IEA GEOTHERMAL

IEA Geothermal
Implementing Agreement

Switzerland
Country Report
2014

1.1 Introduction and Overview

Switzerland's uptake of shallow geothermal continues unabated and is not constrained by its 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 (with support mechanisms) economic potential is limited to between 1-20 TWh, plus the associated co-produced heat.

In the wake of the major incident at the Fukushima Daiichi Nuclear Power Plant in Japan 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 the 2050 energy strategy. Legislation has continued to work its way through parliament (final votes in both chambers of parliament are expected in 2016 with the possibility of a referendum).

Table 1 Status of geothermal energy use in Switzerland for 2014.

Electricity	
Total Installed Capacity (MW_e)	0
New Installed Capacity (MW_e)	0
Contribution to National Capacity (%)	0
Total Generation (GWh)	0
Contribution to National Generation (%)	0
Target (MW_e, % national generation, etc.)	0
Estimated Country Potential (MW_e or GWh)	4400
Direct Use	
Total Installed Capacity (MW_{th})	34.1
New Installed Capacity (MW_{th})	1.6
Total Heat Used (PJ/yr or GWh/yr)	0.89 [247.2]
Total Installed Capacity Heat Pumps (MW_{th})	1532
Total Net Heat Pump Use [GWh/yr]	1739.5
Target (PJ/yr,)	Na
Estimated Country Potential (MW_{th} /PJ/yr/GWh/yr)	Na

1.2 Highlights and Achievements

2014 saw the continued execution of the hydrothermal geothermal project in Schlattingen (Canton Thurgau, direct heat for an agricultural business) in the north of the country and, unfortunately, the termination of a hydrothermal project in the city of St. Gallen (Canton St Gallen) located in the east of the country. The power project of the City Utility of St Gallen was terminated after a natural gas reservoir of unknown but likely of limited extent was found. Also the hydrothermal reservoir and associated major fault architecture was found to be critically stressed – to the extent that perturbations in pore pressure caused felt seismicity.

The near-surface geothermal sector has enjoyed annual compound growth rates of about 11% per annum for the last 14 years (Figure 1), with a total of some 90 000 ground source heat pump systems deployed in Switzerland by the end of 2014[1].

1.3 National Programme

In 2013, Switzerland's government put forward a completely revised Energy Act. In 2014, the legislative commission of the National Council (lower chamber of parliament) and the plenary National Council reviewed the proposed Energy Act. The Energy Act will feature an expansion of Switzerland's geothermal guarantee scheme, both in terms of scope and budgets. The National Council has also proposed a modification of the CO_2-Act, which would explicitly mandate that the federal government supports direct use geothermal energy projects as long as they help to

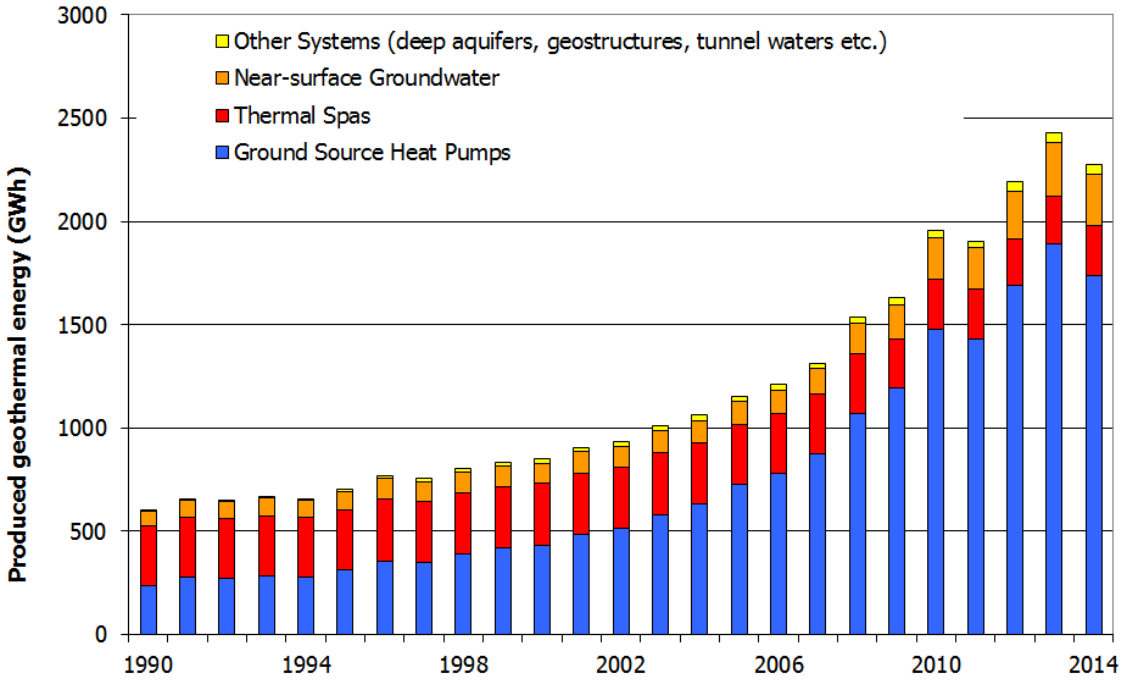

Figure 1 Geothermal energy utilization in Switzerland.

reduce CO_2 emissions from the use of fossil fuels in buildings. In 2015/2016, the legislative commission of the plenary Council of States (upper chamber of parliament) will follow suit. Pending a national referendum, the revised Energy Act is likely to enter into force by 2017. The revised Energy Act and associated revisionsin the CO_2-Act are to provide important provisions for the support of geothermal energy development.

One of the main features of Switzerland's energy strategy 2050 is a phased exit over the next approximately 20-30 years from nuclear energy, which today supplies around 40% (25 TWh) of the country's electricity demand[2]. One of the consequences is an ambitious drive to increase the share of power from renewables from today's 2.2 TWh to some 4.4 TWh by 2020 and 14.5 TWh by2035. Geothermal energy is envisaged to provide about 1 TWh by 2035 compared to today's zero. Further aggressive targets for end-users in terms of energy efficiency and reduced greenhouse gas emissions are expected to fuel growth for indirect and direct heat supply from geothermal energy. While targets are discussed in terms of consumption, no targets are given for individual sources on the supply side.

While near-surface geothermal utilization is a successful market-driven application, Switzerland encounters severe challenges for developing its geothermal resources suitable for direct use and combined heat and power use.

1.4 Industry Status and Market Development

Market conditions for industry players in the ground source heat pump sector are increasingly challenging[3]. Due to the success of ground source heat pump deployment, many players have entered a market which based on anecdotal evidence suggests early signs of consolidation. Most shallow geothermal drilling companies compete on price, yet quality assurance has been maintained at a high level owing to quality labeling schemes for heat pumps and drilling companies, and norms (SIA 384/6) and guidelines provided by the Swiss Federal Office of the Environment for ground source heat pumps. A number of gaps have been identified for ground source heat pump schemes; checks and controls

are not implemented widely, and completions of ground source heat pumps pose the biggest risks (installation, backfilling and testing). In addition, the lack of spatial planning regulations in Switzerland suggests a poorly regulated legal framework for the deployment of deep ground source heat pumps. In general, ground source heat pumps are problem-free to depths of 150 m. At depths larger than 250 m, risks are higher and problems are observed. In general, it appears, however, that the Swiss Molasse Basin which straddles about 50% of the country by area and serves as the deep underground reservoir of more than 75% of its population is well suited for wide-spread uptake of ground source heat pumps[3].

The Swiss federal government does not have any direct incentive schemes for utilizing geothermal energy. A number of Switzerland's 26 cantons have support schemes that are, in effect, investment subsidies for ground source heat pumps.

Switzerland's industry is less well developed in respect to the development of its deep geothermal resources. This covers the entire value chain from exploration, drilling, facilities and operation of geothermal heat and power plants. There are only very few players in the practically nonexistent market. The development is constrained by lack of financial resources, lack of skilled human resources and deficits in the legal and regulatory framework. It should be noted, however, that most of the core competencies for overcoming these barriers exist, and notably cantonal administrations and legislators are willing to work with developers in designing and implementing business-friendly legal and regulatory frameworks.

Complimentary to these efforts, the Swiss federal government continues to implement feed-in tariffs and a geothermal guarantee scheme for geothermal power plants. The requisite funds for financing the feed-in tariffs and other related measures such as the geothermal guarantee derives from a surcharge that end-users pay for power transmitted via the high voltage grid.

Since the revenues resulting from the surcharge are determined by the power transmitted via the high voltage grid, there is a cap on the annual subsidies available for all measures. In effect, this implies a wait-list for projects. The wait-list has a substantial turn-over because many announced projects (mostly photovoltaic or wind energy) do not materialize. Feed-in tariffs remain in effect for 20 years.

Since feed-in tariffs are governed by the Energy Ordinance, there is one unusual side effect on the feed-in tariff for geothermal power: the power required for artificial lift is not subtracted from the power supplied to the grid subject to the feed-in tariff. This feature stems from an analogy to power from biomass. The energy required to mobilize bio-feedstock to the factory gate is not subtracted from the power supplied to the grid. Hence artificial lift, the energy necessary to deliver hot water/steam to the power plant is also discounted.

Table 2 Feed-in tariffs for electricity from geothermal energy resources[4].

Installed capacity	Feed-in Tariff (Rp./kWh)
≤ 5 MW	40.0
≤10 MW	36.0
≤20 MW	28.0
>20 MW	22.7

US$ 1 = CHF 1 or 100 Rappen (Rp.)

Owing to the severe gaps in the knowledge of the deep subsurface of Switzerland (only 10 wells have been drilled in the country to depths greater than 3000 m), the federal government has instituted a geothermal guarantee scheme for geothermal power projects[5]. The scheme is underwritten by a CHF 150 million fund that has been financed by the grid surcharge. Geothermal power projects may apply for a geothermal guarantee and once qualified may be reimbursed for up to 50% of the total subsurface development cost of the project in case of failure.

Despite all this, Switzerland's energy industry has been in dire straits for the last 5 years. The distortion in neighbouring European energy markets due to highly subsidized renewable energy has caused major havoc on established long-running and profitable business models. Margins have eroded, asset write-downs are the norm and industry players have not been able to adapt to the new world.

1.5 Research, Development and Demonstration/Deployment

Research and innovation is funded by the Swiss National Science Foundation (fundamental research), the Swiss Federal Office of Energy (applied research) and the Commission for Technology and Innovation (market-driven research). In addition, the federally funded Swiss Federal Institutes of Technology (of the five institutes, chiefly the ETH Zurich, EPF Lausanne, and the Paul Scherrer Institute) have their own funds that can be used for geothermal energy research and innovation.

2014 saw the official launch of eight new Swiss Competence Centers for Energy Research (SCCER) that have been designed to kick off research and innovation in those fields that are deemed critical for Switzerland's energy strategy 2050. One of the SCCERs, called SCCER – Supply of Electricity or SCCER-SoE, is by and large focused on geothermal energy and particularly with technologies required to unlock Engineered Geothermal Systems. The SCCER SoE is very much set up along the lines of a public-private partnership in that industry players are encouraged to participate in the SCCER-SoE – as in any other SCCER. Research and Development funds for 2014 are at a level of US$ 5 million (including funds for deployment activities).

Industry classifies a large part of their geothermal development activities in the areas of hydrothermal project development and EGS as research and innovation oriented. Financial information is not available.

1.6 Geothermal Education

The University of Neuchâtel is running successful, oversubscribed Certificate for Advance Studies or CAS DEEGEOSYS - Exploration & Development of Deep Geothermal Systems. A new full professorship was filled in 2014. At ETH Zurich one full professorship related to geothermal energy and another related to subsurface energy applications have been filled in the Earth Science Department, and one in the field of Mechanical Engineering is still being advertised. As a consequence of the establishment of the SCCER-SoE, a number of tenure-track professorships at EPF Lausanne and at the Universities of Geneva and Neuchâtel have been filled with incumbents expected to take up their posts in 2015.

1.7 Future Outlook

Beyond 2014 a number of policy changes will be considered; most notably the totally revised Energy Act will be discussed in the upper chamber of parliament in 2015.

1.8 Publications and Websites

1 - Statistik der geothermischen Nutzung in der Schweiz Ausgabe 2014 (2015). Published by the Swiss Geothermal Association geothermie.ch
http://geothermie.ch/data/dokumente/miscellanusPDF/Publikationen/Geothermiestatistik%20Schweiz%20Ausgabe%202014.pdf
[Document only available in German]

2 - Energiestrategie 2050 – Erstes Massnahmenpaket Zusammenstellung der Massnahmenbeschriebe (2012)
http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_691836301.pdf
[Document only available in German; deep geothermal enery support program pp. 116-140]

3 – Qualitätssicherung Erdwärmesonden by Dr. Walter Eugster, dipl. Natw. ETH
http://www.fws.ch/tl_files/download_d/Downloads/Eugster-QS-EWS_Eugster.pdf

[Document only available in German; presentation on Quality Assurance in Ground Source Heat Pumps]

4 – Energy Ordinance (730.01) - Appendix 1.4
http://www.admin.ch/opc/de/classified-compilation/19983391/201210010000/730.01.pdf
[Document available in German and French]

5 – Energy Ordinance (730.01) - Appendix 1.6
http://www.admin.ch/opc/de/classified-compilation/19983391/201210010000/730.01.pdf
[Document available in German and French]

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