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WIEN ENERGIE
DIE ENERGIE VON WIEN

Decarbonization of large-scale district heating / cooling networks with a focus on sector coupling

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Content

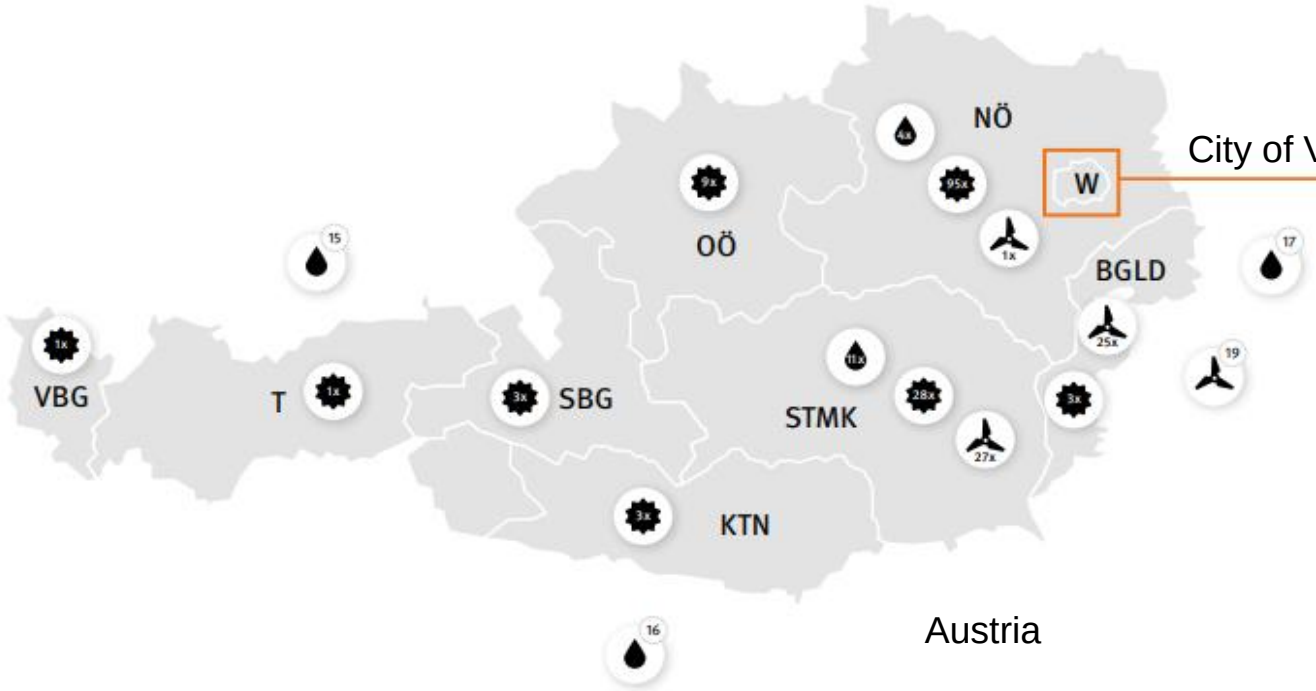
- Introduction
- District heating and cooling in Vienna
- Energy system optimization for long term decarbonization strategy
- Sector coupling examples

Product Portfolio Wien Energie

- Electricity
- Natural gas
- Heat
- Cooling Energy
- Photovoltaic
- Hydropower
- Windpower
- Energy Services
- Energy Efficiency
- E-Mobility
- Energy Communities
- Citizen Power Plants
- Smart Services
- Security Solutions
- Research and Innovation
- Tele-communication

Wer, wenn nicht wir. WIEN ENERGIE

Wien Energie Assets



City of Vienna

Austria

Number of PV systems per federal state

Number of wind farms per federal state

Number of hydroelectric power plants per federal state

Wien Energie in Numbers

2 mio.

We provide 2 million people with power, gas, heating and cooling

2040

We will achieve net zero emissions in 2040

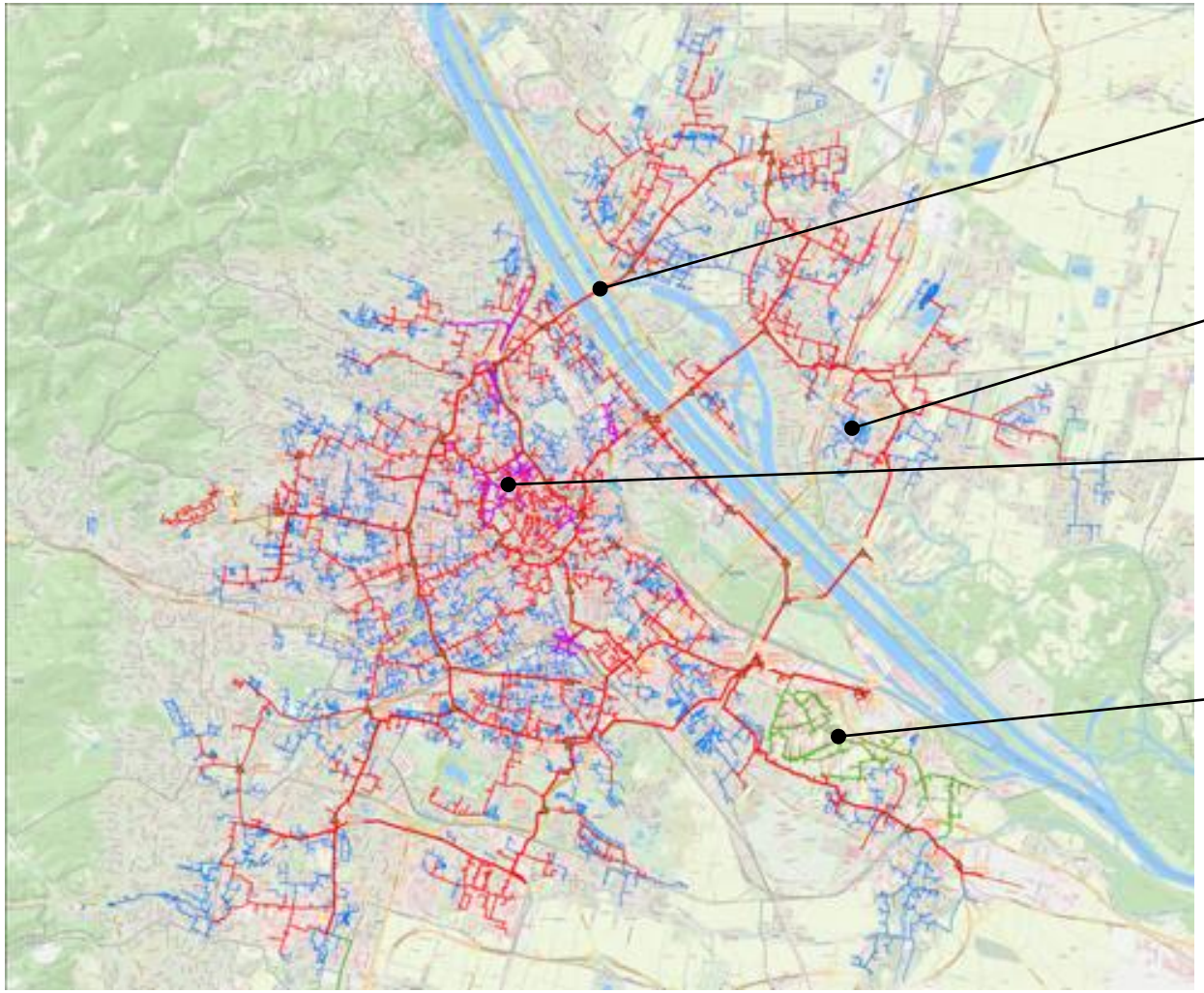
1 mio.t

We turn 1 million tones of waste into green heating & electricity

Nr. 1

We are Austria’s largest producer of solar power

District heating and cooling in Vienna | Overview



Primary district heating grid
Forward temperature: 95-145°C
Network length: 561 km
Purpose: Transportation and distribution

Secondary district heating grids
Forward temperature: 63-90°C
Network length: 700 km
Number of networks: >600
Purpose: Distribution

District cooling grids
Forward temperature: 4-6°C
Network length: 25 km
Number of networks: 15
Purpose: Distribution

Lower temperature primary district heating grids
Forward temperature: 80-110°C
Network length: 20 km
Number of networks: 2
Purpose: Distribution

Generation Assets – Installed Capacity in MW

Combined Heat and Power	Plant	Power	Heat
	Donaustadt	*395*	*350*
	Simmering 1	*710*	*520*
	Simmering 2	*60*	*150*
	Simmering 3	*350*	*450*
	Biomasse KWK	*24*	*35*
	Sum	**1 539**	**1 505**

Simmering 1-3

Donaustadt

Biomass CHP

Heat Generation	Plant	Heat
	Heat pump (Simmering, EBS, UNO, Theme Wien)	*92*
	Gas boiler (Spittelau, Arsenal, Leopoldau, Inzersdorf)	*1.250*
	Power-to-Heat (Spittelau, Leopoldau)	*30*
	Heat storage (Simmering)	*140*
	Sum	**1227**

Heat pump

Gas boiler (Arsenal, Spittelau, Inzersdorf, Leopoldau)

Waste Inceration	Plant	Power	Heat
	Simmeringer Haide	*14*	*55*
	Spittelau	*13*	*75*
	Flötzersteig		*54*
	Pfaffenau	*12*	*67*
	Sum	**29**	**251**

Spittelau

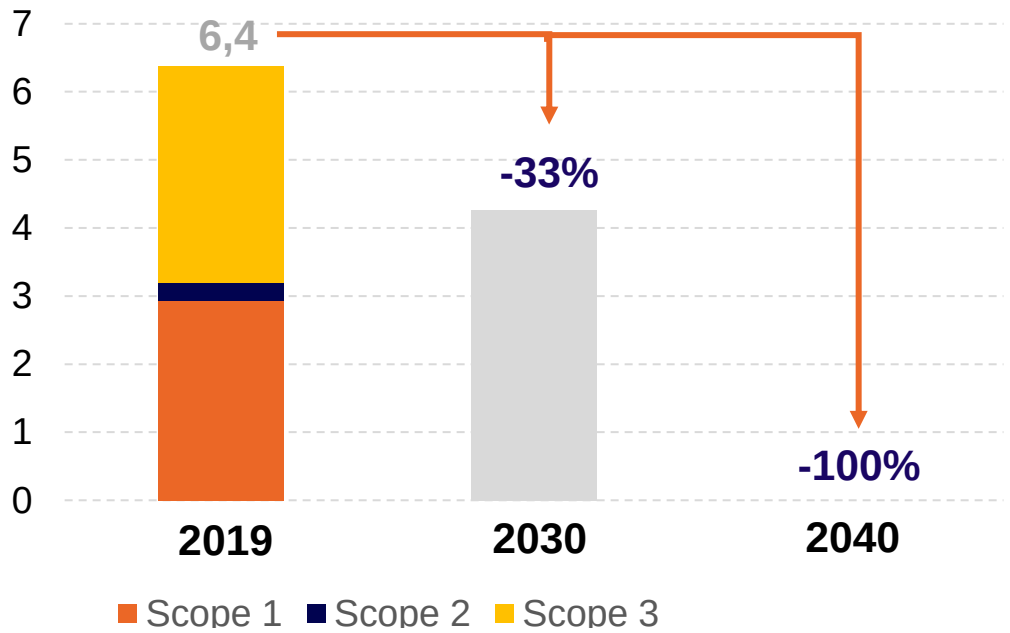
Flötzersteig

Simmeringer Haide

With our sustainability strategy, we set ambitious climate targets

EWS - Strategische Energiewirtschaft
WIEN ENERGIE
WIENER STADTWERKE GRUPPE

Greenhouse gas emissions per scope (million tonnes CO_2)



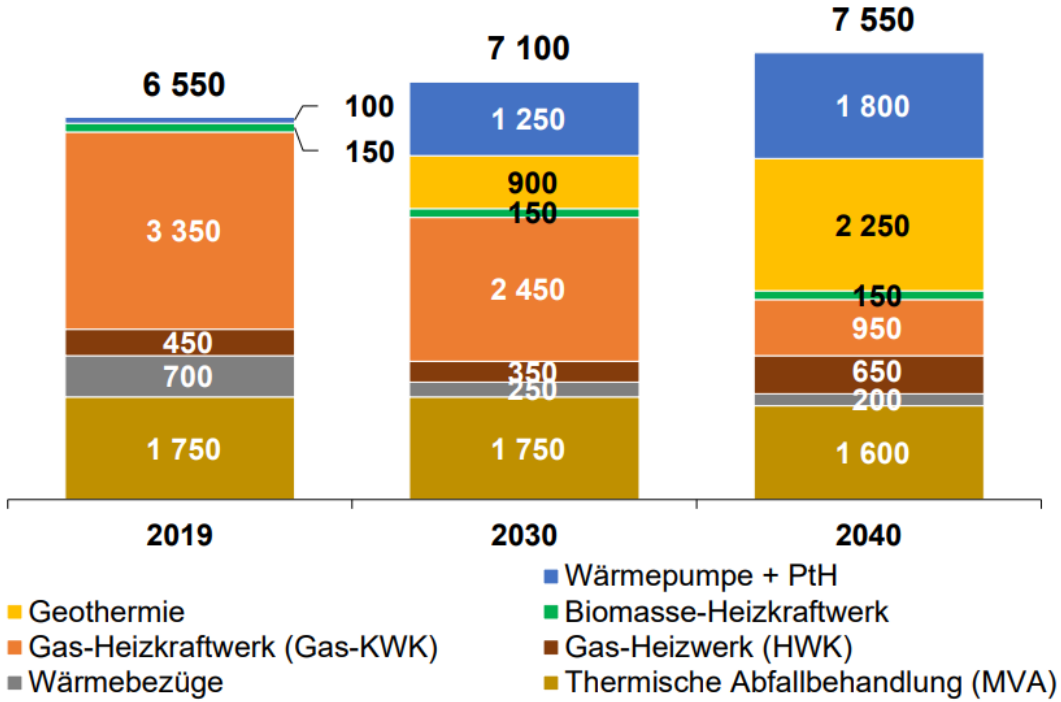
Key objectives of the sustainability strategy

- The greenhouse gas balances for 2019 and 2020 provide a comprehensive picture of Wien Energie's emissions along the entire value chain (Scope 1-3).
- Reduction paths were drawn up and targets defined based on the greenhouse gas balance.
- Wien Energie will achieve net zero emissions in 2040 and defines an ambitious interim target in 2030 of -33% compared to 2019.

Decarb21 Study

District heating production share

- Increasingly high share of heat pumps and geothermal heat
- Reduction of CHP heat
- Increasing demand (decarbonization of the City of Vienna)
- Waste incineration remains as base load (CCU, CCS)



Anmerkungen: *Zahlenwerte sind auf ganze 50 GWh gerundet; Summenproduktion über den Säulen Summen gerundeter Werte entsprechen nicht immer den gerundeten Summenwerten.*

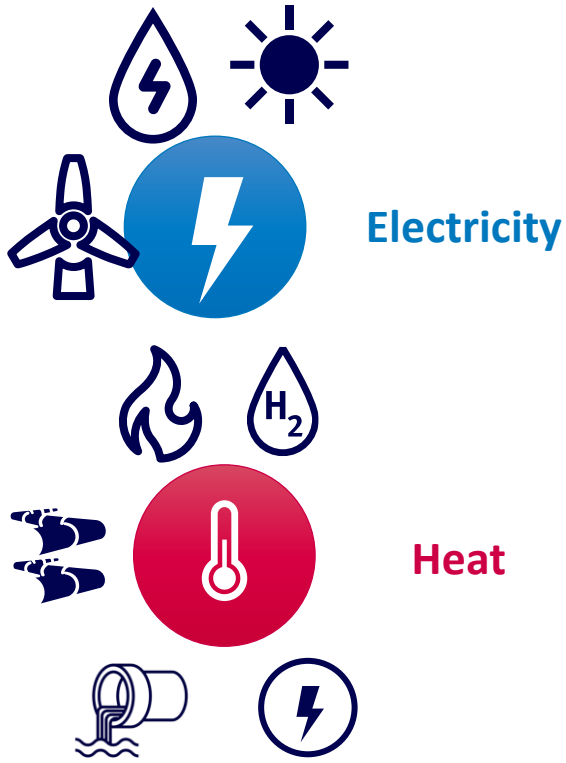
Quelle: *Compass Lexecon-Analyse auf Basis Statistik Austria, 2020a (für 2019) und auf Basis der Studienannahmen (2030 und 2040)*

Total cost energy system optimization

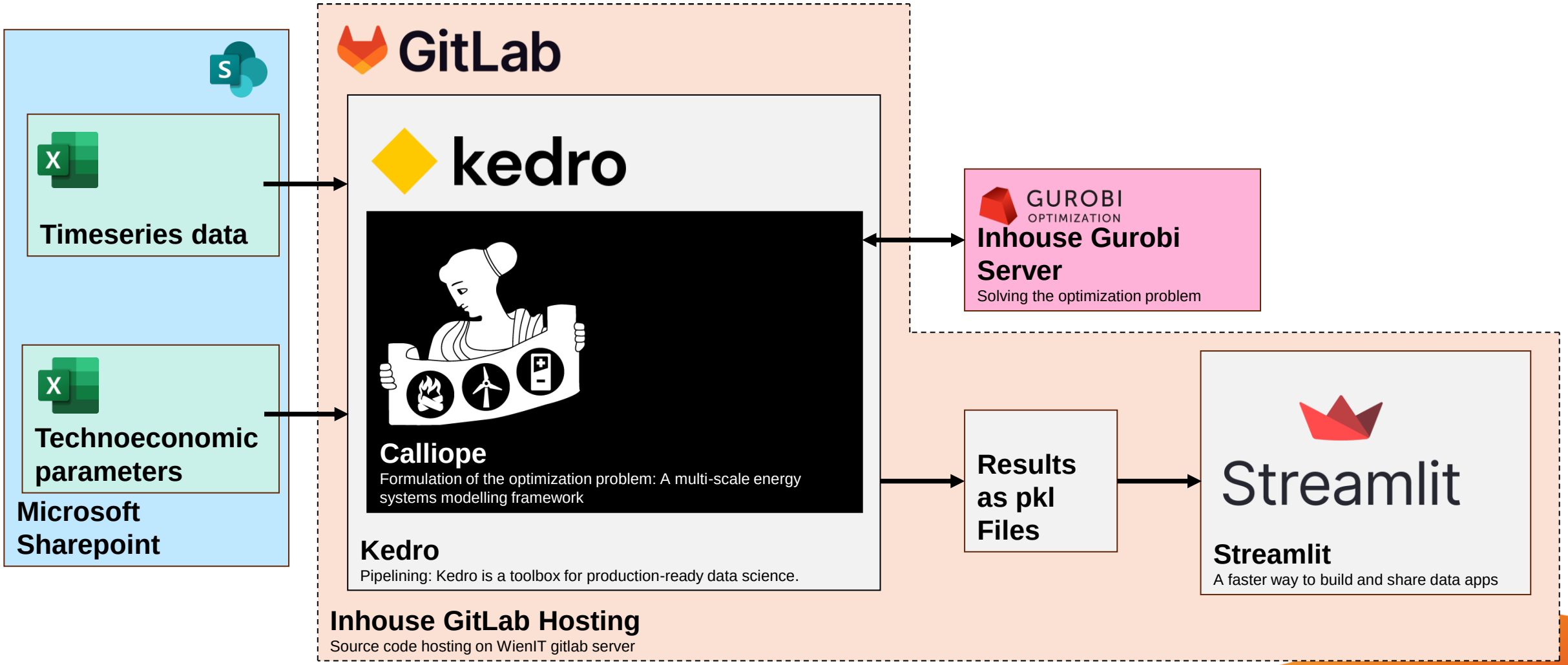
Total cost optimization model

Motivation

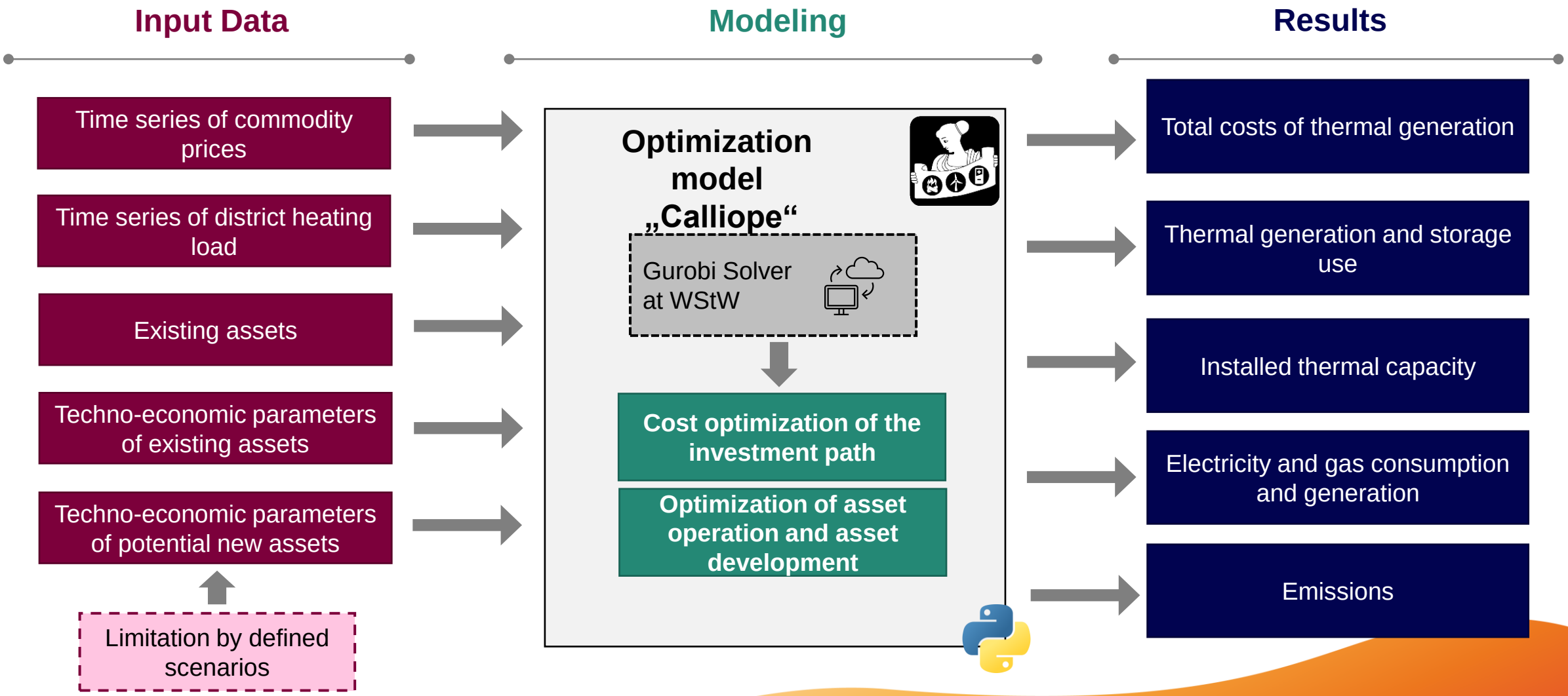
- Overall overview and forecast of the profitability of the products district heating and electricity, taking into account **expansion and decarbonisation**
- Examination of the **competitiveness** of products in the energy markets
- **Long-term outlook** on investment needs, energy volumes, costs and emissions until 2055
- Create a **uniform basis** for profitability assessments of district heating assets and distribution



Calliope at Wien Energie | Open-Source based modeling framework

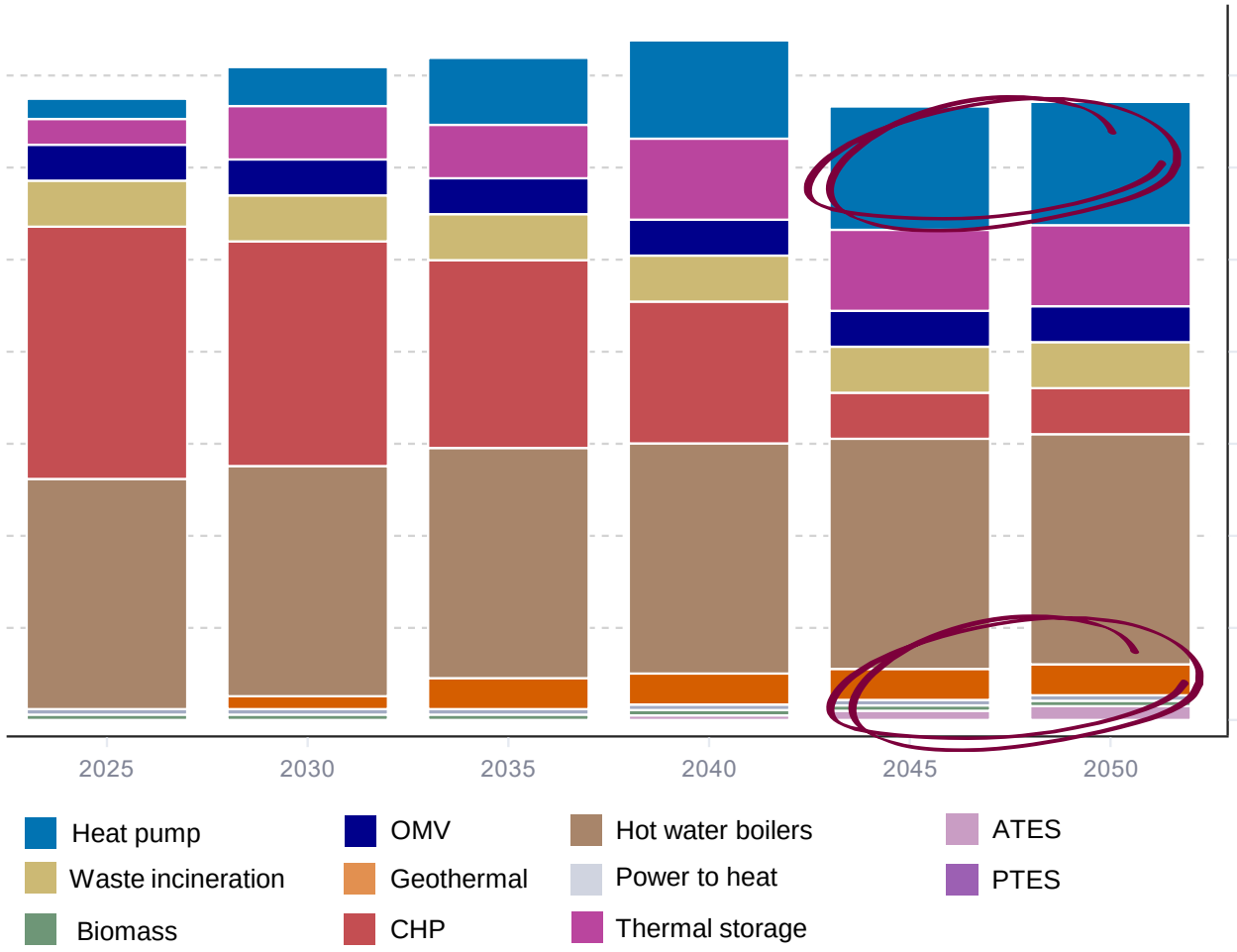


Method of total cost optimization with Calliope



Total cost optimized scenario 2023 | Asset development

Installed thermal capacity



Heat Pumps

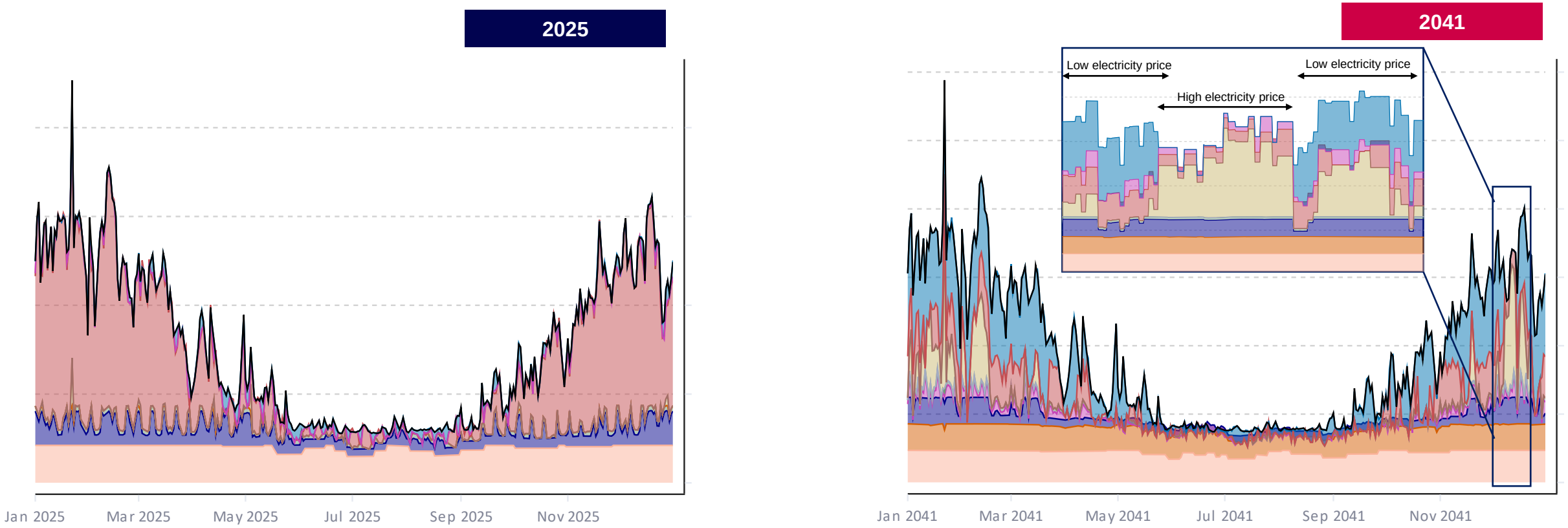
- Significant grow in heat pump capacity
- High temperature waste heat sources preferred
- Limitation through high forward temperature – reheating necessary
- Replacing exciting CHP capacities

Geothermal Energy

- Development in a JV with OMV
- High number of full load hours necessary
- High fix costs – low variable costs
- Drilling success risk

Deep Dive | Comparison of 2025 and 2041

Thermal generation| daily resolution| 2025 | 2041



Deep dives – sector coupling examples

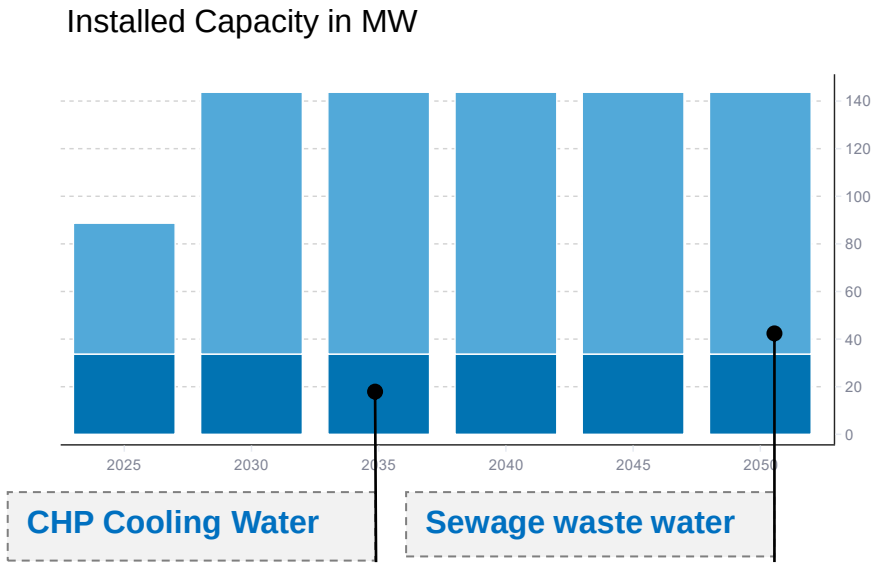
Deep Dive | Heat Pumps

Heat Pumps

- Installed capacity: 90 MW (2027: 144 MW)
- Heat source: CHP cooling water and sewage waste water
- The sewage waste water plant will double the capacity from 2027 ongoing
- Forward temperature: 95°C

Sewage waste water heat pump (55-110 MW)

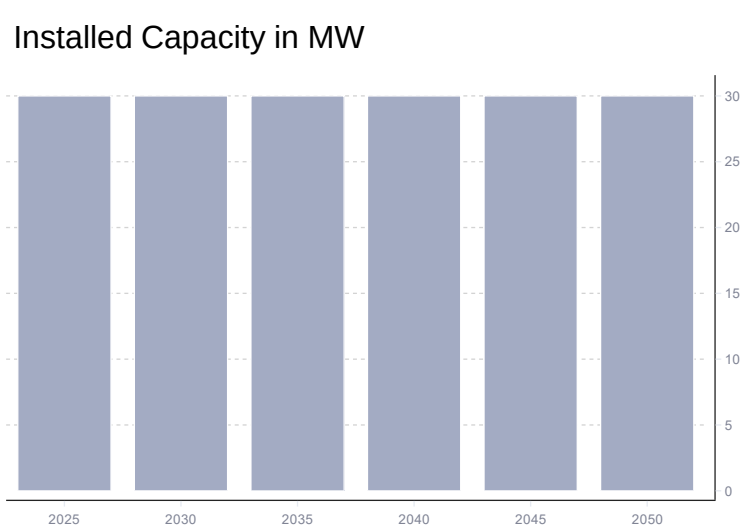
CHP cooling water heat pump (32 MW)



Deep Dive | Power to Heat

Power to Heat

- Installed capacity: 30 MW
- Forward temperature: 150°C
- **Operation type: Secondary Control Market (aFRR)**
- **Capacity factor 0.03-0.05**

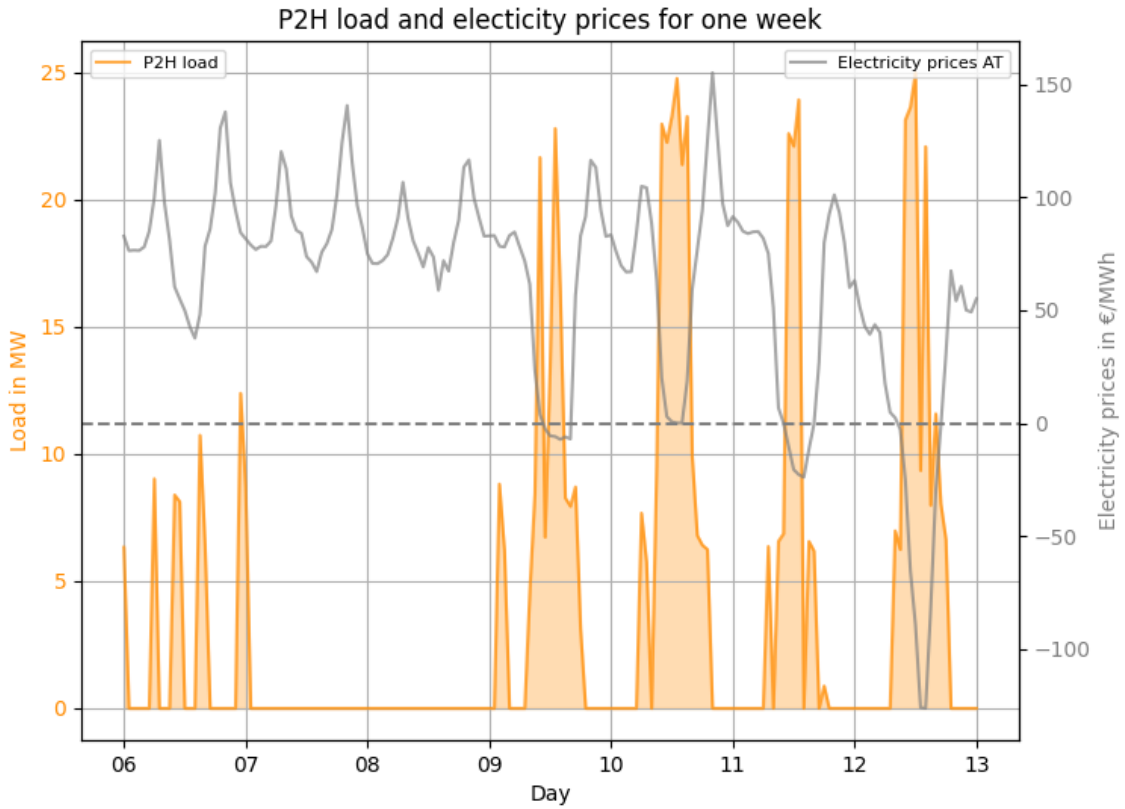


Power to heat plant Spittelau (10 MW)

Deep Dive | Power to Heat

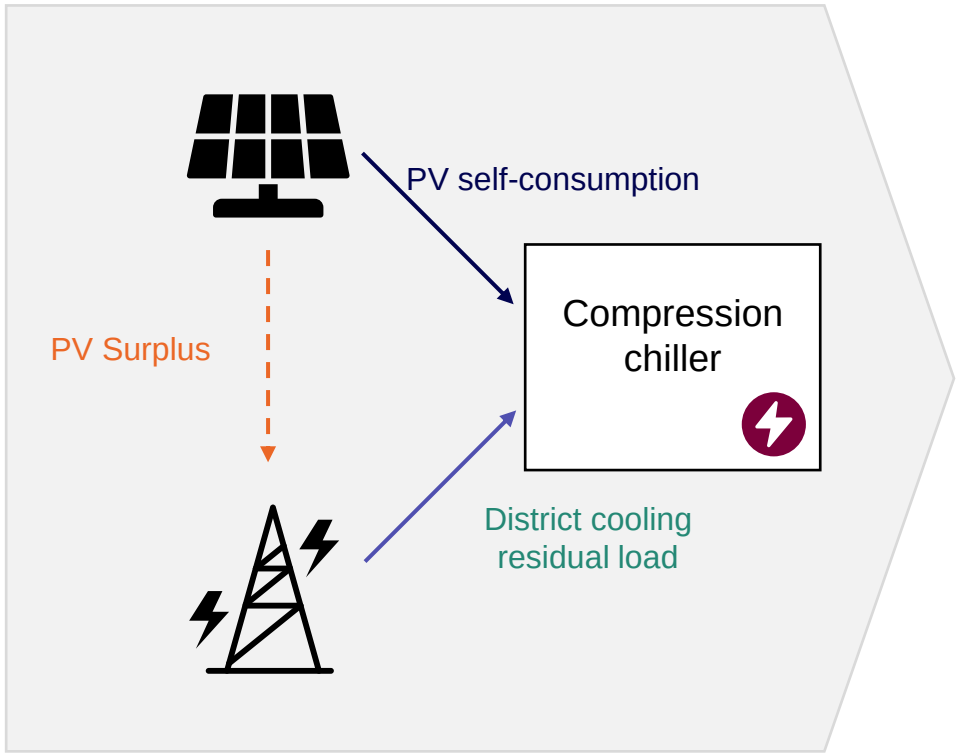
Power to Heat

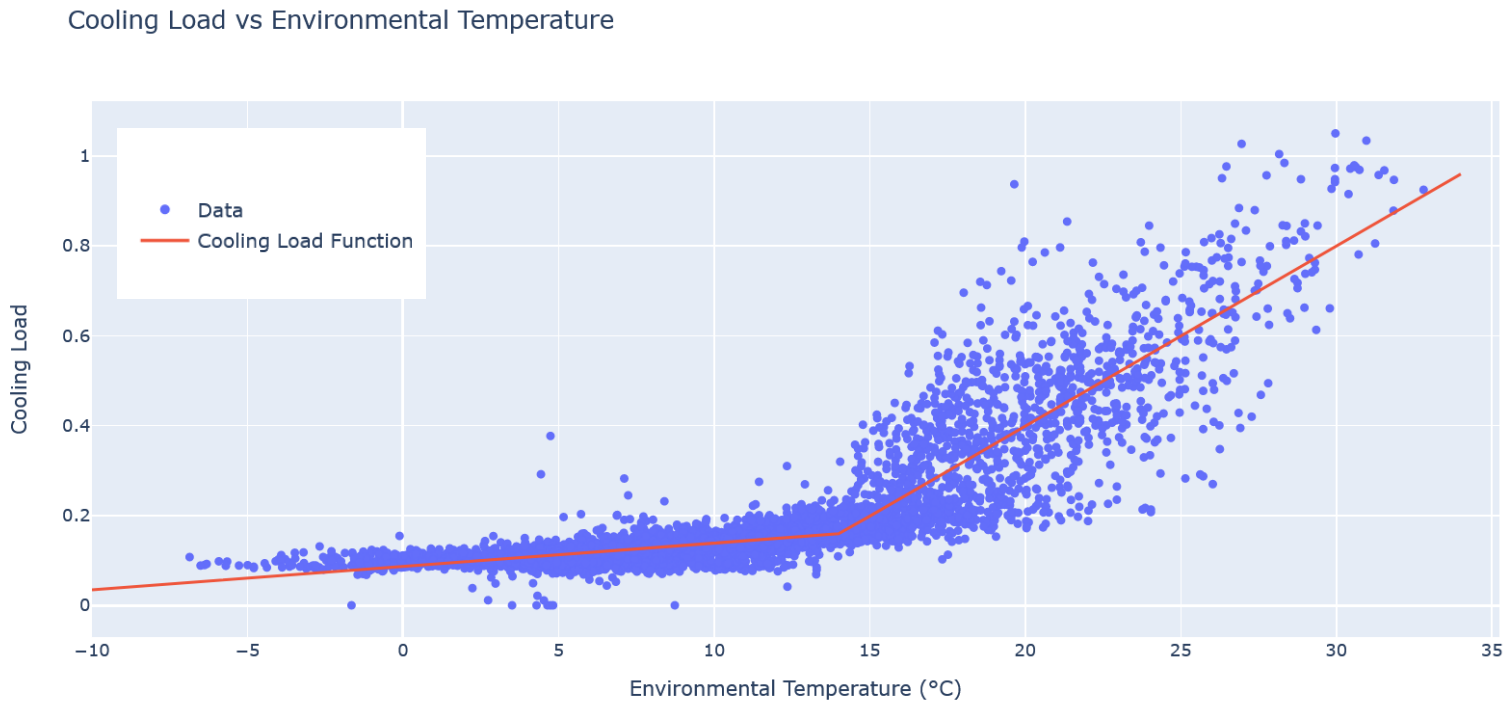
- Installed capacity: 30 MW
- Forward temperature: 150°C
- **Operation type: Secondary Control Market (aFRR)**
- **Capacity factor 0.03-0.05**



Analysis of the P2H operation for an average spring week

PV-PPA for district cooling





- **Electricity prices** for district cooling with compression chillers **can be reduced with an PV-PPA**
- **PV market value can be increased** with the sector coupling with district cooling
- Even with low heat prices in summer absorption chiller are hardly competitive

Conclusion

- The phase-out of fossil gas and the development of efficient renewable heat sources will **reduce the the primary energy demand** of district heating and cooling grids

- The **electricity demand for heating and cooling will increase significantly** but will still be a magnitude lower then the actual gas consumption

- Smart sector coupling solutions together with green gas peak load plants can **reduce price risk for district** heating/cooling consumers

Thanks for your attention!