Thermal Storages for Swiss District Heating Systems

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SPF INSTITUT FÜR SOLARTECHNIK

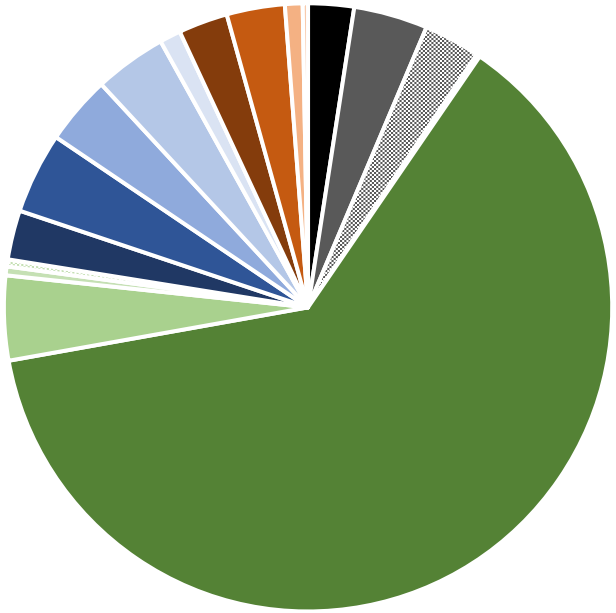
OST Ostschweizer Fachhochschule

Content

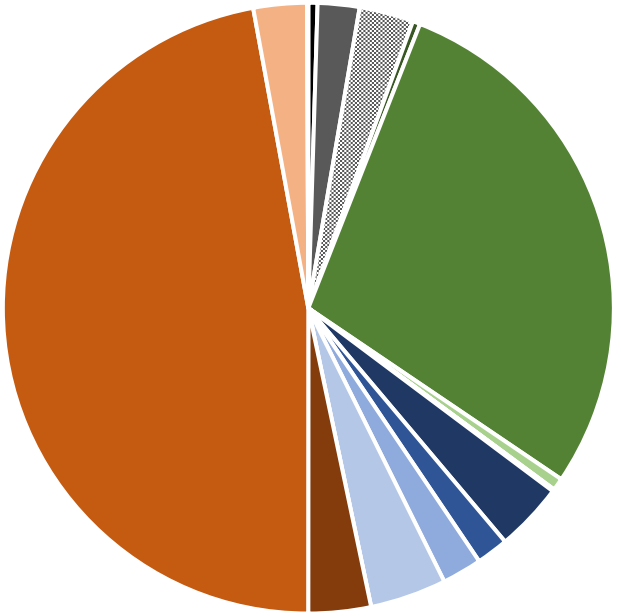
- Introduction and Overview
- Biomass Networks
- Seasonal Storage
- Low Temperature Networks
- Ice Storages
- Conclusion Outlook

Energy Sources in Swiss District Heating

Number



Energy delivered



Data source:
www.maps.admin.ch,
«Thermische Netze»

Biomass:
- 1.8 MW

Waste Heat:
- 33 MW

Heat Pump
- 3.2 MW

Fossil
- 4.2 MW

Storage for (Solar) Biomass Networks

Ongoing

Goal:

- avoid fossile part load
- avoid start/stop

Storage:

- Mainly pressurized steel tanks
- 30-200 m^3

Status:

- Guidelines QM Holzwärme
- Manufacturer Jenni: »two folders of unreplied requests»

Short/Mid-term

Goal:

- Combination with solar
- Switch off biomass in summer

Storage:

- Pressurized or atmospheric steel tanks
- 100 - several 1'000 m^3

Status:

- Commercial examples (ex. D & AUT)
- Not standard in Switzerland

Long-term

Goal:

- Seasonal storage of renewable heat

Storage:

- Pit, aquifer, borehole
- … 1'000'000 m^3

Status:

- Pilot examples worldwide
- Switzerland: BTES (focus: low T)

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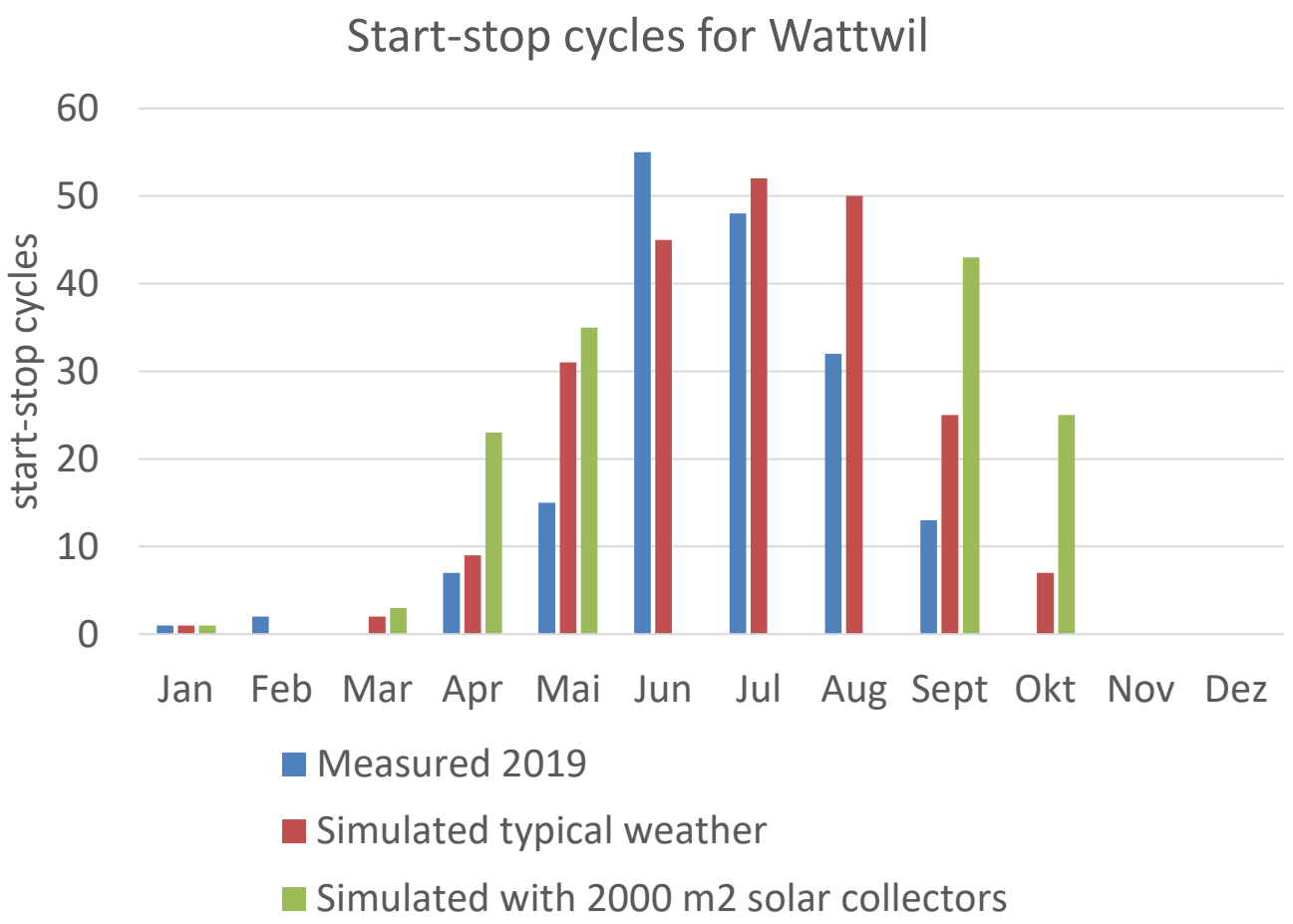
Switch-off Biomass in Summer?



Case study biomass network Wattwil:

~7 GWh biomass + fossil peak load

+ 2000 m^2 ETC & 300 m^3 TES:

Solar fraction: 18%
Start cycles: 220 -> 130

Ruesch, F. et al. BioSolFer, SFOE final report, SPF 2020

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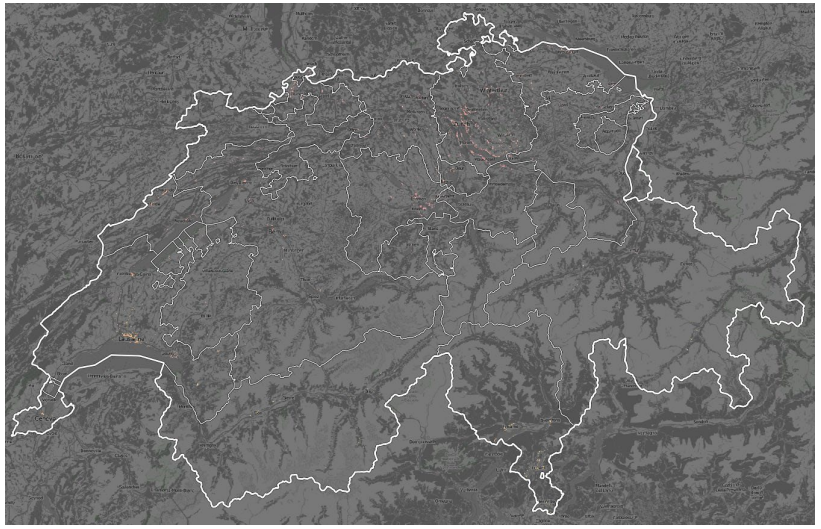
Seasonal Storage

Pit: Vojens, ~50 % solar

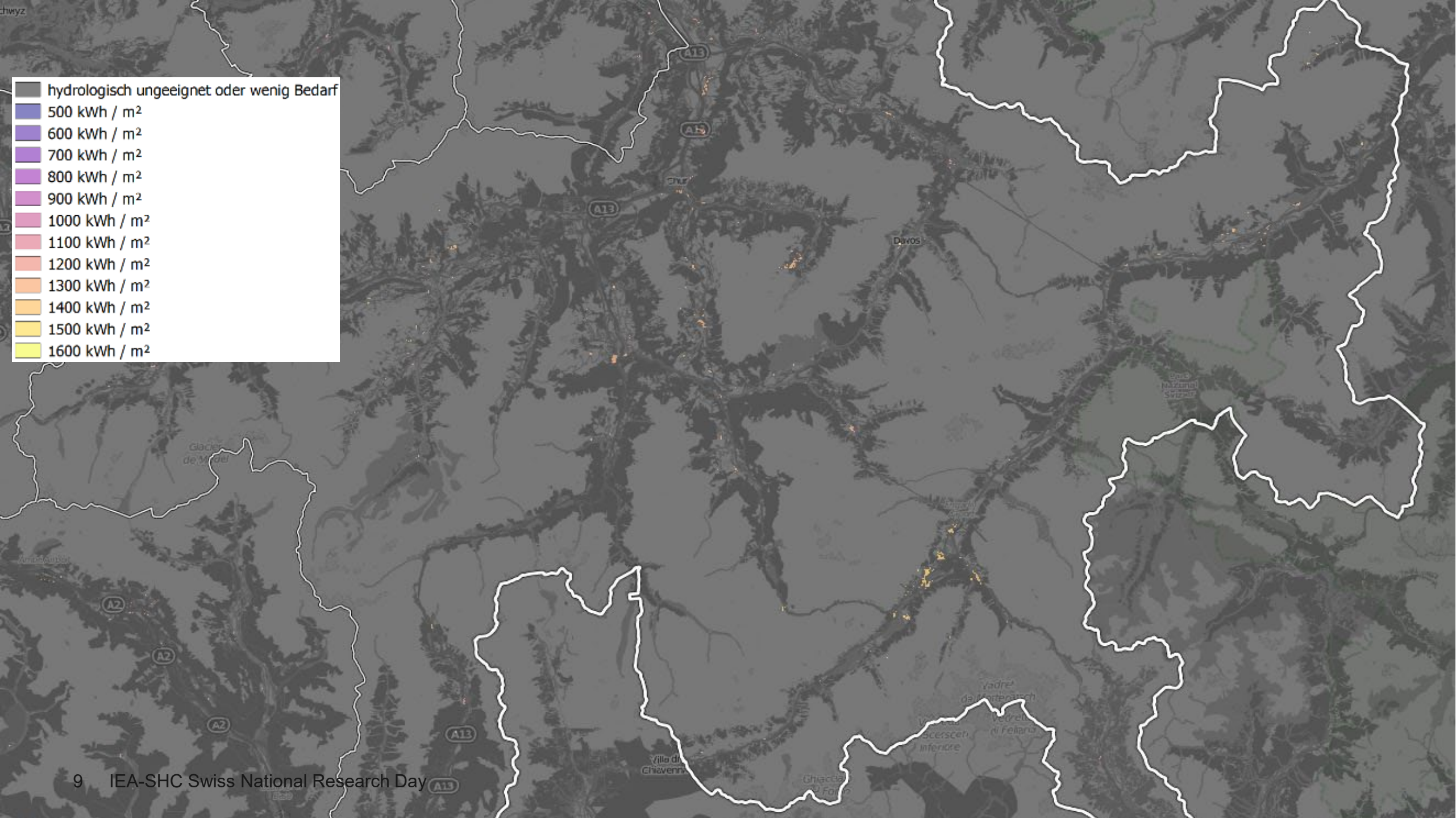
Borehole storage: DLSC, 90-100 % solar

HotSpot: DLSC in Switzerland?



Ruesch, F et al. Hotspot- Speicherung solarer Wärme im Untergrund auf direkt nutzbarem Temperaturniveau, BFE Bericht, SPF 2019

- Potential in alpine regions
- 22 (subsidies) … 28 Rp./kWh heat production cost (without distribution)
- Size x 10:
  - storage losses: 50 % ->10 %
  - potential for further cost reduction


hydrologisch ungeeignet oder wenig Bedarf
500 kWh / m²
600 kWh / m²
700 kWh / m²
800 kWh / m²
900 kWh / m²
1000 kWh / m²
1100 kWh / m²
1200 kWh / m²
1300 kWh / m²
1400 kWh / m²
1500 kWh / m²
1600 kWh / m²
A13
A2
Davos

Storage in low-Ex Grids

Low Ex Grid:

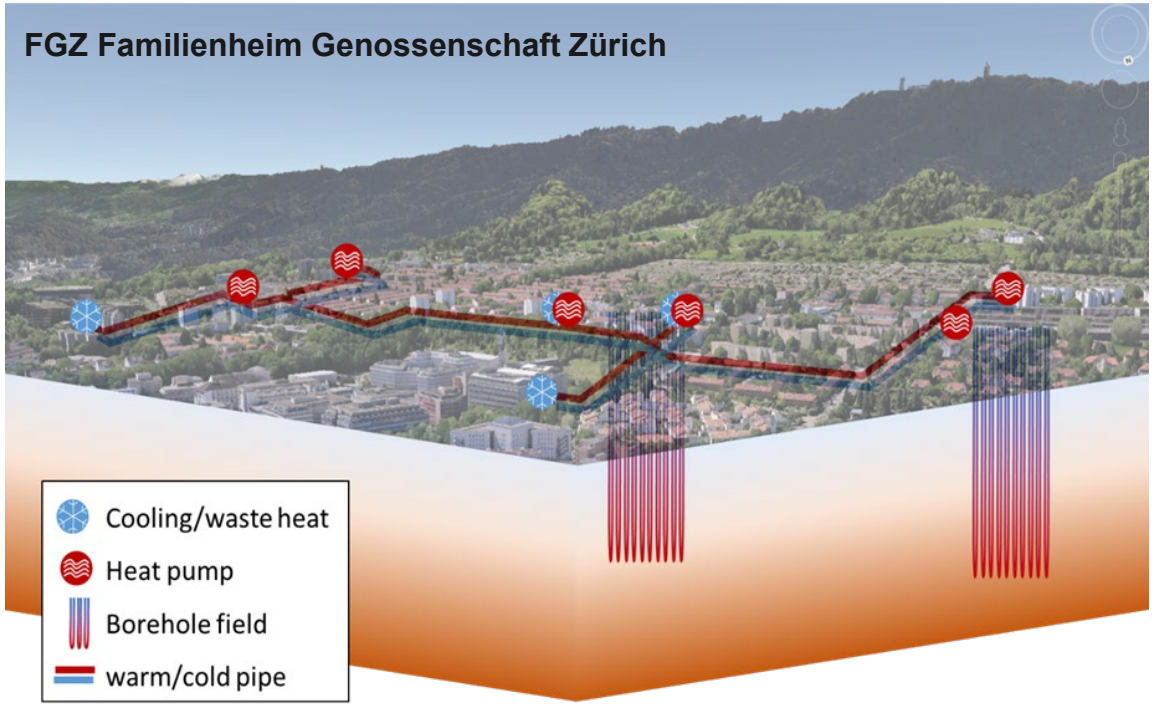
- Temperature ~ 3-30 °C
- Decentralized HP
- Heating and cooling applications
- Switzerland technology leader

Examples with BTES

- Suurstoffi
- Hönggerberg
- FGZ
- …

Disadvantage:

- Direct “Freecooling” limited
- Cost

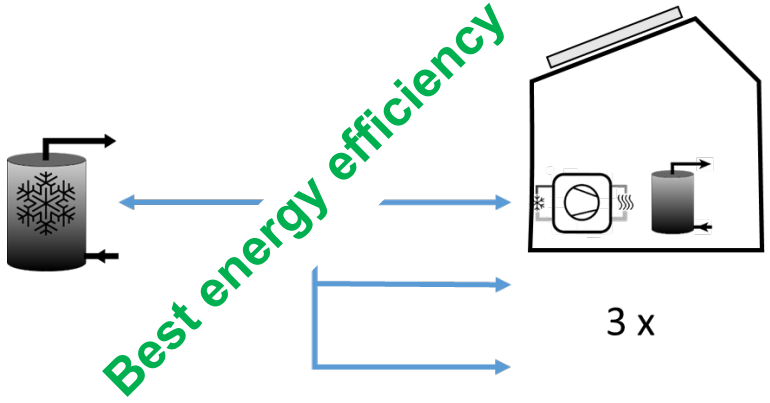


Ruesch, F et al., Potential and limitations of using low-temperature district heating and cooling networks for direct cooling of buildings, Energy Procedia, Volume 122, 2017,

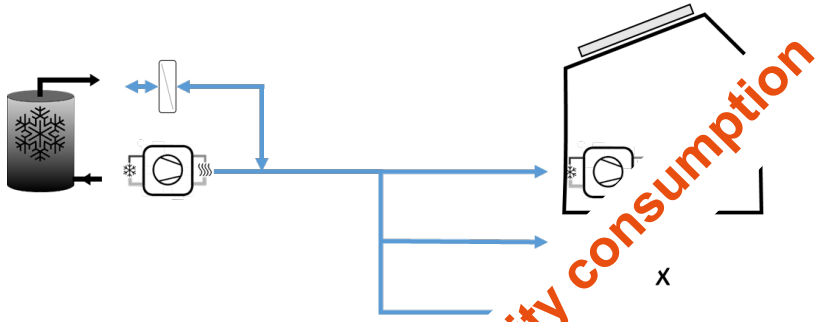
SolarIce system in LowEx Grids

Example "plain du loups" Lausanne, innocheque in cooperation with energie solaire SA

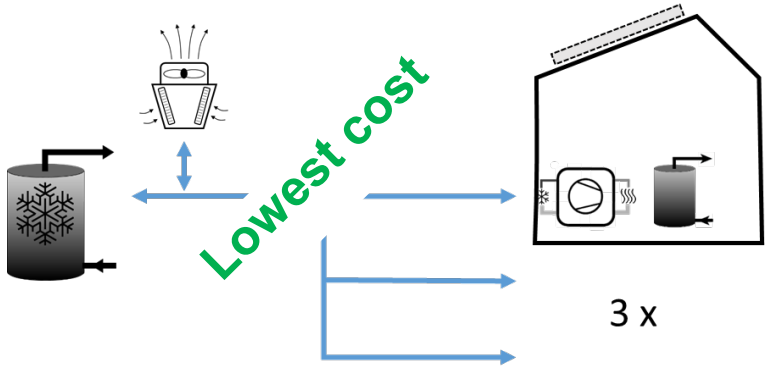
A: uncovered collectors, PVT, brine network



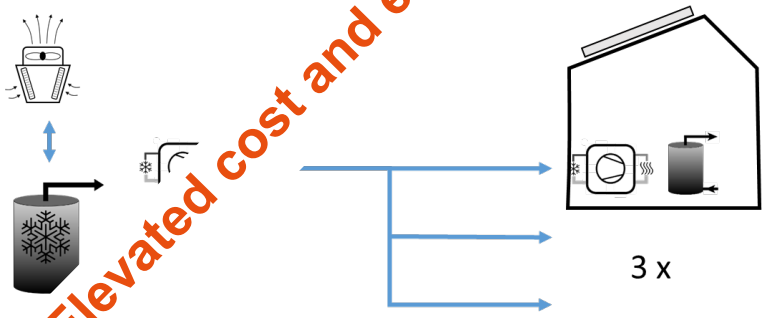
B: uncovered collector, PVT, water network



C: Air HX, PV, brine network



D: uncovered collectors , network, air HX



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SFOE projects BigStoreDH & IceGrid

- Models of generic networks
- Guidelines and factsheets
- Case studies

ewz

EV Altstetten/Höngg

- Combination of hot and cold network
- HP with sewage
- Waste burning

TES at EV Altstetten

iwb

Fernheizkraftwerk Volta

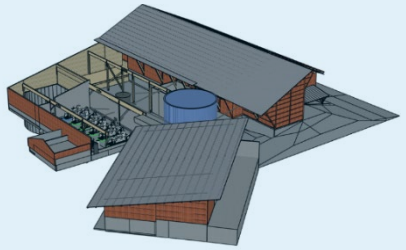
- Existing gas and vapor
- Fossil fade out
- Use of existing turbines

Powerplant Volta, Basel

Wärmeverbund buttisholz

WV Buttisholz

- New network with wood gasification
- Big PV Installation
- Combination of PV, HP and ground storage

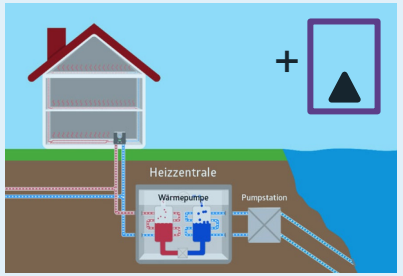


Plan for the central plant

energie360°

EV Tiefenbrunnen

- HP with lake for a "hot" grid
- Fossil peak
- Limited space
- Storage for peak shaving



Sketch of underground HP;

ENERGIE ZürichseeLinth

Energieverbund Jona

- Low temperature network
- Sewage plant
- Limited power

Grid from sewage plant Jona

Outlook

- Simulation models in TRNSYS with gui (PYTRNSYS)
- Factsheets for the Swiss context (BigStoreDH)
- Guidelines for integration in the Swiss context (BigStoreDH, IceGrid)
- National cooperation in DeCarbCH
- Task 68 participation (SPF & HEIG)

Thank you!

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE

Innosuisse

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AMSTEIN+WALTHERT

FGZ Familienheim Genossenschaft Zürich

polysun® SIMULATION SOFTWARE

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