

Multi-family buildings with supply of surrounding buildings



14th IEA Heat Pump Conference,
Heat Pumps in Positive Energy Districts – Opportunities, Challenges and Perspectives

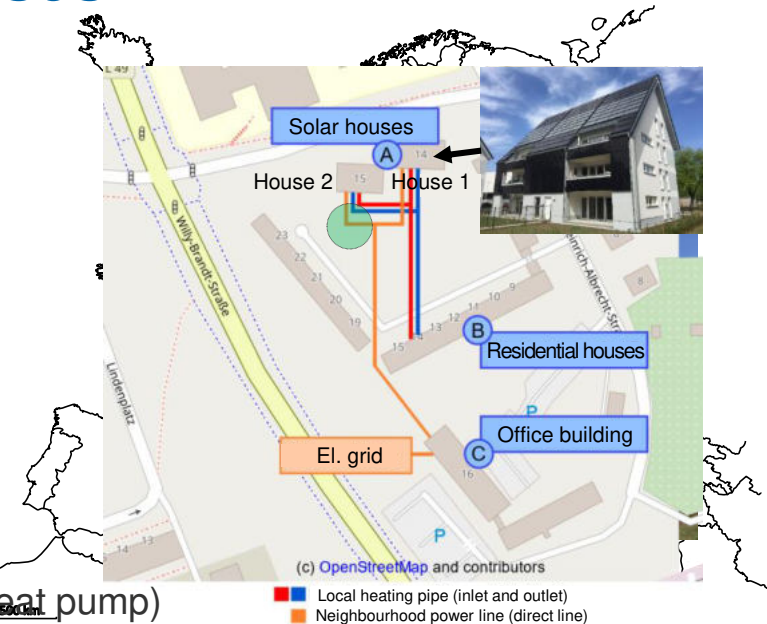
Characteristics of the two houses

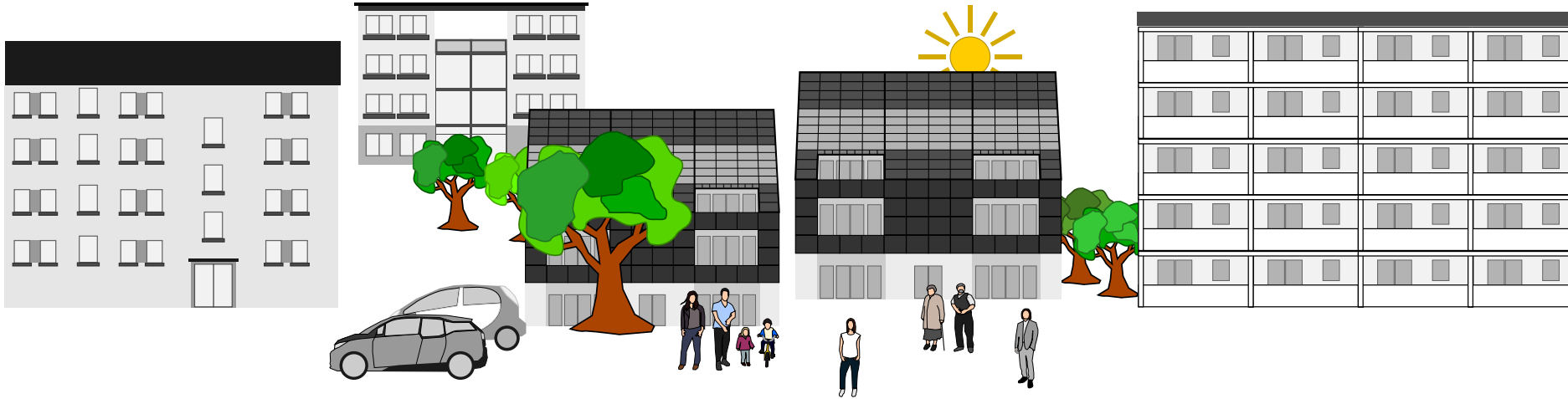
Parameter	House 1
Heating demand (kWh/m ² /a) *	15,58
Primary energy dem. (kWh/m ² /a) *	8,40
Area solar thermal (m ²)	100
Solar fraction heat (%) **	65
Photovoltaik power (kWp)	29,6
Solar fraction electricity (%) **	77

* From EnEV energy certificate; ** Simulations for 6 flats variant → 7 realised

Further highlights:

- Passive floor cooling through geothermal pipes (no heat pump)
- Surplus heat is transferred to neighbouring buildings (hot water)
- No own electricity connection (sub-grid) → Surplus used by office building



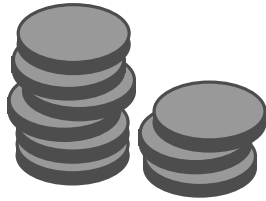


Resident structure:

- 34 residents (incl. 7 children)
- Predominantly 30 - 49 year olds
- High level of education
- Income > 2,500 €

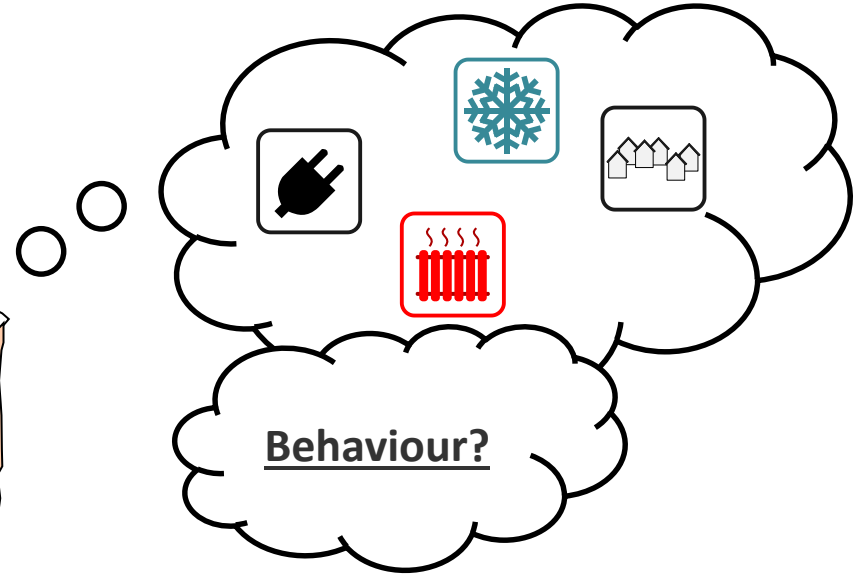
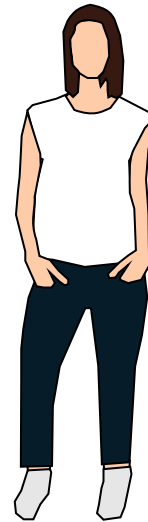
Rental model (10.50 €/m² flat rate):

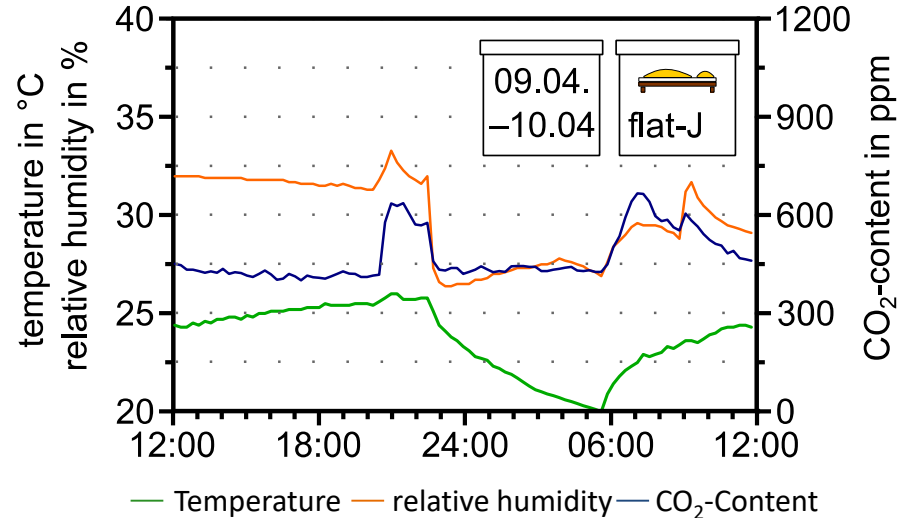
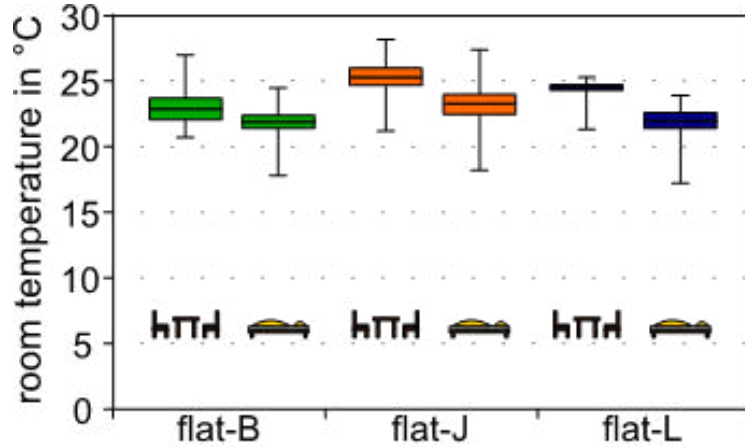
- Initially difficult to understand
- Disadvantageous in rental portals
- Current: residents mostly satisfied
- Main advantage: comfort



Rental model, 10.50 €/m²:

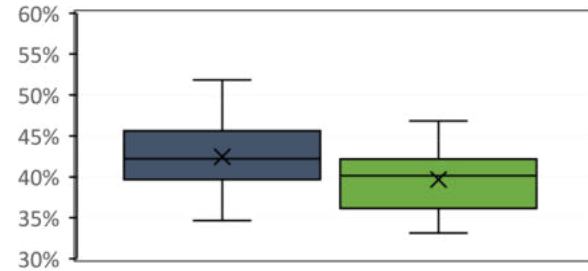
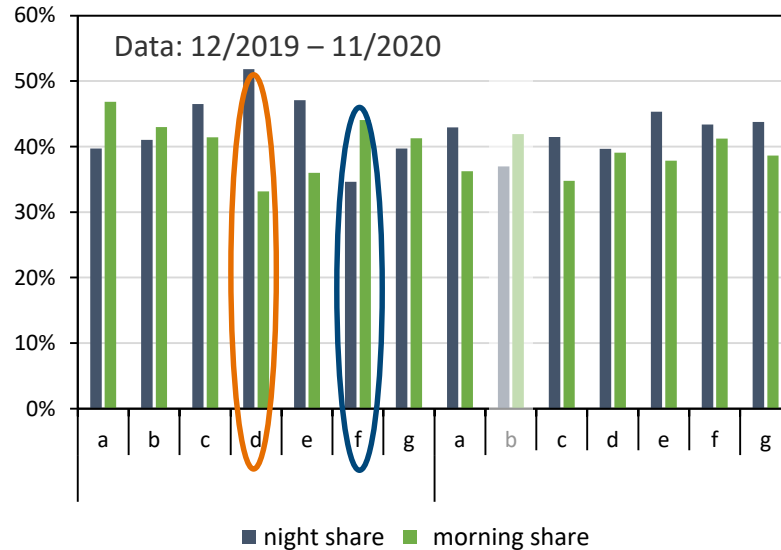
- Living
- Electricity
- Heating
- Cooling





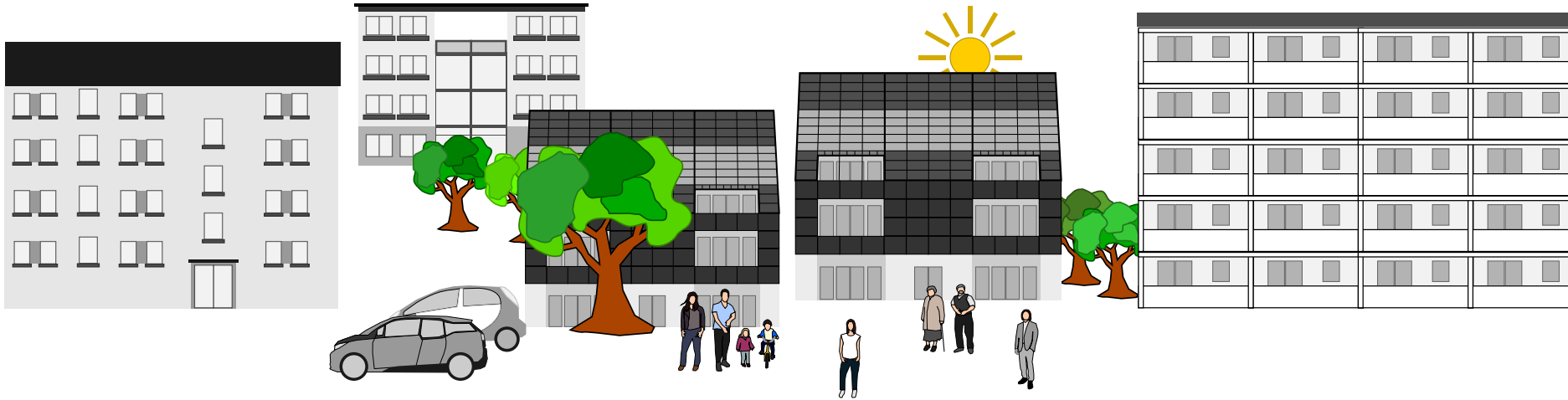
- High room temperatures compared to planning and energy certificate (assumption 19 °C)
- Problem with heating control + user behaviour (window tilted at night & floor heating on)

Consumption according to time of day *



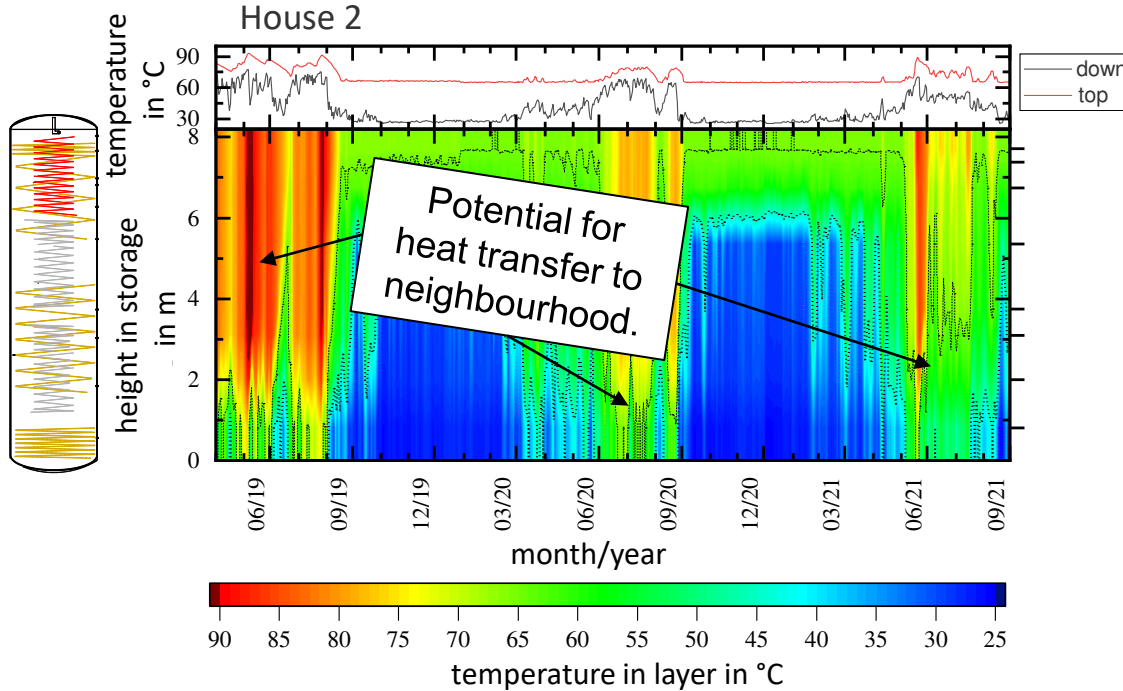
- Individually very different behaviour
- “Night owls” with low morning share → little PV use
- Ideal: high morning and low night share

*according to: J. Weniger et al: Dezentrale Solarstromspeicher für die Energiewende



And what lessons can now be learned from the monitoring?

Heat storage

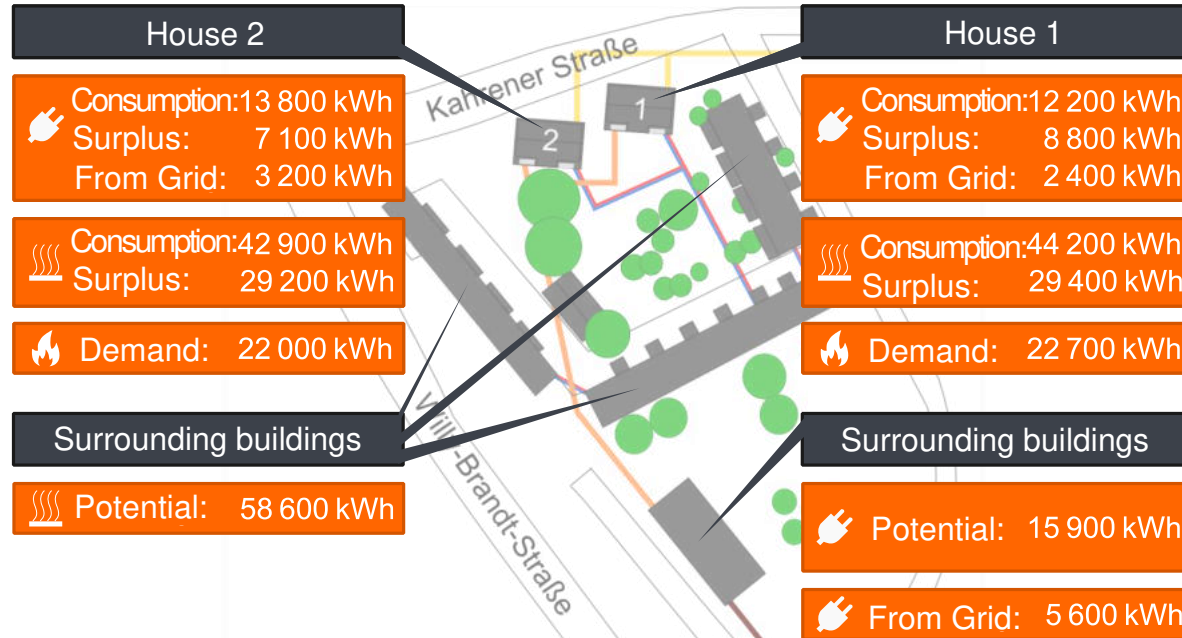


- Large ΔT in storage \rightarrow good stratification
- $\frac{3}{4}$ of reservoir volume ST \rightarrow 4 – 5 mon/year unused
- Retention time: \sim 1 week

Recommendations:

- \rightarrow Storage significantly smaller
- \rightarrow Caution: Stagnation ST

Supply of surrounding buildings



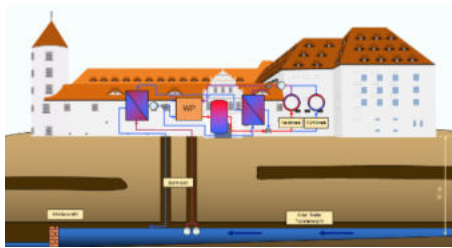
And what lessons can now be learned from the monitoring?

Summary results

- ✓ Concept with flat rent works
- ✓ Technically, there is room for improvement:
 - Smaller heat storage and smaller battery
 - Transferring surpluses (heat and electricity) into the local heating network
 - More smart communication between the buildings
 - Alternative to ST+PV → HP+PV ?

⇒ Does the concept also work in another location?

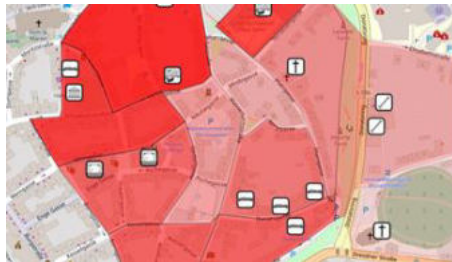




Renewable energy sources

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

Wednesday
15:05
Room A



Potential analyses

- Potentials of renewable energies
- Development of district/ quarter concepts



Fouling/ Scaling

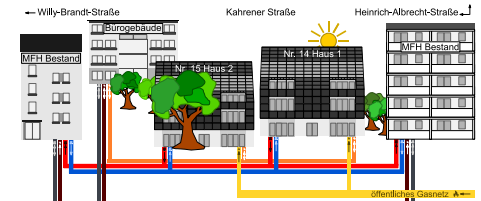
- Optimisation of plate heat exchangers
- In-situ tests with mobile test stand

Wednesday, 14:25 – 14:45
Coffee Break and Poster Session

Wednesday, 14:45 – 16:10

1.7 Ground Source Heat Pump Systems
Session Keynote: Heat pump system performance measurement in Annex 52 (303)
Sigahid Gelen*, Jeffrey D. Spitzer
Abandoned mines as a source of heat and cold (44)
Lukas Oppelt*, Thomas Grub, Thomas Storch, Timo Wunderlich, Tom Ebel, Tobias Fieback
Assessment of ambient loop-coupled GSHP and WWHP systems in a cold-climate institutional/residential development (524)
Monica Brandt*, Utsava Saha, Alan Fang
Optimisation of a Novel Dry Air-Ground Source (DAGS) Heat Pump System (954)
Markel Peñayo*, Bassant E. Shalton, Caroline Haglund Stigron, Monica Avel, Ole Gustafsson

2.7 Hybrid Heat Pumps, Combination of Technologies
Session Keynote: Long term performance analysis of a Dual-Source Heat Pump system by means of the Matlab/Simulink tool ALMABuild (725)
Christian Hantke, Claudio Rossi, Matteo Dongell*, Gian Luca Morini
Experimental Assessment of Air-Source and Hybrid Ground-Source Heat Pump Systems (553)
Brian Muir Cindri*, Tatsuki Hano, Keishi Kanjo, Akio Miyara



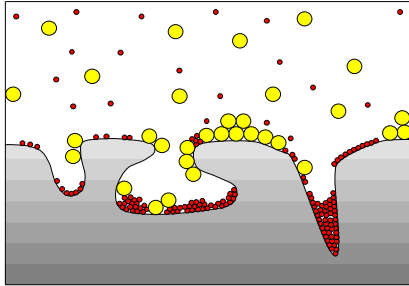


Use of industrial waste heat

- Heat integration
- Use e.g. for O₂ generation

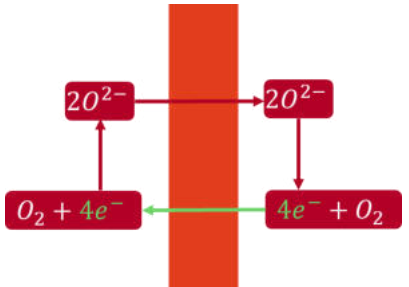
Adsorption chiller

- Comparison Sorbent
 - weighing accumulations in the nano-gram range
 - 20-1650 °C, 200 bar



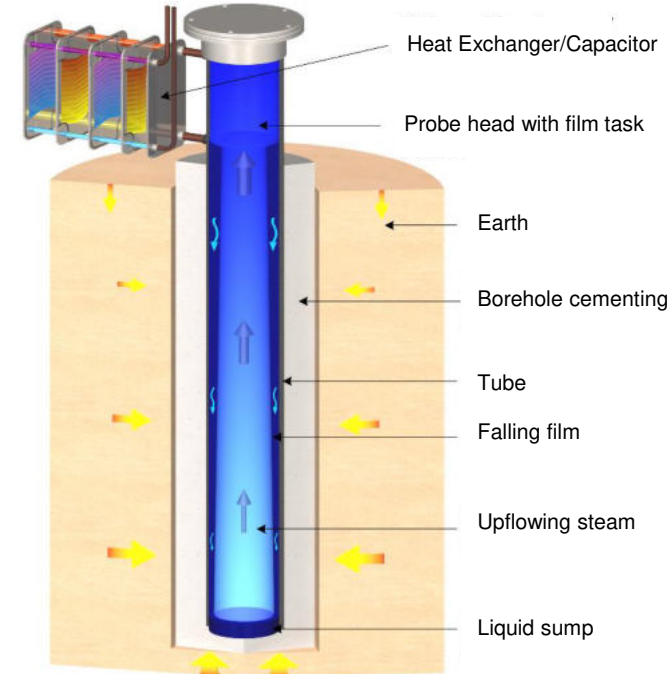
Gas phase adsorption

- Comparison of storage materials for gas storage (e.g. H₂)
- Carbon capture



Heat pipe/ phase change sondes

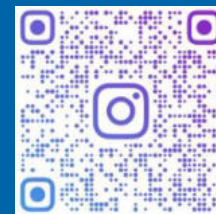
- Use of natural refrigerants
- Integration of structured surfaces





Thanks for
your interest.

More informations:
eversol.
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