2016 Switzerland Country Report

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March 2017

IEA Geothermal

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1. Introduction

Switzerland's uptake of shallow geothermal continues unabated and unconstrained by natural potential. The theoretical potential for direct use geothermal and geothermal for power generation is considered very large. Yet arguably, realistic estimates of the technical and economic potential (with support mechanisms) is limited to between 1 and 20 TWh along with associated co-produced heat.

In the wake of the major incident at the Fukushima Daiichi Nuclear Power Plant due to the 11 March 2011 earthquake and tsunami, the cost reduction in renewables, and political instabilities in North Africa and the Middle East, Switzerland is in the process of developing and implementing an Energy Strategy 2050, which comprises several measures and incentives for geothermal energy. Geothermal legislation has continued to work its way through parliament. Both chambers of parliament voted on the new energy law and its package of measures in autumn 2016. The Swiss population will vote on the new law on 21 May 2017, which, once approved, would enter into force on 1 January 2018. The adoption of this law is crucial for the further development of geothermal energy in Switzerland.

Table 1 Status of geothermal energy use in Switzerland (figures from 2015)

Electricity		Direct Use	
Total Installed Capacity (MW_e)	0	Total Installed Capacity (MW_{th})	26.7
New Installed Capacity (MW_e)	0	New Installed Capacity (MW_{th})	-3.9
Total Running Capacity (MW_e)	0	Total Heat Used (PJ/yr) [GWh/yr]	0.78 (215.9)
Contribution to National Capacity (%)	0	Total Installed Capacity Heat Pumps (MW_{th})	1925.5
Total Generation (GWh)	0	Total Net Heat Pump Use [GWh/yr]	2320.2
Contribution to National Generation (%)	0	Target (PJ/yr)	N/A
Target 2050 (GWh/yr)	4'400	Estimated Country Potential (MW_{th} or PJ/yr or GWh/yr)	N/A
Estimated Country Potential (GWh/yr)	N/A		

(N/A = data not available)

2. Changes to Policy Supporting Geothermal Development

Since 2008 Switzerland has been operating a geothermal guarantee scheme for geothermal power projects. Under this scheme up to 50% of the actual subsurface development cost may be reimbursed to project developers in case of a failure to find a suitable geothermal resource. Additionally, geothermal power production is remunerated by a feed-in tariff.

The Swiss government has developed the Energy Strategy 2050, which targets reducing energy consumption, improving efficiency, and enhancing the utilisation of renewable energies. Several measures and incentives aim to boost the development of geothermal energy, e.g.:

- Increase coverage of the geothermal guarantee scheme for geothermal power projects from 50% to 60% and extending the eligible costs to include exploration expenses
- Direct financial support for exploration
- Direct financial support for heat projects (via Switzerland's levy on carbon in fossil fuels used for stationary heat supply)
- Higher feed-in tariffs for power production with EGS technology: bonus of 7.5 Rappen/kWh (1 Rappen ~ 1 US Cent); the feed-in tariff for hydrothermal projects continues unchanged but now for a period of 15 years instead of 20 years

Capacity (MW_e)	Feed-in tariff (Rappen/kWh)
≤5 MW	40.0
≤10 MW	36.0
≤20 MW	28.0
>20 MW	22.7

The Energy Strategy 2050 also includes an "action plan coordinated energy research". Financial support for geothermal research and innovation has grown considerably in the last 2 years from about US$ 5 million to US$ 12 million per year.

In addition, in early 2017 the Swiss Federal Council has decided not to impose a ban on hydraulic stimulation. But, the highest regulatory and industry standards have to be upheld.

3. Geothermal Project Development

3.1 Projects Commissioned

The following projects are in the planning phase in 2016:

Project name	Project developer	Technology	Energy use
Haute Sorne (JU)	Geo-Energie Suisse AG	EGS	Power (and heat); Permit granted
Etzwilen (TG)	Geo-Energie Suisse AG	EGS	Power (and heat); Planning phase
Triengen (LU)	Geo-Energie Suisse AG	EGS	Power (and heat); Planning phase
Pfaffnau (LU)	Geo-Energie Suisse AG	EGS	Power (and heat); Planning phase
Avanches (VD)	Geo-Energie Suisse AG	EGS	Power (and heat); Planning phase
Lavey-les-Bains (VD)	JV of regional energy utilities, cantons and communities	Combined heat and power - hydrothermal	Heat, power; permitting stage

GEothermie 2020	Services Industriels de Genève (SIG) and Canton of Geneva	All geothermal applications considered	Heat, cold, power; seismic completed, planning of drilling
Geothermie Schlattingen (TG)	Grob Gemüse GmbH	Hydrothermal	Heat agriculture; Underground system completed, long term test
Geothermie Oftringen (AG)	Erwärme Oftringen AG	Hydrothermal, heat storage	Heat; planning phase
EnergÒ Vinzel	EnergÒ SA	Hydrothermal	Heat; planning phase

3.2 Projects Operational

There are no geothermal power projects in operation in 2016. Direct and indirect use projects in operation in 2016 are found below, all figures are from 2015:

Heating project	Capacity [MW][*)]	Heating energy [GWh/yr]	Heat energy without heat pump contribution
Lötschberg base tunnel, Frutigen, direct Tunnel water	NA	2.00	See left
Riehen (BS), direct	1.5 MW	4.18	See left
Riehen (BS), heat pumps	3.5	10.08	7.69
Bassersdorf (ZH)	0.24	0.47	0.24
Itingen (BL)	0.08	0.18	0.13
Kloten (ZH)	0.24	0.74	0.47
Seon (AG)	1.35	2.47	1.70
Furka Railway tunnel, Oberwald (VS)	1.37	2.74	2.02
Gotthard road tunnel, Airolo (TI)	0.72	0.86	0.65
Ricken railway tunnel, Kaltbrunn (SG)	0.16	0.25	0.17
Lötschberg base/railway tunnel, Frutigen (BE/VS)	1.08	1.44	0.98
Hauenstein railway tunnel, Trimbach (SO)	0.37	0.34	0.14
Mappo Morettina, road tunnel, Minusio/Tenero (TI)	0.07	0.12	0.07

Thermal spas in operation in 2016, all figures from 2015:

Thermal spa	Capacity [MW]*)	Heating energy [GWh/yr]
Andeer (GR)	0.04	0.37
Baden (AG)	Currently (2016) under undergoing reconstruction	
Bad Ragaz (SG)	2.65	22.03
Bad Schinznach S3 (AG)	1.01	8.43
Brigerbad (VS)	4.67	38.88
Kreuzlingen	0.05	0.38
Lavey-les-Bains (VD)	3.94	32.76
Leukerbad (VS)	7.18	59.74
Lostorf (SO)	Currently not in operation (2016)	
Ovronnaz (VS)	0.18	1.49
Saillon (VS)	2.51	20.85
Stabio (TI)	0.01	0.07
Val d'Illiez (VS)	1.84	15.29
Vals (GR)	Currently not in operation (2016)	
Yverdon-les-Bains (VD)	0.23	1.90
Zurzach (AG)	0.91	7.54
Total	25.22	209.73

4. Research Highlights

Research and innovation is funded by the Swiss National Science Foundation (fundamental research), the Swiss Federal Office of Energy (applied research, piloting and demonstration) and the Commission for Technology and Innovation (market-driven research). Some of the federally funded Swiss Federal Institutes of Technology have allocated funds to be used for geothermal energy research and innovation. Of the five institutes, ETH Zurich, EPF Lausanne and the Paul Scherrer Institute engage in geothermal research and innovation.

Eight new Swiss Competence Centers for Energy Research (SCCER) officially launched in 2014 have been established to initiate research and innovation in fields deemed critical for Switzerland's Energy Strategy 2050. One of the SCCERs, SCCER – Supply of Electricity or SCCER-SoE, has a focus on geothermal energy and particularly on technologies required to unlock Engineered Geothermal Systems. The SCCER's are set up along the lines of a public-private partnership with industry players encouraged to participate.

R&D funds for 2015 have been at a level of US$ 10 million (incl. funds for piloting) with slightly higher levels at US$ 12 million expected in 2016. A highlight are research activities of the SCCER-

SoE on controlled hydraulic stimulation experiments at the Grimsel Test Site, an underground laboratory in the crystalline basement of the Alps.

As of 1 January 2017 Switzerland is once again a fully associated member of the EU research framework program, Horizon 2020. Hence, the Swiss Federal Office of Energy, via its dedicated funding program for geothermal energy research and innovation, cooperates with European funding agents in the European Commission through the European Research Area Network GEOTHERMICA, as well as the International Partnership for Geothermal Technology (with the USA, Iceland, Australia and New Zealand). The longest standing backbone of Switzerland's international engagement is the IEA's Geothermal Technology Collaboration Program.

Industry engages in geothermal development activities mostly in the areas of hydrothermal project development, subsurface heat storage, and EGS. Financial information is not available.

Geothermal research highlights in 2016:

- ThermoDrill (International) – fast track innovative drilling system for deep geothermal challenges in Europe (http://thermodrill.unileoben.ac.at/)
- DESTRESS (International) – Demonstration of Soft Stimulation treatments of geothermal reservoirs (http://www.destress-h2020.eu/home/)
- DG-WOW – Deep Geothermal Well Optimisation Workflow
- RT-RAMSIS – Real-Time Risk Assessment and Mitigation System for Induced Seismicity
- Hydraulic stimulation / fracking tests at the Grimsel Test Site

Research activities in the area of shallow geothermal applications especially concentrate on quality assurance and control, as well as enhancing efficiency.

5. Other National Activities

5.1 Geothermal Education

The University of Neuchâtel runs a successful and popular Certificate for Advance Studies on Exploration & Development of Deep Geothermal Systems (CAS DEEGEOSYS). Through the SCCER-SoE, the significant number of tenured and tenure-track professorships at ETH Zurich, EPF Lausanne, and at the Universities of Geneva and Neuchâtel has given rise to a number of undergraduate and graduate level courses in geothermal energy.

5.2 Conferences

In 2016, a number of geothermal conferences and conferences with significant geothermal interest took place in Switzerland:

- Geothermie Bodensee: an international conference, St.Gallen (SG)
- Swiss Geothermal Conference: a two-day international event at Yverdon-les-Bains (VD), focus in 2016 on heating, cooling and energy storage
- SCCER-SoE Annual Conference in Sion (VS) from 12-13 September 2016.
- EPF Lausanne's 13th Greenhouse Gas Control Technology Conference in November 2016, the world's premier CCS conference with sessions on geothermal energy.

5.3 Publications

See the publication website of the SCCER-SoE (http://www.sccer-soe.ch/publications/)

5.4 Useful Websites

Geothermie-Schweiz (Swiss Geothermal Association)	http://geothermie-schweiz.ch
Fachvereinigung Wärmepumpen Schweiz FWS (Swiss Heat Pump Association)	http://www.fws.ch
Swiss Competence Center for Energy Research – Supply of Energy (SCCER SoE)	http://www.sccer-soe.ch http://www.sccer-soe.ch/research/geo-energy/
Felslabor Grimsel (Grimsel Test Site)	http://www.grimsel.com
Geo-Energie Suisse AG (EGS projects)	www.geo-energie.ch

6. Future Activity

Geo-Energie Suisse AG is planning to realise at least one EGS project for power and heat production. The hydrothermal projects in Western Switzerland (Geneva, EnergeÔ Vinzel, and Lavey-les-Bains) will continue. But, future activities fundamentally depend on the outcome of the vote on Switzerland's Energy Strategy 2050 on 21 May 2017.

7. References

Geothermal statistical data are from:

Link, Katharina; Blum, Andreas and Wyss, Roland: Statistik der geothermischen Nutzung in der Schweiz – Ausgabe 2015. Schlussbericht, 28. Juli 2016.

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