Thermal Storages for Swiss District Heating Systems

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# Introduction

## Energy Sources in Swiss District Heating

### Number

- **Biomass:** 1.8 MW

### Energy delivered

- **Waste Heat:** 33 MW
- **Heat Pump:** 3.2 MW
- **Fossil:** 4.2 MW

Data source: [www.maps.admin.ch](http://www.maps.admin.ch), «Thermische Netze»
### Biomass

#### Storage for (Solar) Biomass Networks

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Biomass

Storage for (Solar) Biomass Networks

**Ongoing**

**Goal:**
- avoid fossil part load
- avoid start/stop

**Storage:**
- Mainly pressurized steel tanks
- 30-200 m³

**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 m³

**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 m³

**Status:**
- Pilot examples worldwide
- Switzerland: BTES (focus: low T)
### Switch-off Biomass in Summer?

**Case study biomass network Wattwil:**

- ~7 GWh biomass + fossil peak load
- + 2000 m² ETC & 300 m³ TES:
  - Solar fraction: 18%
  - Start cycles: 220 -> 130

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**Start-stop cycles for Wattwil**

- Measured 2019
- Simulated typical weather
- Simulated with 2000 m² solar collectors

Seasonal Storage

Storage for (Solar) Biomass Networks

Ongoing

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Long-term

Goal:
- Seasonal storage of renewable heat

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- Pit, Aquifer, Borehole
- … 1’000’000 m³

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

Pit: Vojens, ~50 % solar

source: www.ramboll.com

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
Seasonal storage?

Motivation

source: www.ramboll.com

Pit: Vojens, ~50% solar

Borehole storage: 90-100% solar in Vojens


IEA-SHC Swiss National Research Day
Low Temperature Networks

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

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
Ongoing Projects

SFOE projects BigStoreDH & IceGrid

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

EV Altstetten/Höngg
- Combination of hot and cold network
- HP with sewage
- Waste burning

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

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

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

Energieverbund Jona
- Low temperature network
- Sewage plant
- Limited power

TES at EV Altstetten
Powerplant Volta, Basel
Plan for the central plant
Sketch of underground HP
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