

OST
Ostschweizer
Fachhochschule

RegEWS: Feasibility study on reducing land requirements for large borehole fields in district energy networks

Florian Ruesch, Amelia Heid, Krisztina Kelewitz – OST University of Applied Sciences

10/12/2026

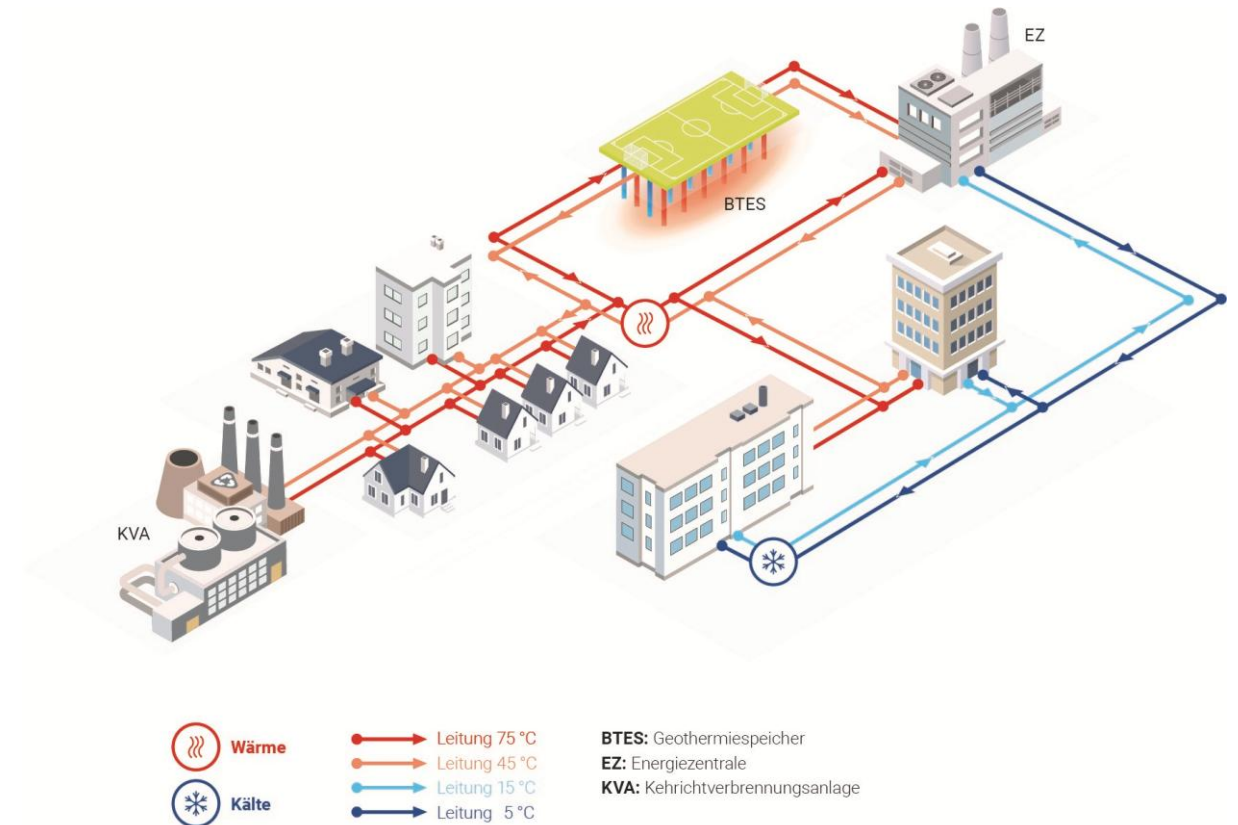


INSTITUT FÜR
SOLARTECHNIK



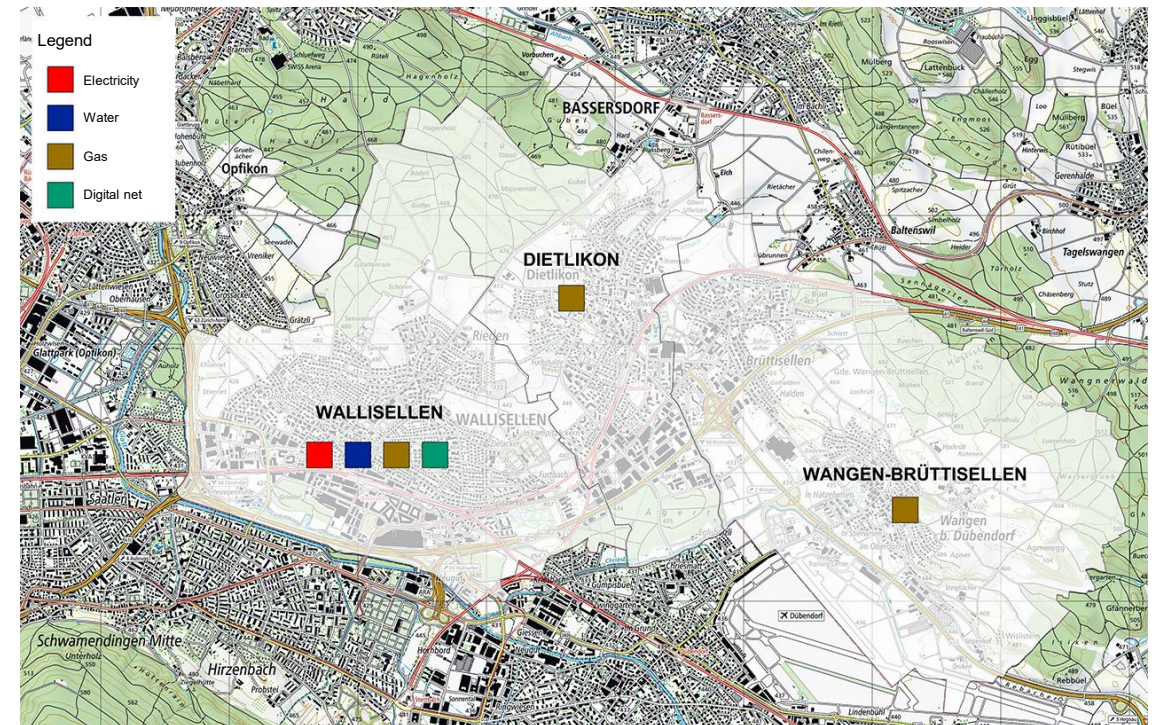
Content

- Introduction & Background
- SaisonLink concept and simulation results
- Environmental impact
- Conclusion & outlook
- Excursus campus OST: reducing winter electricity



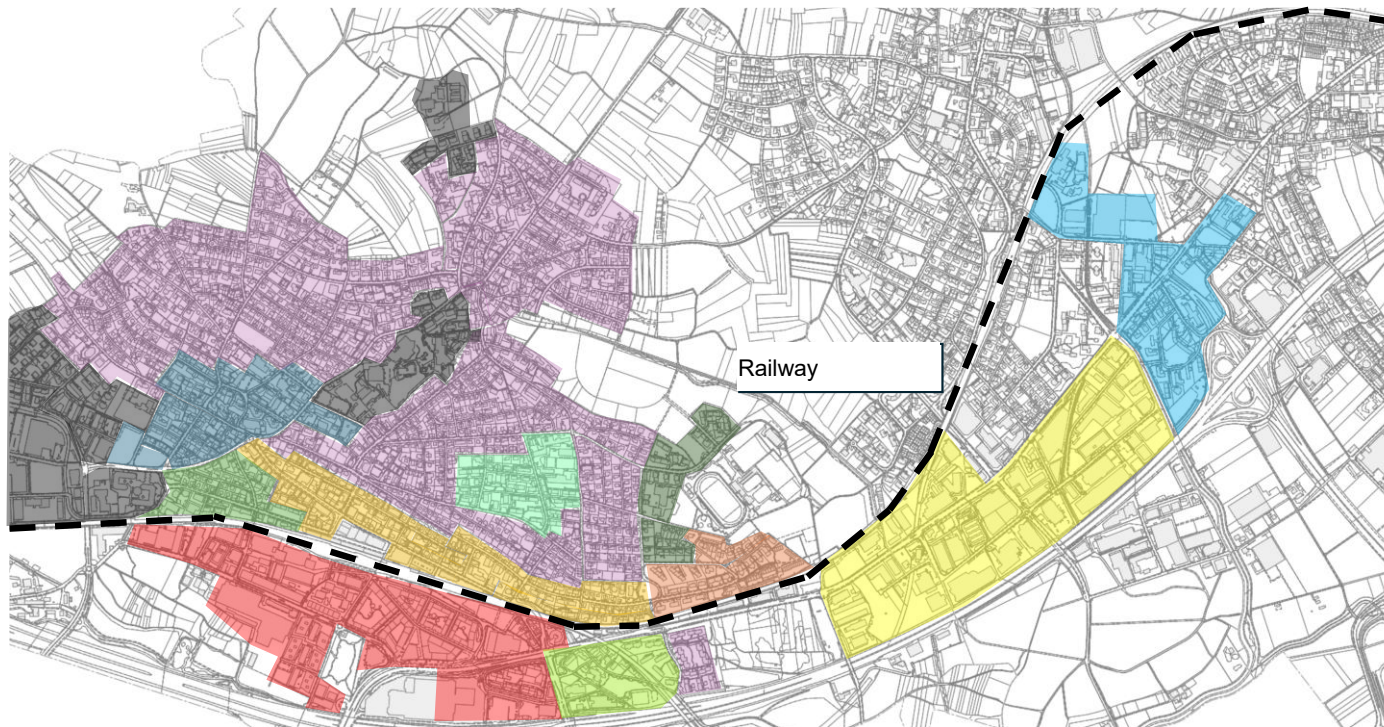
Background – die werke Wallisellen

- die werke is a multi-utility company owned by the City of Wallisellen
- Both the city and die werke aim to achieve the national net zero target by 2050
- Zurich cantonal energy law severely restricts replacement of fossil fuel heating
- Declining gas sales
- To meet economic and environmental goals, a decision was taken in 2022 to establish a new business unit for district energy networks

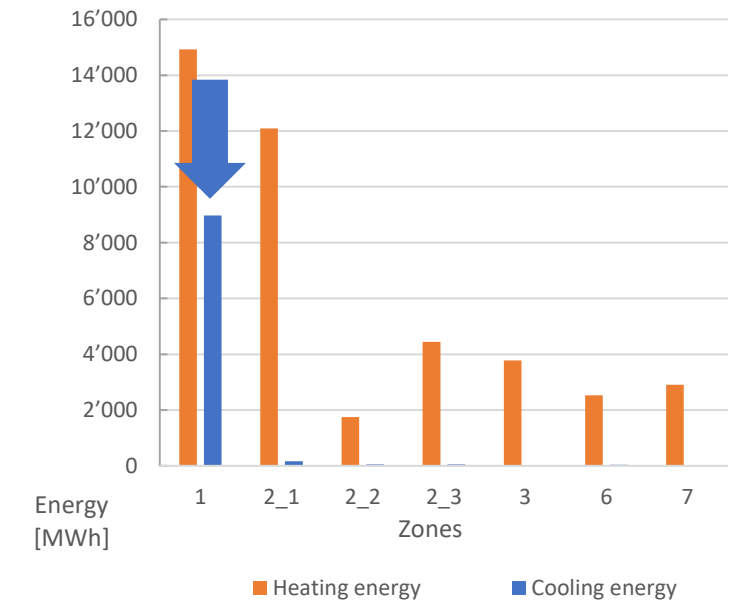


Feasibility: demand in Wallisellen

- North of the railway: housing, mainly heating demand
- South of the railway: mixed use, heating and cooling



Including Wangen-Brüttisellen, the estimated potential heat demand has recently doubled!



	Heating energy (MWh/a)	Heating capacity (kW)	Cooling energy (MWh/a)	Cooling capacity (kW)
Total	42'300	17'000	9'300	8'000

Feasibility: energy sources

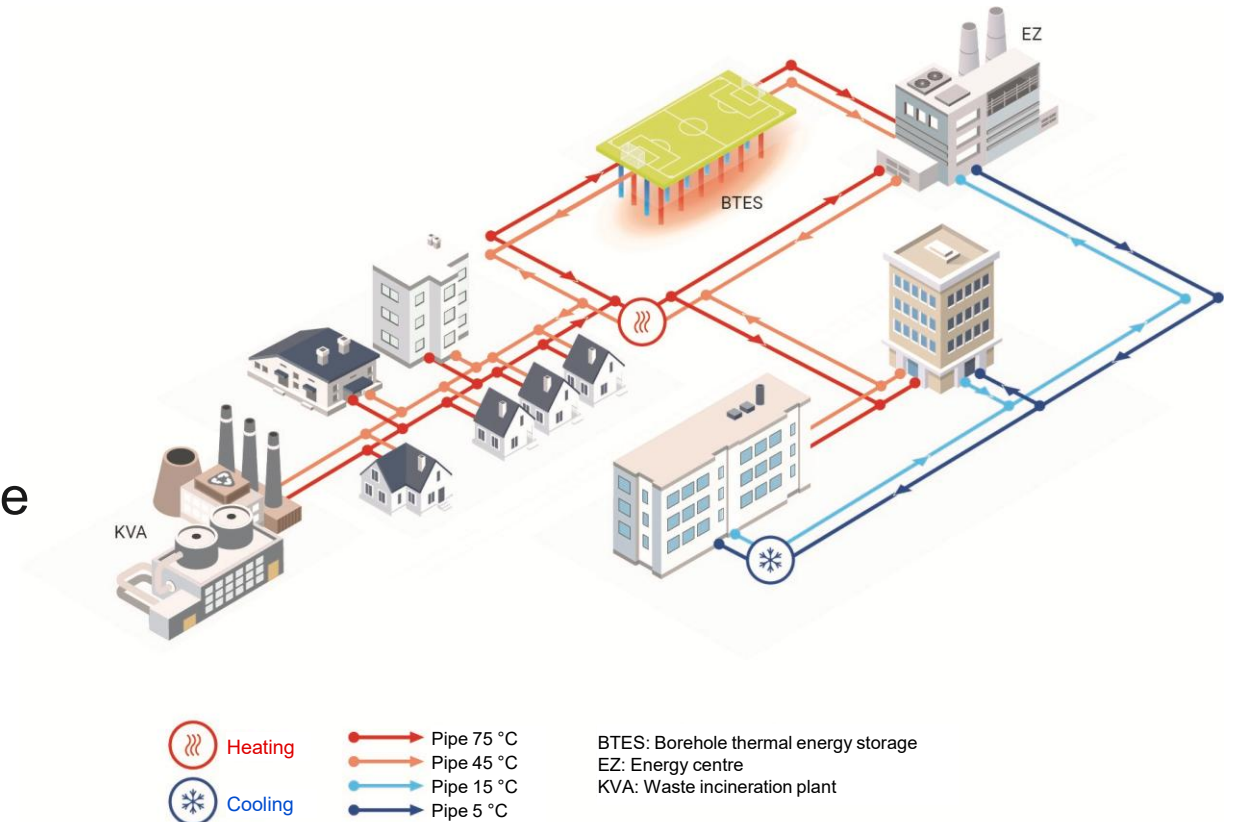
- Limited options for energy sources
 - No major bodies of water (the Glatt could supplement supply)
 - Insufficient groundwater resources or restrictions on use
 - No wastewater treatment plants
 - Little industrial waste heat apart from cooling systems
 - Wood is not preferred due to potential national shortages
 - Zurich's network uses all available winter heat from the nearby Hagenholz waste incineration plant
- Shallow geothermal energy remains: approx. 1,200 boreholes (area: 60,000 m²)
- Economic viability is challenging but possible (just enough energy density)

As the local energy utility with a clear mandate, die werke continued despite these challenges...

AWEL ZH feasibility study: RegEWS

- Reducing land requirements
 - Recharge with high-temperature waste heat from waste incineration
 - Additional sources (ambient air)
- Improving economic viability
- Use of agricultural land
- Impact on groundwater and surface land use

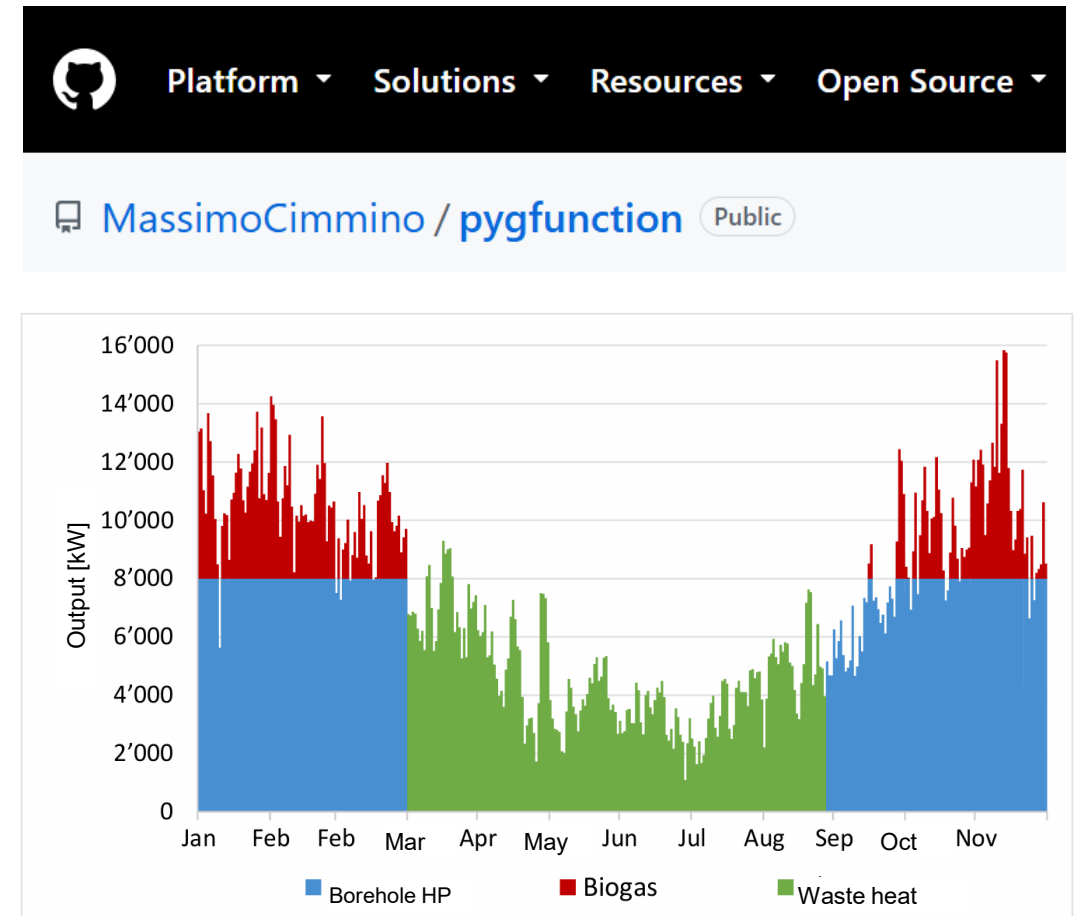
➤ Developpment of “SaisonLink” concept



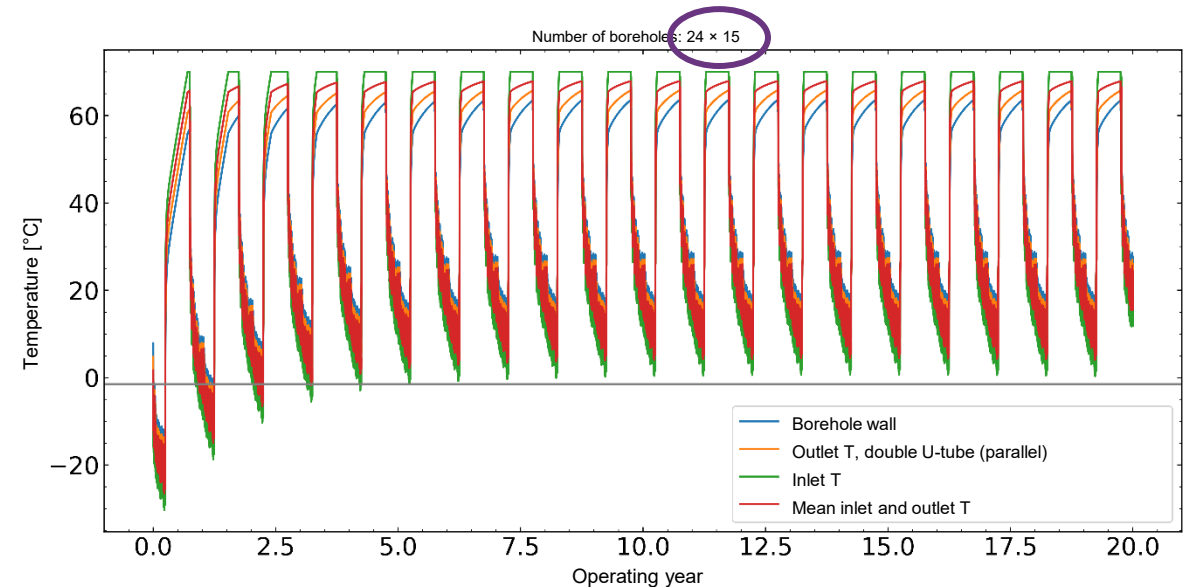
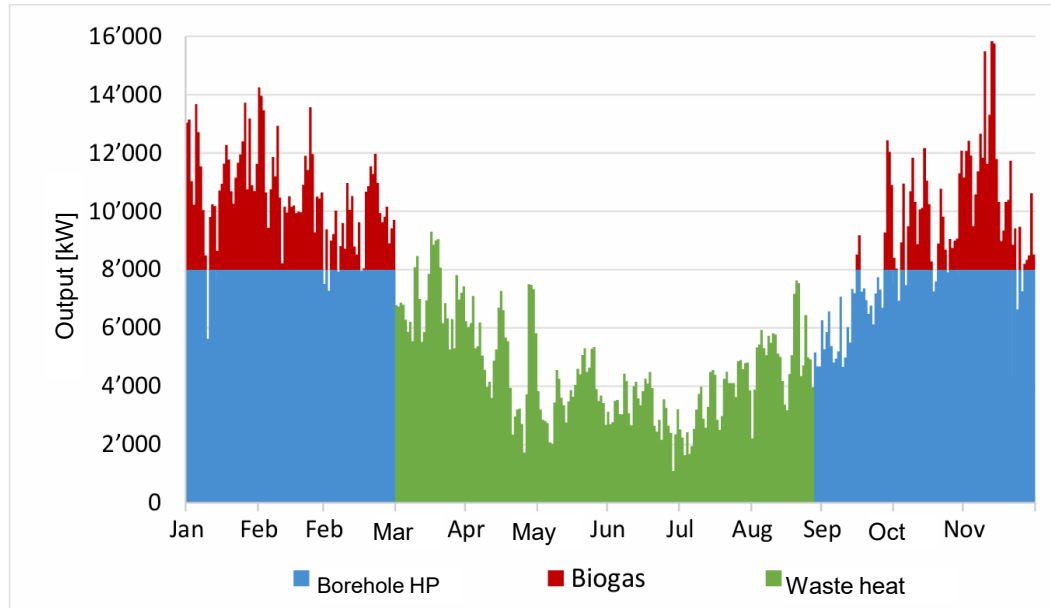
Simulation

Modelling

- Detailed borehole model by Cimmino
- Demand profiles (hourly, 70 °C flow)
- Simplified models of heat pumps, gas boilers and waste heat from incineration
- Heat pump: Carnot * 65 % efficiency (manufacturer: 66-69% for anomia)
- Waste heat (70°C, 10 MW in summer)
- Cooling not included

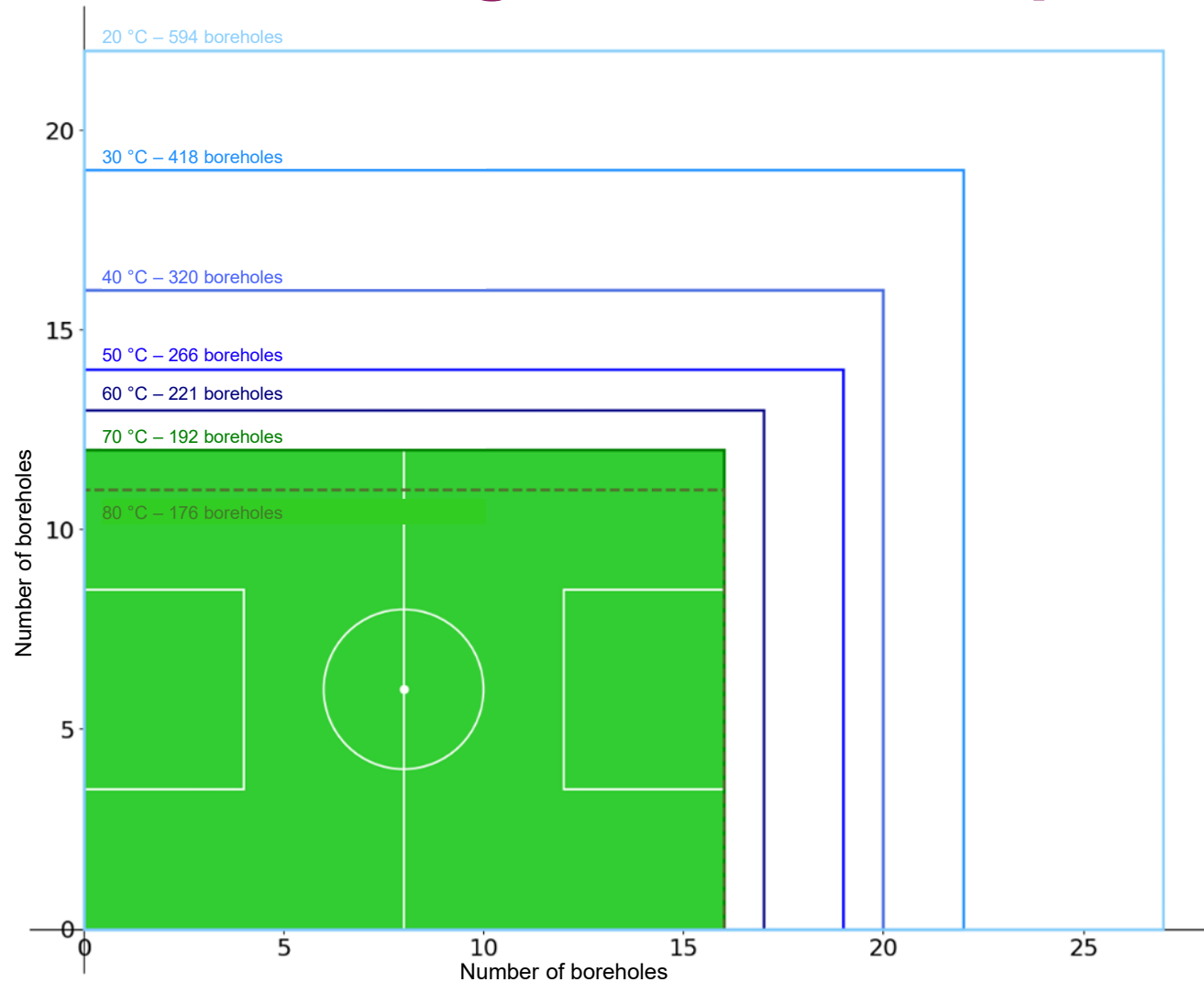


Simulation: biogas peak loads and two football fields



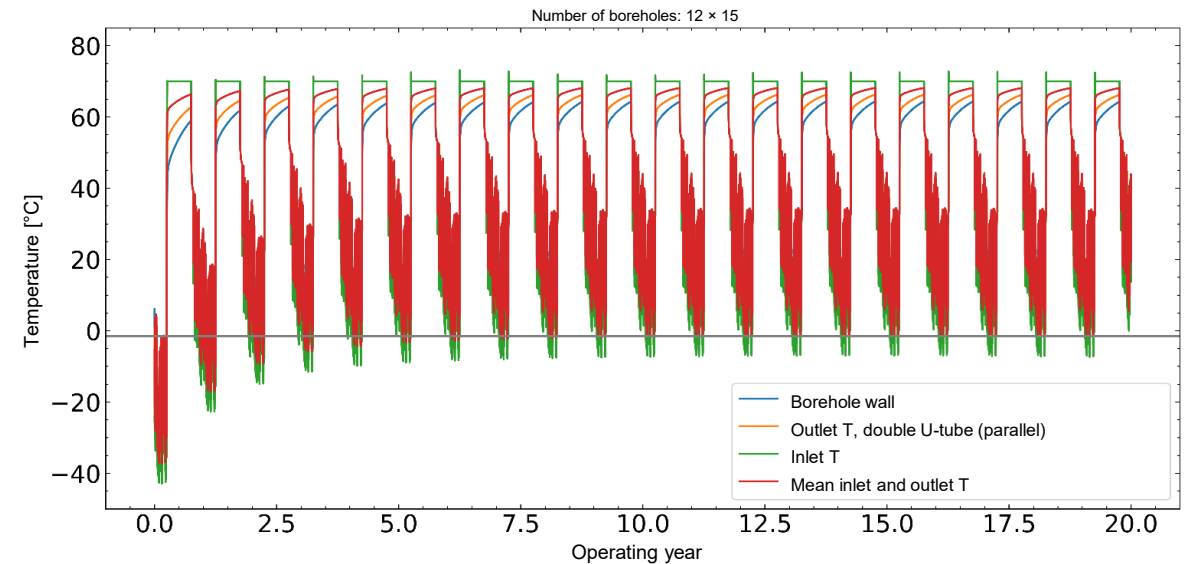
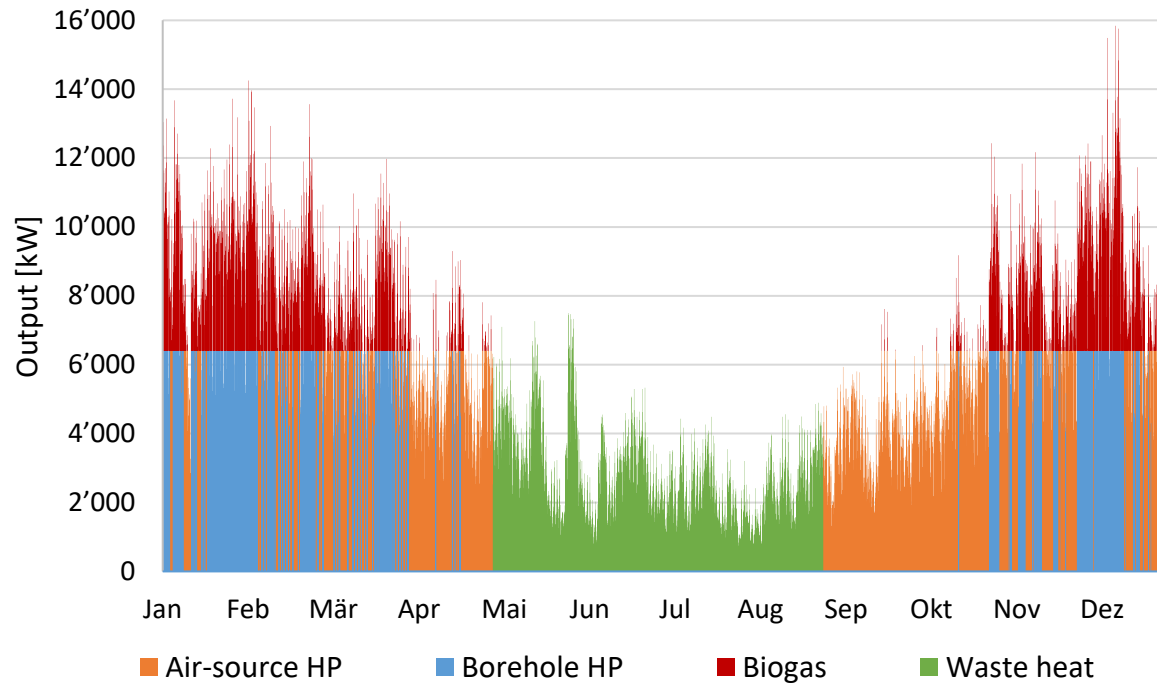
- Criteria:
 - Borehole temperature must stay above -1.5 °C (SIA 384/6), including long-term steady-state conditions
 - Biogas covers peak loads
 - **BTES below two football fields can meet heating demand**

Effect of regeneration temperature

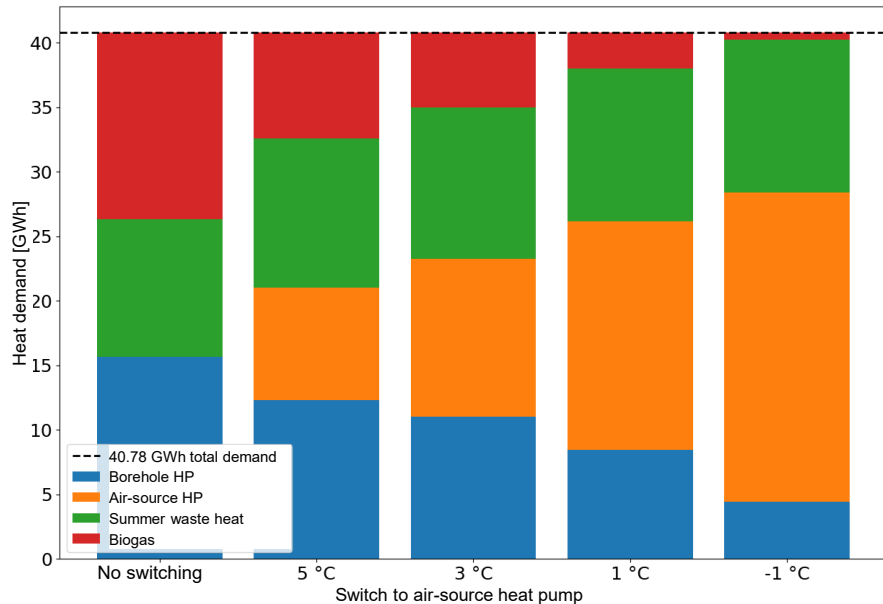


➤ Recharge at 70 °C can reduce the borehole field area by a factor of about 3.

Simulation: biogas, ambient air and one football field



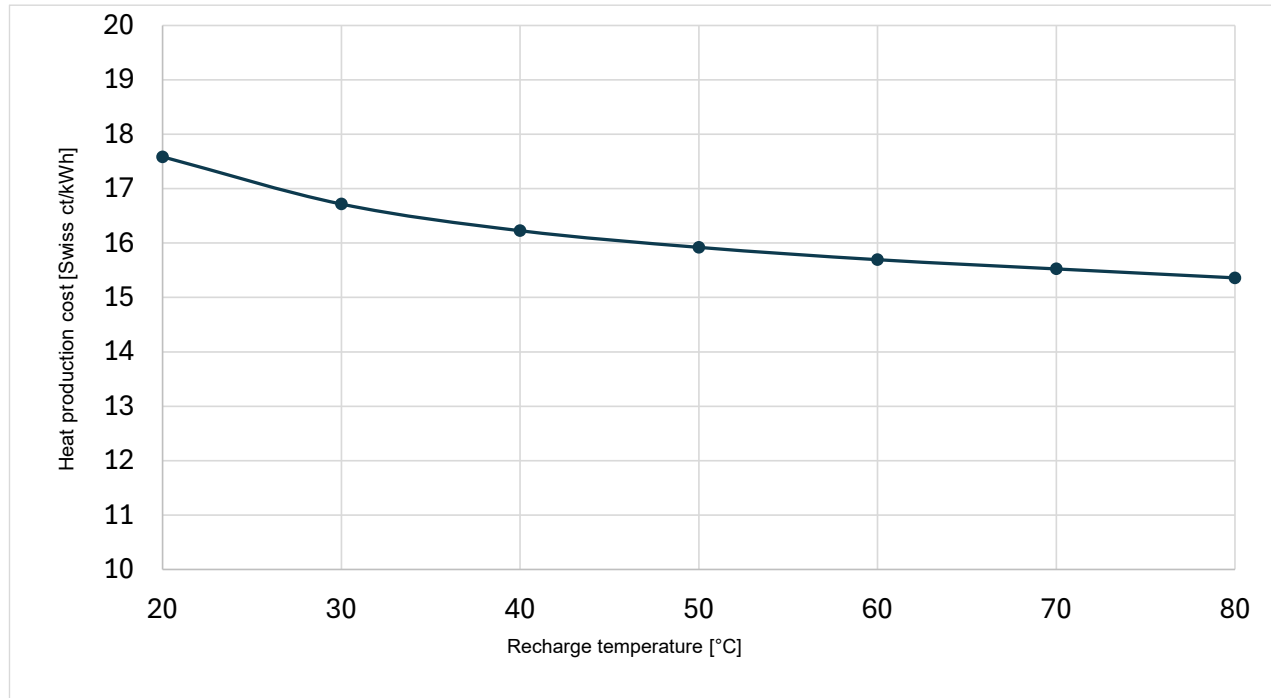
Ambient air combined with one borehole field



- Ambient air can indirectly reduce biogas peak loads
- Performance factors decrease only slightly

	Autumn PF Oct., Nov.		Winter PF Dec., Jan., Feb.		Spring PF (March)	
No switching	3.98		3.14		2.82	
Switch at 5°C	3.31	-17%	3.08	-1.9%	3.03	+7.4%
Switch at 3°C	3.22	-19%	3.02	-3.8%	3.05	+8.2%
Switch at 1°C	3.12	-22%	2.97	-5.4%	3.03	+7.4%
Switch at -1°C	3.01	-24%	2.91	-7.3%	2.94	+4.2%

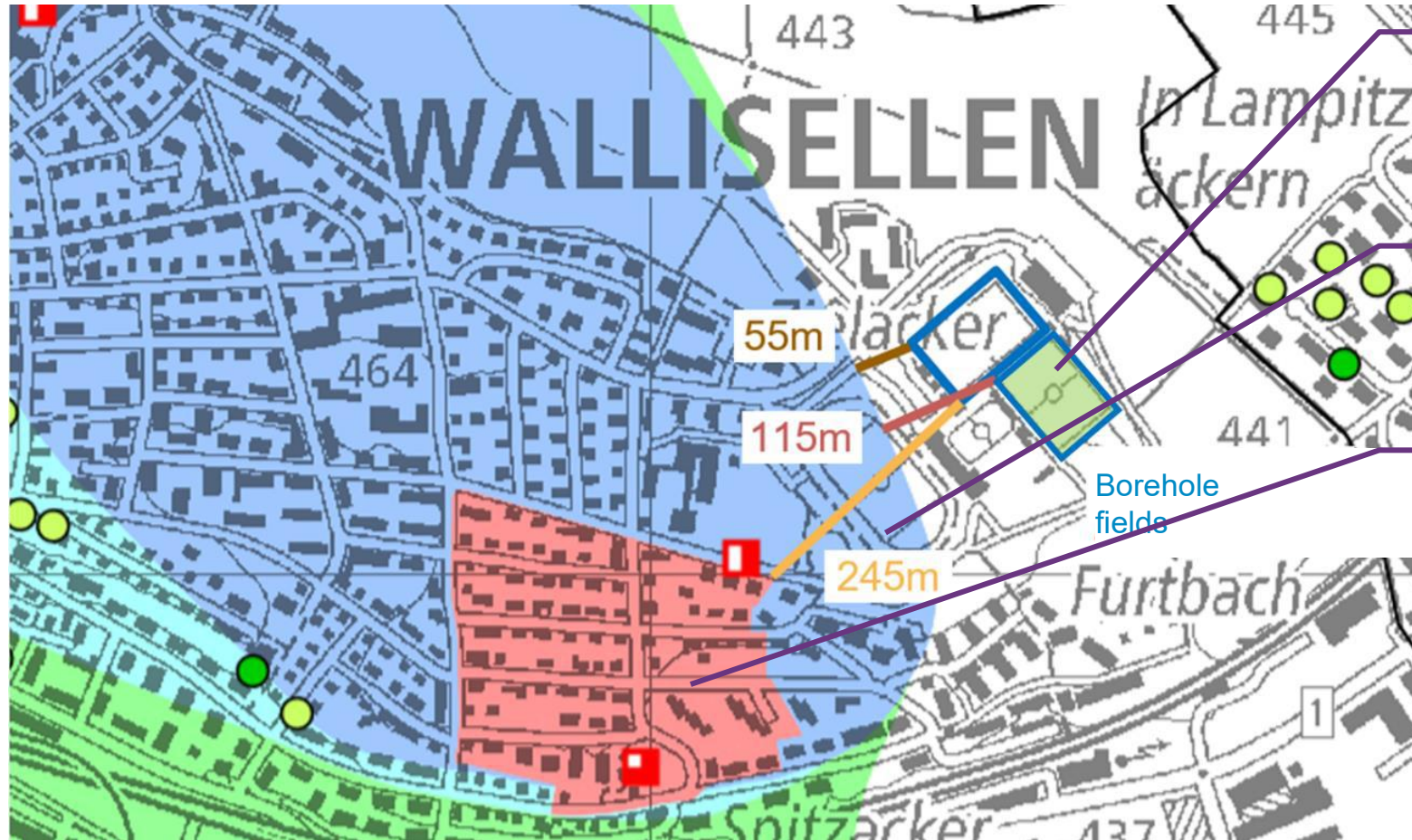
Economic viability



- Heat production costs estimated by die werke
- Includes transmission piping, heat pumps, BTES, air heat exchangers, boilers and energy (summer waste heat: 2.5 Rp.kWh)
- Excludes buildings, local distribution, design, and gas and electricity connections
- Relative differences are the key consideration

➤ High-temperature recharge is economically attractive

Groundwater protection: temperature change < 3 K

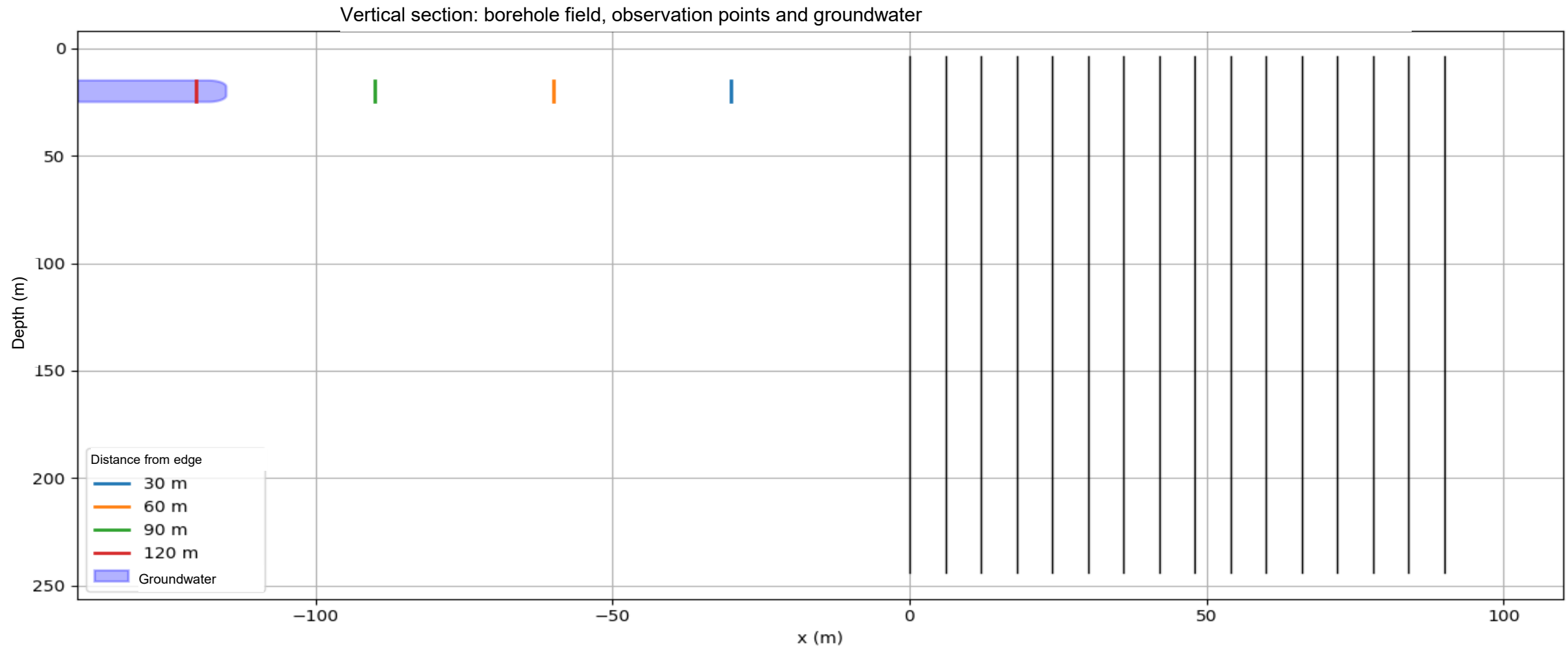


Artificial turf planned

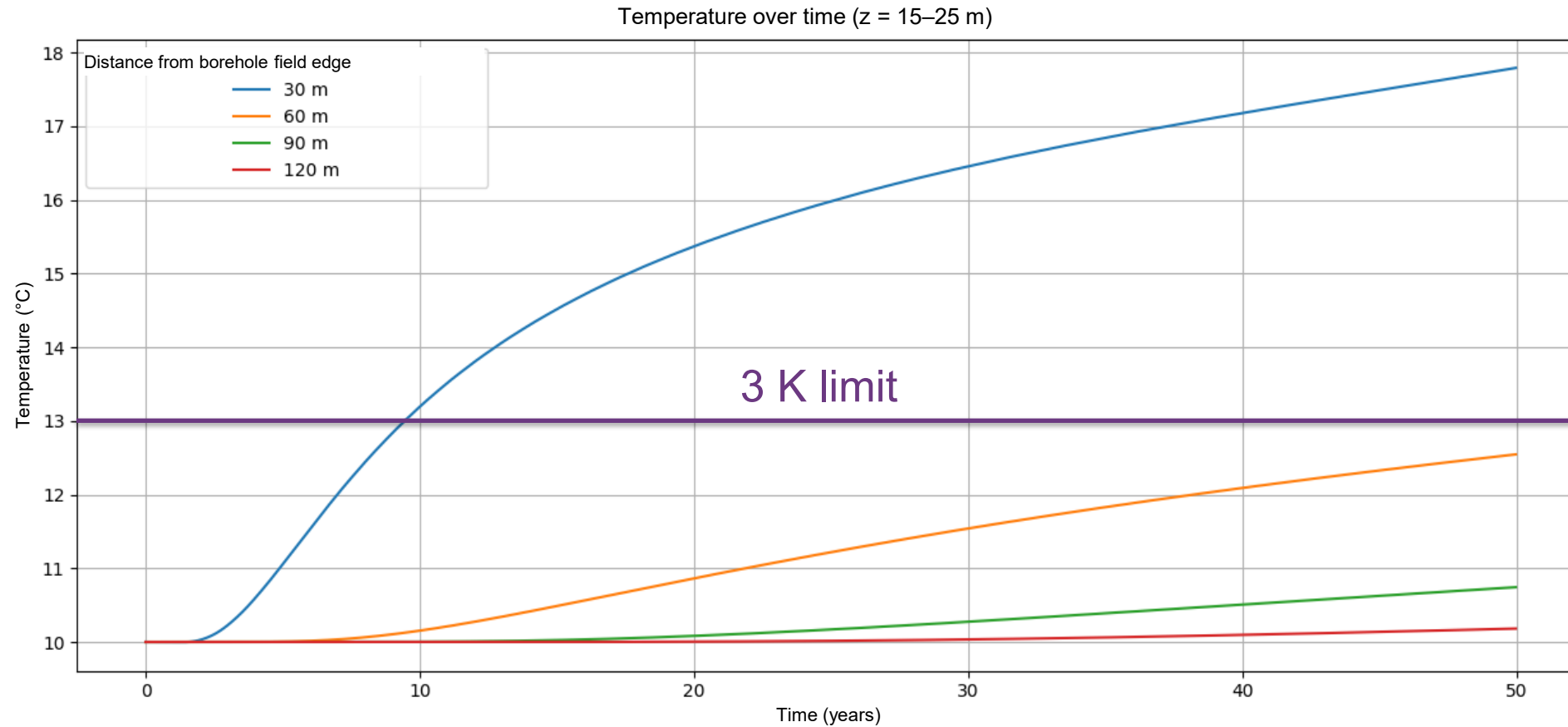
Groundwater present

Groundwater protection zone

Groundwater protection

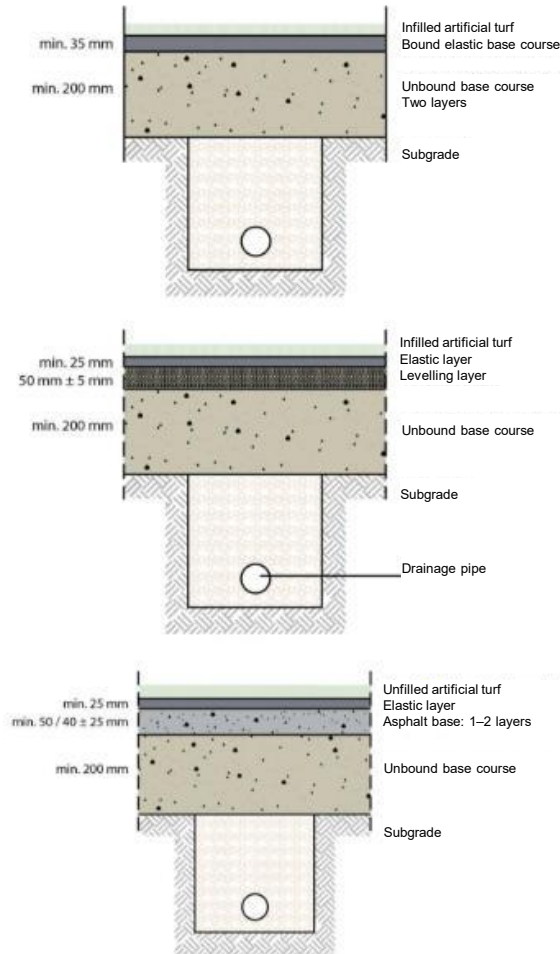


Groundwater protection



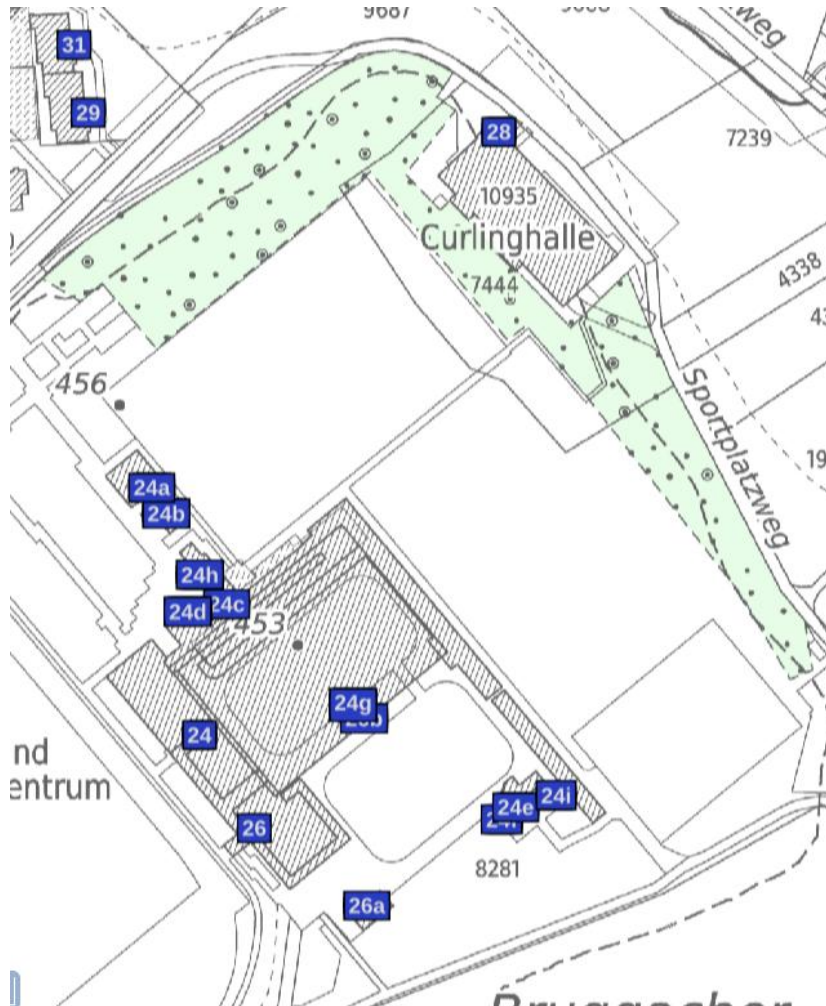
Effects on the ground surface

Standard designs to DIN 18035-7



Conditions	Borehole temp. [°C]	Grass surface temp. [°C]	Typical net surface radiation [W/m²]	Heat loss from ground storage with insulation [W/m²]	[%]	Heat loss from ground storage without insulation [W/m²]	[%]
Summer, sunny	70	50	800	5.7	1%	20	3%
Summer, cloudy	70	20	200	14.3	7%	50	25%
Summer, night	70	10	-100	17.1	-17%	60	-60%
Winter, sunny	0	20	400	-5.7	-1%	-20	-5%
Winter, cloudy	0	5	100	-1.4	-1%	-5	-5%
Winter, night	0	-10	-100	2.9	-3%	10	-10%

Effects on trees and woodland



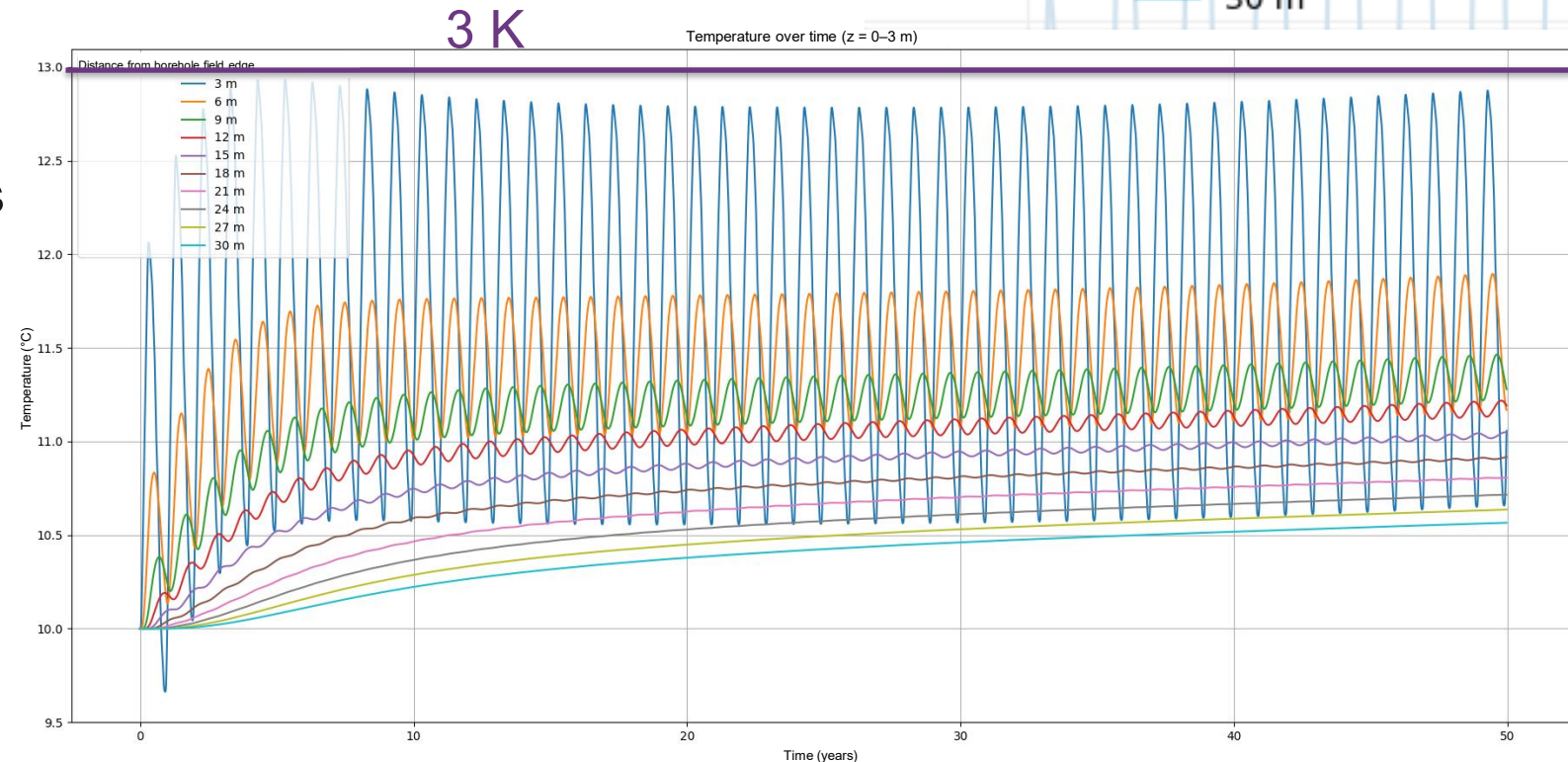
Spatial planning assessment:

- Close proximity to woodland
- Discussions with the Zurich cantonal building authorities
- An exemption may be possible for an underground installation
- What is the impact on roots at depths of 0–3 m?

Effects on trees and woodland

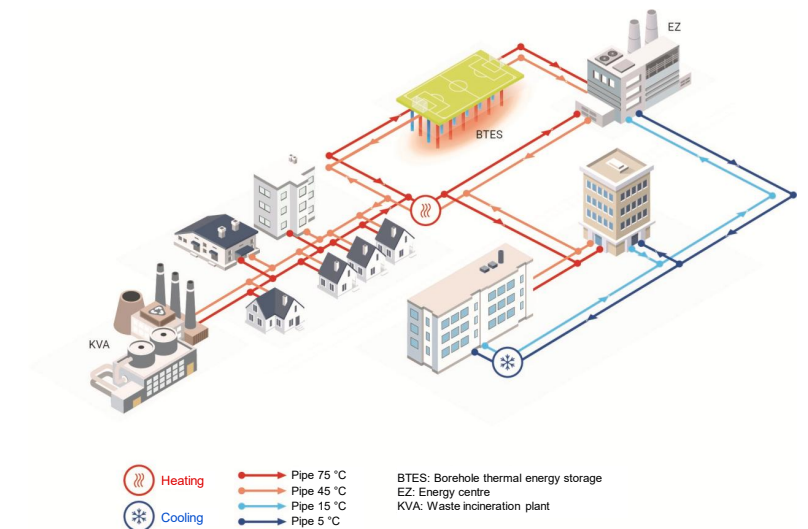
Near the ground surface:

- Heat exchange with the ambient air
- Temperature change at a distance of 6 m: < 2 K
- Authorities report no concerns



Conclusion

- High-temperature recharge reduces the number of boreholes required by a factor of about 3
- Combining BTES with ambient air further reduces the number of boreholes required
- The SaisonLink concept uses BTES beneath one football pitch (~200 boreholes, 8,000 m²), compared with the initial design (~1,200 boreholes, 60,000 m²)
- No major environmental or permitting issues identified



Current status and outlook

- The concept is being developed further within the SaisonLink district energy project
- SaisonLink is in preliminary design (Gruner AG, supported by OST-SPF)
- Public referendum in September 2027
- Construction of the first stage starts in 2028
- Construction of seasonal geothermal storage and the energy centre starts in 2030
- Several research projects explore different aspects and ideas (DeCarbCH, PeakNCool4Districts)

New variants

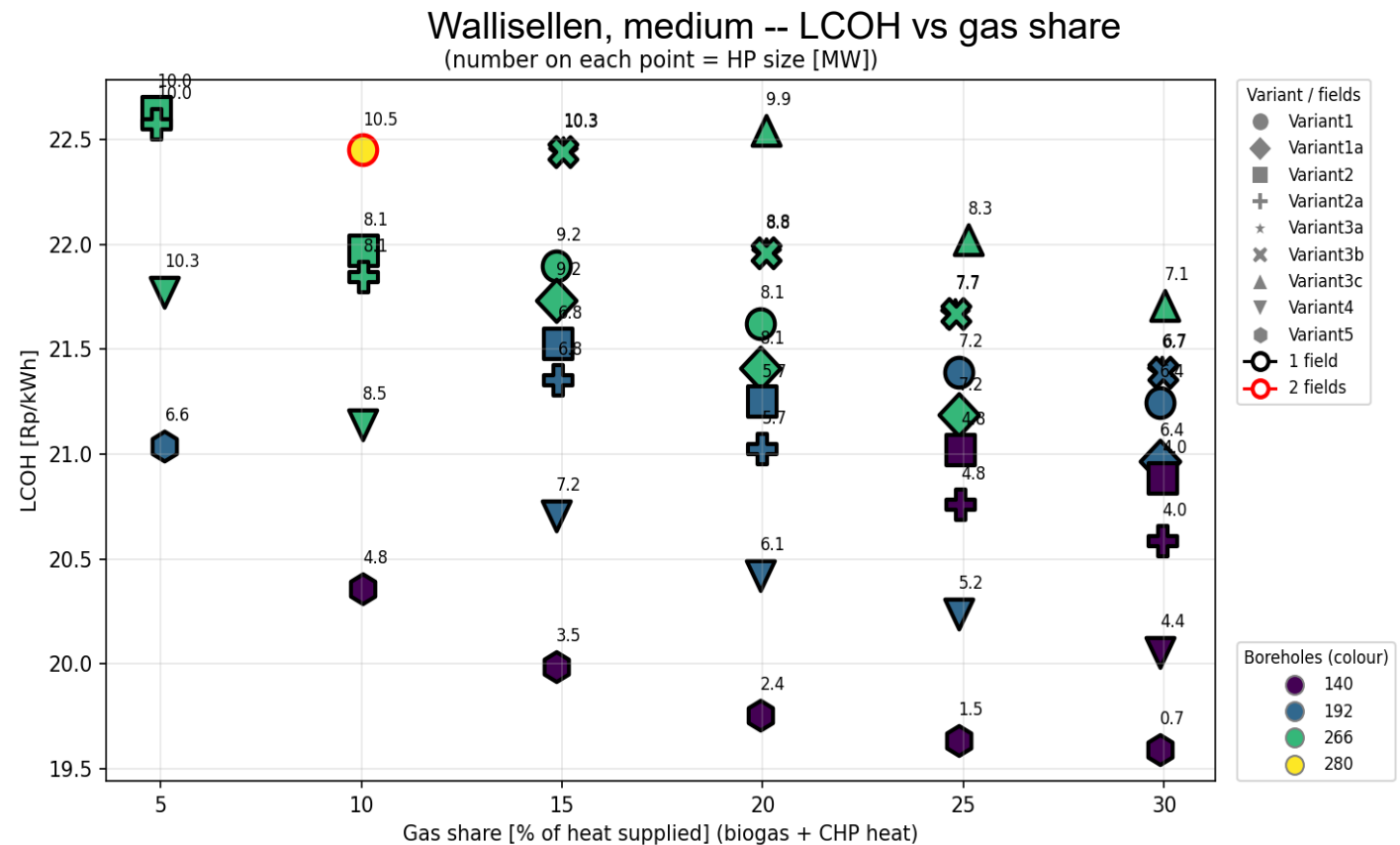
Additional energy sources

- CHP
- Existing wood-fired boiler
- Heat from the River Glatt
- Opfikon district heating/cooling (data centre)

Including neighbouring municipalities

- Dietlikon
- Wangen-Brüttisellen

Integration of cooling



Acknowledgements

Thank you!

