

MINERAL RESOURCES OF HUNGARY

as of 1 January, 2021

The Supervisory Authority for Regulated Affairs (hereinafter: SZTFH), as the body performing state geological tasks, was established by Act XLVIII of 1993 (hereinafter: Act on Mining). According to § 25 of this Act, and in accordance with the SZTFH President's Decree 2/2021 on the SZTFH SZMSZ (XII. 29.) with the provisions of Appendix 2, SZTFH maintains the State Register of Mineral Resources and Geothermal Energy.

According to the Act on Mining, the country's mineral resources are owned by the state in their natural state. These mineral resources are part of our country's natural resources and national property, and have been registered by the SZTFH and its legal predecessors since 1953.

The record of domestic mineral resources is based on mandatory data submissions by mining entrepreneurs, and the decisions issued by the regional Mining Supervision Departments of the Directorate of Mining Supervision of the SZTFH. Base data of the register:

- quantity and quality of mineral resources;
- the annual change in mineral resources (exploitation, exploration, reclassification etc.) according to the annual reports;
- the mineral resources left behind when the mine is closed or the field is abandoned.

Extractable mineral resources enumerated in decisions establishing the mining plots, are listed in the register by occurrences, based on available data.

The State Register of Mineral Resources and Geothermal Energy includes 4,203 registered deposits. Mineral resources of Hungary as of 1st January, 2021 and the production in 2020 are published in tables 1 and 2.

*Table 1. Data on Hungary's known mineral resources for hydrocarbons and ores
(based on incoming data)*

Mineral resource	Production in 2020		Geological resource 1 Jan 2021		Exploitable resource 1 Jan 2021	
	Mm ³	kt	Mm ³	kt	Mm ³	kt
Crude oil*						
Conventional	1.02	848.8	286.65	237,920	24,73	20,526
Non-conventional	<0.001	<0.001	537.11	445,801	58,52	48,572
Natural gas**						
Conventional	1886.3		185,793.32		73,790	
Non-conventional	1.64		3,923,313.9		1,565,324	
CO ₂ gas	128,53		44,268.75		28,392	
Black coal***		1,513		1,625,036		1,915,313
Brown coal		51,591		3,204,621		2,246,010
Lignite		6,069		5,664,761		4,219,712
Uranium ore		0		31,843		31,843
Iron ore		0		43,151		43,664
Bauxite		0		123,955		79,783

Mineral resource	Production in 2020		Geological resource 1 Jan 2021		Exploitable resource 1 Jan 2021	
	Mm ³	kt	Mm ³	kt	Mm ³	kt
Lead-zinc ore		0		90,775		100,817
Copper ore		0		781,170		726,459
Precious metal ore		0		36,588		36,507
Manganese ore		0		78,868		51,982

* 1000 m³ natural gas equals 1 ton

** 1 m³ crude oil equals 0.83 ton

*** Dilution is higher than loss (exploitable resource = geological resource + dilution – loss – pillar, thus quantity of exploitable coal + interim waste rock may exceed the registered exploitable resource).

Table 2. Data on Hungary's known mineral resources for non-metallic solid mineral resources (based on incoming data)

Non-metallic mineral resources	Production in 2020	Geological resource 1 Jan 2021	Exploitable resource 1 Jan 2021
	Mm ³	Mm ³	Mm ³
Industrial minerals	1.15	1,712.87	1,449.31
Raw materials for cement and lime industry	0.94	1,131.58	693.35
Raw materials for building and decoration stone industry	7.43	2,063.28	1,681.32
Sand	9.23	1,069.70	909.64
Gravel	13.01	3,744.76	2,886.56
Raw materials for ceramics industry	2.68	1,024.33	860.33
Peat, paludal mud, paludal lime	0.21	538.18	342.89
In total	34.64	11,284.68	8,823.40

Coals

Geological resources of coals by coal types in Hungary are presented in Table 3.

Table 3. Coal and lignite resources of Hungary

Coals	Geological resources 1 Jan 2020 (Mt)	Geological resources 1 Jan 2021 (Mt)
Black coal	1,625.0	1,625.0
Brown coal	3,204.8	3,204.6
Lignite	5,671.2	5,664.8
Coals in total	10,501.0	10,494.4

The total coal production (black and brown coal, lignite) has fluctuated between 6 and 7 million tons in the past years. Production of black coal in 2021 was minimal. Production of brown coal and lignite has decreased compared to the previous year. Data for the coal production in 2019 and 2020 are shown in Table 4, and the production of the last few years is presented on a graph in Figure 1.

Table 4. Coal production of Hungary in 2019 and in 2020

Coals	Production in 2019	Production in 2020
	kt	kt
Black coal	6.095	1.513
Brown coal	50.742	51.591
Lignite	6,790	6,090
In total	6,846.837	6,143.104

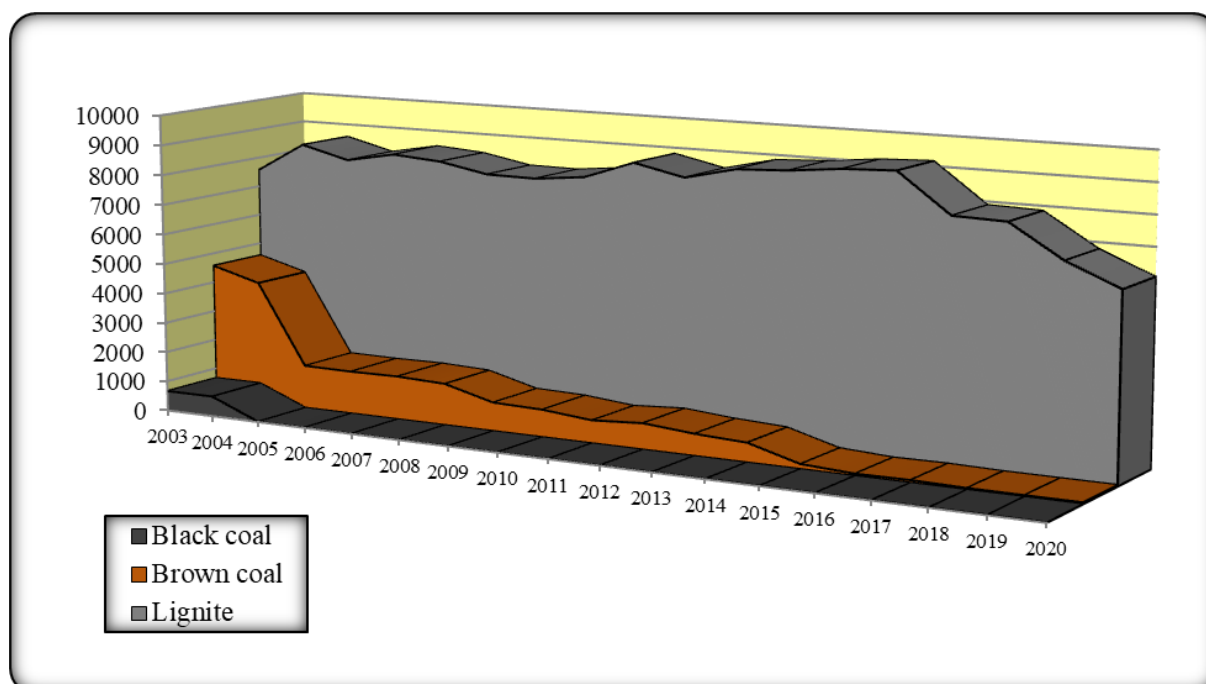


Figure 1. Coal production (kt) of Hungary from 2003 to 2020

Hydrocarbon and carbon-dioxide

In the case of the 319 registered oil and natural gas occurrences (+15 exploration areas), the changes in mineral resources during 2020 resulted from the activities of 27 mining companies. The hydrocarbon mineral resources brought to the surface in the current year were almost exclusively extracted by the entrepreneurs using traditional (so-called conventional) methods, and mineral resource data on occurrences of crude oil and hydrocarbon natural gas that can be extracted using non-conventional methods has not changed significantly. Data on geological resource and exploitable resource of carbon dioxide natural gas has decreased slightly compared to the previous year, the production has increased by 13.69 Mm³ compared to 2019. Hungary's hydrocarbon and CO₂ resources are presented in Table 5.

Figures 2 and 3 show the production and geological resources for previous years on graph.

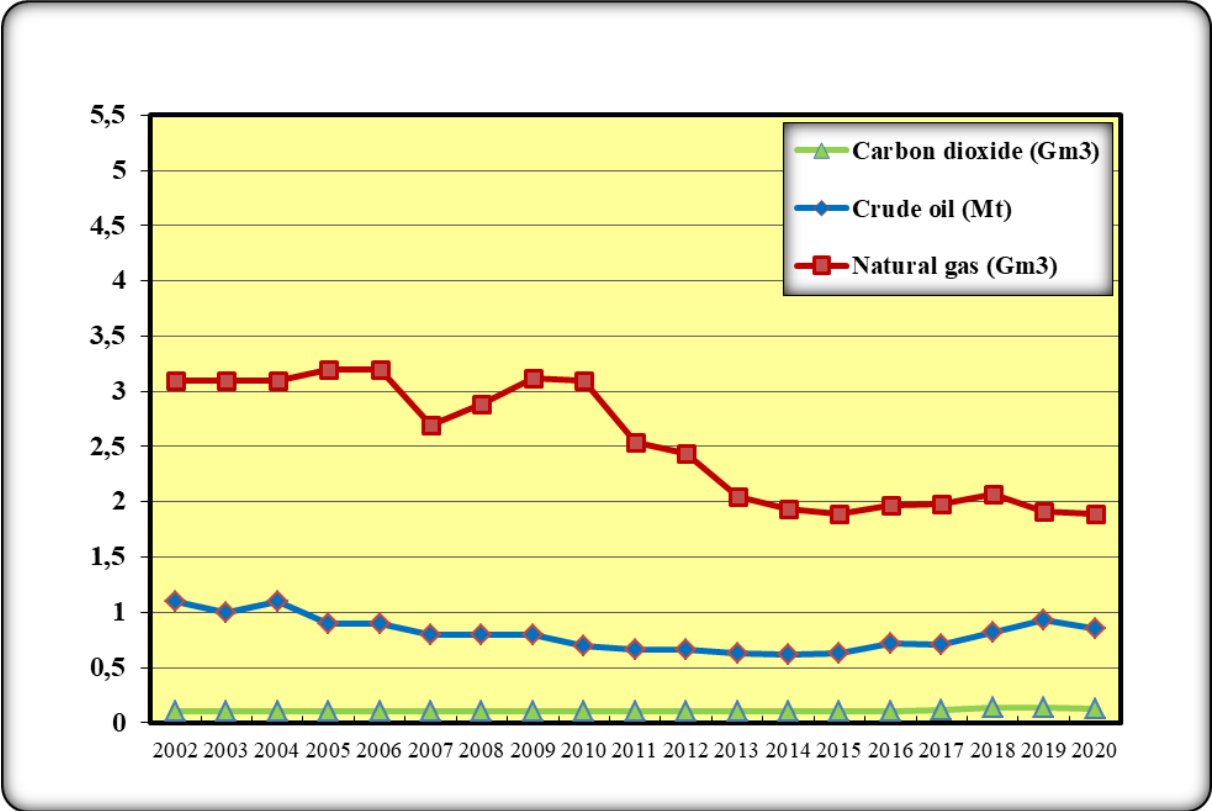


Figure 2. Crude oil and natural gas production (BCM) in Hungary from 2002 to 2020

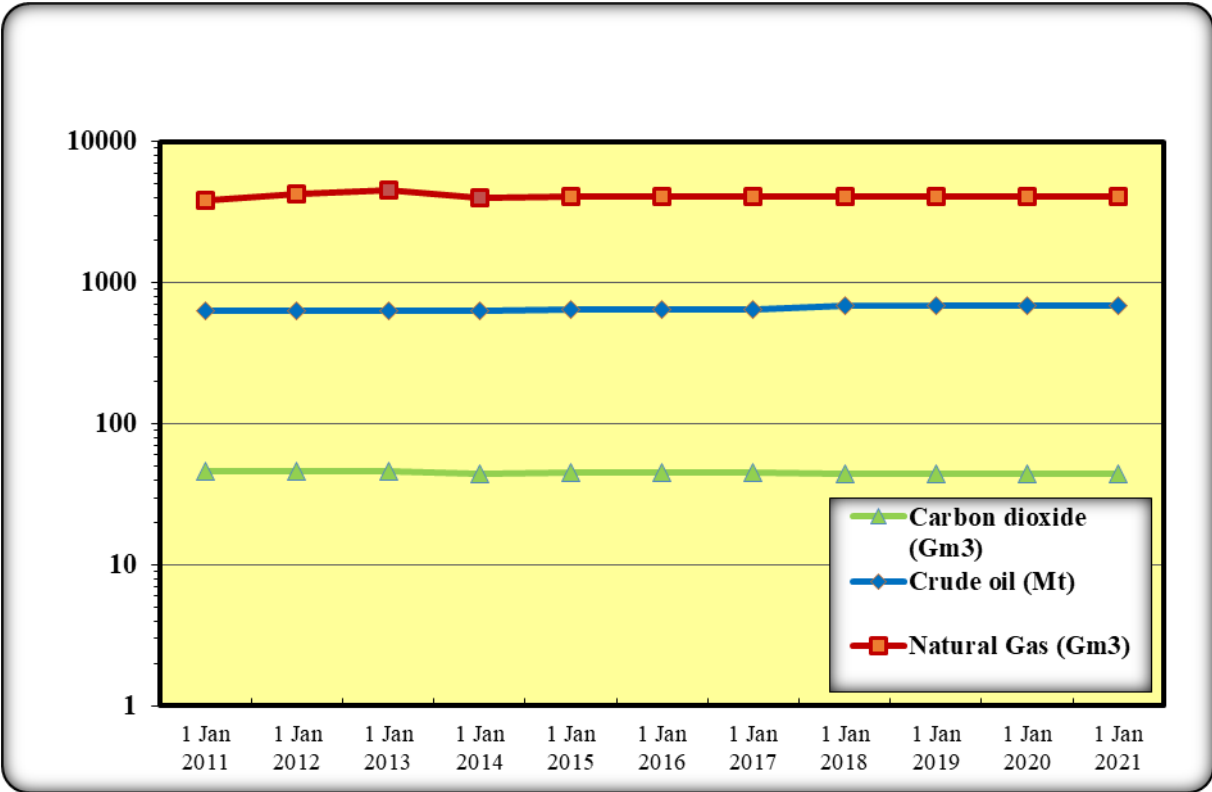


Figure 3. Geological resources of crude oil, natural gas, and carbon-dioxide

Ores

No ore was produced in Hungary in 2020. Bauxite was last mined in 2018, and manganese ore production ended in mid-2016. Tables 5 and 6 show Hungary's ore resources on 1st January 2021, and Figure 4 shows bauxite production in recent years.

Table 5. Iron, uranium and non-ferrous metal ore resources of Hungary on 1st January 2020

Mineral resource	Geological resource (Mt)
Iron ore	43.15
Lead-zinc ore	90.8
Copper ore	781.2
Precious metal ore	36.6
Uranium ore	31.84

Table 6. Bauxite and manganese ore resources of Hungary, production in 2019 and 2020

	Geological resource	Exploitable resource	Geological resource	Exploitable resource	Production	Production
	(Mt)		(Mt)		(Mt)	(Mt)
	1 Jan 2020		1 Jan 2020		2019	2020
Bauxite	124.0	79.8	124.0	79.8	0	0
Manganese ore	78.9	52.0	78.9	52.0	0	0

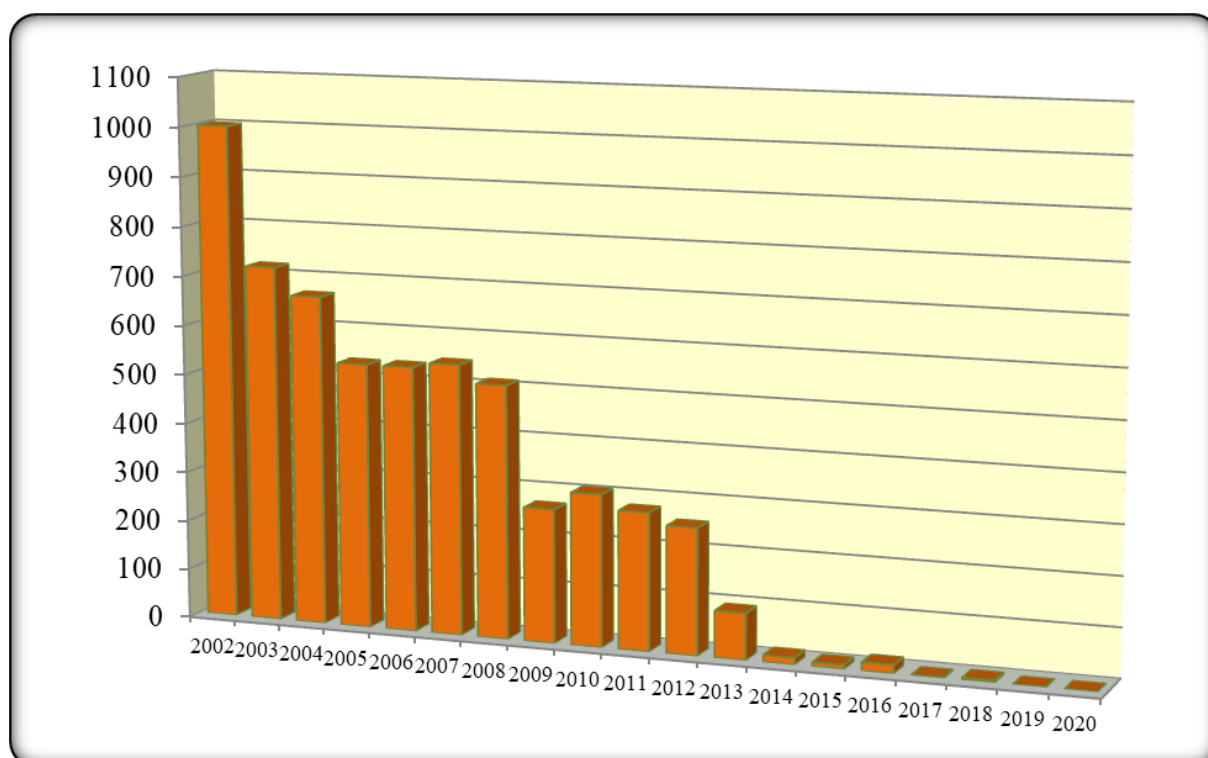


Figure 4. Bauxite production (kt) in Hungary in the past few years

Non-metallic mineral raw materials

By non-metallic mineral raw materials are meant those, more than 60 kinds of solid mineral types of various geological age and origin that do not belong to fossil fuels and ores, and can be used in many areas of national economy.

The total explored non-metallic geological resource is 11,285 Mm³, from which 8,823 Mm³ is exploitable. The present resources are distributed among a total of 3 394 occurrences. Based upon utilization, non-metallic mineral raw materials are classified into 7 main raw material categories as follows:

1. **Industrial minerals:** areas of use include the chemical industry, metallurgy, ceramics industry, agriculture, building materials industry (precious plasters, insulating materials). These materials include alginite, refractory and acid-resistant clay, industrial and glass sand, various quality limestones and dolomites, kaolin, etc.
2. **Peat, paludal mud, paludal lime:** used mainly as soil fertilizers in agriculture and horticulture.
3. **Raw materials for cement and lime industry:** basic materials of cement and lime industry such as limestone, marl.
4. **Raw materials for building and decoration stone industry:** main areas of use are: building/construction industry, transport development, water engineering, and sculpture.
5. **Sand for building industry:** used mainly in construction and building industry.
6. **Gravel for building industry:** concrete component, basic material for road construction.
7. **Raw materials for ceramics industry:** main areas of use are: brick, tile and porcelain factories, SME ceramics industry.

The production of non-metallic raw materials, sorted by groups is shown in Table 7, and the production between 2002 and 2020 is shown on Figure 5.

Figure 7. Non-metallic resources of Hungary, with production

Main raw material category	Geological resource (Mm ³)		Exploitable resource (Mm ³)		Production (TCM)	Production (TCM)
	1 Jan 2020	1 Jan 2021	1 Jan 2020	1 Jan 2021	2019	2020
Industrial minerals	1,711.56	1,712.87	524.44	1,449.31	1,314.46	1,146.72
Peat, paludal mud, paludal lime	538.08	538.18	304.83	342.89	130.62	213.98
Raw materials for cement and lime industry	1,132.82	1,131.58	564.86	693.35	1,337.19	937.71
Raw materials for building and decoration stone industry	2,067.45	2,063.28	1,357.13	1,681.32	7,632.82	7,425.55
Sand for building industry	953.99	1,069.70	710.42	909.64	6,534.03	9,229.24
Gravel for building industry	3,656.40	3,744.76	2,326.18	2,886.56	20,861.58	13,012.39
Raw materials for ceramics industry	1,031.41	1,024.33	673.77	860.33	1,646.05	2,678.92
Others	72.60	-	56.42	-	1,519.08	-
Non-metallic raw materials in total	11,164.30	11,284.70	6,518.05	8,823.40	40,975.82	34,644.51

The production of non-metallic raw materials in 2020 has decreased by 6.3 million m³ as compared to the previous year.

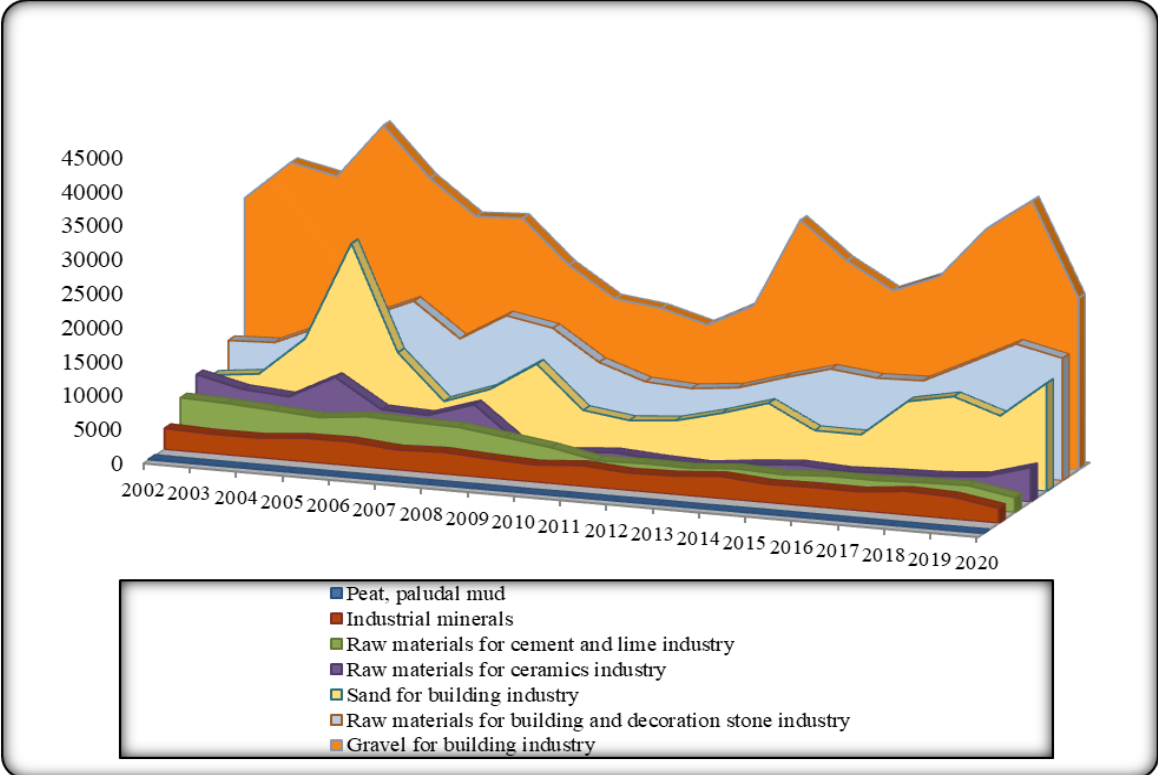


Figure 5. Production (kt) of non-metallic raw materials in Hungary in the past few years

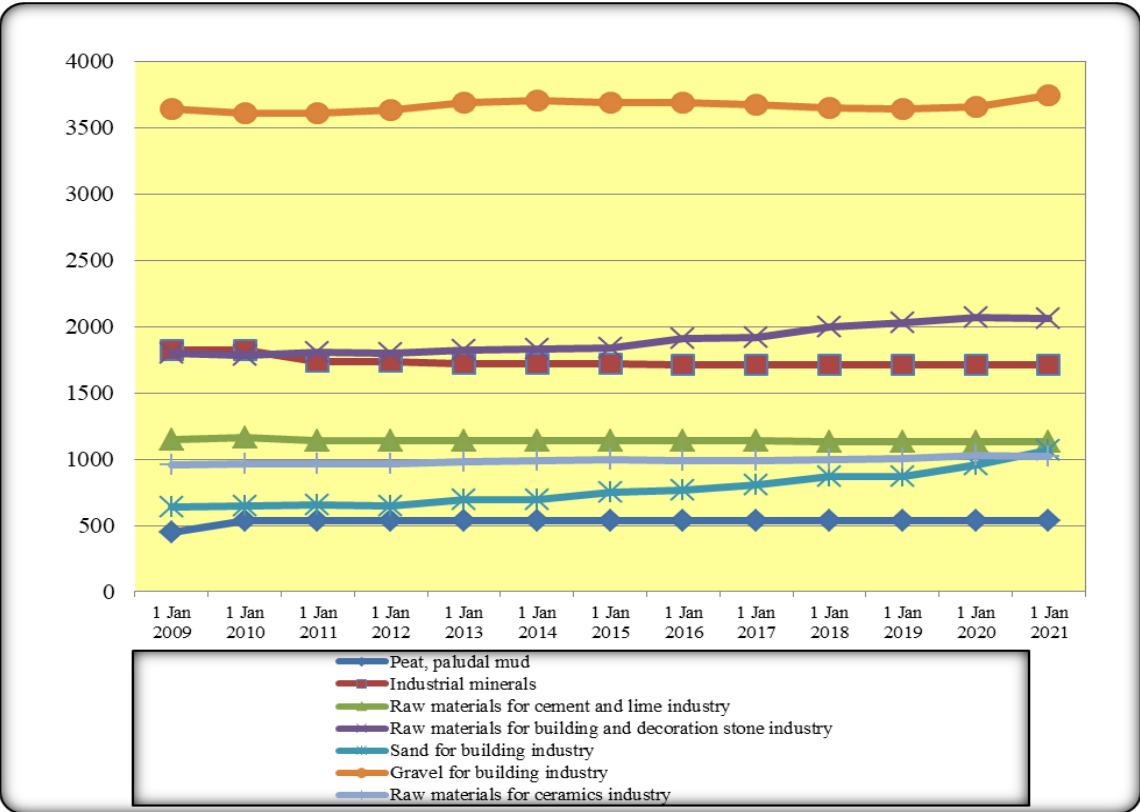


Figure 6. Geological resource (MCM) of non-metallic raw materials in Hungary

Geothermal energy

Geothermal energy is the heat quantity surplus stored in geological formations as a result of their higher temperature, compared to the annual surface temperature. In Hungary the value of geothermal gradient is 5 °C/100 m on average, which is one-and-a-half times higher than the world average. The superficial average temperature is about 11 °C. Considering the before-mentioned geothermal gradient, the temperature of rocks and stored fluids is around 60 °C at a depth of 1 km, and cca. 110 °C at a 2 km depth. The reason for this is that the Earth's crust in the Pannonian basin is thinner than the world average (24-26 km thick, approx. 10-15 km thinner than in other areas). Thus, the hot mantle is closer to the surface. The measured heat flow values are also one-and-a-half times higher (90.4 mW/m²) than the European average (60 mW/m²). Geothermal gradients are higher on the southern part of Transdanubia and on the Hungarian Great Plain than the national average, while the lowest on the north-western part of Hungary and on the mountain areas.

According to the definition given in Government Decree 54/2008. (III. 20.): ‘Geothermal energy: The internal thermal energy of the Earth's crust, which can be utilized for energetic purposes. Geothermal energy is energy obtained by extracting or recirculating liquid or gaseous substances with a temperature of at least +30 °C (geothermal energy carriers), directly from the Earth's crust.’

In 2020, the amounts of extracted volume and recovered energy reported to the Department of Mineral Resource Registry and Mining Revenue Declaration of the SZTFH were as follows: Volume of recovered energy carriers was 52,331,217.00 m³, of which the volume of energy carriers extracted by companies utilizing geothermal energy for energy purposes was 36,841,115.5 m³. The amount of energy used according to the provisions of the 54/2008. Government Decree (III. 20.) was 4,520,151.58 GJ.

In the scope of the State Register of Mineral Resources and Geothermal Energy, the registration of geothermal energy resources, the geothermal protection zones, the geothermal energy utilization facilities, and the amount of extracted and utilized geothermal energy was established in 2014 (as prescribed in the Act on Mining), and has continued ever since. Uploading of the registers – based on the data sheets sent by licensees using geothermal energy – for the period 2010-2020 was implemented. Based on it, the amount of geothermal energy extracted for non-energetic purposes (not subject to mining royalties) in 2010-2020 was 96,618,889.46 GJ. The amount of geothermal energy utilized for non-energetic purposes in 2010-2020 was 35,212,385.95 GJ.

Waste rocks and mining waste

Based on the obligation of the European Union, the 13/2022. (I. 28.) SZTFH decree § 14. (3) prescribes an obligation to provide data regarding changes in mining waste. Accordingly, since 2009, the mining authority has been recording quantitative and qualitative data on changes in mining waste.

The mining entrepreneurs – in the frame of the annual data provision – report data on waste rock and mining waste extracted in the previous year, with indication of the amount of waste that were deposited, sold with official permission, or used for landscaping in the mine, as well as the amount of humus topsoil.

The amount of waste material deposited in landfills or tailing reservoirs was as follows: On the 1st January, 2020: 68.4 million m³, on the 1st January, 2021: 71.1 million m³.

Table 8 shows the amount of removed humus topsoil.

Table 8. The quantity of removed and deposited humus topsoil

	Volume (TCM)
Total removed in current year	1,350.4
Sold with official permission	8.5
Used for landscaping in the mine	668.3
Deposited in previous years	3,536.6
Deposited in 2020	683.3

According to the register, 2.4 million m³ of the 2.9 million m³ of waste extracted in 2020 were used for backfilling and landscaping.

Table 9 shows aggregate registration data for waste rock/waste.

Table 9. Waste rock / waste (TCM)

	Inert waste	Non-inert, non-hazardous waste	Hazardous waste
Sold with permission issued by mining inspectorate	304.5	13.3	-
Disposed on heaps / tailing	779.7	98.9	3.6

The total amount of drilling mud generated was as follows:

On 1st January, 2020: 902.11 TCM, on 1st January, 2021: 919.95 TCM.

Table 10 shows the amount of drilling mud produced in the current year.

Table 10. The amount of drilling mud produced in 2020 (TCM)

	Inert waste	Non-inert, non-hazardous waste	Hazardous waste	Total
Deposited in-self managed mud treatment facility	-	-	-	-
Deposited in external waste facility (deposited), or recycled	21.19	1.33	0.68	23.20
In total	21.19	1.33	0.68	23.20