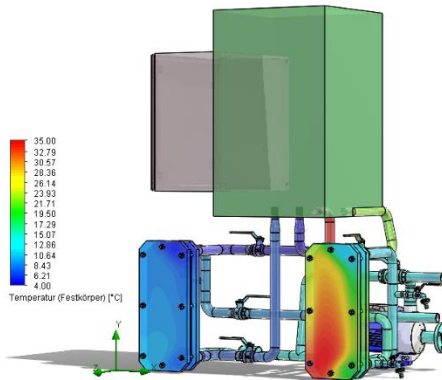


Mine Water Geothermal Energy

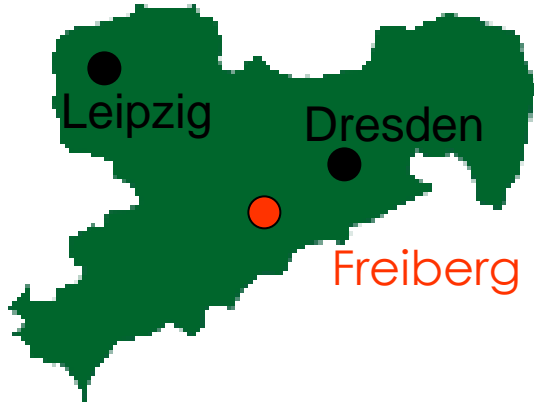
abandoned mines as a green energy source



ENERDAY - Dresden, 12.04.2024



TU Bergakademie Freiberg



Freiberg

- 40 km from Dresden
- Founded in 1186
- 800+ years of mining

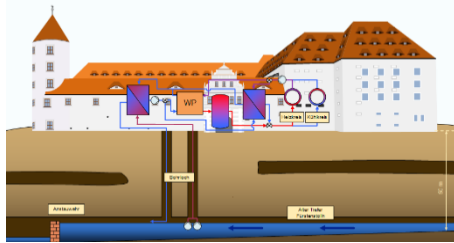


TUBAF

The University of Resources.
Since 1765.

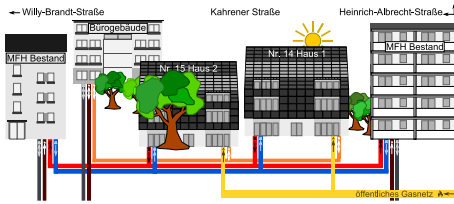
TU Bergakademie Freiberg

- Founded in 1765
- 95 chairs, 6 faculties
- 4.215 Students
- Research mine



Renewable energy sources

- Solar thermal energy
- Geothermal energy
- Lake thermal energy
- Mine water geothermal energy



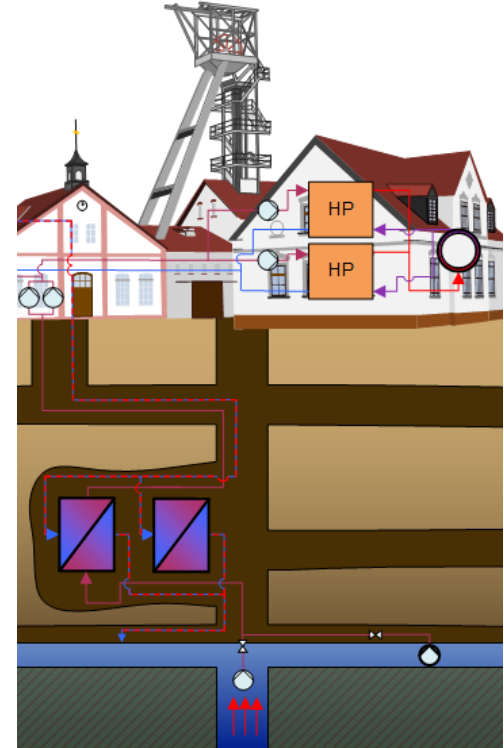
Connecting of buildings

- Networking potential for district heating
- Monitoring

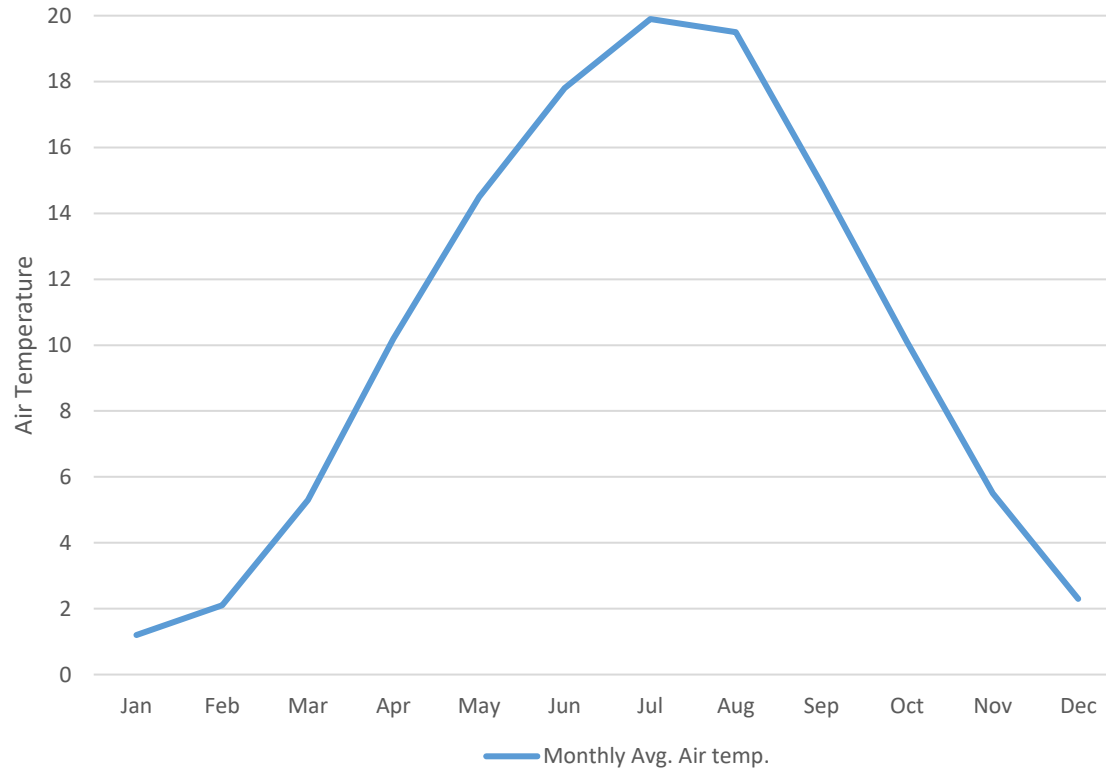


Energy self-sufficient buildings

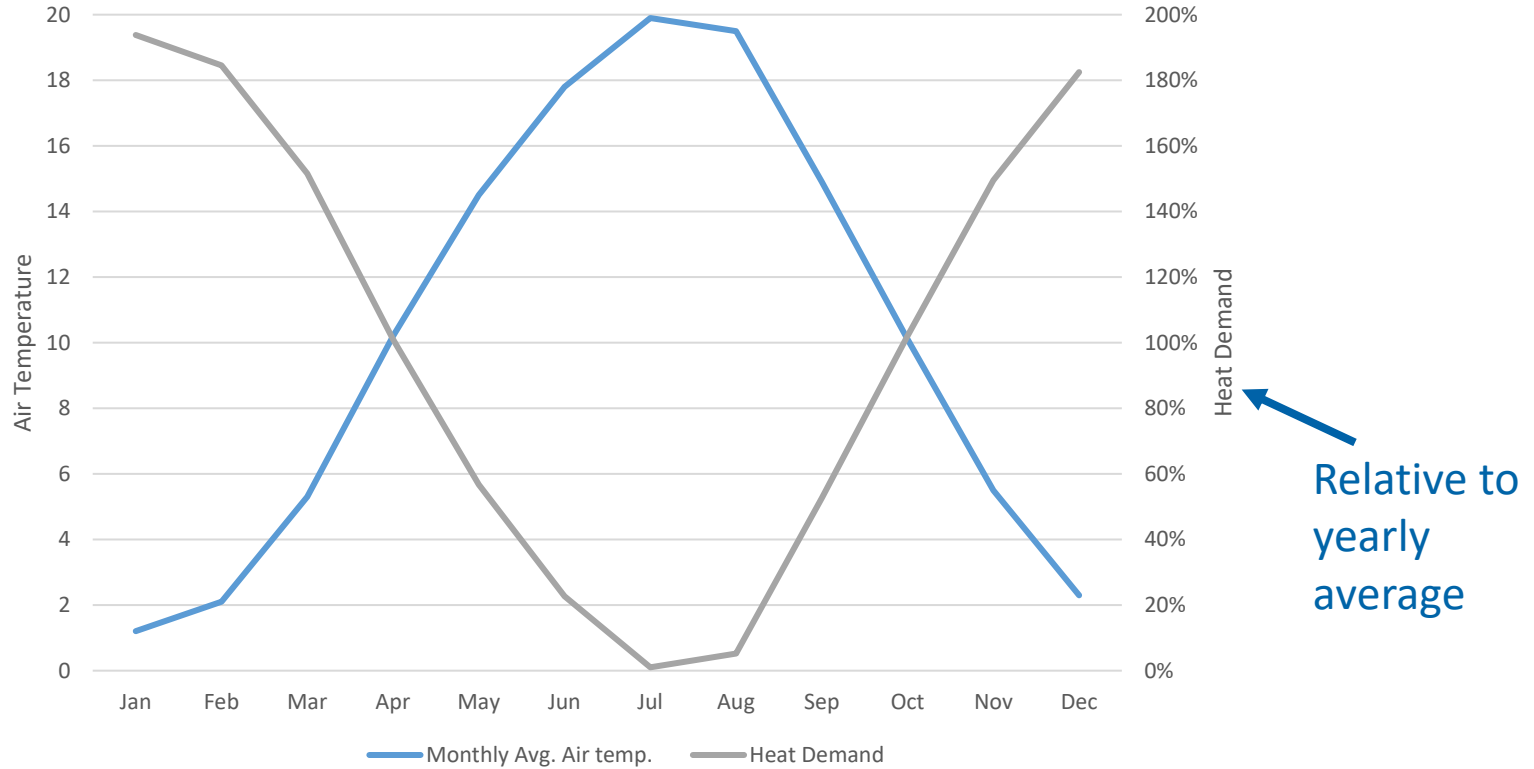
- Monitoring
- Technology / concept comparison



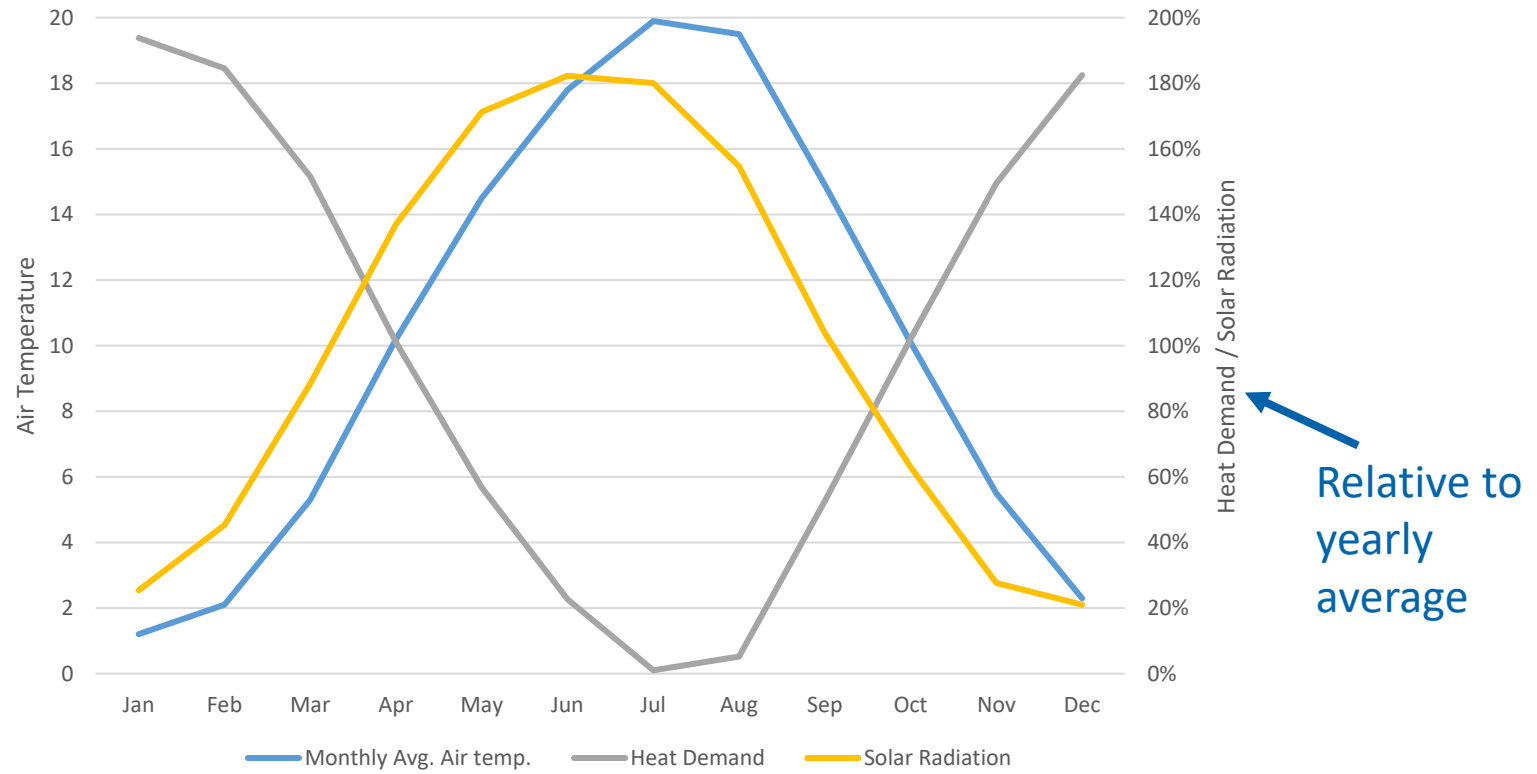
Cyclicity of Heat Demand and renewable sources



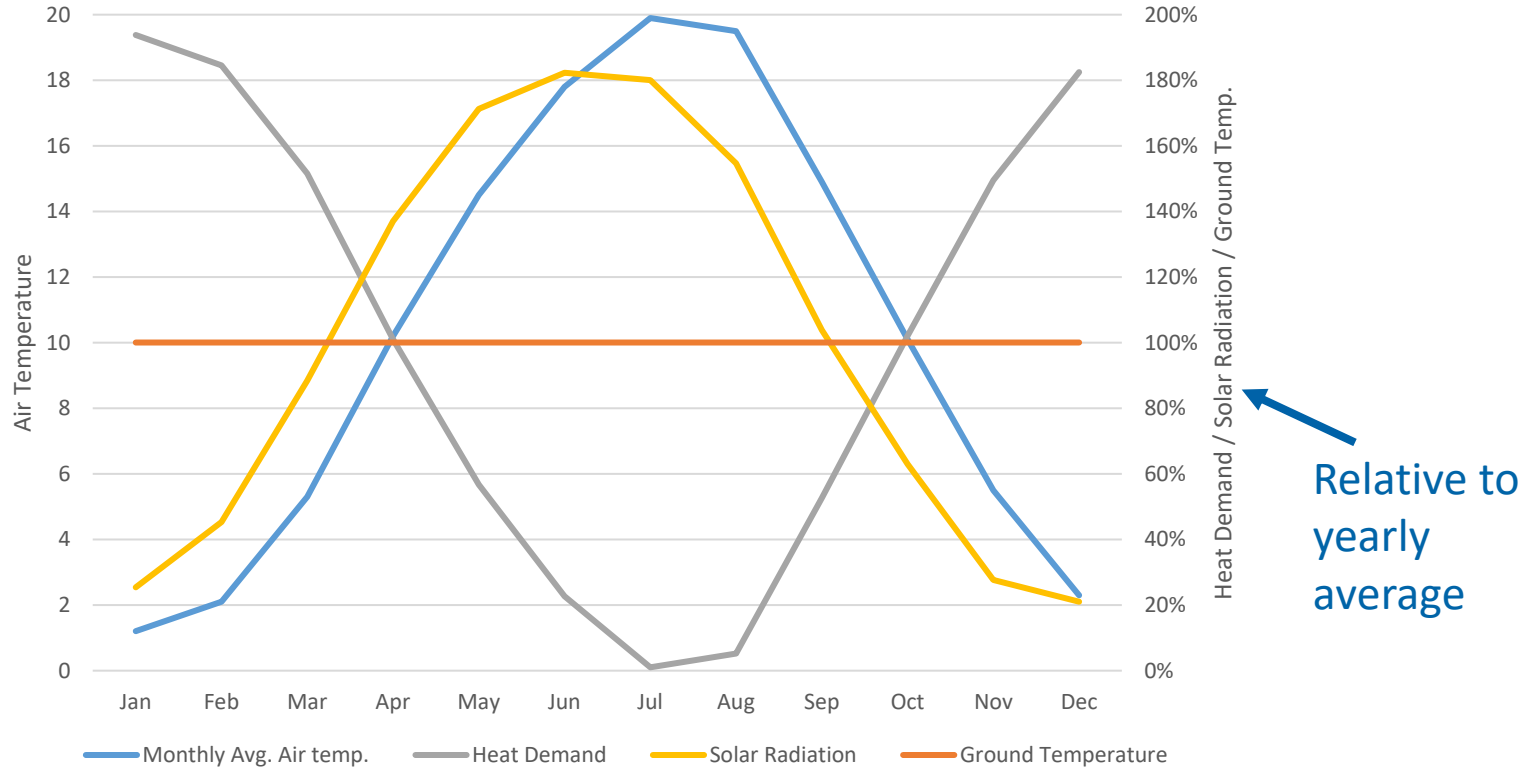
Cyclicity of Heat Demand and renewable sources

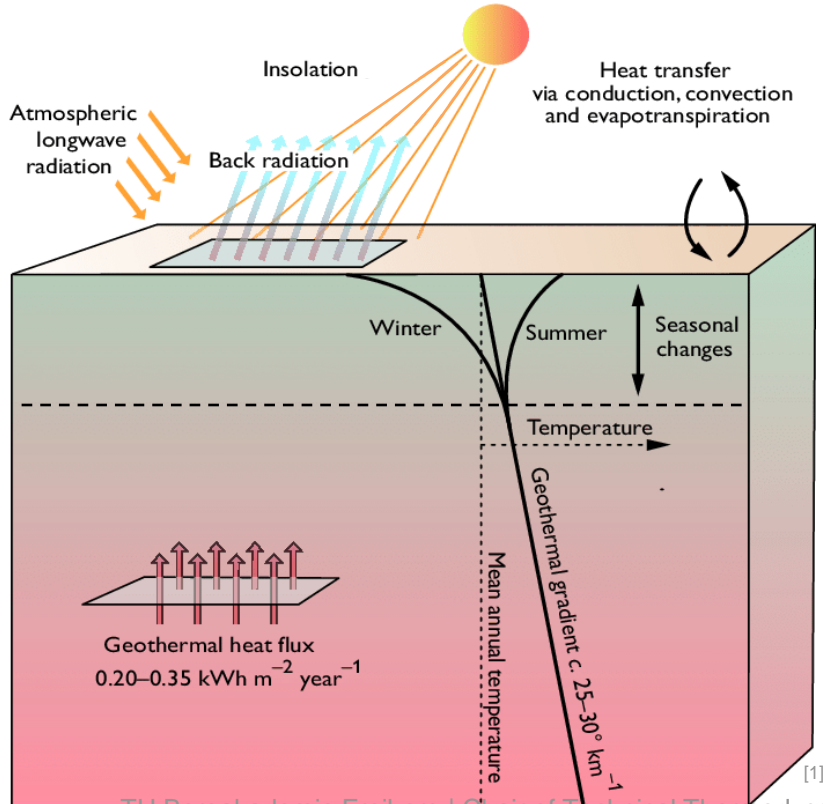


Cyclicity of Heat Demand and renewable sources



Cyclicity of Heat Demand and renewable sources





Geothermal energy as heat source

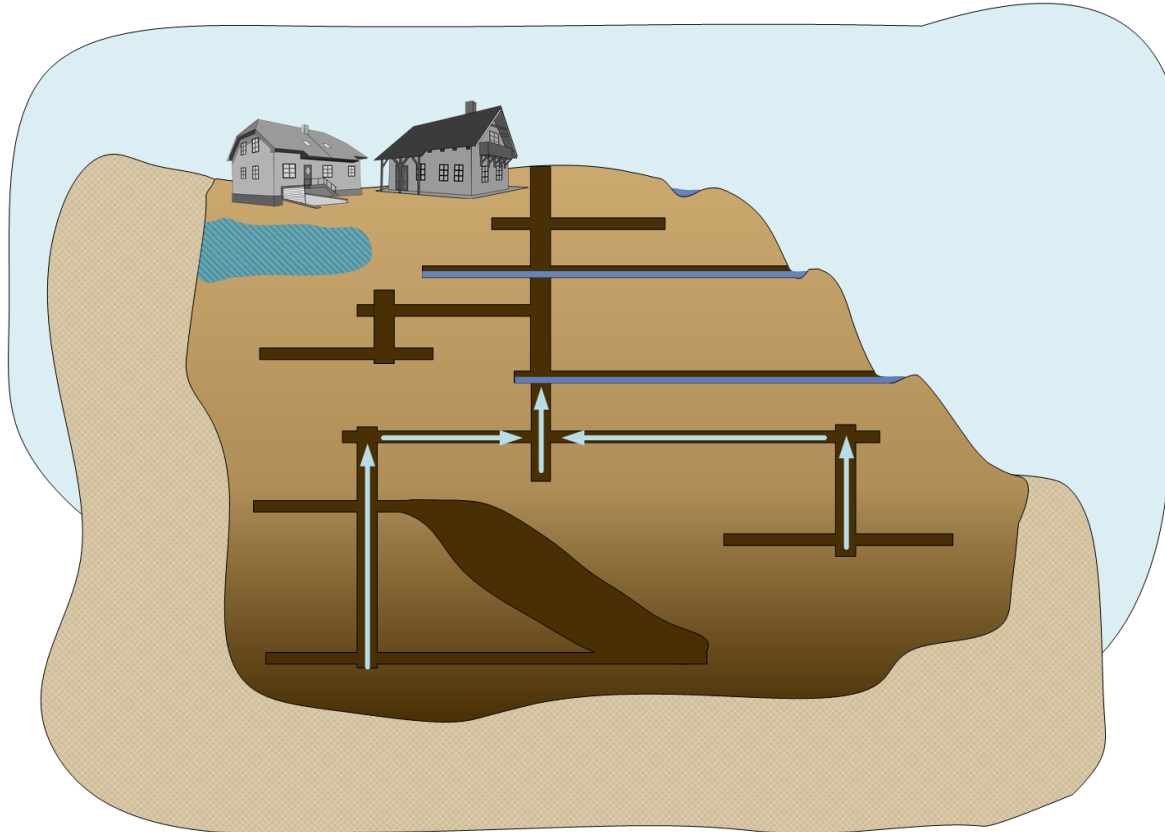
- + Low depth of solar/cyclic influence
- + Constant temperature levels
- + Geothermal heat gradient $\approx 25 - 30 \text{ K/km}$

Restrictions

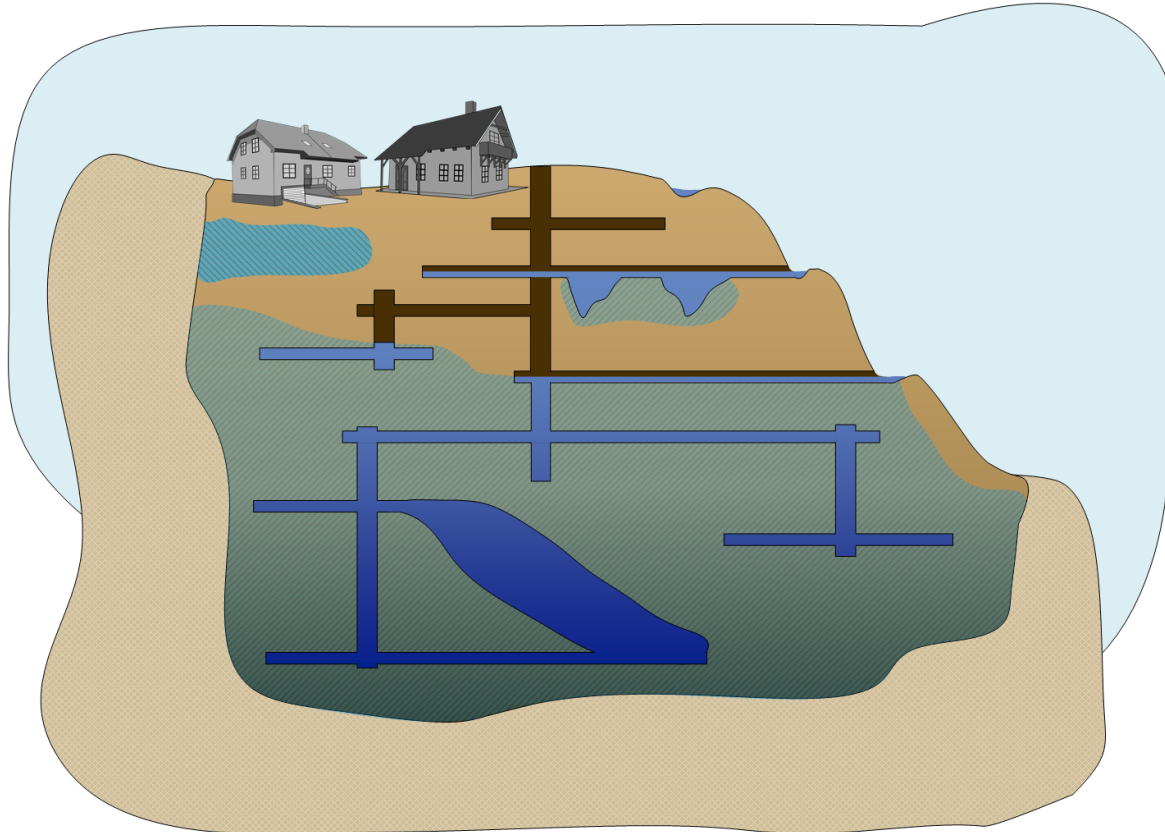
- Low thermal diffusivity of the ground
- Difficult heat transfer between rock and probe
- Bureaucratic restrictions

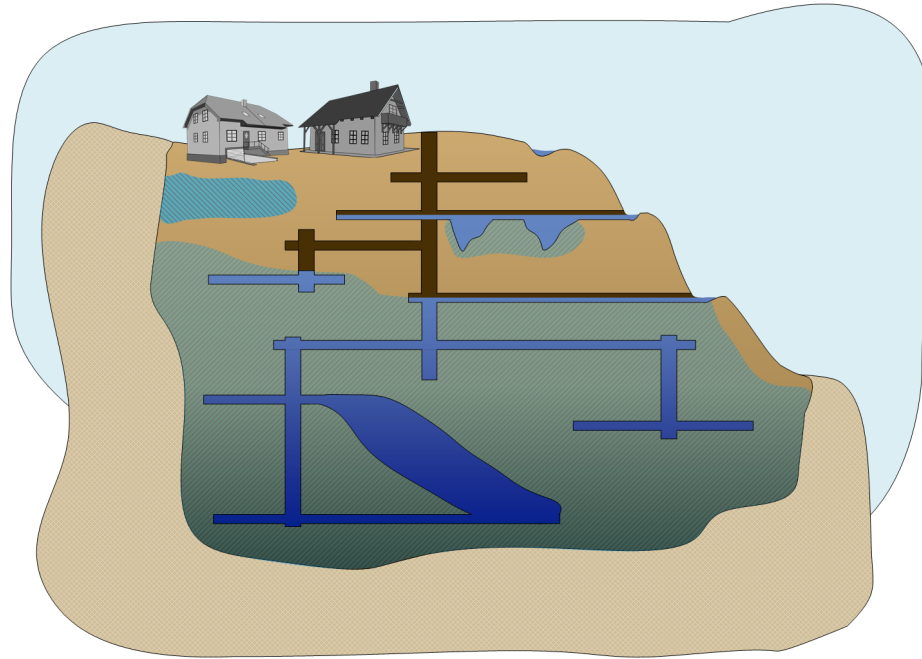
[1] T. Grab – lecture - heat pumps and cooling systems; 2024

Mine water as an alternative heat source



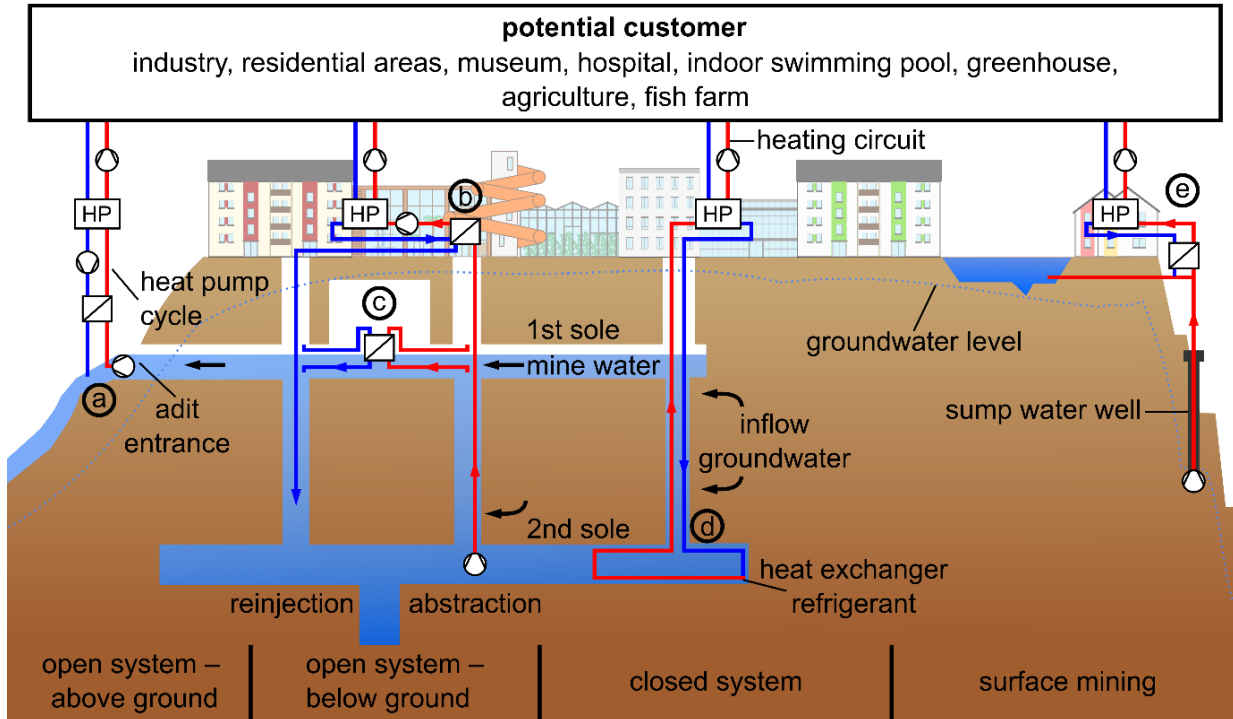
Mine water as an alternative heat source





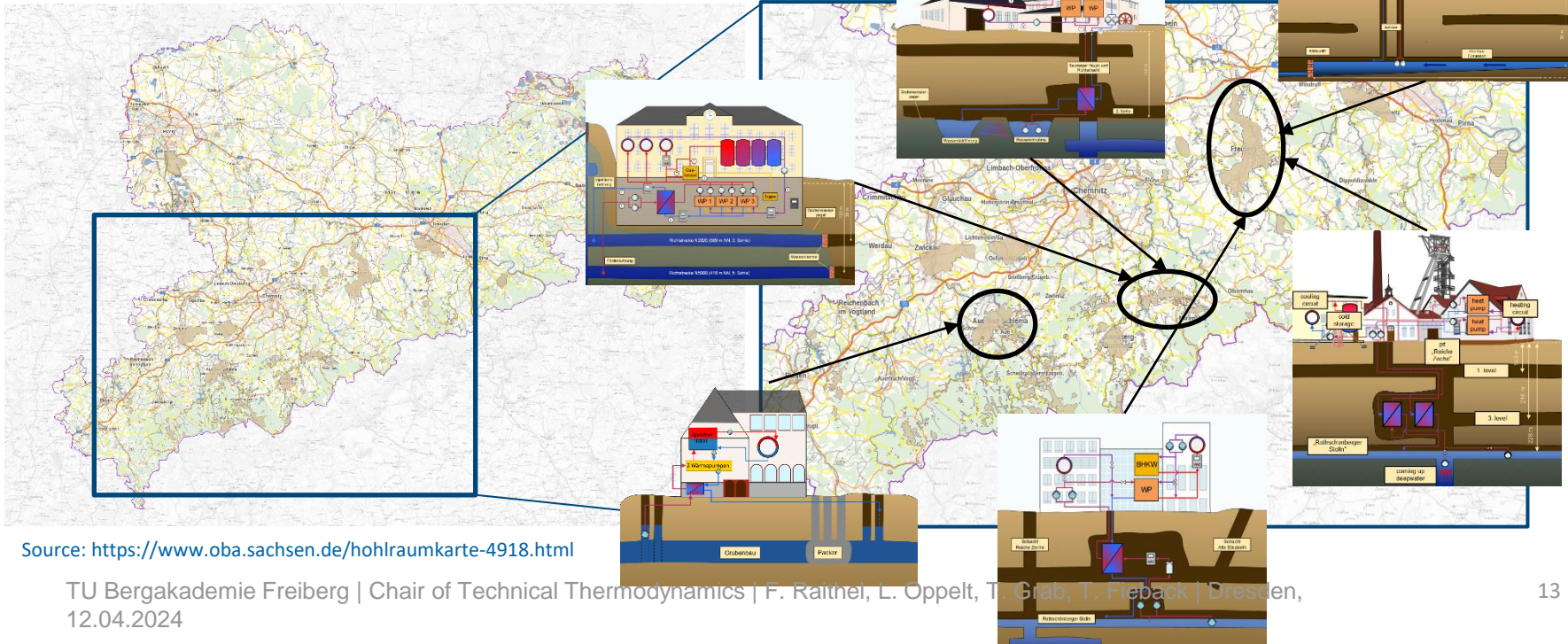
Water filled mines as renewable energy source

- + High water temperatures due to depth of mine
- + Large heat transferring areas between soil and water
- + Easy heat transfer between water and consumer
- + Abandoned mines are already available



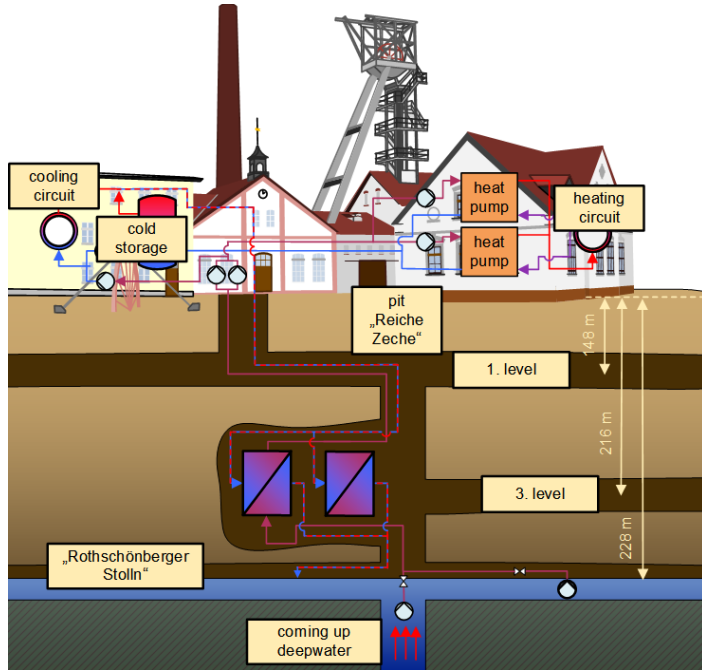
Selected plants of Saxony

Cavity Map of Saxony

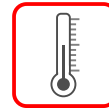


Source: <https://www.oba.sachsen.de/hohlraumkarte-4918.html>

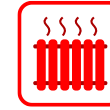
Reiche Zeche Freiberg



➤ In operation since 2013



19 °C



175 kW

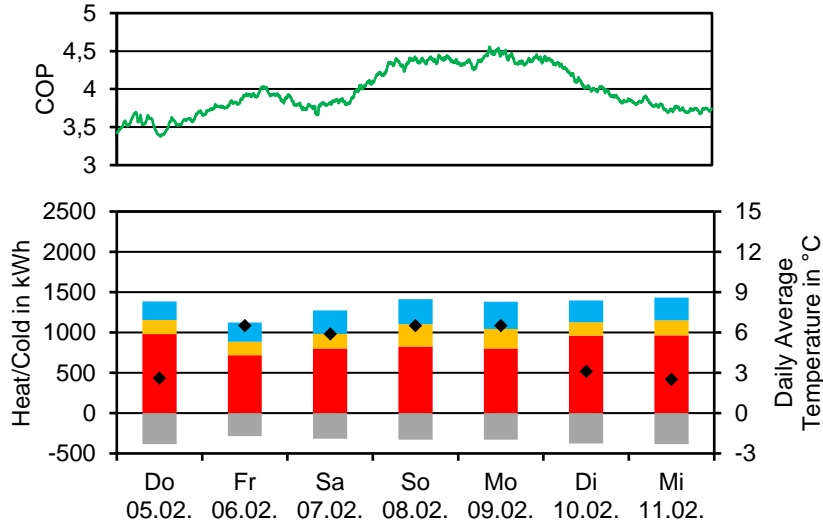


14 °C

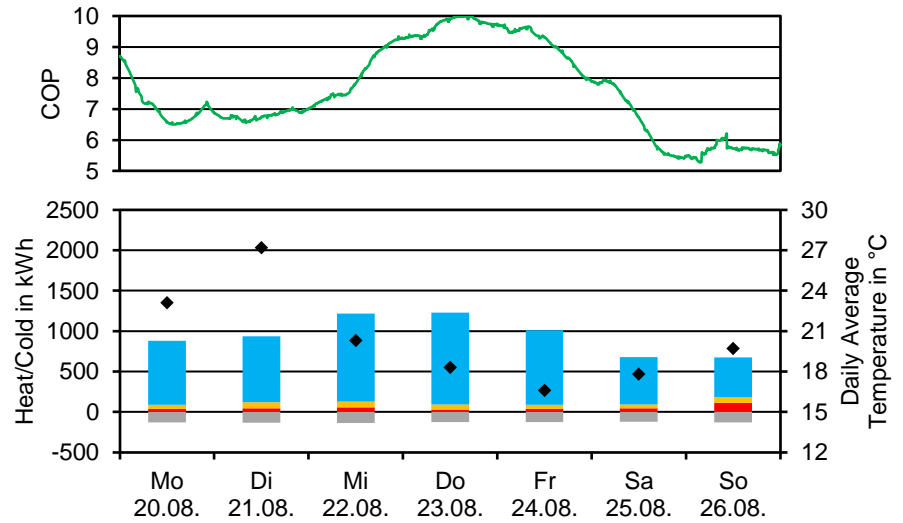


100 kW

Winter

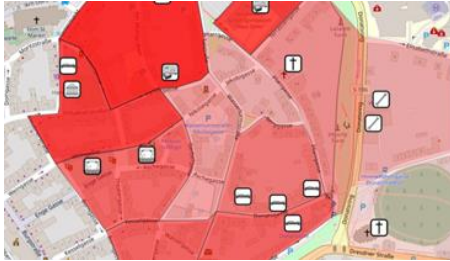


Summer



- Expense
- Heating
- Cooling
- Cooling storage
- Daily temperature
- Coefficient of Performance (COP)

Risk	Prevention	Fix
Economic viability	<ul style="list-style-type: none"> - Precise system planning - Feasibility study - Potential analysis 	-
Availability of mine water	<ul style="list-style-type: none"> - Clarification of existing water retention and water management systems 	-
Reduced water temperature during operation	<ul style="list-style-type: none"> - Careful design of plant 	<ul style="list-style-type: none"> - Regeneration via heat injection (eg. cooling during summer)
Clogging/Fouling of the heat exchangers	<ul style="list-style-type: none"> - Water analysis - Surface coating and choice of material - Low temperature difference 	<ul style="list-style-type: none"> - Rinsing - Mechanical cleaning



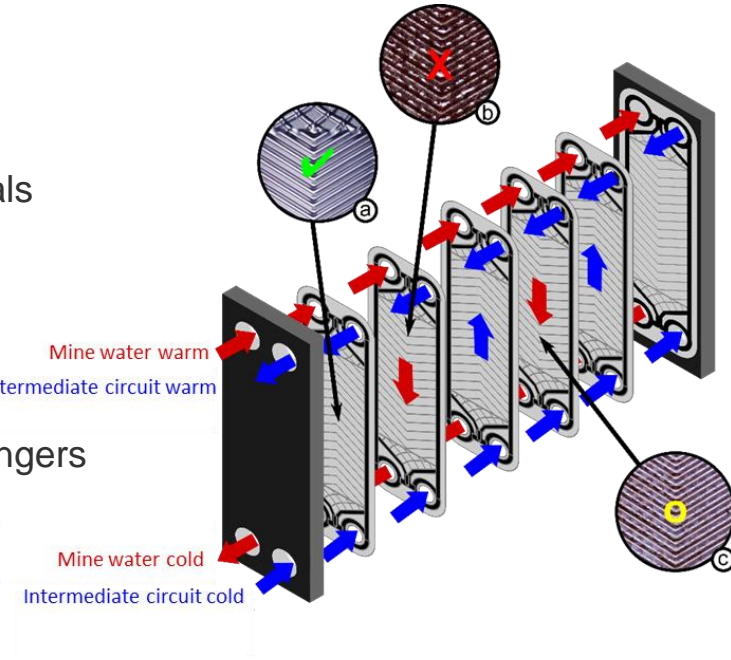
Potential analysis

- Feasibility study Saxony
- Interorganisational cooperation between stakeholders
- Analysis of underground potentials
- Development of district / quarter concepts












Fouling/ Scaling

- Optimisation of plate heat exchangers
- In-situ tests with mobile test rig



Research projects with mine water focus

	<p>Since 2022</p>	<p>Feasibility study Saxony for mine water utilisation</p>
	<p>Since 2022</p>	<p>WINZER heat storage in coal mines of the Ruhr area</p>
	<p>Since 2022</p>	<p>MineATES heat storage in water loaded mines</p>
	<p>Since 2022</p>	<p>BrineRIS Brines of RIS countries as a source of critical raw materials and energy supply</p>
	<p>Since 2022</p>	<p>GEOQart District concepts in combination with mine water</p>
	<p>2020-2021</p>	<p>MareEn Development of an energy concept for supplying the communities in the Lugau/Oelsnitz mining area with mine water geothermal energy</p>
	<p>2020-2021</p>	<p>Heat transport in a flooded in Schlema-Alberoda</p>
	<p>2019-2021</p>	<p>GeoMAP Investigations on heat exchangers for the energetic use of mine water</p>
	<p>2016-2020</p>	<p>VODAMIN II Potentials and risks of mining waters</p>



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