



GEOtherMAL
IWG

Iceland
Liechtenstein
Norway grants



REPUBLIC OF SLOVENIA
MINISTRY OF THE ENVIRONMENT,
CLIMATE AND ENERGY



Strategies & Policies on Geothermal Energy in Switzerland

Stefano Benato

Outlook → 2050 Energy Transition Strategy

-43



By 2035, average energy consumption per capita is to be reduced by 43%.

SFOE

1
**INCREASING
ENERGY EFFICIENCY**



2
**INCREASING THE
USE OF RENEWABLE ENERGY**



3
**WITHDRAWAL
FROM NUCLEAR ENERGY**



SFOE

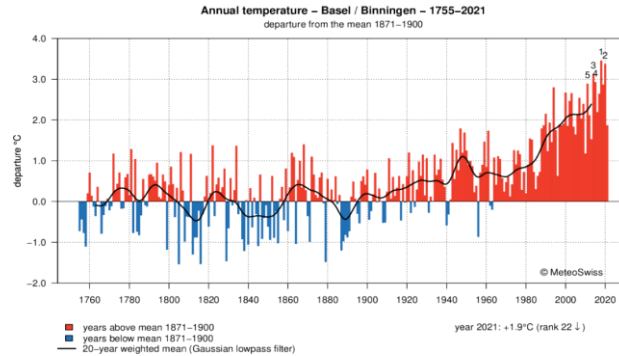
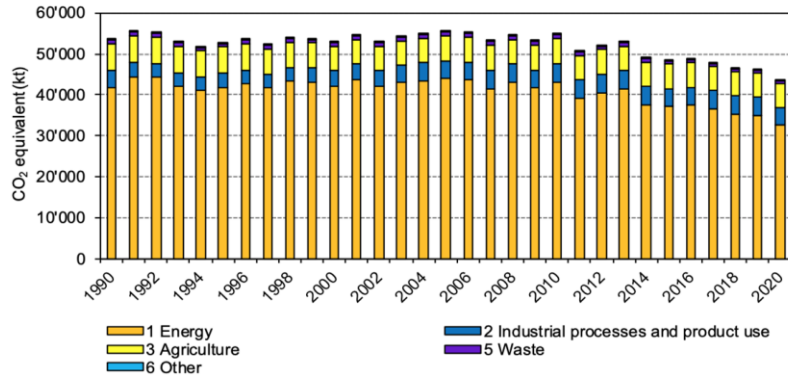


Building with solar panels in Wittigkofen (Berne)
© FDFA, Presence Switzerland

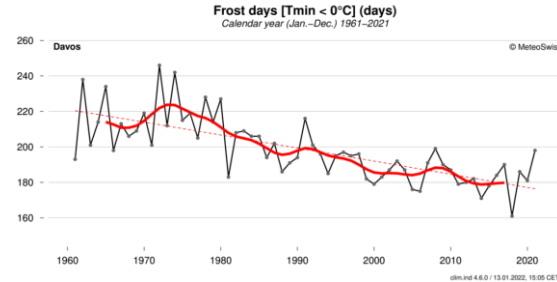


The Gösgen nuclear power plant
© Alessandro Della Bella

Outlook → 2050 Energy Transition Strategy



- 1864 - 2016 → avg T increased by **+2.0°C** (2022 FOEN National Inventory Report)
- In 2021 trees pollinated **11 days** before the avg (Meteo Suisse)
- 1970 climate → to be found **300m** higher today (Yann Vitasse, WSL)

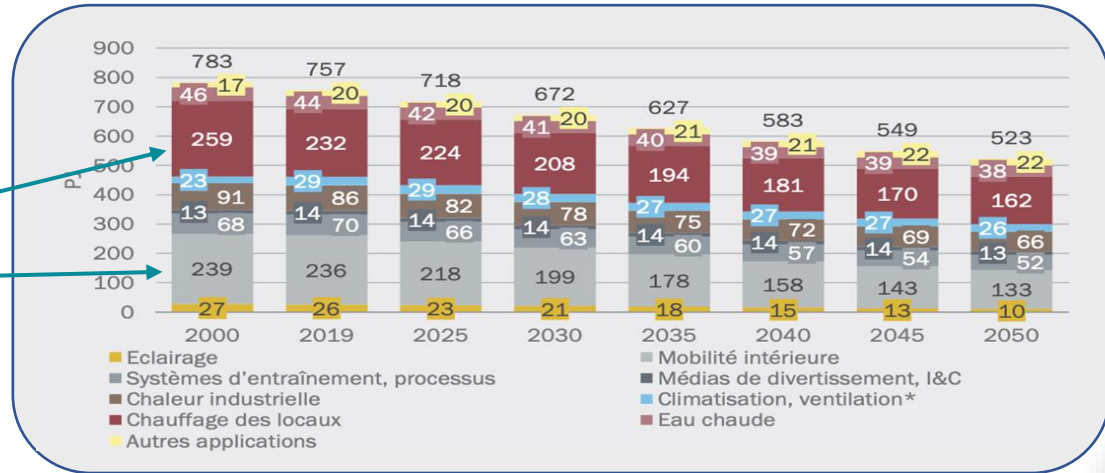


Outlook → 2050 Energy Transition Strategy

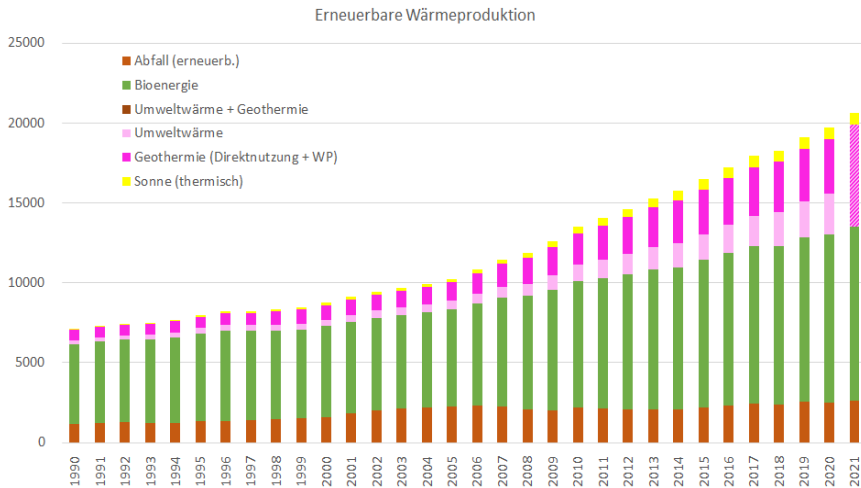
Residential heating → 20% emissions

Road transportation → 30% emissions

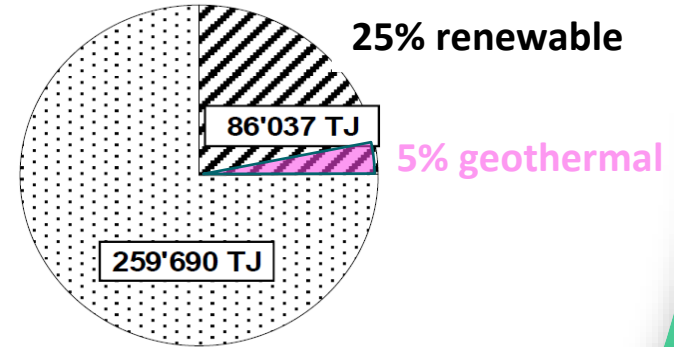
(CH → 5.0 t CO2 eq/capita)



Outlook → renewable heat supply

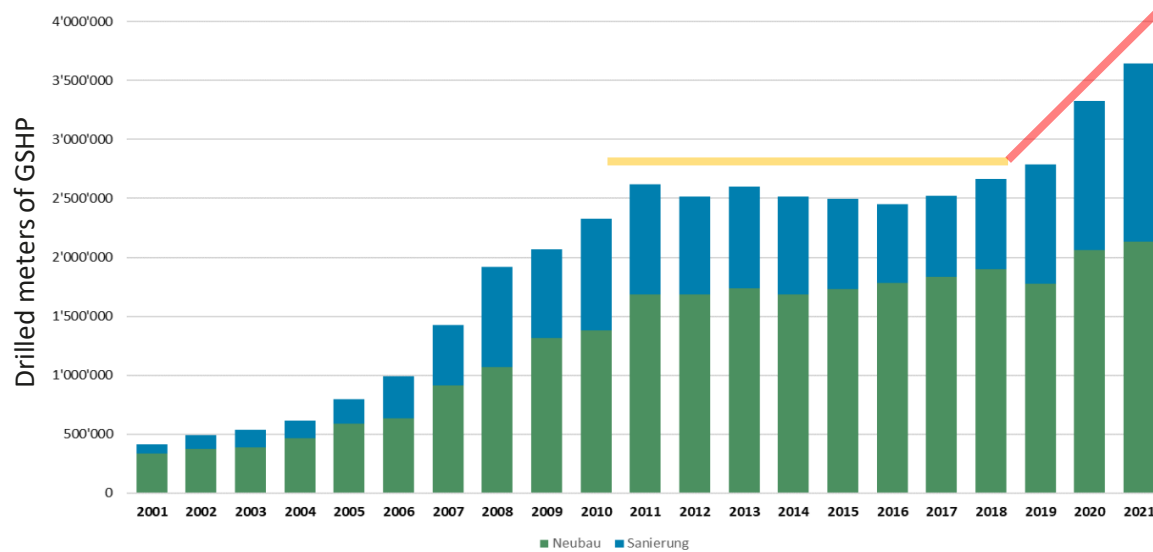


Geothermal installed heat capacity → 2390 MW_t



- GSHP → 1993 MW_t (83%) - 5.32 MW_{th} per 100 km²
- near-surface groundwater → 331.4 MW (14%)
- geo-structures → 29.6 MW (1%)
- thermal baths 22.3 MW (0.9%)
- tunnel water uses → 3.9 MW (0.2%)
- direct uses deep aquifers → 1.5 MW (0.1%)

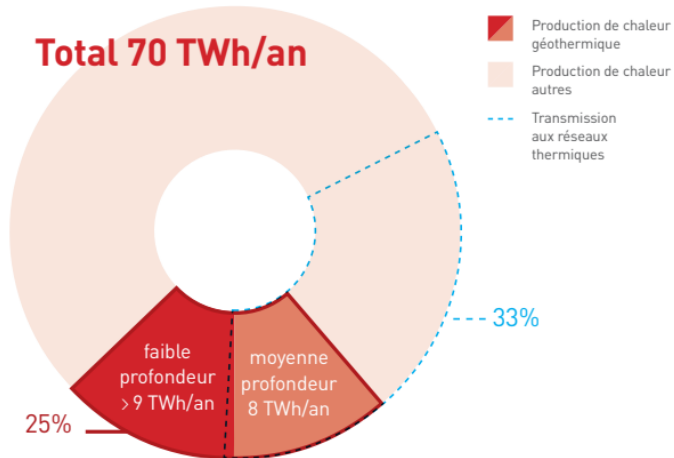
Outlook → Heat Supply [GSHP]



Ca. 130 GWh yearly growth

Outlook → Heat Supply 2050 estimate

Le besoin en chaleur en 2050 en Suisse sera d'env. 70 TWh/an. La géothermie y contribue pour au moins un quart.



70 TWh/an
25 % (= 17 TWh/a)

Besoin en chaleur en Suisse en 2050
Part de la géothermie dans la production de chaleur 2050

4.5 millions de tonnes

d'économies de CO₂ par an (substitution mazout par la géothermie)

1.7 mrd. de litres
1.2 mrd. de fr.

d'économie de mazout par an

d'économie de frais annuelle pour le mazout

250

Nombre d'installations géothermiques de moyenne profondeur d'ici 2050

6 mrd. de fr.

Total des coûts d'investissement pour les installations géothermiques de moyenne profondeur (hors subventions)

Outlook → heat from geothermal

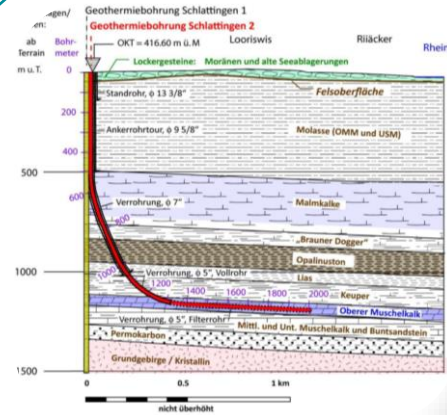
- **31 shallow geothermal installations:** heating, thermal baths, geothermal probes, storage, tunnel water for space heating, greenhouses, balneology, fish farming (e.g., Grob in Schlattingen TG, 1 of 2 boreholes 800 m horizontal section, 1.2 km deep aquifer)
- **Smart thermal grids** (Zurich Greencity 3rd stage of development)
- **1 DHN Riehen** (1500 m deep aquifer Muschelkalk, Upper Rhine Graben, 65°C, 20 l/s, 5MW_{th}, geo2riehen being planned)
- **Deep(er) geothermal entering the picture ≈ 300 GWh** in project pipeline



Tropical gardens of Tropenhaus Frutigen,
tropenhaus-frutigen.ch

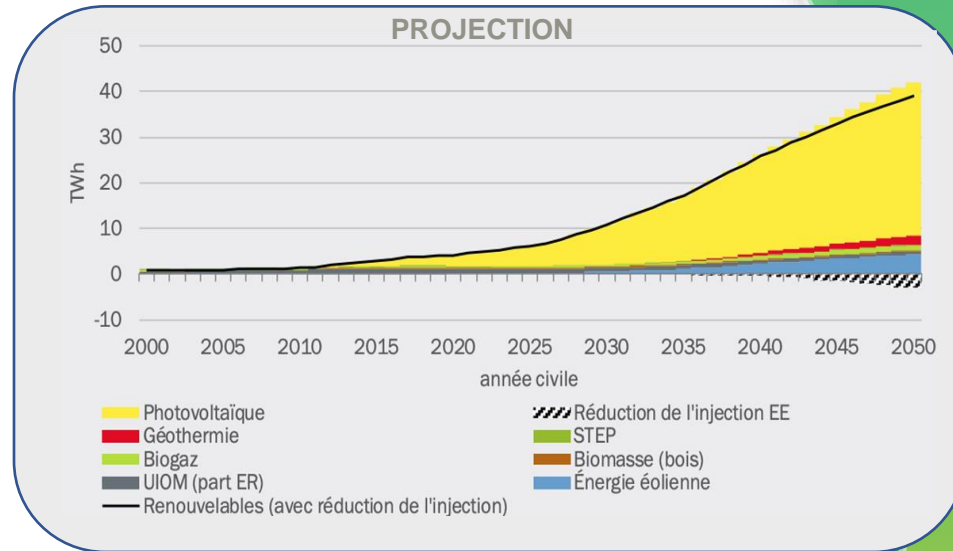
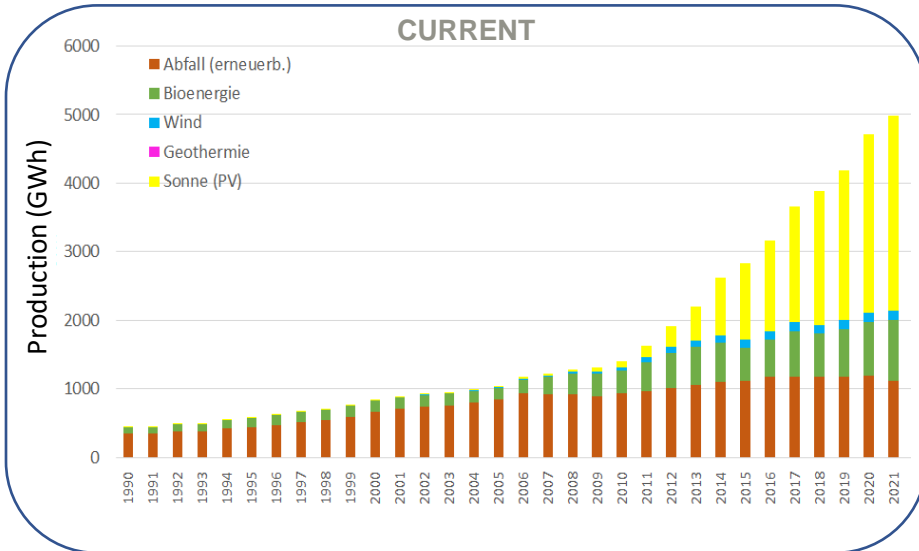


Riehen district heating network ©2018 Simon Havlik, Basel



Grob project in Schlattingen

Outlook → electricity from renewables



- **Guideline 2035 → 11,400 GWh (assumed linear growth: + 465 GWh p.a.)**
- **Geothermal power today → absent!**

Challenges → what stands in the way?



Geological Risk

- Poorly known subsurface

Significant financial downside

Public acceptance

Regulatory Framework

- Individual Cantonal mining laws

Long delivery times for Heat Pumps, especially GSHP

- Reorganisation of supply chain after COVID and Ukraine war

Shortage of skilled labor

- Insufficient planners/installers
- Focus on maximising number of installations at the detriment of careful planning and maximising energy efficiency

Spatial planning

- High GSHP density → overexploitation → obligation to regenerate
- Conflicts e.g. with underground transport infrastructure

Measures → subsidy scheme

HEAT

Exploration subsidies

Max. 60% of eligible costs

30 M CHF/year

POWER

Exploration subsidies

Max. 60% of eligible costs

50 M CHF/year

Geothermal guarantee scheme

60% of total sunk subsurface development cost

Feed-in tariffs

For 15 years for projects with approval (no approvals given after 1 Jan 2023)

Outlook → Deep Geothermal

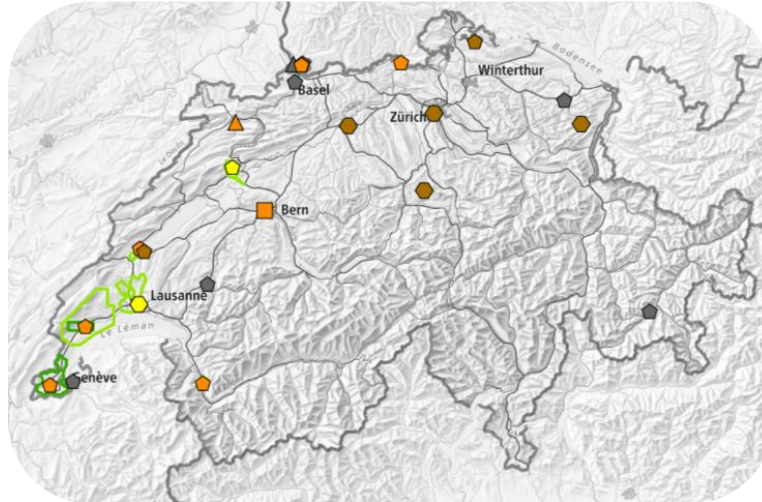
10 projects granted SFOE subsidy support planned/under way [187 M CHF since 2018]:

HEAT

- Project EnergieÔ Vinzel
- Project Bern Forsthaus
- Project SIG
- Project geo2Riehen
- Project EnergieÔ La Côte
- Kreuzlingen

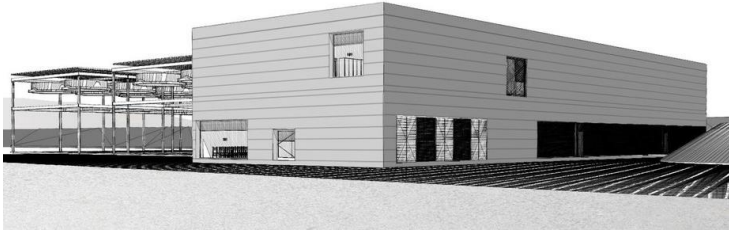
POWER

- Project Haute-Sorne
- Project AGEPP Lavey-les-Bains
- Project GeoCogen Eclépens
- Gruyere Energie AG



Five further subsidy requests formally submitted and more subsidy requests being evaluated

Showcase → Haute-Sorne (power)

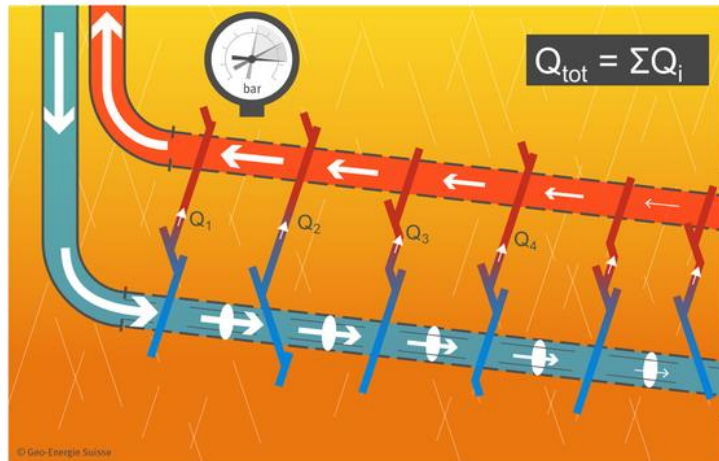


GOALS

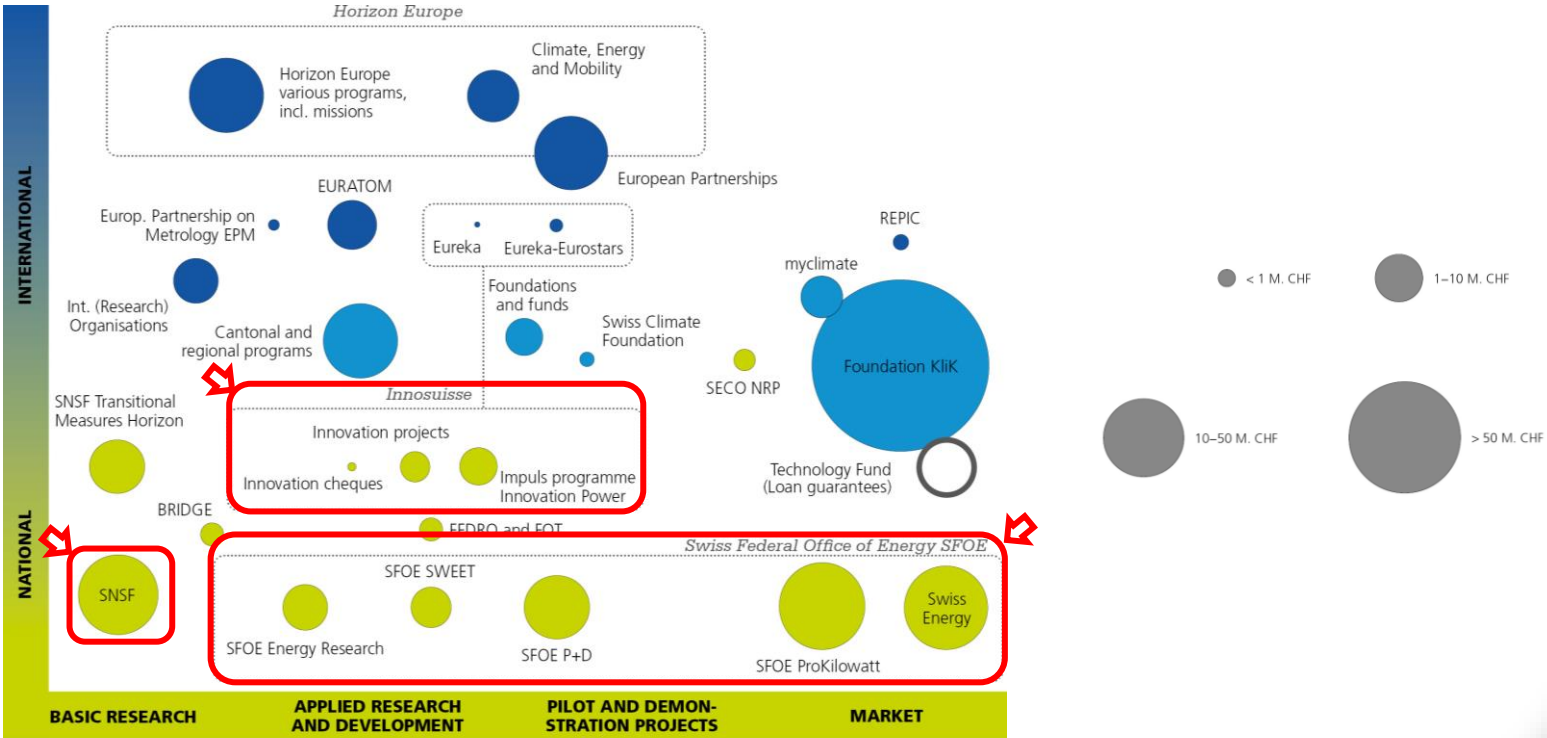
- 140 – 170 °C EGS
- 25 – 40 GWh_{el} by ORC
- 160 - 200 GWh_{th} tentative for district heating at a later stage
- Strong innovation component; collaboration with FORGE
- 90 M CHF Federal subsidy

STATUS

- Preparation for operations. 3D Seismic Campaign to start.
- Drilling to start in 2024.



Measures → SFOE RD&D funding scheme



Measures → SFOE RD&D funding scheme

R+D

TRL 1 - 6
50% to 100% of direct costs
1 M CHF/year

Tenders **TOP-DOWN** or
BOTTOM-UP

P+D

TRL 4 – 9
40% to 60% of NASC
28 M CHF/year

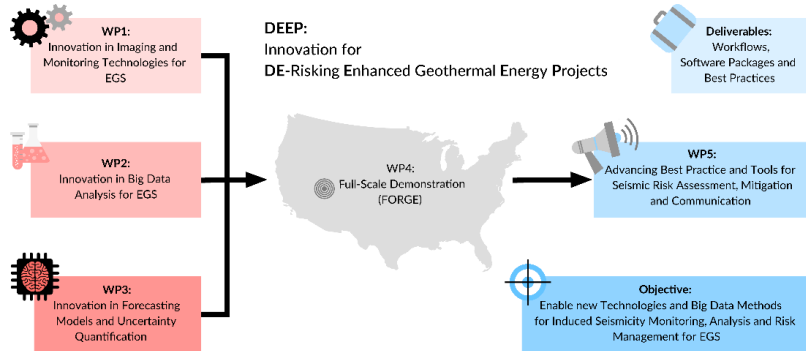
Tenders **TOP-DOWN** or
BOTTOM-UP

Innovation → EGS-related innovation

DEEP

Real-time demonstration of innovative seismic processing, seismicity forecast modelling & adaptive risk assessment ([Advanced Traffic Light System](#)) for EGS projects.

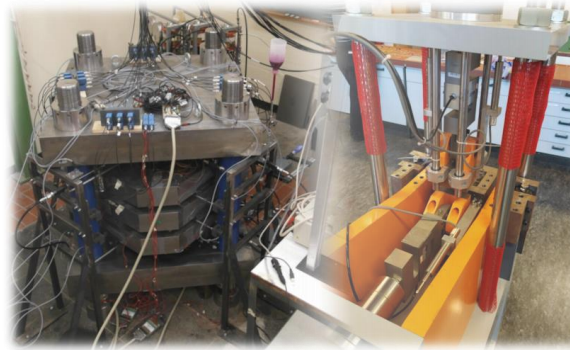
Duration: 2021 – 2023



SPINE / TIBEX

Stress Profiling using a novel tool to measure 3D dislocation during stimulation tool / Development of a new tool to thermally induce breakouts.

Duration: 2021 – 2023



Innovation → Bedretto Lab

Bedretto Underground Laboratory for Geoennergies → 1.5 km below surface within a 5.2 km long tunnel.

Duration

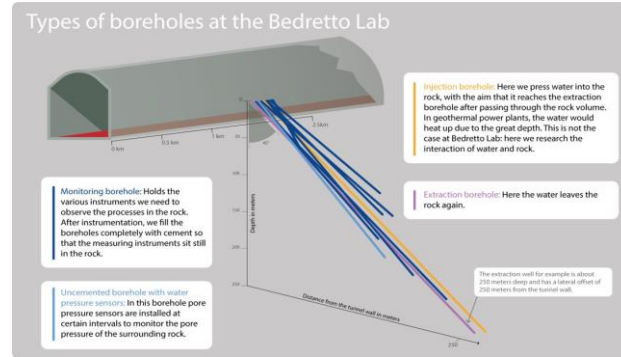
Inauguration May 2019

<http://www.bedrettolab.ethz.ch/home/>

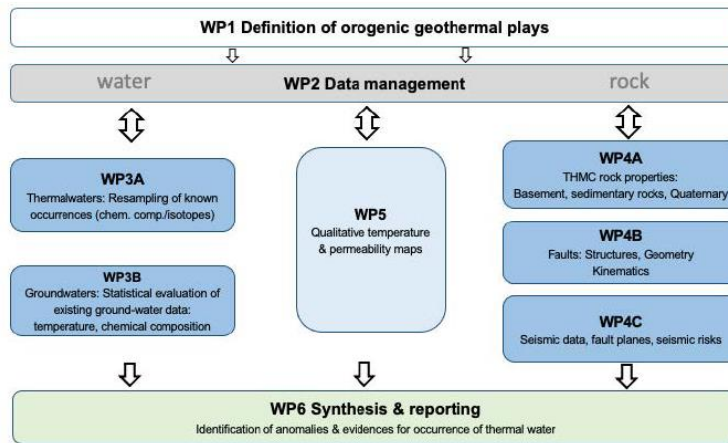
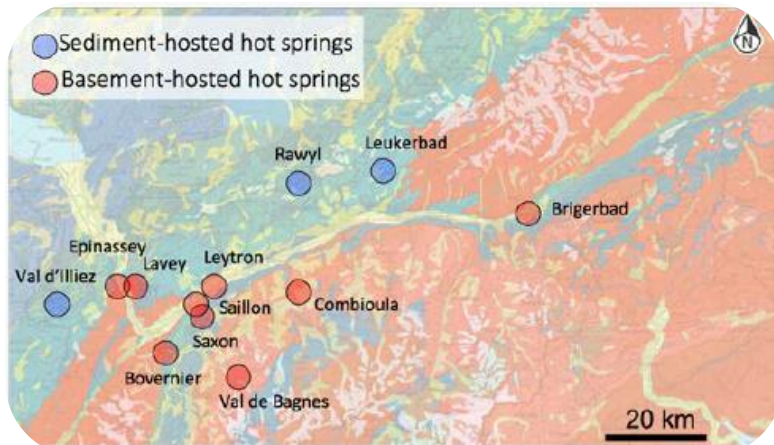
The laboratory hosted/hosts a number of EGS-related projects, e.g. VALTER (P+D Project, SFOE)

DESTRESS (Horizon EU)

ZoDrEx (Era-net GEOHERMICA)



Innovation → Play Fair Analysis Alps



Nationwide activity with the goal to start systematically to explore the Swiss underground.

As 2/3 of Switzerland is made up of mountains, standard PFA approaches do not work. A research project is trying to establish a workflow.

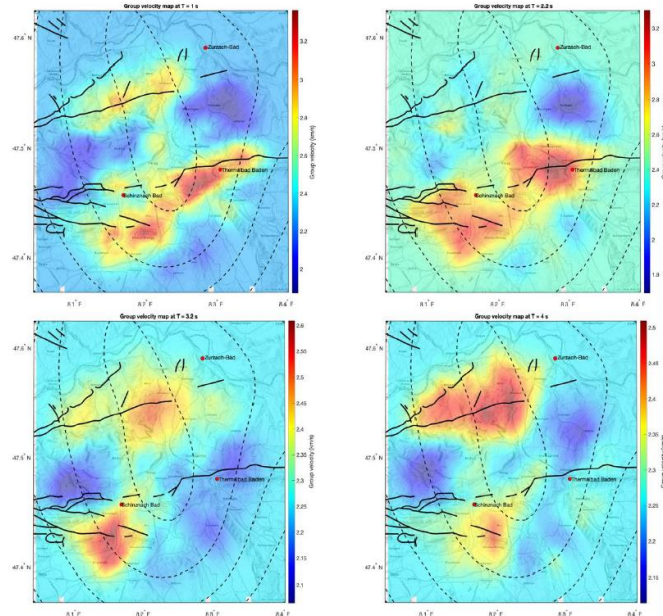
Innovation → PSIGE

An alternative method to 3D seismics might be ambient noise technology. Low-cost and able to highlight potential flow zones underground.

<https://www.unige.ch/sciences/terre/en/research/crustal-deformation-and-fluid-flow/>

Impact

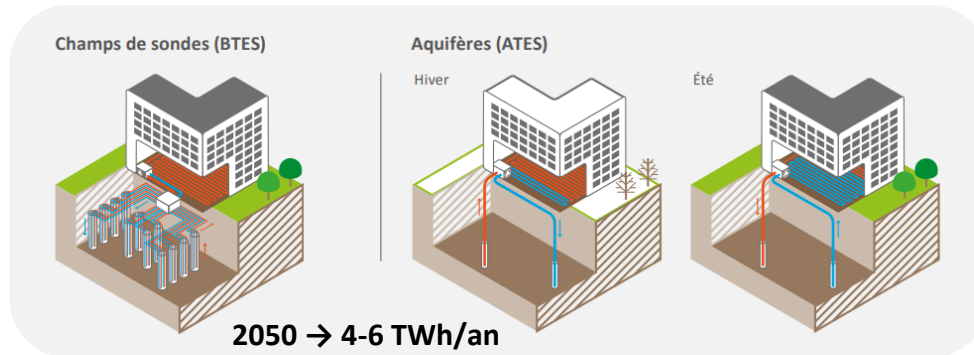
After successful demonstration of the method in Canton Aargau, it will be applied elsewhere



Challenge → Heat Storage

Increased interest:

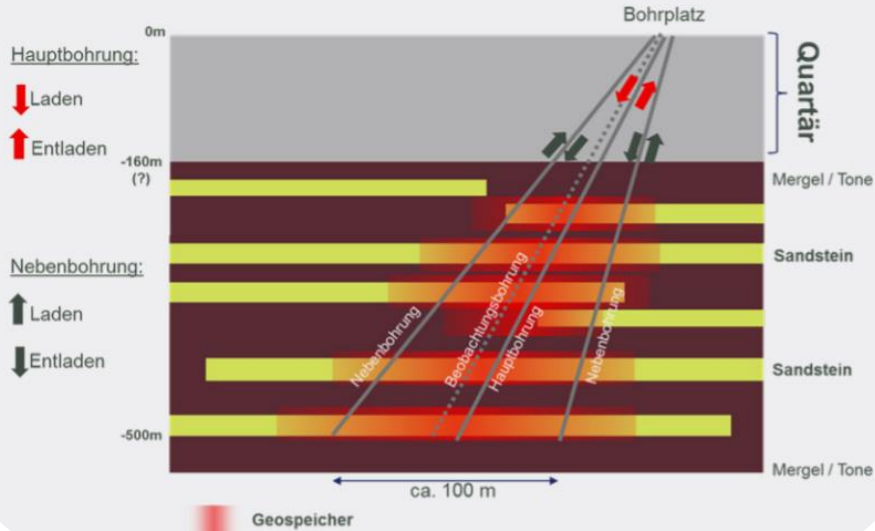
- Parliamentary motion for financial support of heat storage technologies
- Parliamentary motion for relaxing groundwater protection laws to allow for increased energy use
- Both motions are being studied



BUT:

- No clear national or cantonal vision / strategy
- No policy alignment yet

Showcase → HT-ATES in Bern



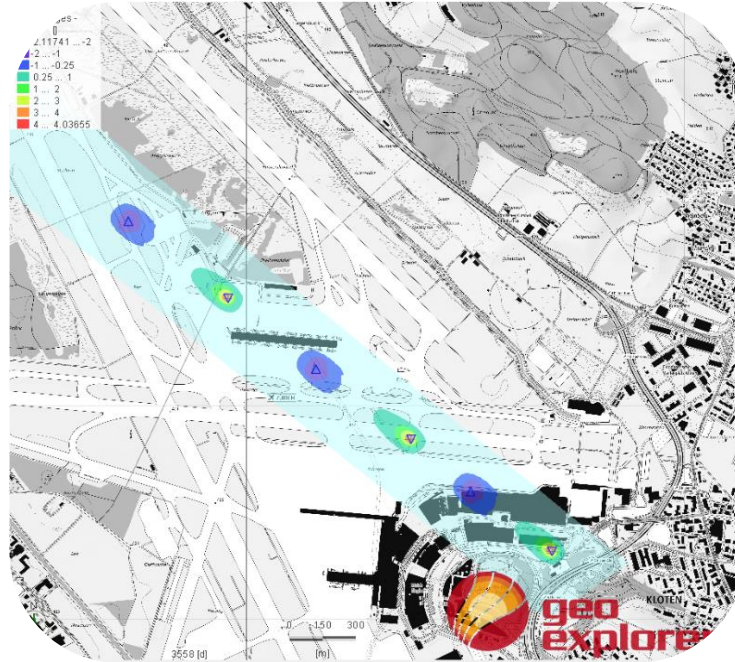
- Seasonal storage of waste incinerator surplus heat
- District heating system
- Loading temperature ca. 60°C (after power production)
- Injection at 200-500 m depth
- Capacity 3-12 MW_{th}
- First drilling campaign under way

Showcase → ATES Zürich airport

Important ATES project. Excess heat of the airport is stored underground and reused in winter. Target depth ca. 300 m.

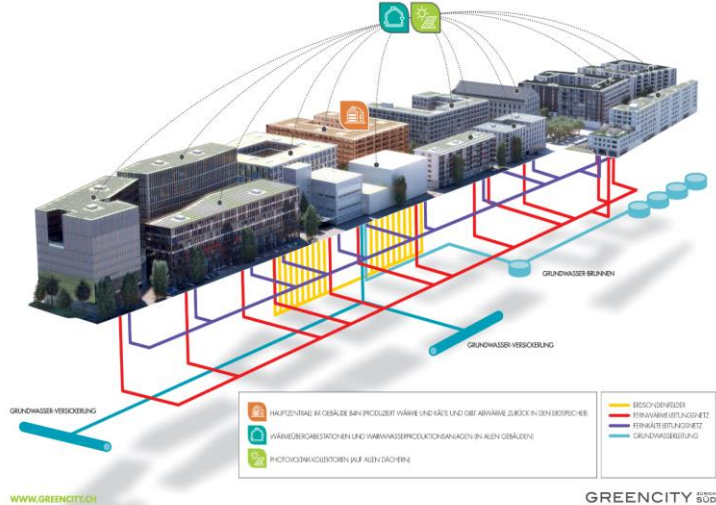
Prospection in progress, first boreholes being drilled.

Relevance within the ongoing political discussion on the narrow regulatory boundary conditions for ATES.



Showcase → Energy grid, Greencity Zürich

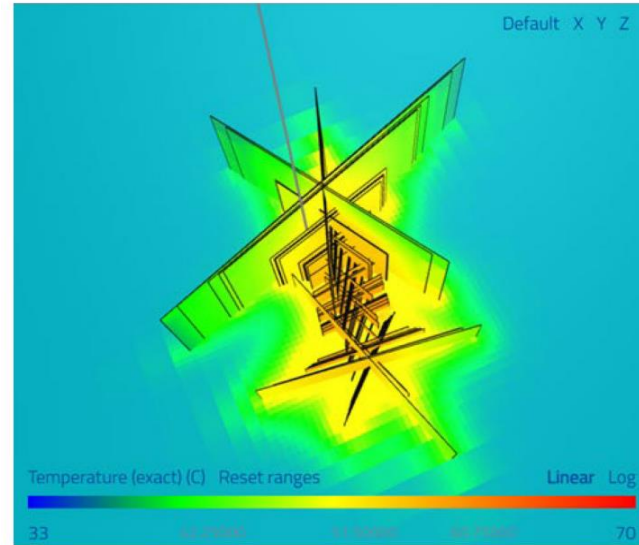
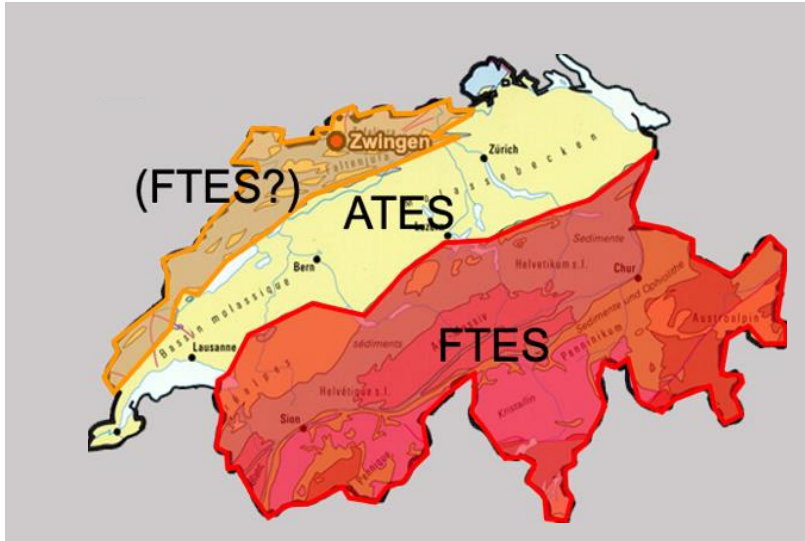
ENERGIEKONZEPT GREENCITY



- installed capacity: 4.8 MW_{th}
- certified 2000-watt area
- 2000 apartments
- 3000 workplaces
- school, hotel
- geothermal probe fields and groundwater systems serve as energy sources for heating and cooling
- electricity for heat pumps provided by photovoltaic systems

Innovation → FTES-ResFrac

Thermal Heat Storage in fractures - modelling investigation



Temperature @ 6th production cycle

Policies → on the horizon

Parliamentary Motion **Black Box Subsurface**

- Asking for a national Exploration programme, organised and financed by the confederation.
- Led by SFOE
- Potential game changer

Geothermal Play Fairway Analysis

- Standardisation of methodology for the analysis of local and regional potential. US-PFA as blueprint
- Foundation for planning and investing in prospection campaigns
- In line with cantonal needs and with Motion «Black Box Subsurface»
- Pilot study initiated by Swiss geological survey



GEOtherMAL
IWG

Iceland
Liechtenstein
Norway grants



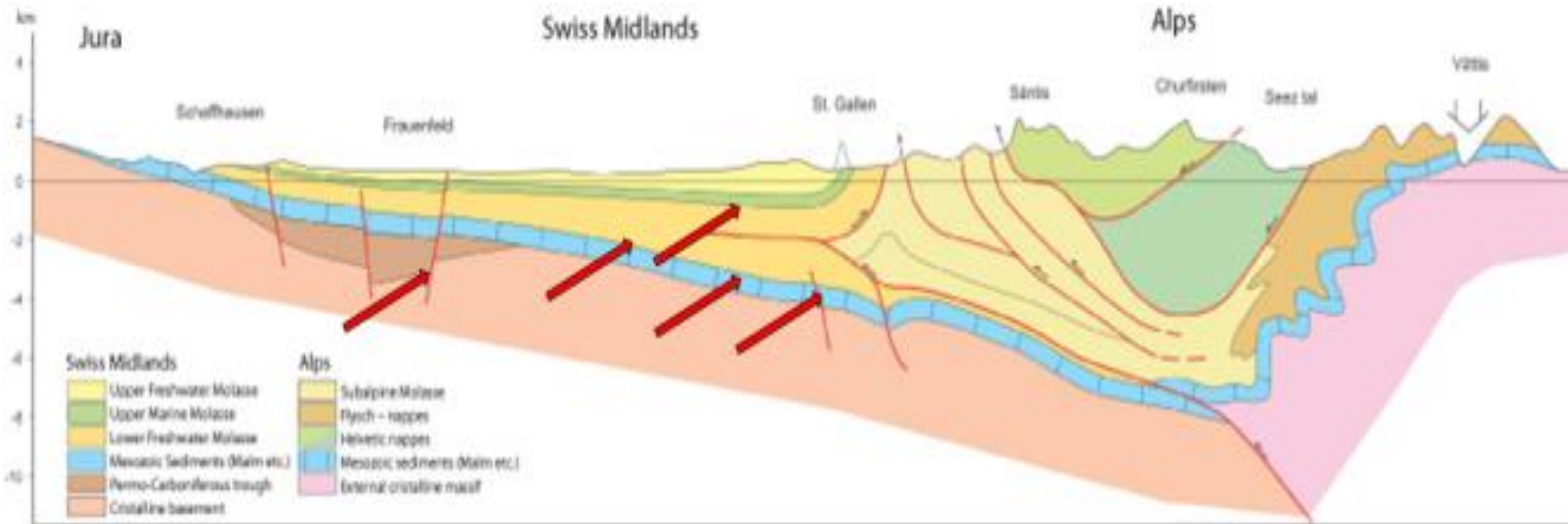
REPUBLIC OF SLOVENIA
MINISTRY OF THE ENVIRONMENT,
CLIMATE AND ENERGY



Strategies & Policies on Geothermal Energy in Switzerland

Stefano Benato

Extra 1



Extra 2

GeoMol15
Modelleinsicht

