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Country Update: Poland, 2023-2025

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ABSTRACT

The paper updates the status of geothermal energy development in Poland for the period 2023–2025, following the country report for 2020–2022 presented at World Geothermal Congress 2023 (Kępińska and Hajto, 2023). By the end of 2025, ten geothermal district heating plants (geoDH) were operational, including two commissioned in 2024 and one launched in 2025. In 2024, the total installed geothermal capacity reached 219.3 MW, a 78% increase over 2022, and geothermal heat production totaled about 360 GWh (1,297 TJ) in 2024, up 16% from 2022. Across geoDH systems, geothermal contributed 4.3–99% of total heat sales, averaging 56% (median 60%). The geothermal recreation sector continued expanding, with at least 19 facilities in operation by the end of 2024. Geothermal water was used for health treatments in 15 localities (including 14 health resorts). Between 2022 and 2025, 23 new geothermal wells were drilled to depths of 1.1–6.1 km. Outflow geothermal water temperatures varied between 20 and 92°C (while water temperature in one of the newly drilled wells during testing reached about 120°C). Next geothermal drillings and investment projects were ongoing, supported by government programs including: 'Accessing Thermal Waters in Poland' (since 2020), the earlier 'Recognition of the Geological Structure of the Country' (2016–2022), and 'Geotermia Plus' (2019–2025). As a result, Poland is expected to see further growth in district heating systems using geothermal energy in the coming years. Other applications included fish farming, wood drying, heating football pitches, walking paths, and parking areas, as well as CO_2 and bath salts extraction, cosmetics production, and food processing. The shallow geothermal sector, after strong growth in 2022, declined in 2023–2024, affecting sales of ground-source heat pumps (GSHPs) as well. Rough estimates indicated 94,300 operational GSHPs in 2024, with a total installed capacity of ca. 965 MW and geothermal heat generation of around 1,378 GWh (4,960 TJ).

1 INTRODUCTION

Geothermal uses in Poland remain focused on direct applications, primarily space heating, bathing, and swimming, with few other uses. In 2023–2025, ten geoDH plants were operational (up from seven at the end of 2022, as reported at WGC2023) – including two new plants launched in 2024 in the cities of Koło and Sieradz, and the third one in the city of Konin completed in 2024 (heat production/sales started there in autumn 2025). Since 2023, one geothermal recreation center has been opened.

Despite recent progress, the overall scale of geothermal utilization remained modest. Nevertheless, activities related to geothermal drilling and investments aimed at integrating geothermal energy into geoDH intensified. This expansion was predominantly driven by public support mechanisms progressively implemented since 2016. In 2023, grant funding was allocated to 30 municipalities to drill the first geothermal wells, while some local authorities benefited from low-interest loans supporting infrastructure development. In parallel, drilling operations continued for approximately 15 wells funded under an earlier program concluded in 2020 (with results announced in 2021 and drilling activities carried out in 2022–2024).

From 2015 through the end of 2025, a total of 47 geothermal exploration wells were drilled nationwide, 21 of which have been completed since 2023.

Further development of deep geothermal resource uses in Poland is anticipated, particularly following the 'Multi-annual Program for the Development of Geothermal Resource Use until 2040/2050' (2021), which prioritizes district heating. Consequently, geothermal energy is expected to be integrated into several dozen next district heating systems nationwide in the coming years.

2 GEOLOGY BACKGROUND, GEOTHERMAL RESOURCES, AND POTENTIAL

Geothermal resources in Poland are mainly associated with Mesozoic sedimentary formations of the Polish Lowlands and the Inner Carpathians. Additional small potential occurs locally in the Outer Carpathians and the

Carpathian Foredeep (also sedimentary types), as well as in the Sudetes, where fractured crystalline and metamorphic rocks provide favorable conditions in some cases.

Prospective hydrogeothermal conditions are generally found at depths of approximately 1–4 km, with temperatures typically not exceeding 100°C, although locally higher temperatures occur in deeper structures. The highest proven geothermal water temperature to date has been recorded in Konin (Mogilno–Łódź Trough, central Poland), where the Konin GT-1 well (2660 m depth) taps a Lower Jurassic sandstone with a reservoir temperature of 97.5°C and a wellhead temperature of 92°C.

Regionally, the Lower Jurassic and the Lower Cretaceous sandstone formations exhibit favorable reservoir properties, resulting in substantial geothermal water yields (Górecki and Hajto eds., et al., 2006).

Proven discharge rates from individual geothermal wells in Poland range from several to 550 m^3/h, while total mineralization varies widely from 0.4 to 150 g/L.

The spatial distribution of deep geothermal potential closely follows terrestrial heat-flow patterns. The Polish Lowlands are characterized by moderate to low heat flow (40–70 mW/m^2), whereas higher values occur in the Sudetes and Fore–Sudetic regions (60–90 mW/m^2). Heat flow in the Carpathians is variable (50–90 mW/m^2) while the Lublin, Podlasie, and Suwałki regions exhibit lower values (35–55 mW/m^2) due to the influence of the East European Craton. Local geothermal anomalies are associated with fault zones and sedimentary basins, particularly within the Szczecin–Mogilno–Łódź Trough and in the parts of the Sudetes (Szewczyk and Gientka, 2009; Majorowicz, 2021).

The potential for geothermal electricity generation from conventional hydrothermal resources is limited, as most identified reservoirs are low- to medium-enthalpy and therefore better suited for direct heat applications rather than power production.

Enhanced and advanced geothermal systems (EGS/AGS) represent a longer-term option for heat and electricity generation in the country, particularly in crystalline and higher-heat-flow regions, although their development remains at the research stage with significant geological and techno-economic uncertainties.

Geothermal and mineral waters in Poland locally contain dissolved compounds and elements, which may suggest the potential for co-production. However, concentrations, flow rates, and economic viability require further detailed studies and site-specific assessment.

In parallel, Poland shows substantial development potential in shallow geothermal applications, especially through the deployment of ground-source heat pumps, as reflected in national energy strategies and geothermal development programs, e.g., 'Multi-annual Program for the Development of Geothermal Resource Use until 2040/2050' (2021).

3 GEOTHERMAL UTILIZATION 2023–2025 – A REVIEW

This chapter provides an overview of geothermal energy uses in Poland in 2023–2025, including direct applications such as space heating, bathing, and swimming, other uses, and shallow geothermal systems based on heat pumps. Compared to the earlier period 2020–2022 (Kępińska and Hajto, 2023) further increase in installed geothermal capacity and heat uses was observed. Geothermal resources were exploited for direct heat uses (no electricity generation). Pilot projects involving geothermal binary systems are anticipated in the coming years, supported by the identification of ca. 120–140°C hydro-geothermal resources in the Podhale, which provide prospective conditions for such an installation. The map showing localities with geothermal direct uses in Poland is given in Figure 1.

3.1 District heating

At the end of 2024, ten geothermal district heating plants were operational, with a total installed capacity of 219 MW, annual heat production of about 1,297 TJ, and heat sales of about 1,077 TJ. A brief overview of the operating geothermal district heating systems is provided below. Main data as of 2024 are given in Table 1.

3.1.1 The Podhale region

The geoDH system has been operational since 1993 and is constantly being expanded. The approved maximum artesian water flow rate from three wells is 1,070 m^3/h, with outflow temperatures from 82°C to 86°C. The geothermal reservoir is hosted primarily by the Middle Triassic limestones and dolomites, locally overlain by

the Middle Eocene carbonates, with additional contributions from Jurassic sandstones and carbonates in some cases.

In 2024, the system had an installed geothermal capacity of 94.8 MW (out of a total of approximately 140 MW), with geothermal heat sales of 512 TJ, accounting for around 99% of total sales. In 2025, approximately 2,000 buildings were connected to the geoDH system, primarily in Zakopane, the main city of the region. The system met about 40% of Zakopane's heating demand. Most of the spent geothermal water stream was injected back through three wells, while the remainder was used to supply two recreation centers. The operator of that geoDH system is PEC Geotermia Podhalańska S.A. In addition, in the main office building that company had a small absorption chiller driven by geothermal heat. It was connected with compressor heat pump. So far, this is the only case in Poland where such cooling has taken place.

In 2023, the company received public support for drilling the fourth production well (started in 2025) and some surface infrastructure. These will increase capacity, heat sales, and enable new connections to the geothermal heating network. The Podhale system is among the largest geoDHs in continental Europe.

Furthermore, in 2023–2025, the drilling of a 6.1 km deep Bańska PGP-4 research well in the Podhale region (Szaflary municipality) was conducted. It was supported by public funds and aimed to widen the understanding of the geological structure and geothermal conditions of that region, potentially enhancing also the effectiveness of geothermal heating investments in the region. Primarily, the well will serve the heat for the Szaflary and the Nowy Targ municipalities. Electricity production is also being considered (as mentioned at the beginning of this chapter).



Figure 1. Poland - geothermal direct uses, 2025

1. district heating plants, 2. health resorts, 3. recreation centers, 4. wood drying, 5. fish farming (by mid-2025), 6. individual heating systems

3.1.2 Pyrzyce

The geothermal district heating plant is located in northwestern Poland and has been operational since 1996. In 2024, the maximum water flow rate discharged by a production well from the Lower Jurassic aquifer was approximately 198 m^3/h of 65°C highly mineralized water (120 g/L). The system operated one production and four injection wells. In 2024, the plant's total installed capacity was 28 MW, including 12 MW geothermal. It provided heat and domestic hot water, meeting about 50% of the total heat demand of the town

(13,000 residents). In 2024, geothermal heat sales were 20 TJ, less than in previous years (primarily due to maintenance works on the injection system). The operator of the plant is Geotermia Pyrzyce Sp. z o. o.

3.1.3 Mszczonów

The geothermal district heating is situated in central Poland and has been in operation since 2000. The maximum geothermal water flow rate was approximately 60 m^3/h at 42.5°C, with a mineralization of 0.5 g/L. By 2023, water was produced from the Lower Cretaceous aquifer by a single production well. In 2023, the second well was drilled, enabling the system to operate in a doublet configuration (since 2024). In 2024, the geothermal capacity was 2.5 MW while the total capacity was 7.1 MW (including gas boilers, absorption heat pump, and compressor heat pump). In 2024, geothermal heat sales were 15.2 TJ (ca. 38% of total heat sales, around 39.7 TJ). After cooling, part of the water volume was used for drinking (via the water supply system). Part of the geothermal water stream supplied the recreation center and, since 2021, a unique deep spot for free diving (45 meters deep). New projects aimed at improving geothermal energy efficiency and water management were in progress. The plant's operator is Geotermia Mazowiecka S.A.

3.1.4 Uniejów

The geothermal district heating plant is located in central Poland, northwest of Łódź city, in operation since 2001. The system used to operate three deep wells in a doublet-dominant configuration: one production well and two injection wells (with one of the injection wells serving as a backup), supplying geothermal water to the local heating network and other uses. The production well yielded a maximum discharge of 120 m^3/h of 68°C water from the Lower Cretaceous aquifer, with a mineralization of 8 g/L. The total installed capacity was 7.4 MW, including 3.2 MW from geothermal, 1.8 MW from a biomass boiler, and 2.4 MW from fuel oil peak-load boilers. In 2024, approximately 80% of the town's buildings were supplied by the geoDH, with geothermal heat sales about 21 TJ, accounting for 60% of total heat sales. The operator is Geotermia Uniejów Sp. z o.o. Beyond district heating, a substantial portion of the geothermal water was applied by spa and recreational facilities. Uniejów has held the status of a health resort since 2012. Additionally, the discharged water was used for heating a football pitch and walking pathways.

3.1.5. Poddębice

The geoDH began operation in 2013. In 2024, the installed geothermal capacity reached 10 MW, with a total installed capacity of 18.6 MW. The plant used water at 71°C discharged by the Lower Cretaceous aquifer, with a maximum flow rate of 252 m^3/h and a mineralization of 0.4 g/L. It supplied heat to public buildings, schools, multi-family residential buildings, and a hospital (in a hospital, geothermal water is also applied for rehabilitation). The operator of the plant is Geotermia Poddębice Sp. z o.o. Part of the water stream supplied the Hydrotherapy and Leisure Centre. In 2024, geothermal heat production was about 60 TJ, with 47 TJ sales, i.e. over 98.5% of total heat generation. The remaining demand was met by peak-load gas boilers distributed across multiple locations within the municipal heating network. Additionally, geothermal water was applied for potable purposes, albeit on a limited scale. Further geothermal uses were in various stages of implementation and planning in 2025.

3.1.6. Stargard

The geothermal heating plant has been in operation since 2012 (following a renovation). The owner of Geotermia Stargard is G-Term Energy Sp. z o.o. As of 2024, the plant operated with two production wells and five injection wells, achieving a maximum production rate of 345 m^3/h of 87–90°C water from the Lower Jurassic aquifer. The produced water was highly saline, with total dissolved solids reaching 140 g/L. In 2024, the plant's geothermal capacity reached 44 MW, while annual heat sales amounted to 388.4 TJ, all supplied to the municipal district heating system. The municipal heating network, primarily powered by a coal-fired plant with a total capacity of 120 MW, served approximately 75% of the city's population (75,000 residents). In 2024, the geothermal plant operator supplied geothermal heat covering a significant share of the city's heat demand, with planned investments aiming to increase this share to up to 90% in Stargard in the longer term.

3.1.5 Toruń

The geothermal heating plant was commissioned in 2022. It operated as a doublet system on the basis of water from the Lower Jurassic aquifer. The approved exploitable reserves were approximately 320 m^3/h of 61°C water. The installed geothermal capacity was 18 MW. Owned by Geotermia Toruń Sp. z o. o., the plant supplied heat to the Academy of Social and Media Culture complex as well as to a part of the municipal district heating system operated by PGE Toruń S.A. (PGE Toruń S.A. served a population of over 100,000 citizens). The planned annual sales of geothermal heat to that system were about 230 TJ. The geothermal heat sales via PGE Toruń S.A.

municipal network in 2024 were very roughly estimated by the authors for ca. 50 TJ (based on general information on https://pgetorun.pl/o-spolce/efektywny-system-cieplowniczy).

3.1.6 Koło

The geothermal heating plant was launched in March 2024. It operated on a basis on a doublet of wells. Geothermal water was produced from Lower Cretaceous sandstones. As of 2024, geothermal water reserves were 311 m^3/h, with a maximum outflow temperature of 90°C and a mineralization of approximately 104 g/L. The installed geothermal capacity was 17.4 MW, contributing to a total installed thermal capacity of 55.9 MW. Geothermal heat sales in 2024 amounted to 16.4 TJ, supplying 70% of the district heating system's total demand. The operator of the plant is Geotermia Koło Sp. z o. o.

3.1.7 Sieradz

The geothermal district heating plant was launched in 2024. It was a geothermal-biomass facility with a total installed capacity of approximately 31.5 MW, of which 9.3 MW derived from geothermal. The system was designed to meet the city's heating demand for 8–9 months per year and operates based on a doublet of wells (depths: 1,505 m and 1,990 m). The geothermal aquifer is situated in the Lower Jurassic sandstones. The proven water reserves were 250 m^3/h, with a temperature of 53°C and mineralization of 2.6 g/L. Geothermal water was used both for district heating (preheating return water via plate heat exchangers) and as a low-temperature source for two 10 MW absorption heat pumps to enhance the system's efficiency. The city (population approximately 40,000) operated a 40 km district heating network previously supplied by two coal-fired plants (50 MW and 20 MW), with peak winter demand of 50–55 MW. In 2024, geothermal heat sales reached 6.2 TJ, covering about 22% of total demand. Operated by PEC Sieradz Sp. z o.o., the geoDH represented a significant step towards low-emission, renewable urban heating through the exploitation of local geothermal resources.

3.1.8 Konin

The construction of the geothermal district heating plant was completed in 2024, while heat production started in October 2025. The operator of the plant is MPEC Konin Sp. z o. o. The geothermal capacity reached 8.1 MW. The annual production is planned for about 159 TJ (no production has been recorded in 2024). The plant is based on a doublet of wells, while drilling of the next injection well was planned. The outlet temperature of water extracted from the production well was 92°C, whilst the flow rate was 156 m^3/h, and water mineralization 150 g/L. The Konin GT-1 production well reached a total depth of 2,660 m and has the highest temperature among all geoDHs in Poland, with a reservoir temperature of 97.5°C in the Lower Jurassic aquifer sandstones. This is the city's third ecological heat source, complementing the existing biomass boilers and the Municipal Waste Thermal Treatment Plant.

To sum up, in the reported period 2023–2025, the geothermal district heating sector in Poland experienced substantial growth. At the end of 2022, as reported at WGC2023 (Kępińska and Hajto, 2023), seven operational geothermal district heating plants had a total installed capacity of 123.4 MW and produced 1,121 TJ of geothermal heat, while by the end of 2024 (this WGC2026 country update report), the number of geoDH plants had increased to ten. In 2024, their total installed capacity was 219.3 MW, and geothermal heat production was 1,296.8 TJ (comprehensive data for 2025 were not yet available when this report was prepared). That corresponded to a 78% increase in installed capacity and a 16% increase in geothermal heat production over the two-year period, which reflected both the commissioning of new plants and the gradual expansion of existing systems.

The comparatively limited growth in geothermal heat production relative to the expansion of installed capacity is attributable to reduced operational output caused by maintenance work, scheduled and unscheduled downtime at certain heating plants, and lower heat demand during the winter seasons.

3.1.9 Individual space heating

In 2024 and 2025, moderate-scale individual space heating using geothermal water (28–80°C) served a school complex, a hotel, and spa facilities in two localities. Also, several recreation centers had their own geothermal heating systems. Indicative estimates suggest a cumulative capacity of approximately 52 MW and annual heat use of 100 TJ (including ca. 1.5 MW and 1 TJ for the school, hotel, and spa facilities in two localities). Some recreation centers were supplied via geothermal district heating networks.

3.2 Health resorts and recreation centers

Between 2023 and 2005, one new recreation center was launched - an open-air sulfur pool in Kazimierza Wielka (2023), supplied by a well drilled in 2015 in nearby Cudzynowice.

In 2025, geothermal waters were used for curative treatments in at least 15 localities, including 14 health resorts, with approved flow rates of 2–205 m^3/h and outflow temperatures of 20–90°C (Hajto and Kępińska, 2025). Additional heating was required in some cases when water temperatures were too low for treatments.

At least 19 recreation centers were operational (some serving several thousand visitors daily) distributed across the Podhale region, Polish Lowlands, Carpathian Foredeep, and Sudetes. Some facilities applied water extracted by other enterprises (i.e. geoDH companies) rather than their own wells. Based on available data, the sector's total geothermal capacity in 2024 was estimated at a minimum of 50 MW, with annual heat use of 200–300 TJ, though precise figures are limited by incomplete technical data and complex system configurations.

Geothermal bathing and recreation continue to thrive as a dynamic sector, delivering notable health benefits as well as stimulating local economic growth, with substantial potential for further expansion in the coming years.

Table 1. Geothermal district heating plants in Poland, 2024 – capacities, heat production, heat sales

Locality (Plant name)	Year commissioned	Geoth. capacity installed (MW)	Total capacity installed (MW)	Geoth. heat production (GWh / TJ)	Geoth. share in total heat production (%)	Geoth. heat sales (GWh / TJ)
Podhale Region (PEC Geotermia Podhalańska S.A.)	1993	94.8	133.9	170.0 / 612.0	99.0	142.2 / 512.0
Pyrzyce (Geotermia Pyrzyce Sp. z o.o.)	1996	12.0	28.0	6.5 / 23.4	50.0	5.6 / 20.0
Mszczonów (Geotermia Mazowiecka S.A.)	2000	2.5	7.1	4.6 / 16.6	38.2	4.2 / 15.2
Uniejów (Geotermia Uniejów Sp. z o.o.)	2006	3.2	7.4	8.0 / 28.8	60.0	5.8 / 21.0
Poddębice (Geotermia Poddębice Sp. z o.o.)	2013	10.0	18.6	16.6 / 59.8	98.5	13.0 / 47.0
Stargard (Geotermia Stargard Sp. z o.o.)	2005/ 2020*	44.0	120.0	130.0 / 468.0	63.0	107.9 / 388.4
Toruń (Geotermia Toruń Sp. z o.o.)	2022	18.0	28.0	17.0 / 61.2	4.3	13.9 / 50.0
Koło (Geotermia Koło Sp. z o.o.)	2024	17.4	55.9	5.5 / 19.8	70.0	4.6 / 16.4
Sieradz (PEC Sieradz Sp. z o.o.)	2024	9.3	31.5	2.0 / 7.2	22.3	1.7 / 6.2
Konin (Geotermia Konin Sp. z o.o.)	2024	8.1	111.2	0.0	–	0.0 / 0.0
Total		219.3	541.6	360.2 / 1,296.8	56.1	298.9 / 1,076.2

* Project renewal

3.3 Other direct uses

Beyond applications in space heating, health, and recreation, geothermal waters and energy in Poland have been employed in some other sectors, typically at small or pilot scales. These include aquaculture, wood drying, heating up of sport and pedestrian facilities, snow melting, cosmetics production, agri-food processing, drinking water supply, bath salt extraction, CO_2 recovery. For the former period of 2020-2022, the pilot algae cultivation using geothermal water and heat was also reported (Kępińska and Hajto, 2025). However, it was not operated in 2023–2025 as it had fulfilled its experimental role.

The largest single commercial application was an Atlantic salmon farm in Janowo (West Pomerania, near the Baltic coast), the biggest in continental Europe. It has been operating since 2015, by mid of 2025, using high-quality, microbiologically safe geothermal water from a deep borehole. The facility had an estimated geothermal capacity of 2 MW and annual heat use of approximately 18 TJ (Kępińska and Hajto, 2025).

According to the Polish Geological Survey's official statistics – 'Balance of Mineral Resources in Poland, 2024' (Szuflicki et al., 2025), 43 geothermal water deposits had been identified as of 31 December 2024, 26 of which were licensed for exploitation. Total proven reserves were estimated at over 9,000 m^3/h, with geothermal water extraction exceeding 13.2 million m^3 in 2024.

3.4 Pilot ORC installation

In 2024, a moderate-scale geothermal cogeneration installation for the production of heat, electricity, and cooling, integrated with a PV power plant and an energy storage system, was commissioned in Chochołów (Podhale region) as a result of a project co-funded by the European Economic Area and Nordic Financial Mechanisms (https://eko.chocholowskietermy.pl/hydro-geo-solar-english).

3.5 Geothermal heat pumps

Ground-source heat pumps (GSHPs) in Poland were primarily installed for individual space heating, as well as in large-capacity facilities, geothermal district heating systems, and recreation centers, often operating in both heating and cooling modes.

In 2024, GSHP sales totaled approximately 6,000 units, representing a year-on-year decline of over 25% and continuing the downward trend that began in 2023 (Polish Organization for the Development of Heat Pump - PORT PC, 2025). Rough estimates indicate that the total operational GSHP stock corresponded to an installed thermal capacity of about 965 MW, generating approximately 4,960 TJ of geothermal heat annually.

Market projections based on PORT PC statistics suggest that cumulative GSHP capacity could reach 1.9–5.3 GW by 2030, depending on development scenarios (Ryżyński, 2022), contributing to Poland's renewable energy targets under the Polish energy policy until 2040 (PEP, 2021).

3.6 Geothermal drillings

Between 2023 and 2025, 21 new deep geothermal wells were drilled in Poland, including production, injection, and exploration wells, intended primarily to serve the next district heating grids. The cumulative drilled depth during that period was approximately 49.2 km, i.e., an average depth of approximately 2,340 m per well.

All geothermal projects and drilling activities implemented in Poland so far have been focused on low-enthalpy resources and, consequently, on direct applications – primarily district heating, balneotherapy, and recreation. However, it is worth mentioning a notable development in the reported period, i.e., the well Bańska PGP-4 drilled in the Podhale region in 2023–2025. It reached a total depth of ca. 6,100 m, being the deepest geothermal borehole in Poland to date. In that well the temperatures of about 140°C were found. It provided critical subsurface geological and hydrodynamic data for exploitation models of the region's deep geothermal resources. That well opened also significant options for both heat and, potentially, for power generation (which has been under consideration).

3.7 Shallow geothermal drillings

Unfortunately, official statistics on wells drilled for shallow geothermal applications did not exist, which may result in imprecise estimates in this sector. Therefore, no numbers are given here.

4 GEOTHERMAL SHARE IN THE RES MIX

In recent years, Poland has continued the transition toward renewable energy sources, although the pace and structure of this transition vary across sectors. According to official data from Statistics Poland (GUS, 2025), the

share of energy from renewable sources in gross final energy consumption was 17.7% in 2024 (an increase from 16.5 % in 2023), reflecting ongoing growth in renewable deployment.

In the HC sector, renewables accounted for 21.2% of gross consumption in 2024: solid biofuels, then photovoltaics, wind, ambient heat (e.g., heat pumps), biomass/biogas, municipal wastes, liquid biofuels, while the geothermal share was very small. In the case of gross electricity generation, renewables accounted for an estimated 30.4% in 2024, driven mainly by wind and solar, while fossil fuels (especially coal) remained significant contributors to the overall energy mix (GUS, 2025).

Within the renewable sector, the contribution of individual sources showed substantial heterogeneity. In national statistics, geothermal represented a minor component of the overall renewable portfolio. According to official data, the share of geothermal in the structure of total renewable energy production had remained around 0.2–0.3% in recent years, significantly lower than contributions from other renewable sources. That contrasted with the EU-27 average, where geothermal accounted for approximately 2.8% of renewables. While the current geothermal contribution to the renewable energy mix remains small, ongoing development of geothermal district heating and other direct applications is expected to increase its share within the national renewable energy mix (GUS, 2025).

5 MAIN FUNDING SOURCES

During 2023–2025, the development of geothermal projects, particularly well drillings, had been driven predominantly by public support priority programs, including the following: 'Recognition of the Geological Structure of the Country' (2016–2022), 'Accessing Thermal Waters in Poland' (since 2020), 'Geotermia Plus' (2019–2025). Those funds primarily assisted local municipalities in planning and implementing geothermal projects for district heating applications.

In particular, in 2023, the program 'Accessing Thermal Waters in Poland' granted funds for 30 municipalities to initiate new geothermal projects, mainly the drilling of a first exploration/production well. In parallel, other beneficiaries received low-interest loans to support infrastructure development. At the same time, drilling works continued for approximately 15 geothermal wells that had obtained funding under an earlier call of that program (drilling activities were initiated or continued during 2022–2025). Next, municipalities and towns that were granted funding were at the preparatory stages (administrative procedures, selection of project engineers, tendering for drilling services). Given the limited timeframe for using the awarded public funds, it can be assumed that most of these drilling projects will commence within the next two years (2026–2027).

6 PROJECTS UNDER DEVELOPMENT AND EXPLORATION

6.1 Projects under construction and pre-construction

During the period 2023–2025, along with new drillings, several geothermal investments were under construction or pre-construction. Those were oriented toward space heating and, to some extent, recreational uses. They included, among others:

– Increasing geothermal capacities, improving heat extraction efficiency, and connecting new consumers to existing geothermal district heating systems,

– Construction of several next geothermal district heating systems (based on wells drilled in recent years), with planned geothermal capacities usually from several to several dozen MW per single plant,

– Recreation, balneotherapy, and some other applications.

6.2 Projects in pre-investment and exploration stages

Many pre-investment works and feasibility studies were conducted, related mostly to geothermal district heating in various localities. The bases for them will be mostly positive wells that were drilled in recent years. Seismic campaigns were in progress to explore details of subsurface conditions and to determine the optimal location of wells that would serve for district heating systems in some municipalities.

7 DISCUSSION

Below are some general facts and comments related to several basic aspects of the presented state of development of geothermal energy use in Poland in the reporting period 2023–2025.

- Pointing out any unusual or questionable data, highlighting progress and growth:

During 2023–2025, substantial progress was made in geothermal development in Poland. It was highlighted by the commissioning of the next three geothermal district heating plants (resulting in ten geoDHs at the end of 2025), by the completion of over twenty wells (including over 6 km deep well), and related infrastructure investments. At the same time, further drilling and investments were underway. Those advances were largely enabled by extensive public support schemes. Some growth was also observed in the recreation sector. The continuation of several other direct-use applications took place. Works begun on reviewing the implementation and updating the 'Multi-annual program for the development of the use of geothermal resources in Poland until 2040/2050' (2021).

- Cost of geothermal electric generation and direct utilization, and comparison with fossil fuel/electricity and heating/cooling energy prices in your country:

Taking into account economic aspects, in recent years, the prices of geothermal heat supplied by district heating plants have become increasingly competitive compared to the prices of heat from fossils and some other renewables. Geothermal offered more stable or lower rates, even if, generally, heat prices increased in recent years, especially in 2025 following the withdrawal of protective mechanisms (previously in force in responses for the increase in fuel prices, inflation, market speculations, and the many effects of the war in Ukraine, etc.). Geothermal prices would be even more competitive if, inter alia, a heat pricing system were introduced that would be appropriate to the specificity of this source and to current challenges (which is what geothermal entrepreneurs have been striving for).

- Comments on the local legislation/regulatory/environmental framework related to renewable energies with a focus on geothermal energy:

The references and provisions related to geothermal energy were found in various national policies and plans. Among key strategic documents in force in 2023-2025 were:

- 'National Energy and Climate Plan for the years 2021–2030' (NECP, 2019): geothermal was mentioned in the context of the modernization and transformation of district heating systems, as a contribution to energy efficiency, and to the development of technologies for energy production from geothermal sources, job creation, and economic growth (updated Plan was expected in 2025),

- 'Energy Policy of Poland until 2040' (EPP, 2021): defines the selection of technologies for building a low-emission energy system. Focuses on increasing the use of renewable energy technologies in heat production. Geothermal is considered in the context of district heating, hybrid systems, and energy security,

- 'Multi-annual Program for the Development of Geothermal Resource Use in Poland' (2021): an important document for geothermal development in the country, based on three pillars: 1. Research; 2. Execution and implementation of pilot installations; 3. Implementation, education, and promotion (https://www.gov.pl/web/klimat/mapa-drogowa-rozwoju-geotermii-w-polsce). The Program places a strong emphasis on the integration of geothermal energy into district heating systems. As a consequence, geothermal is expected to be incorporated into the next district heating networks across the country in the coming years.

As to the legislation, regulatory, and environmental framework related to renewable energies, with a focus on geothermal, one should indicate that the geothermal sector in Poland is regulated by several laws. The main one is the Geological and Mining Law (in recent years, the subject of necessary amendments and revisions to create better conditions for geothermal). Other laws include Energy Law, Environmental Law, Construction Law, and several others, which shall be harmonized both within national and EU regulations. There was also an urgent need to introduce tariff rules for heat/energy from geothermal (as with other RES) that will take into account their specific characteristics.

- Comments on government plans for continued growth:

Concerning the government's plans for continued geothermal growth, in the coming years, the focus will be on district heating (deep, shallow geothermal), as included in the 'Multi-annual Program for the Development of the Use of Geothermal Resources in Poland by 2040/2050' (2021). At the same time, the funding from sources other than public should also increase, as public funding will be gradually limited. The introduction of risk mitigation tools for geothermal projects is also an urgent issue (which has been postulated for many years, as in other countries).

- Research and Development:

Alongside with drillings and investment activities, extensive feasibility studies, pre-investment analyses, as well as R+D+I work were carried out in 2023–2025. They covered a broad range of geothermal topics, including deep geothermal, deep borehole heat exchangers, various technologies of underground thermal energy storage, geothermal water desalination, applications in agriculture, etc., and shallow geothermal systems, initiating the systematic mapping of the shallow geothermal potential of the country. Those national and international projects were implemented based on funding from Polish sources as well as the European Union programs, the EEA and Norwegian Financial Mechanisms, and other international funding instruments.

- Markets and trends:

Referring to markets and trends, the geothermal market in Poland will continue to develop toward district heating, as well as bathing and recreation, the latter being an attractive line of business, a lever for local development. It is also recommended to develop other geothermal uses, among others, in agriculture and in innovative applications. To achieve this, more involvement of the private sector is necessary, as well as, among other things, the introduction of stable long-term formal and financial conditions and tools, also with regard to risk mitigation in geothermal projects.

5 CLOSING REMARKS

Over the years 2023–2025, further progress was made to develop geothermal energy use in Poland, primarily in district heating. The activities included drilling of over twenty wells, the commencement of operation of the next three geoDHs, and other related investments. Much of that advancement was possible through substantial public support programs. A key driver for the increase in geothermal energy use was the need to decarbonize the heating sector, increase the share of locally sourced energy, and ensure both affordability and security of supply. Geothermal energy has the potential to address these challenges. Poland is expected to see further growth in geothermal-based installations in the coming years, particularly in the heating sector.

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