

Supporting the energy transition and decarbonization: results of SET_HEAT project

Project number: 101119793
Call: LIFE-2022-CET

Contributors:

- UNIZAG-FSB
- HEP Toplinarstvo



Webinar Program LIFE – Prijelaz na čistu energiju – Info dan, 29 July 2026

Sveučilište u Zagrebu
Fakultet stojarstva
i brodogradnje

University of Zagreb
Faculty of Mechanical Engineering
and Naval Architecture



Project timeline



Current month:

YEAR:		2023			2024												2025												2026									DURATION
MONTH:		1	2	3	4	5	6	7	8	9	10	11	#	#	#	15	16	17	18	#	20	21	22	#	24	25	#	27	28	29	30	31	32	33	34	35	36	
Work Package	PMs	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	
WP 1	59.00																																					10
WP 2	26.00																																					12
WP 3	56.90																																					18
WP 4	29.80																																					12
WP 5	32.50																																					10
WP 6	35.80																																					28
WP 7	51.40																																					36
WP 8	38.20																																					36

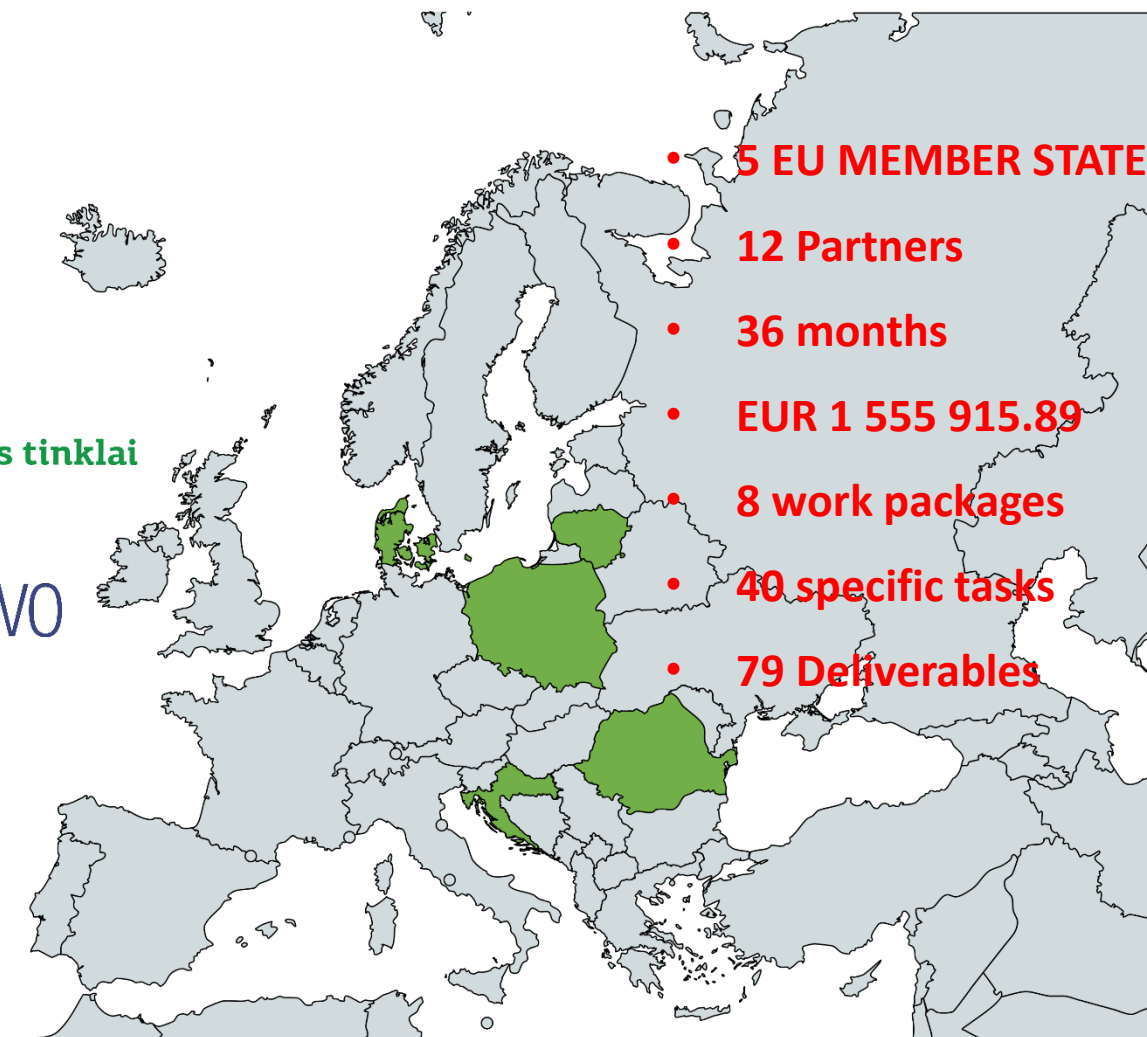
Start date: 01.10.2023

End date: 30.09.2026

Introduction



The SET_HEAT project aims to accelerate the energy transition and decarbonization of district heating (DH) in four targeted Eastern European countries by integrating low-grade heat sources into high-temperature DH networks.



- 5 EU MEMBER STATES
- 12 Partners
- 36 months
- EUR 1 555 915.89
- 8 work packages
- 40 specific tasks
- 79 Deliverables

DH systems directly involved

Bucharest (RO)

Żagań (PL)

Malbork (PL)

Żary (PL)

Opole (PL)

Kutno (PL)

Sisak (HR)

Vilnius (LT)

Strzelce Opolskie (PL)

Kluczbork (PL) Osijek (HR)

Grodków (PL)

Jelenia Góra (PL)

Krapkowice (PL)

Wolsztyn (PL)

Zagreb (HR)

Sulechów (PL)

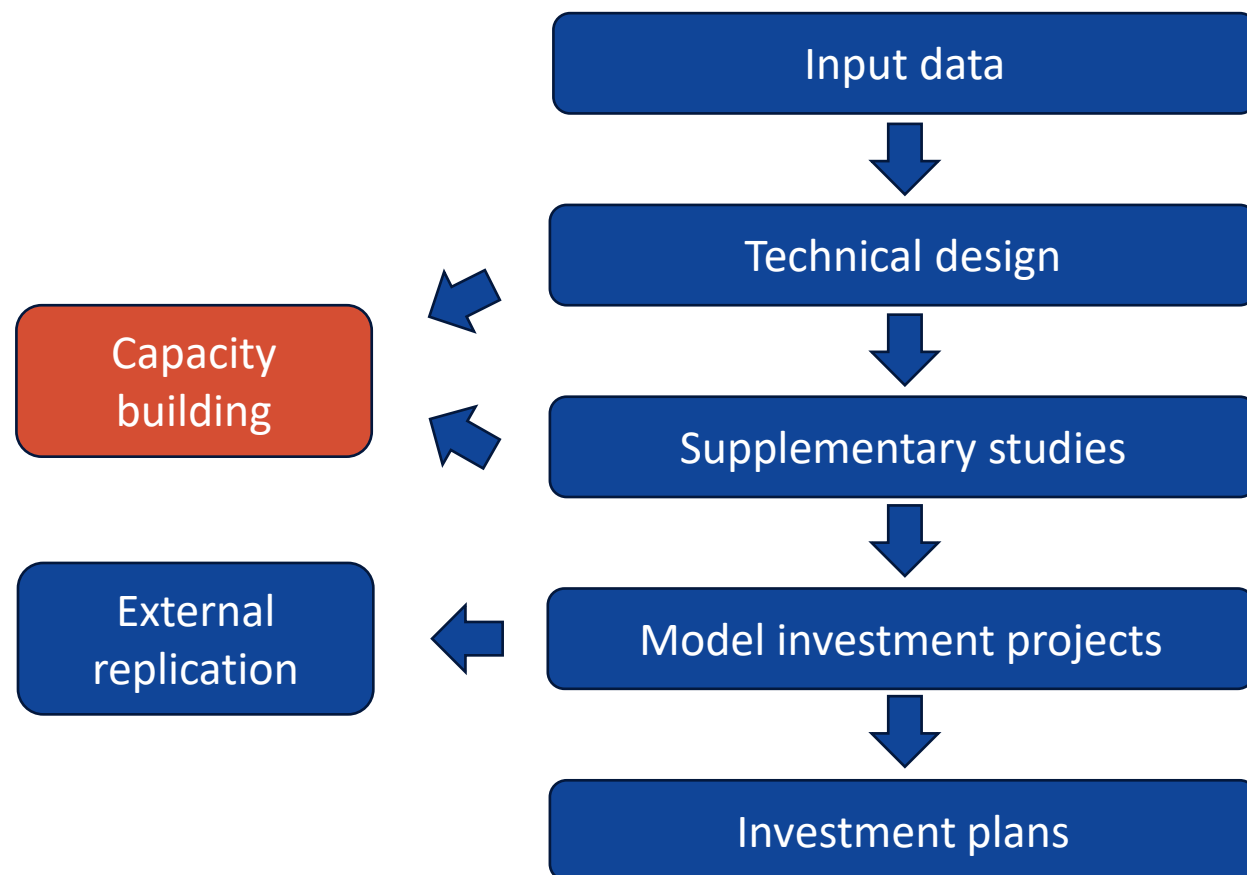
Tarnobrzeg (PL)

Jelcz-Laskowice (PL)

Kęty (PL)

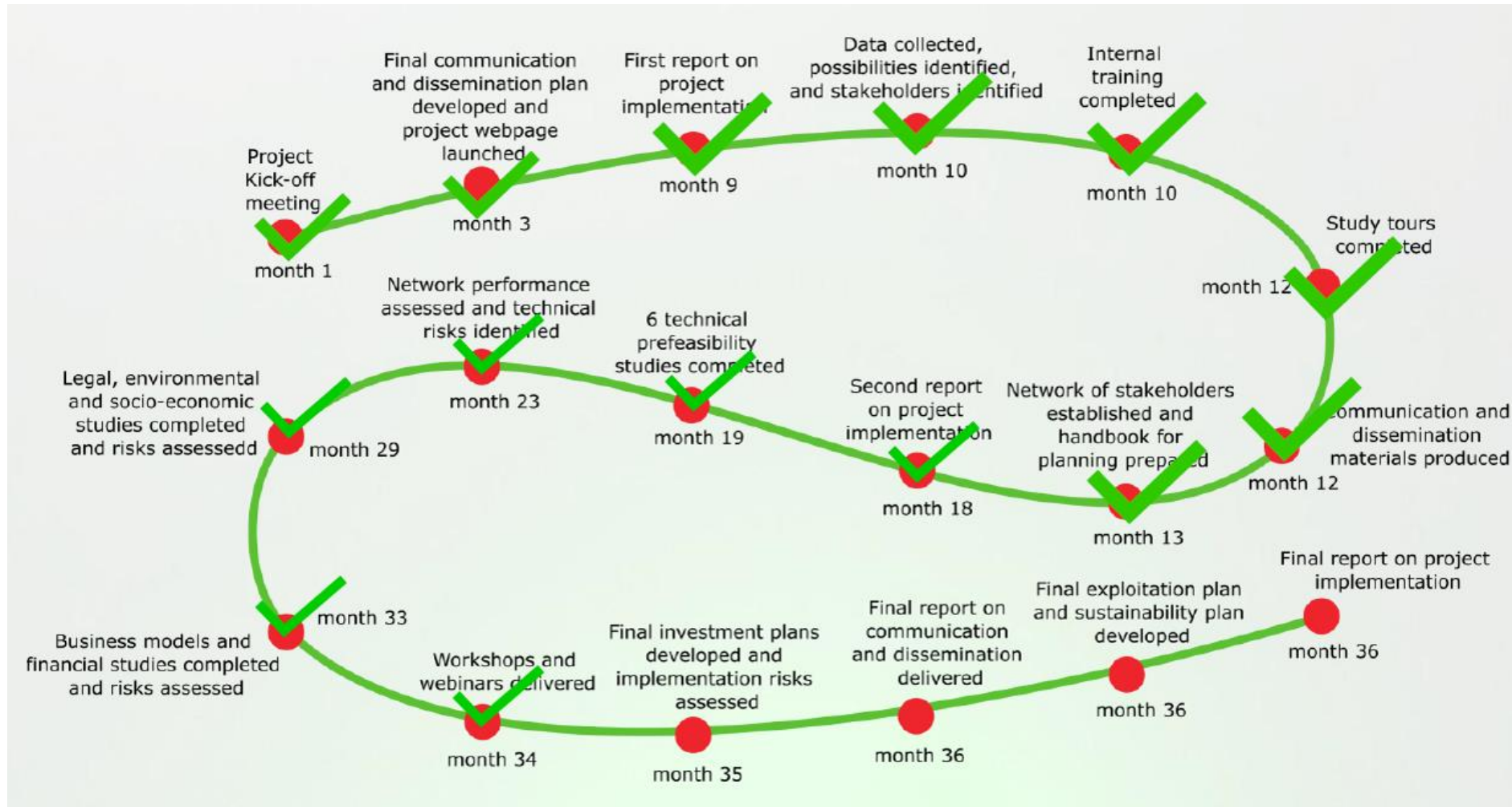
Nowa Sól (PL)

SET_HEAT planning pathway



**PREPARE AND LEARN - DEVELOP -
IMPLEMENT - REPLICATE - DISSEMINATE**

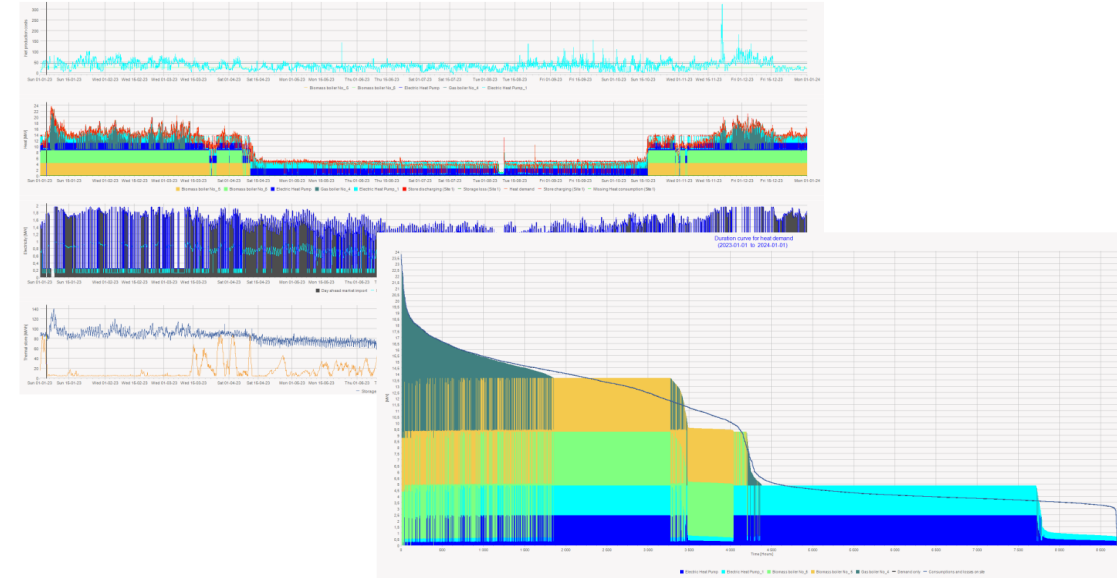
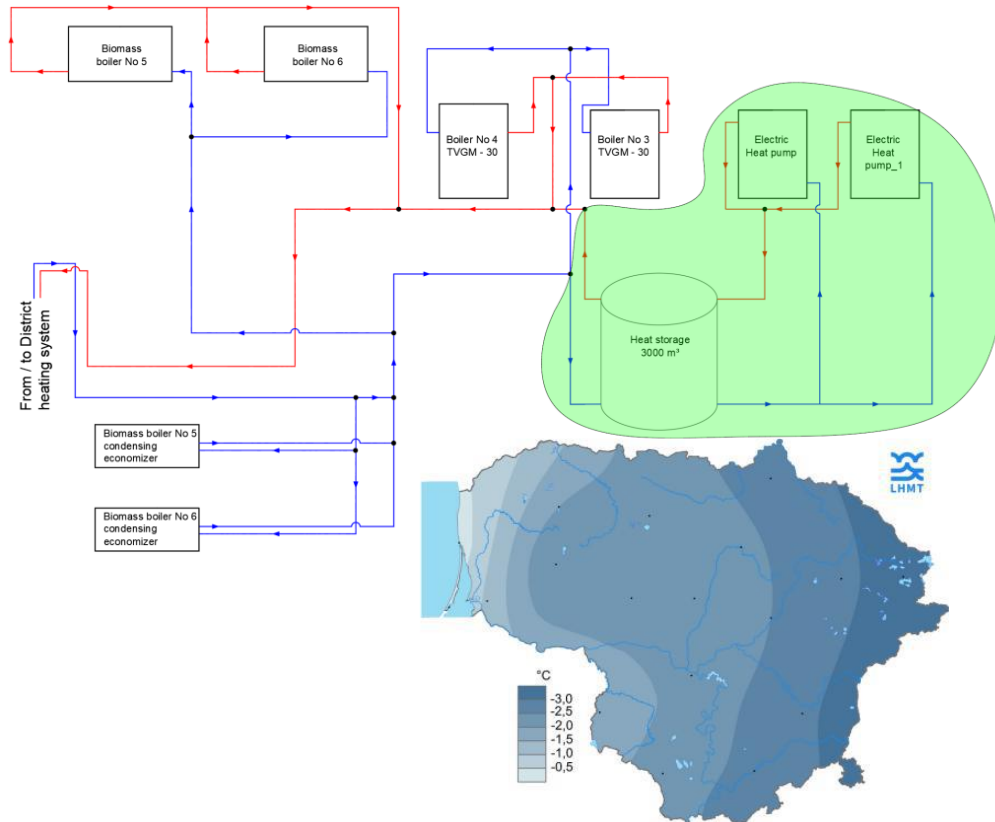
Project timeframe



SET_HEAT model development projects



SET_HEAT_AIR - Vilnius (LT) 2 units 4.9 MW_t

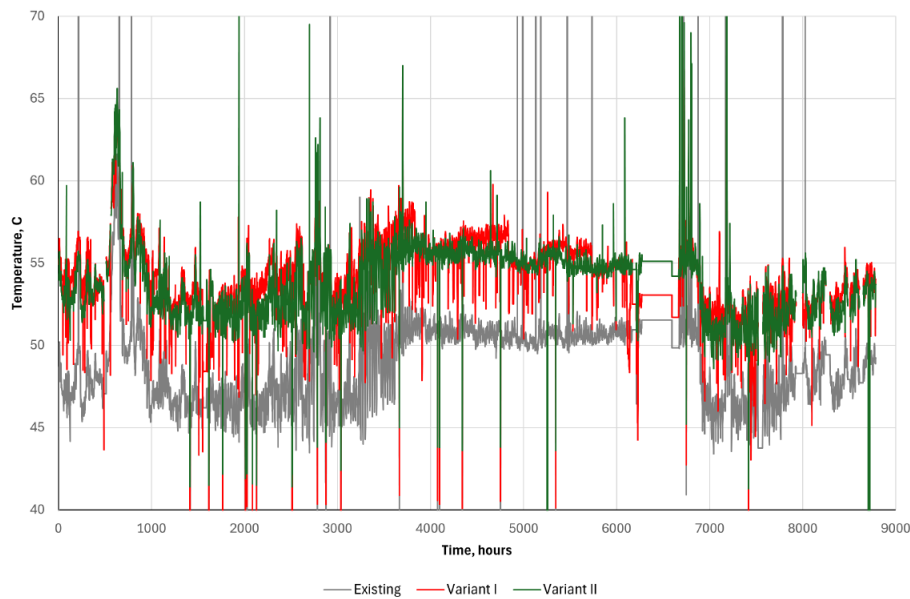
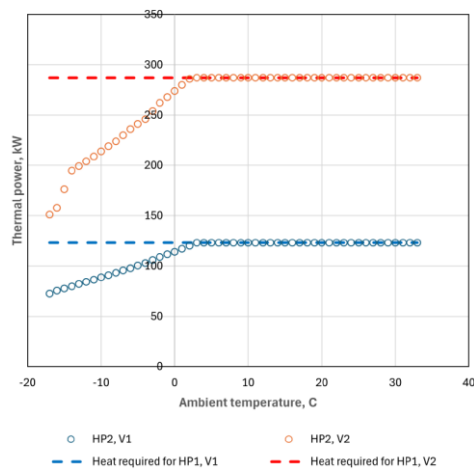
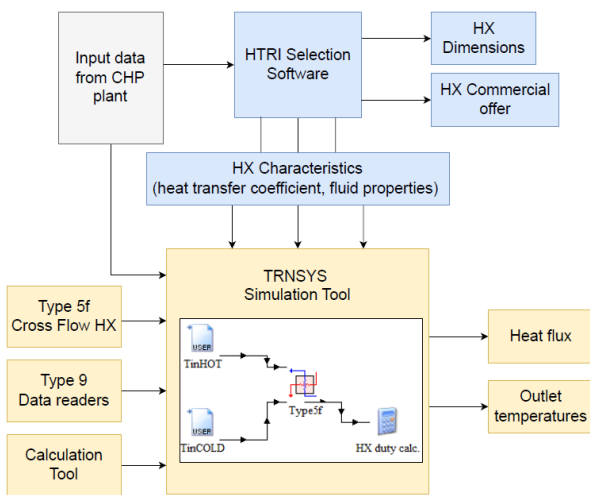
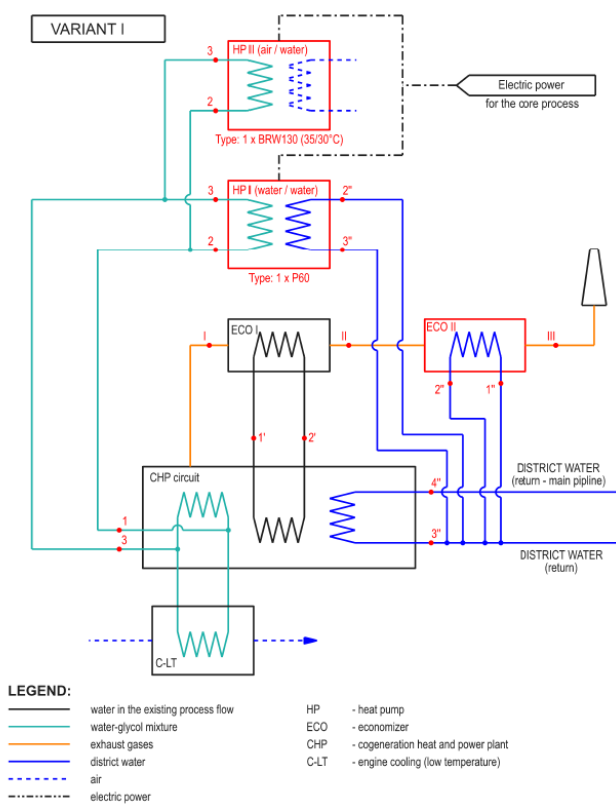


- 8 integrated compressors
- water inlet temperature 45 °C
- outlet temperature 80 °C,
- ambient temperature is 0 °C
- The maximum electrical power is 2.018 MW
- **Capacity 3606 kWt at -10 °C to 6380 kWt at +20 °C**
- COP 2.5
- Storage of 3000 m³

SET_HEAT model development projects



SET_HEAT_CHP - Gliwice (PL) 3 engines 7.6 MW_t



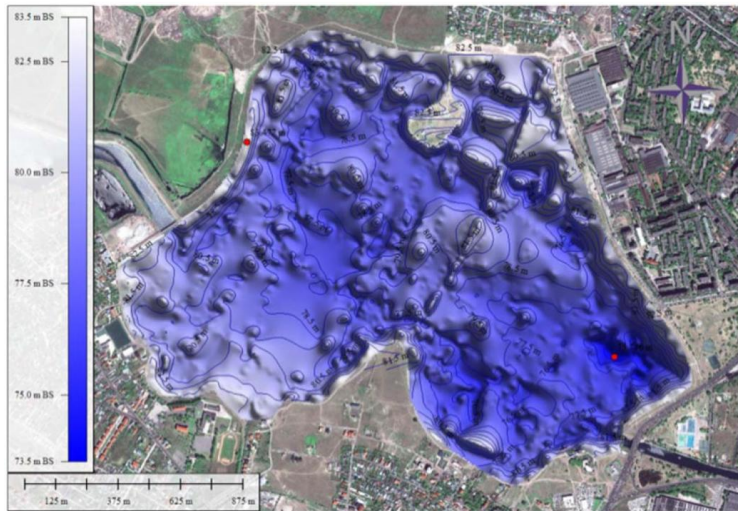
Heat pump performance at various return temperatures

Pump	Return Temp. (°C)	Heating Capacity (kW)	Power demand (kW)	COP
P60	48	144	17	8.27
P60	60	154	28	5.57
P150	48	375	52	6.21
P150	60	392	78	5.04

SET_HEAT model development projects



SET_HEAT_LAKE - Lake Morii, Budapest (RO) 50 MWt

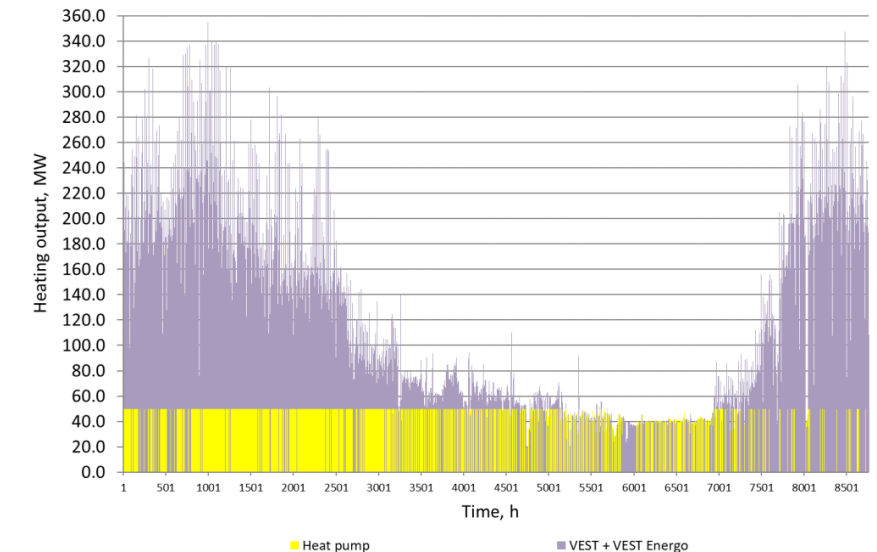
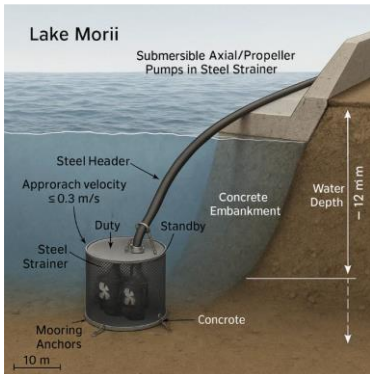
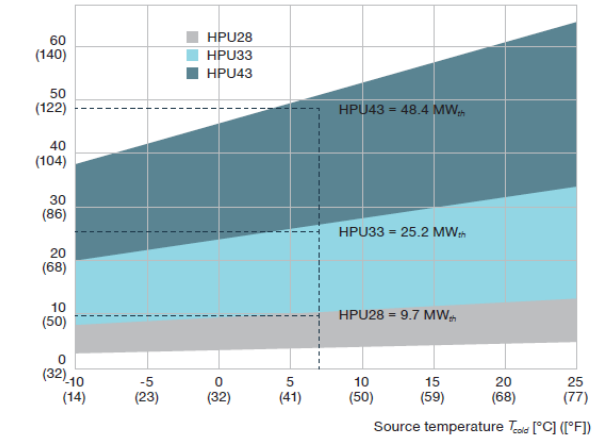


Case A

- Working fluid: iso-butane
- multi-stage turbo-compressor
- lake water at around 10°C
- DH temperature lift 70→100 °C
- Operating load range: 25–100%
- CAPEX is 30 EUR million

Case B

- Working fluid: CO₂
- High-speed multi-stage compressor
- lake water at around 10°C
- DH temperature lift 70→100 °C
- Operating load range: 50–100%.
- CAPEX is 50 EUR million

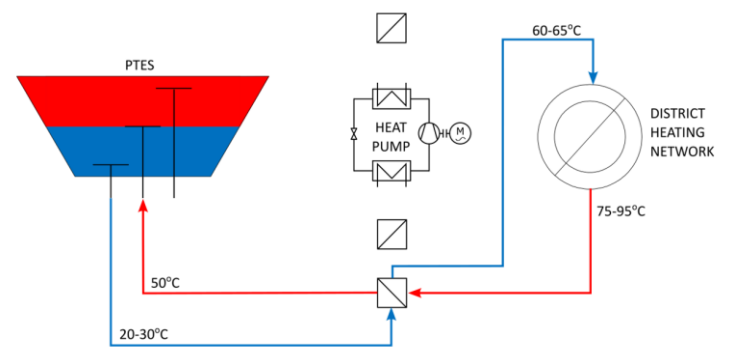
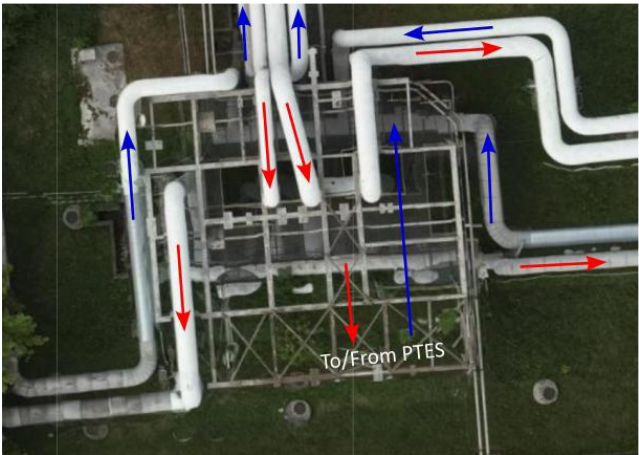
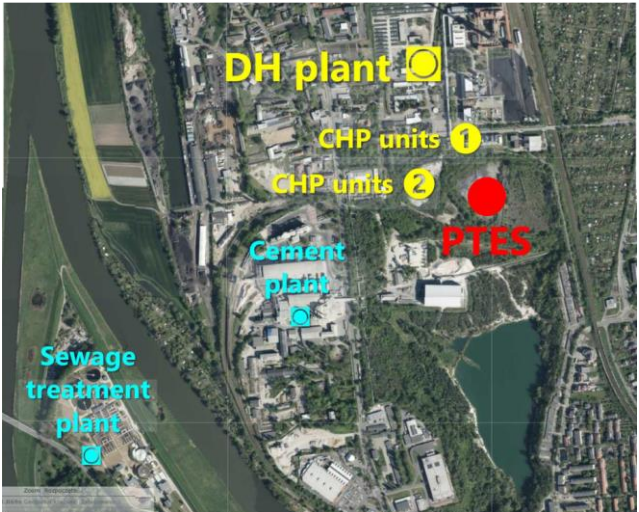


*Bucharest DH system, the **largest in the European Union**, supplies over 500,000 households and public buildings*

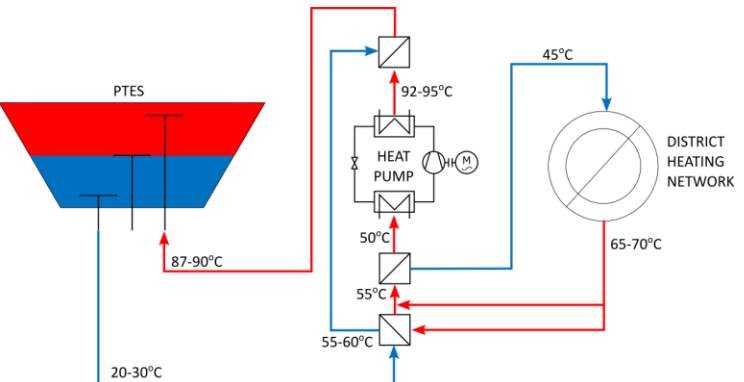
SET_HEAT model development projects



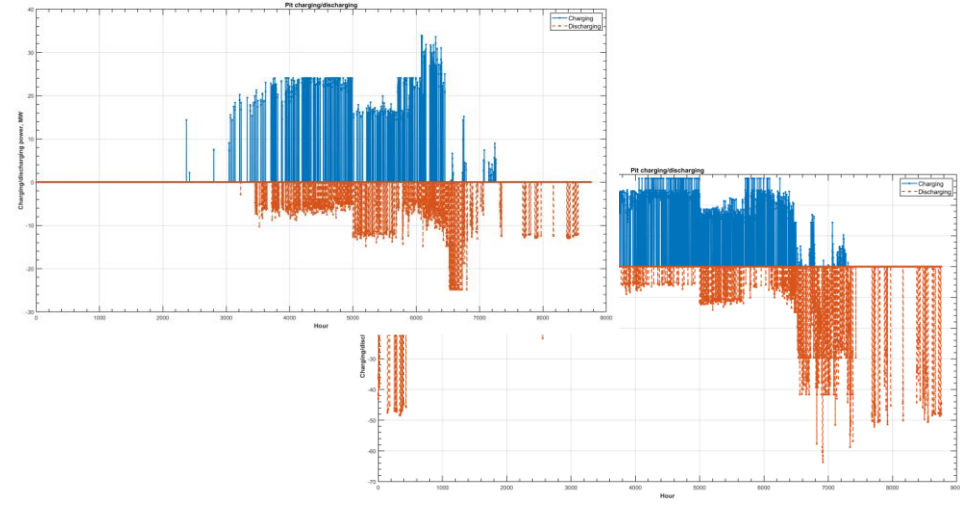
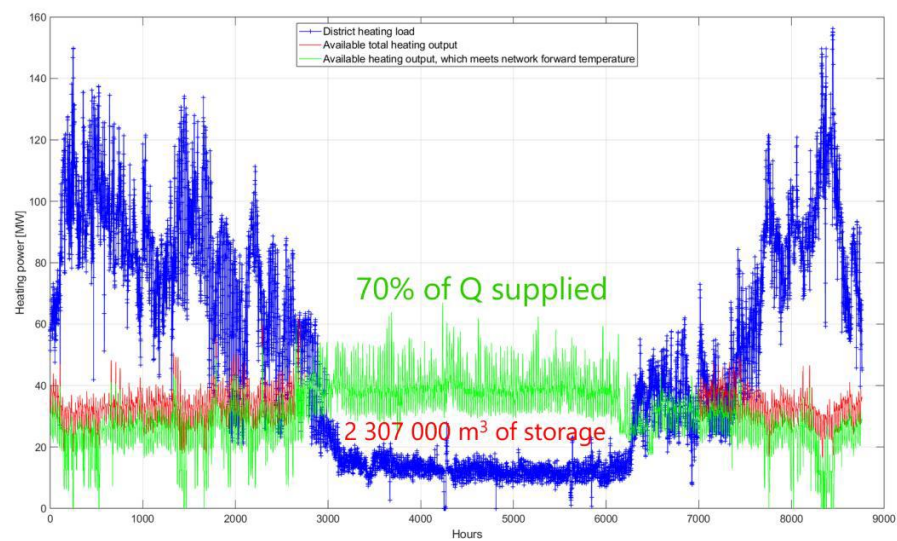
SET_HEAT_PTES - Opole (PL) 100,000–500,000 m³



Charging from the DH network through the heat exchanger



Charging from a cold state in summer from the DH network using an integrated heat pump

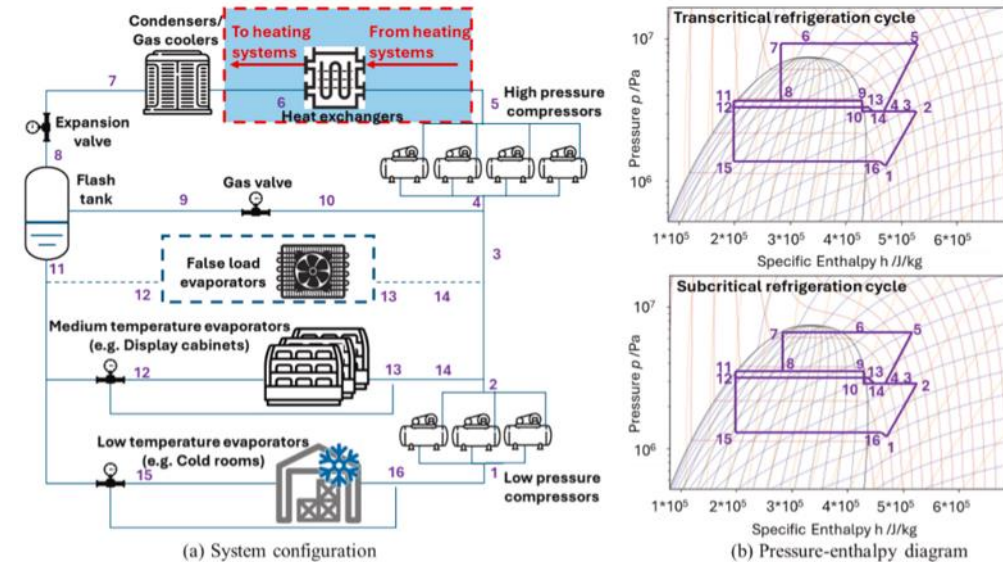
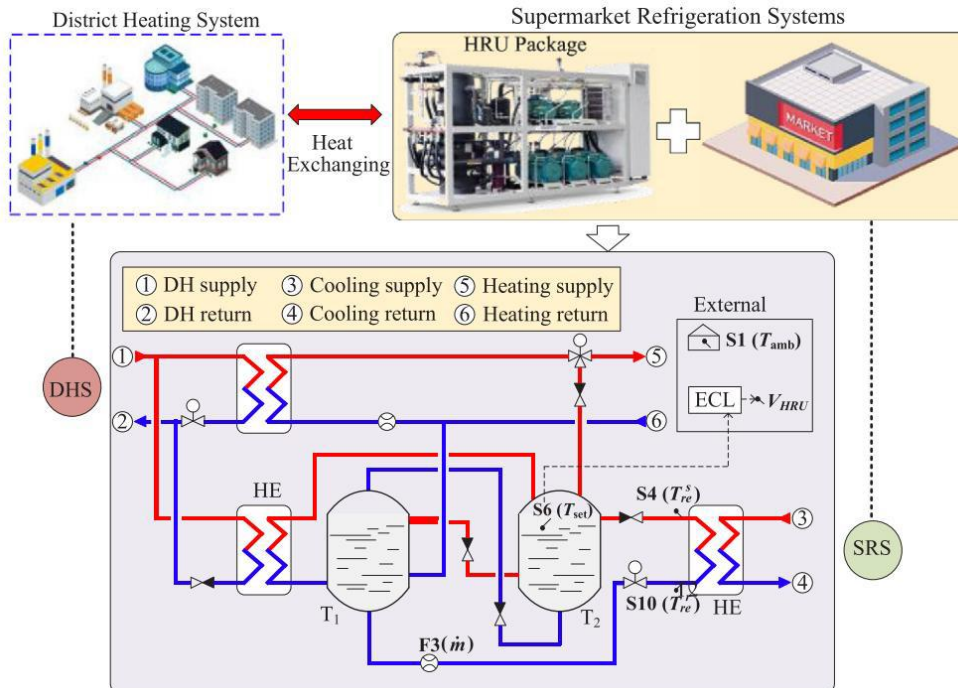


SET_HEAT model development projects



SET_HEAT_RETAIL - Vilnius (LT)

Heat recovery 50 – 250 kW_t

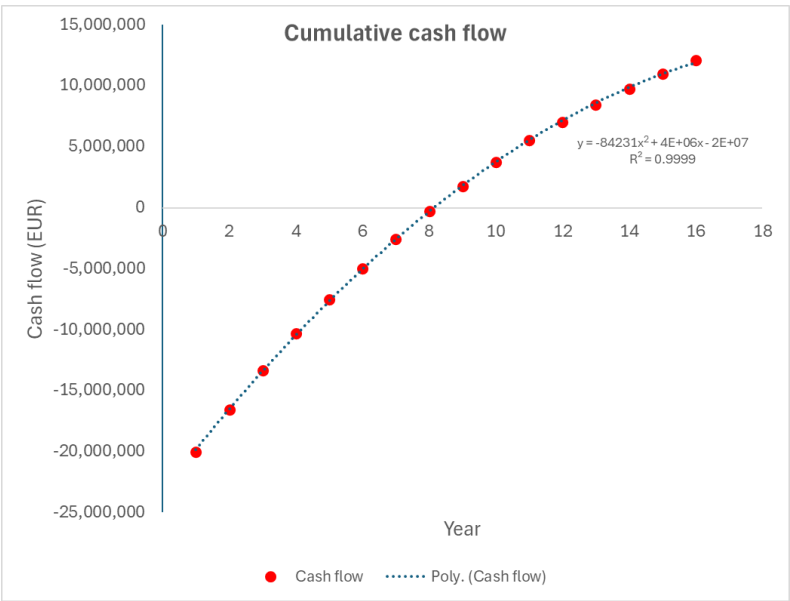
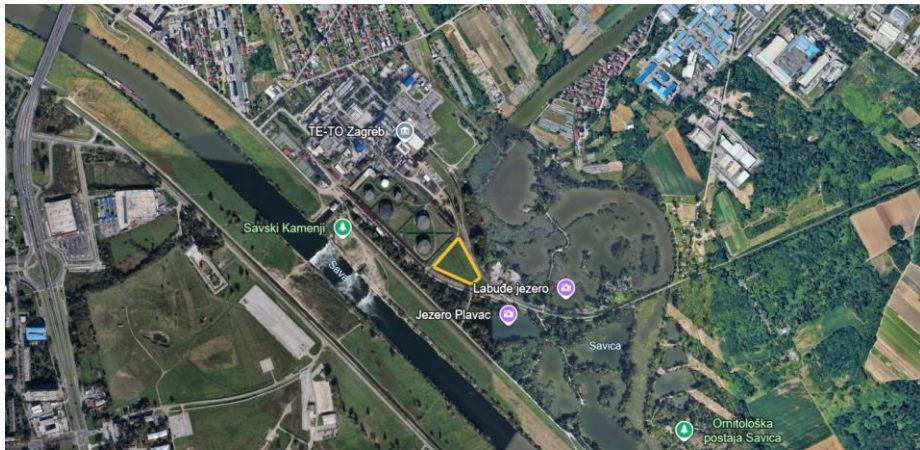
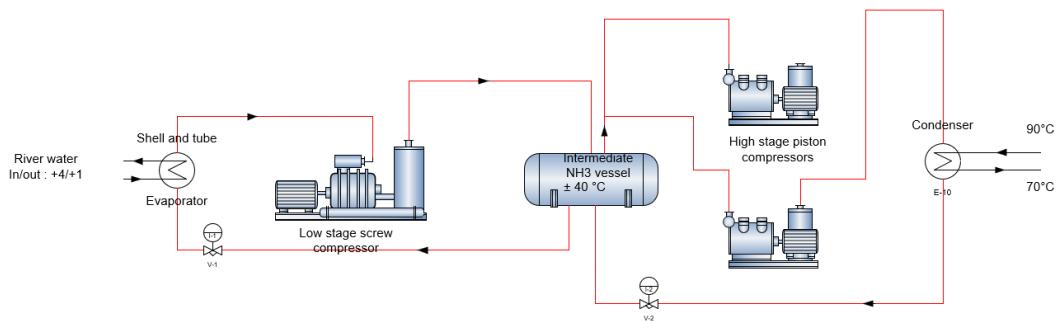


Parameter	Typical Value / Range
System Type	CO ₂ (R-744) transcritical refrigeration
Heat Recovery Capacity	50 – 250 kW
Max Water Outlet Temperature	Up to 80 °C
Water Flow Rate	1 – 10 m ³ /h
Water Temperature Rise	0 – 40 °C
Heat Exchanger Type	Brazed plate heat exchanger
Electrical Power (Pump + Control)	0.5 – 1.5 kW
Dimensions	1.0 – 2.5 m (L), 0.8 – 1.5 m (W), 1.2 – 2.0 m (H)
Payback	5 years

SET_HEAT model development projects



SET_HEAT_WATER Zagreb (HR) - 167,404t MWh/y

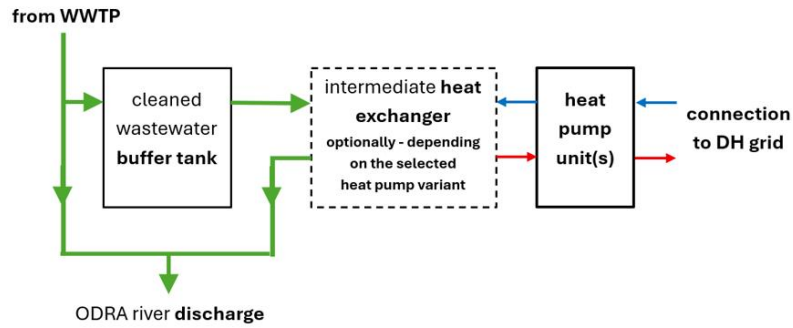


- Heat duty 21 MW
- Investments 20 MEUR
- Discount rate 7 %
- Loan 10 years
- Natural gas price 41 €/MWh
- CO₂ price 65 €/ton

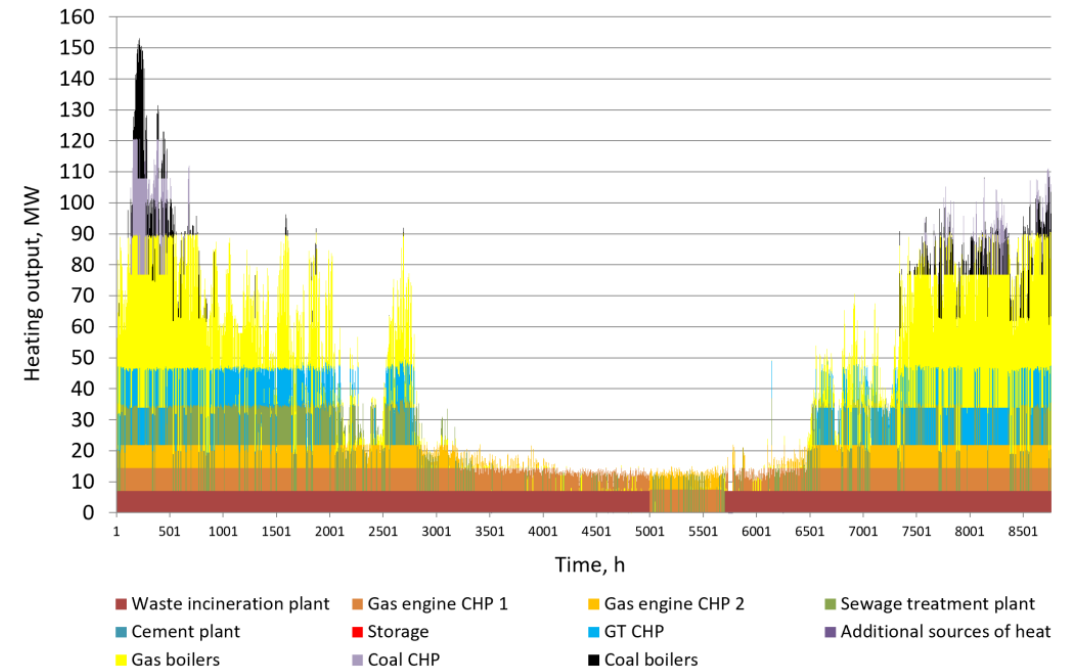
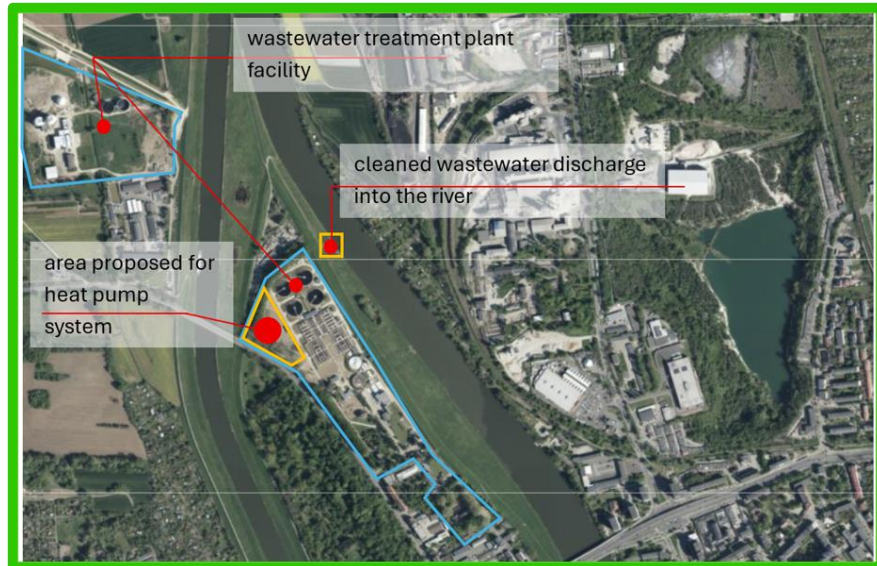
Performance indicator	Value
NPV	5,544,179 EUR
IRR (%)	13%
PI	1.3
Payback period (y)	8

SET_HEAT model development projects

SET_HEAT_SEWAGE - Opole (PL) 8–15 MW_t



- Thermal output capacity: 1.5 MW
- Heat source: treated wastewater (via intermediate exchanger)
- Effective heat source inlet: 10–25 °C
- Heat sink output temperature: 55–65 °C
- Refrigerant: R1234ze
- COP range: 3.6–4.0
- Compressor type: oil-injected screw (high-efficiency)
- Electrical input power: 350–400 kW per unit



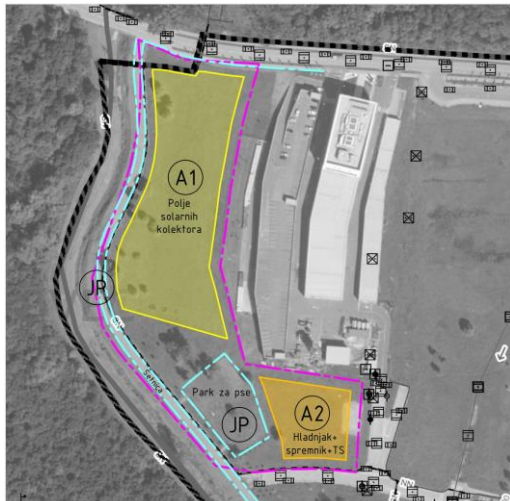
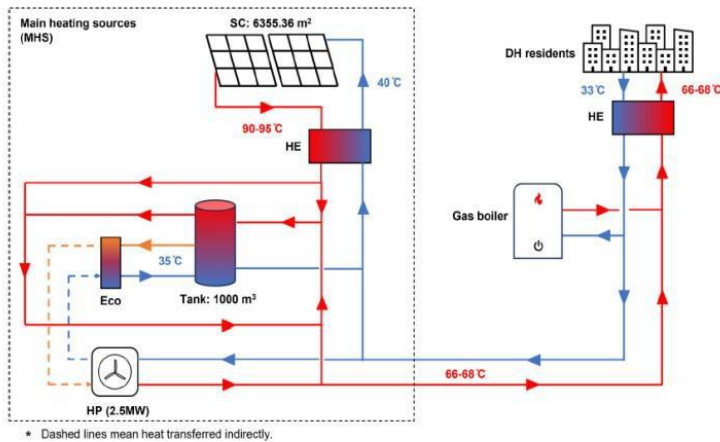
SET_HEAT model development projects



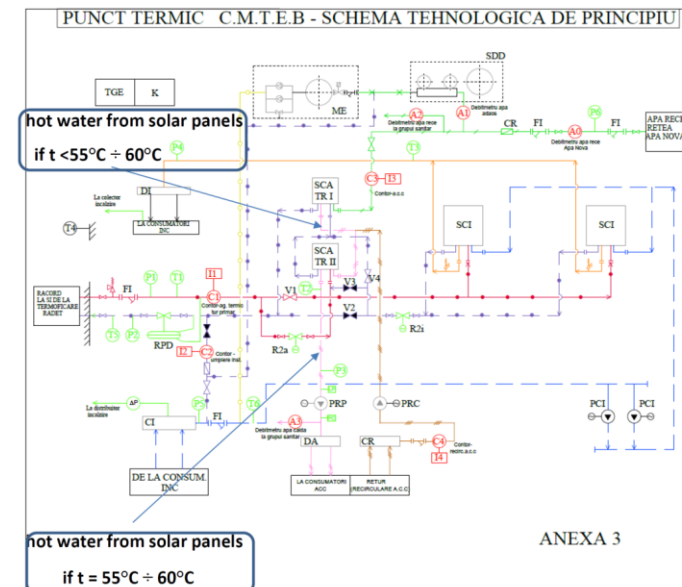
SET_HEAT_SOLAR

Bucharest (RO) – distributed rooftops

Zeprešić (HR) - 2,860 MWh/y



- Number of TVP MT-Power collectors: 2 040
- Area occupied by collectors: 3 998.4 m²
- Collector orientation: 10.4° southwest
- Collector's Angle: 35°
- Medium in collectors: water
- Output temperature from the solar field:
 - Summer: 76 °C
 - Winter: 91 °C



Summary model development project



- ▲ SET_HEAT_SEWAGE
- ▲ SET_HEAT_RETAIL
- ▲ SET_HEAT_RIVER
- ▲ SET_HEAT_LAKE
- ▲ SET_HEAT_AIR
- ▲ SET_HEAT_SOLAR
- ▲ SET_HEAT_PTES
- ▲ SET_HEAT_CHP

All projects are supported by

- Legal, environmental and socio-economic studies
- Business models and financial studies
- Investment plans
- Sustainability, replication, and exploitation of project results

Thank you for your attention!



Q&A session

SET  HEAT <https://setheat.polsl.pl/>



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