Proceedings World Geothermal Congress 2020+1
Reykjavik, Iceland, April - October 2021

Czech Republic Country Update 2018

Petr Dědeček[1], Jan Šafanda[1], Antonín Tym[2] and Jan Holeček[3]

[1]Institute of Geophysics of the CAS, v. v. i., Prague, Czech Republic

[2]Geotermální Litoměřice a.s., Litoměřice, Czech Republic

[3]Czech Geological Survey, Prague, Czech Republic

pd@ig.cas.cz

Keywords: heat pump, district heating, balneology, RINGEN

ABSTRACT

There has been no significant progress in the geothermal energy use in the Czech Republic in recent years. There is no working geothermal power plant, nor direct heat utilization from the deep geothermal sources. In the long run, there are two commercial projects to build a geothermal power plant. However, realization of the projects cannot be anticipated soon, due to missing governmental support of pilot projects and low purchase prices for electricity and heat from geothermal sources.

The main success in the field of deep geothermal energy during the last years is a construction of a new research centre in the town of Litoměřice, 70 km to the north-west of Prague. The Research Infrastructure for Geothermal Energy (RINGEN) groups together several scientific institutions across the Czech Republic and one of its main objectives is to verify the possibilities of building a deep geothermal heat exchanger in the environment of metamorphic rocks and extraction of geothermal energy for local district heating system.

In the Czech Republic, there is a year-on-year increase in the number of heat pump installations but this trend is mainly done by new Air - Water heat pumps. The installation of the Ground – Water heat pumps has been stagnating for several years due to the high costs of ground or drilling works and moderate winters in recent years that make the Air – Water pumps quite effective for most of the heating season.

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 (Figure 1), and in 2017 reached 14,8% (Bufka et al, 2019). However, the share of geothermal energy is absolutely negligible (~ 0.05 %), and it is only due to GrW heat pumps. If we consider only electricity, renewable sources contribute to the production of only 11 percent in 2018 (Figure 2).

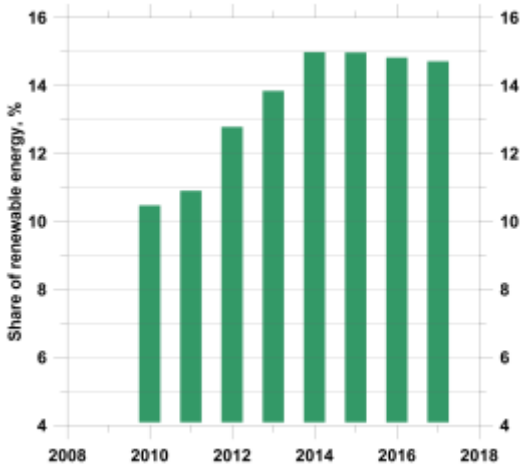

Figure 1: Share of renewable energy in gross final energy consumption in 2017.

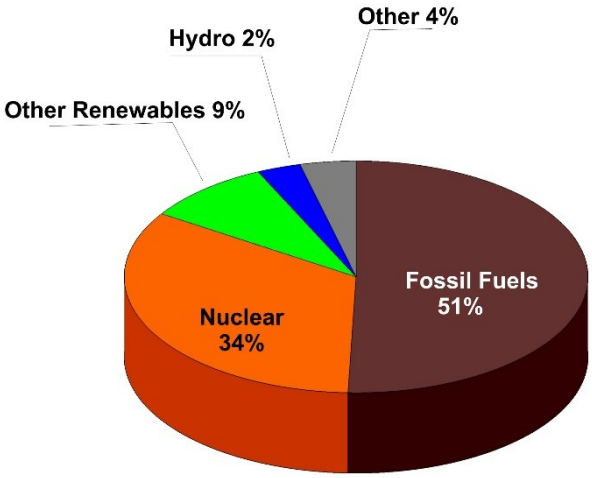

Figure 2: Sources of electricity production in 2018.

2. GEOLOGICAL SETTING

Territory of the Czech Republic is formed by two geological units – the Bohemian Massif and the Western Carpathians. The Bohemian Massif that occupies major part of the area is a stable Variscan platform without active volcanic zones. Beside the local anomalies, the heat flow varies between 40 – 90 mW/m2 around the mean value of 68 mW/m2. In absence of sufficiently large deepreaching hydrothermal zones and with temperatures generally below 150°C in the uppermost 5 km, the country is predetermined to the deep geothermal energy extraction using EGS (HDR) systems for the direct district heating.

3. INDIRECT USE OF LOW ENTHALPY SOURCES

Indirect utilization of low-temperature geothermal energy sources using GrW 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 GrW units, the supply of AW units increases steadily (Figure 3) and outnumbers the GrW 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 AW pumps quite effective for most of the heating season.

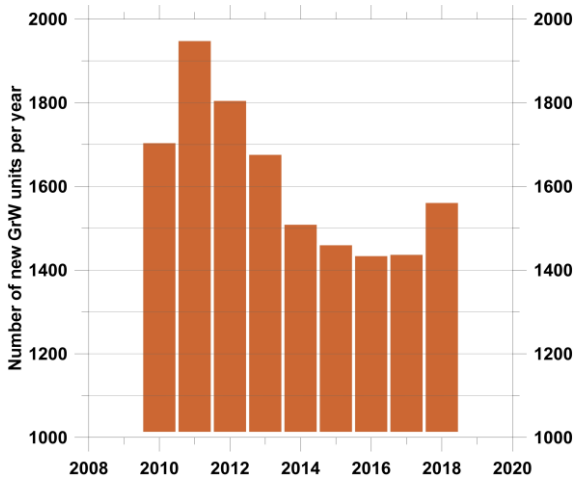

Figure 3: Number of sold GrW units between the years 2010 – 2018 (based on Bufka et al, 2019).

GrW 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 MWt. 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.

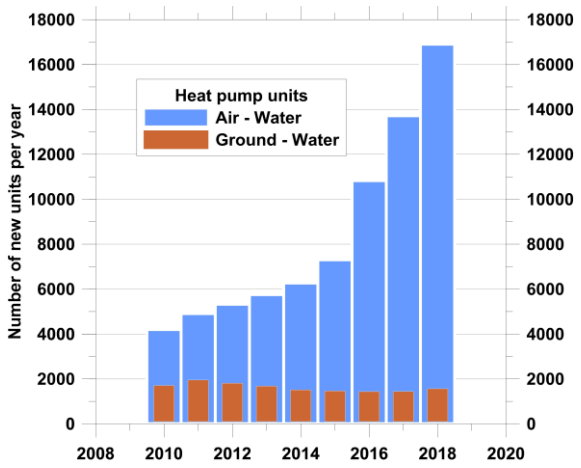

Figure 4: Number of sold AW and GrW units between the years 2010 – 2018.

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.

4. 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 a 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 m2 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.

5. DEEP GEOTHERMAL SOURCES

Deep geothermal energy is not utilized in the Czech Republic, but scientific projects running in recent years could trigger a change.

The RINGEN (acronym for Research INfrastructure for Geothermal ENergy) project is focused on creating professional background for research into effective utilization of deep geothermal energy. The research infrastructure (RI) mainly comprises of establishing a highly specialised geothermal centre in 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 5.

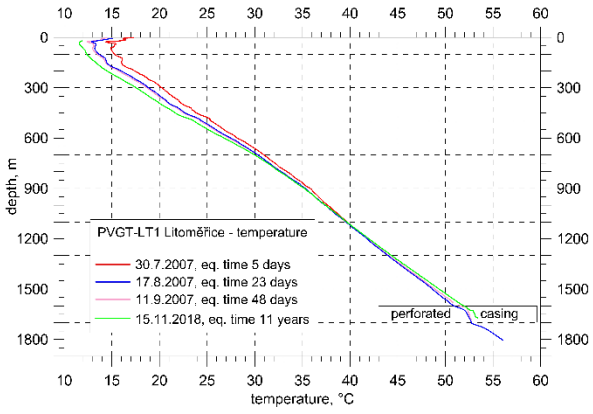

Figure 5: Temperature logs in the borehole PVGT-LT1

In June 2019 a new building of Geothermal Research Centre (Figure 6) as a seat of RINGEN was opened, only several tens of meters away from the borehole PVGT-LT1. It will offer conference hall, laboratories and other supporting facilities and infrastructure. RINGEN will start its full activity by the end of 2019.

Figure 6: RINGEN research centre building

The second significant project managed by Czech Geological Survey started in 2019 was supported by Technology Agency of the Czech Republic. The main aim of the project is to analyse the potential of geothermal energy in the Czech Republic between the depths of approximately 400 m to 5000 m and subsequently refine or redefine areas perspective in terms of utilization of geothermal energy by heat pumps, to direct production of heat or heat and elektricity in the Czech Republic. The existing maps of the geothermal potential of the Czech Republic will be updated and refined. Additional map layers showing conflicts of interest and limiting factors will be prepared, so the users will have an overview not only of geothermal potential, but also about factors limiting its use.

6. DISCUSSION

Only shallow low enthalpy energy sources using heat pumps has been used for energy purposes in the Czech Republic. Direct use of geothermal resources occurs only in spas or recreation facilities. The use of high enthalpy deep geothermal resources for electricity or heat production is hindered by both geological conditions and lack of state support for projects needing high up-front investments and also operation support in the early stages of its development.

REFERENCES

Bufka, A., Veverková, J., Modlík, M.: Renewable energy sources in 2018, Ministry of Industry and Trade of the Czech Republic, Report, (IX/2019)

APPENDIX

Table 1: Present and planned production of electricity.

	Geothermal		Fossil Fuels		Hydro		Nuclear		Other Renewables (specify)		Total	
	Capacity MWe	Gross Prod. GWh/yr	Capacity MWe	Gross Prod. GWh/yr	Capacity MWe	Gross Prod. GWh/yr	Capacity MWe	Gross Prod. GWh/yr	Capacity MWe	Gross Prod. GWh/yr	Capacity MWe	Gross Prod. GWh/yr
In operation in December 2019	0	0	12 810	47 400	2 200	2 600	4 290	30 000	3 000	8 000	22 300	88 000
Under construction in December 2019	0	0										
Funds committed, but not yet under construction in December 2019	0	0										
Estimated total projected use by 2020	0	0										

Table 2: Geothermal (ground-source) heat pumps as of 31 December 2019.

Locality	Ground or Water Temp. (°C)[1)]	Typical Heat Pump Rating or Capacity (kW)	Number of Units	Type[2)]	COP[3)]	Heating Equivalent Full Load Hr/Year[4)]	Thermal Energy Used[5)] (TJ/yr)	Cooling Energy[5)] (TJ/yr)
Děčín	30	3280	2	W	3,4	2010	48	0
Ostrava - University	10	55	25	V		600	3	0
Praha - CSOB	10	1300		V				
TOTAL						2610	51	

Table 3: Summary table of geothermal direct heat uses as of 31 December 2019.

Use	Installed Capacity[1)] (MWt)	Annual Energy Use[2)] (TJ/yr = 10^{12} J/yr)	Capacity Factor[3)]
Individual Space Heating[4)]			
District Heating [4)]			
Air Conditioning (Cooling)			
Greenhouse Heating			
Fish Farming			
Animal Farming			
Agricultural Drying[5)]			
Industrial Process Heat[6)]			
Snow Melting			
Bathing and Swimming[7)]			
Other Uses (specify)			
Subtotal			
Geothermal Heat Pumps	320	1700	0,17
TOTAL	320	1700	0,17