Geothermal Energy Use, Country Update for Czech Republic

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ABSTRACT

There has been no significant progress in the geothermal energy use in the Czech Republic in recent three years. There is a year-on-year increase in the number of heat pump installations, but this trend is mainly done by new air source heat pumps while the number of the new ground source heat pumps installations stagnates for a long time. There is no working geothermal power plant, nor direct heat utilization from the deep geothermal sources. In a long run, there are two commercial projects to build a geothermal power plant. However, realization of the projects cannot be expected soon, due to a missing government support and low feed-in tariffs for electricity from geothermal sources.

1. INTRODUCTION

The share of gross final energy consumption from renewable sources in total gross final energy consumption in the Czech Republic has changed negligibly in recent years (fig. 1), and reached 14,8% in 2017 (Bufka, 2017). However, the share of geothermal energy is negligible (~ 0.05 %), and consists solely of ground source (GS) heat pumps contribution.

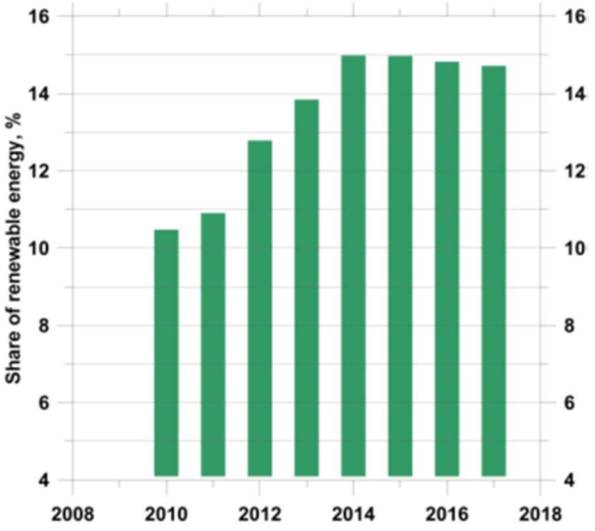

Figure 1: Share of renewable energy in gross final energy consumption in 2017

2. INDIRECT USE OF LOW ENTHALPY SOURCES

Indirect utilization of low-temperature geothermal energy sources using GS heat pumps stagnates in the Czech Republic. Figure 2 shows the evolution of the number of units sold between 2010 and 2018. After a sharp drop in sales during the first half of this decade, the number of installations has stabilized, and in 2018 there has been about 10% year-on-year growth. Contrary to the GS units, the supply of air source (AS) units increases steadily (Figure 3), and outnumbers the GS sales more than 10 times. Reasons for this difference might be too high prices of ground or drilling works and/or moderate winters in recent years that make the AS pumps quite effective for most of the heating season.

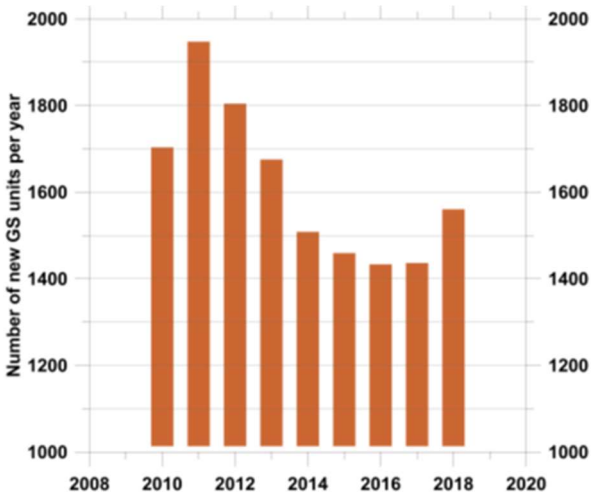

Figure 2: Number of sold GS units between the years 2010 - 2018

GS heat pumps are mostly used in the Czech Republic for heating of individual buildings and only sporadically for district heating of larger urban areas or agglomerations. The largest operating project of district heating is the heating plant in the town Děčín with an installed output of 6.6 MW_t. The yield of the 550 m deep well is 54 l/s and water temperature is approximately 30°C. Gross heat production per year is about 20 GWh. Another relevant installation is a system of geothermal wells at the campus of Technical University in Ostrava with the annual heat output more than 1 GWh.

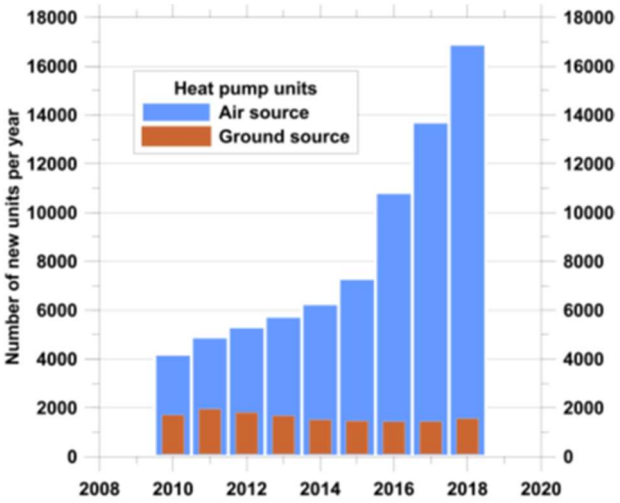

Figure 3: Number of sold AS and GS units between the years 2010 - 2018

There are two new big projects currently implemented in the Czech Republic. One of them is the new headquarters of the ČSOB bank in Prague. The basis of the system that will operate in the bivalent heating and cooling mode are 179 boreholes 150 m deep. The heat pump output will be 1300 kW for heating and 1220 kW for cooling. The second project is a residential housing project 6 km south off Prague, where the whole new agglomeration will be heated and cooled by the system of heat pumps utilising approximately 500 geothermal wells.

3. DIRECT USE OF LOW ENTHALPY SOURCES

In the Czech Republic there is no direct use of low-temperature sources for energy purposes. The use of these resources is limited only to the sphere of balneology or recreation facilities. The most famous spas using hot springs are located in western Bohemia in the Eger/Ohře rift area. The warmest spring in Karlovy Vary spa has temperature of 73 ° C.

At several places in the Czech Republic, hot mineral waters are exploited in wellness resorts. The largest one is located close to village Pasohlávky in southern Moravia where pools with a total area of 3000 m^2 are supplied by a 1.5km deep geothermal borehole. The yield of the well is 74 l / s and the deep-drawn water temperature is 46 ° C.

4. HIGH ENTHALPY GEOTHERMAL SOURCES

As in the case of low-temperature sources, there is no direct use of high-temperature sources bounded to deeper parts of the Earth's crust in the Czech Republic. Contrary to neighbouring countries, it is not possible to expect profound hydrothermal structures in the geological conditions of the Czech Republic. Thus, utilization of deep geothermal energy will only be possible through HDR / EGS systems. Due to the expected moderate temperatures at depths of up to 5 km and a low efficiency of the heat-to-electricity conversion at this temperature range, the direct heating is envisaged as a primarily application.

Two commercial projects to build up a geothermal power plants (< 5MW_e) have been planned for a long time. Both should be situated in the area of granitic plutons in the northern Bohemia. However, if the governmental support of geothermal energy will not change, there are no prospects for their early implementation.

4.1 RINGEN (Research Infrastructure for Geothermal ENergy)

The RINGEN (acronym for Research INfrastructure for Geothermal ENergy) project is focused on creating professional background for research into effective utilisation of deep geothermal energy. The research infrastructure (RI) mainly comprises establishing a highly specialised geothermal centre at the town Litoměřice (70 km north off Prague), where key equipment, technologies and background will be available for research teams of the 7 project partners: 3 universities, 3 institutes of the Czech Academy of Sciences, and the Czech Geological Survey. Its key asset is a 2.1 km deep testing geothermal borehole PVGT-LT1 (drilled in 2006-2007) and the basic seismic monitoring network (established in 2014) allowing in-time testing. The repeated temperature logs of the borehole are shown in Figure 4.

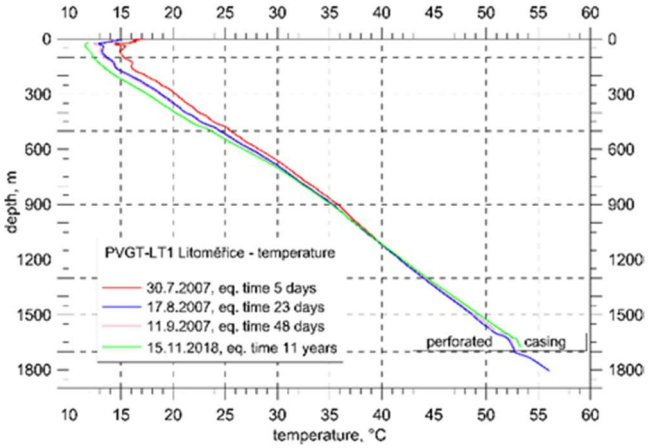

Figure 4: Temperature logs of borehole PVGT-LT1 carried out 5, 23, 48 and 4130 days after drilling

At the beginning of the year 2018, a construction of the Geothermal Research Centre (Figure 5) as a seat of RINGEN started several tens of meters apart the borehole PVGT-LT1. It will offer meeting hall, laboratories and other supporting facilities. RINGEN will start its full activity by the end of 2019.

5. CONCLUSION

Only shallow low enthalpy energy sources using heat pumps are used for energy purposes in the Czech Republic. Direct use of geothermal resources occurs only in spas or recreation facilities. The use of the high enthalpy deep geothermal resources for electricity or heat production is hampered both by geological conditions and a lack of public support.

Figure 5: State of construction works of the RINGEN research centre at the beginning of 2019

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Tables A-G

Table A: Present and planned geothermal power plants, total numbers

	Geothermal Power Plants		Total Electric Power in the country		Share of geothermal in total electric power generation	
	Capacity (MW_e)	Production (GWh_e/yr)	Capacity (MW_e)	Production (GWh_e/yr)	Capacity (%)	Production (%)
In operation end of 2018 *	-	-	22 263	86 620		
Under construction end of 2018	-	-				
Total projected by 2020	-	-			< 0.1%	< 0.1%
Total expected by 2025	< 10	< 80			< 0.1%	< 0.1%
In case information on geothermal licenses is available in your country, please specify here the number of licenses in force in 2018 (indicate exploration/exploitation if applicable):					Under development	
					Under investigation	

Table B: Existing geothermal power plants, individual sites

Geothermal power plants do not exist in the Czech Republic

Table C: Present and planned deep geothermal district heating (DH) plants and other uses for heating and cooling, total numbers

	Geothermal DH plants		Geothermal heat in agriculture and industry		Geothermal heat for buildings		Geothermal heat in balneology and other	
	Capacity (MW_{th})	Production (GWh_{th}/yr)	Capacity (MW_{th})	Production (GWh_{th}/yr)	Capacity (MW_{th})	Production (GWh_{th}/yr)	Capacity (MW_{th})	Production (GWh_{th}/yr)
In operation end of 2018	6.6	21						
Under construction end 2018								
Total projected by 2020								
Total expected by 2025								

Table D1: Existing geothermal district heating (DH) plants, individual sites

Locality	Plant Name	Year commissioned	CHP	Cooling	Geoth. capacity installed (MW_{th})	Total capacity installed (MW_{th})	2018 production (GW_{th}/y)	Geoth. share in total prod. (%)
Děčín	Děčín Geothermal Resource	2002	no	no	6.6		21	
total					**6.6**		**21**	

Table E: Shallow geothermal energy, ground source heat pumps (GSHP)

	Geothermal Heat Pumps (GSHP), total			New (additional) GSHP in 2018		
	Number	Capacity (MW_{th})	Production (GWh_{th}/yr)	Number	Capacity (MW_{th})	Share in new constr. (%)
In operation end of 2018	22740	-	-	1564	-	-
Projected total by 2020	26000	-	-			

Table F: Investment and Employment in geothermal energy

No information available

Table G: Incentives, Information, Education

	Geothermal electricity	Deep Geothermal for heating and cooling	Shallow geothermal
Financial Incentives – R&D	yes	yes	yes
Financial Incentives – Investment	no	no	yes
Financial Incentives – Operation/Production	Yes, FIT	no	no
Information activities – promotion for the public	yes	yes	yes
Information activities – geological information	yes	yes	yes
Education/Training – Academic	yes	yes	yes
Education/Training – Vocational	yes	yes	yes

Key for financial incentives:

DIS	Direct investment support	FIT	Feed-in tariff	-A	Add to FIT or FIP on case the amount is determined by auctioning
LIL	Low-interest loans	FIP	Feed-in premium		
RC	Risk coverage	REQ	Renewable Energy Quota	O	Other (please explain)