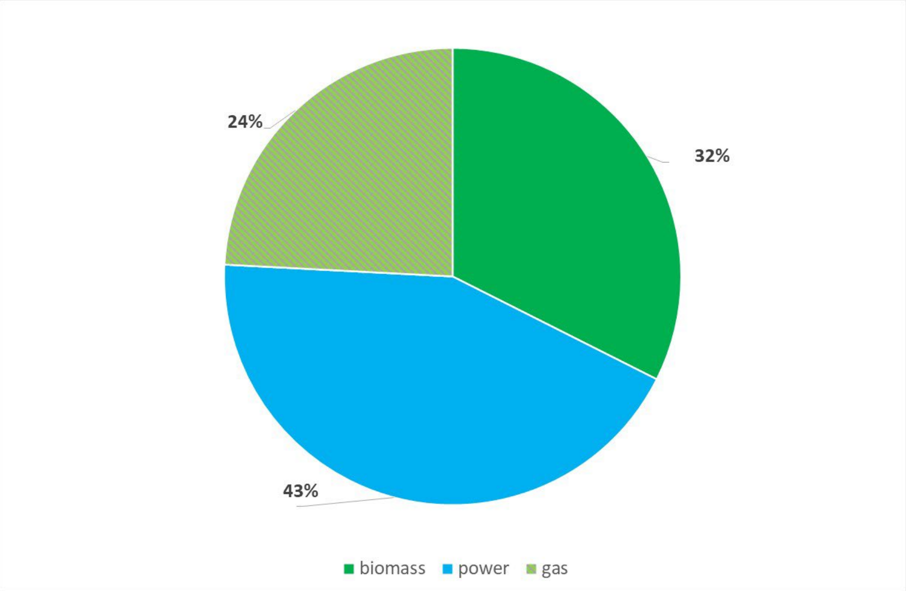
- Phase III: 2031-2050.
- Criteria: simplified approach, diversification of heat sources.
- Options:
  - WW heat pumps,
  - Gas boilers,
  - Electric boilers,
  - Short-term storage.

Options analysis – phase III

	K1	K2	K3	K4	B1	CHP	HP1	HP2	G1	G2	EL	RAZEM
2024	13.5	14.0	12.5	7.0								47.0
2025	**13.5**	**14.0**	**12.5**	**7.0**	**6.0**							**53.0**
2026	13.5	14.0	12.5	7.0	6.0							53.0
2027	13.5	14.0	12.5	7.0	6.0							53.0
2028	13.5	14.0	12.5	7.0	6.0	2.5						55.5
2029	13.5	14.0	12.5	7.0	6.0	2.5						55.5
2030	**13.5**	**14.0**	12.5	**7.0**	**6.0**	**2.5**						**55.5**
2031	13.5	14.0	12.5	7.0	6.0	2.5						55.5
2032	13.5	14.0	12.5	7.0	6.0	2.5						55.5
2033	13.5	14.0	12.5	7.0	6.0	2.5						55.5
2034	13.5	14.0	12.5	7.0	6.0	2.5						55.5
2035		**14.0**		**7.0**	**6.0**	**2.5**	**6.0**		**5.0**	**5.0**		**45.5**
2036		14.0		7.0	6.0	2.5	6.0		5.0	5.0		45.5
2037		14.0		7.0	6.0	2.5	6.0		5.0	5.0		45.5
2038		14.0		7.0	6.0	2.5	6.0		5.0	5.0		45.5
2039		14.0		7.0	6.0	2.5	6.0		5.0	5.0		45.5
2040					**6.0**	**2.5**	**6.0**	**6.0**	**5.0**	**5.0**	**15.0**	**45.5**
2041					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2042					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2043					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2044					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2045					**6.0**	**2.5**	**6.0**	**6.0**	**5.0**	**5.0**	**15.0**	**45.5**
2046					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2047					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2048					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2049					6.0	2.5	6.0	6.0	5.0	5.0	15.0	45.5
2050					**6.0**	**2.5**	**6.0**	**6.0**	**5.0**	**5.0**	**15.0**	**45.5**

Options analysis – phase III

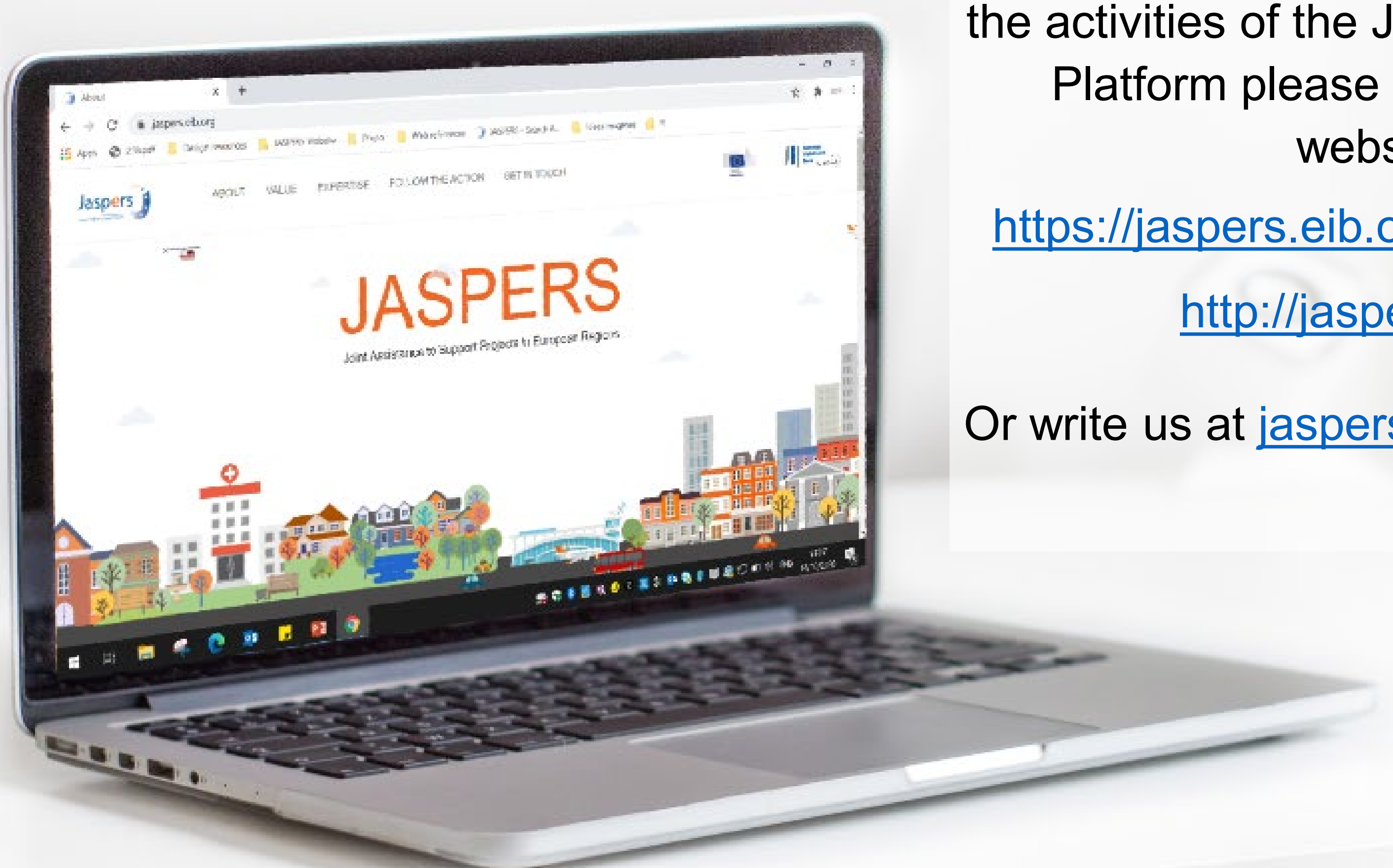




Conclusions

- The typical combination of technologies for efficient DH systems will include gas CHP, biomass, HP, gas boilers, electric boilers and storage. When resource is available locally, waste heat and geothermal is an option too.
- Meeting EED criteria till 2034 or even 2039 for a smaller DH system is generally achievable (CHP, biomass).
  - Gas CHP seems to be the most financially viable solution at this stage. It allows for diversification of the revenues. With the support scheme in place, the beneficiary is locked with CHP for 15 years, while In the longer run, gas prices and ETS cost may rise.
  - Most of the smaller DH systems will rely on local biomass to a certain extent. Increasing demand and sustainability requirements may cause problems with supplies at affordable price.
- Meeting the post 2040 requirements is more challenging (heat pumps).
  - There is a need to reduce the temperature curve.
  - AW HP have poor performance and limited application at low ambient air temperature.
- Meeting 2050 requirements means decarbonising peak load.
  - Peak load corresponds only to a small fraction of the energy balance.
  - Gas boilers shall be phased out as of 2040, while gas CHP could be operational till 2049. We can assume that in the future, both could potentially convert to green gases.
  - Electric boilers, coupled with storage could be an option for peak demand in the future (low energy prices occur mainly over summer; fixed fees).

Thank you for your attention



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