

## MINERAL RESOURCES OF HUNGARY AS OF 1 JANUARY, 2020

The Mining and Geological Survey of Hungary keeps the records of mineral resources and reserves of Hungary pursuant to provisions of the multiple amended Section 25. of Act No. XLVIII. of 1993. on mining as well as Government decree No. 203/1998. for its implementation.

According to the present Act, mineral raw materials of Hungary in their natural occurrence shall be state property. Such treasures form a part of natural resources and national assets of our country, keeping records of them has been on by the Mining and Geological Survey of Hungary and its predecessors since 1953.

Balance-like registry of national mineral raw materials is based on the obligatory data delivery from mining entrepreneurs as well as the resolutions issued by the concerned County Government Offices (the Division of Mining Supervision and four Departments of Mining of Divisions for Authority Affairs). Raw data of the registry are the following:

- quality and quantity of mineral resources and reserves;
- annual change in mineral resources, reserves (production, exploration, reclassification, etc.) according to annual delivery;
- mineral resource, reserve left behind subsequent to mine closure, field abandonment.

Based on such available data, mineral resources and reserves are recorded separately by each raw material including occurrence(s). The National Registry on Mineral Raw Materials and Geothermal Resources consists of more than 4,203 registered mining areas. Resources as of 1 January 2020. as well as production of Hungary in 2019. are presented in the following table.

Mineral resource	Production in 2019		Geological resources in place as of 1 Jan 2020		Exploitable resources of 1 Jan 2020	
	Mm <sup>3</sup>	kt	Mm <sup>3</sup>	kt	Mm <sup>3</sup>	kt
<b>Crude oil</b>						
<b>Conventional</b>	1.59		273.43		23.14	
<b>Non-conventional</b>	0.00		537.11		58.52	
<b>Natural gas</b>						
<b>Conventional</b>	1870.44		185 336.58		75 691.53	
<b>Non-conventional</b>	2.5		3 923 315.59		1 565 326.03	
<b>CO<sub>2</sub> gas</b>	142.22		44 397.28		28520.58	
<b>Black coal</b>		6.095		1 625 037		1 915 314**
<b>Brown coal</b>		50.742		3 204 838		2 246 177

Mineral resource	Production in 2019		Geological resources in place as of 1 Jan 2020		Exploitable resources of 1 Jan 2020	
	Mm <sup>3</sup>	kt	Mm <sup>3</sup>	kt	Mm <sup>3</sup>	kt
Lignite		6790.0		5 671 187		4 225 867
Uranium ore		0		31 483		31 483
Iron ore		0		43 151		43 664
Bauxite		0		123 955		79 783
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

Non-metallic mineral raw materials	Production in 2019	Geological resources in place as of 1 January 2020	Exploitable resources as of 1 Jan 2020
	Mm <sup>3</sup>	Mm <sup>3</sup>	Mm <sup>3</sup>
Industrial minerals (selected)	1.31	1 711.56	524.44
Raw materials for cement and lime industry	1.34	1 132.82	564.86
Raw materials for building and decoration stone industry	7.63	2 067.45	1 357.13
Sand	6.53	953.99	710.418
Gravel	20.86	3 656.40	2 326.18
Raw materials for ceramics industry	1.65	1 031.41	673.77
Peat. paludal mud. paludal lime	0.13	538.08	304.83
Others	1.52	72.60	56.42
<b>In total</b>	<b>40.97</b>	<b>11 164.31</b>	<b>6 518.05</b>

\* 1000 m<sup>3</sup> natural gas equals to 1 ton

\*\* Attenuation is higher than loss (Geological resource + attenuation - loss - pillar = Exploitable resource)

/quantity of exploitable coal + interim waste rock may exceed the registered exploitable resource/.

**Table 1.: Summary data of registered mineral raw material resources of Hungary (based on data provided by companies)**

## Coals

Geological resources of coals in Hungary are presented in Table 2.

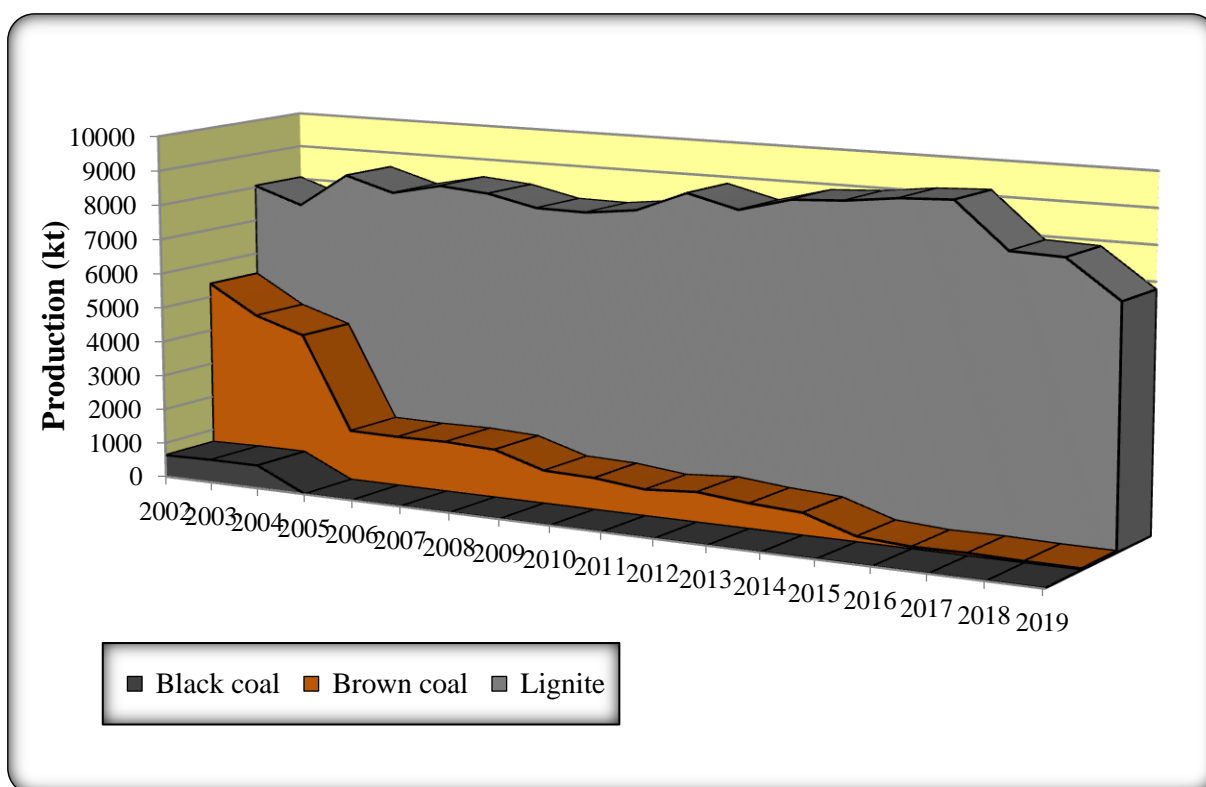
Coals	Geological resources in place of 1 January 2018. (million tons)	Geological resources in place as of 1 January 2019. (million tons)
Black coal	1 625.0	1 625.0
Brown coal	3 195.9	3 204.8
Lignite	5 678.4	5 671.2
<b>Hungary in total</b>	<b>10 499.3</b>	<b>10 501.0</b>

**Table 2. Geological resources in place of coals in Hungary**

The total coal production (black and brown coal, lignite) in Hungary has been around 8 million tons in the past years. Our coal production is insignificant, the lignite production has declined. Coal production figures for 2018 and 2019 are shown in Table 3. Figure 1 shows graphically the production of the last few years.

Black coal	Production in 2018	Production in 2019
	1000 t	1000 t
Brown coal	2.083	6.095
Lignite	53.606	50.742
Coals	7 843	6 790
<i>Hungary in total</i>	<b>7 898.689</b>	<b>6 846.837</b>

*Table 3. Coal production of Hungary in 2018 and 2019*



*Figure 1. Coal production of Hungary in the past few years*

## Hydrocarbon and CO<sub>2</sub>

As for the registered 332 crude oil and natural gas mining plots, all changes in mineral resources, reserves in 2019 are due to the activity of 26 mining entrepreneurs.

Practically, data of non-conventional crude oil as well as natural gas concerning resources were constant.

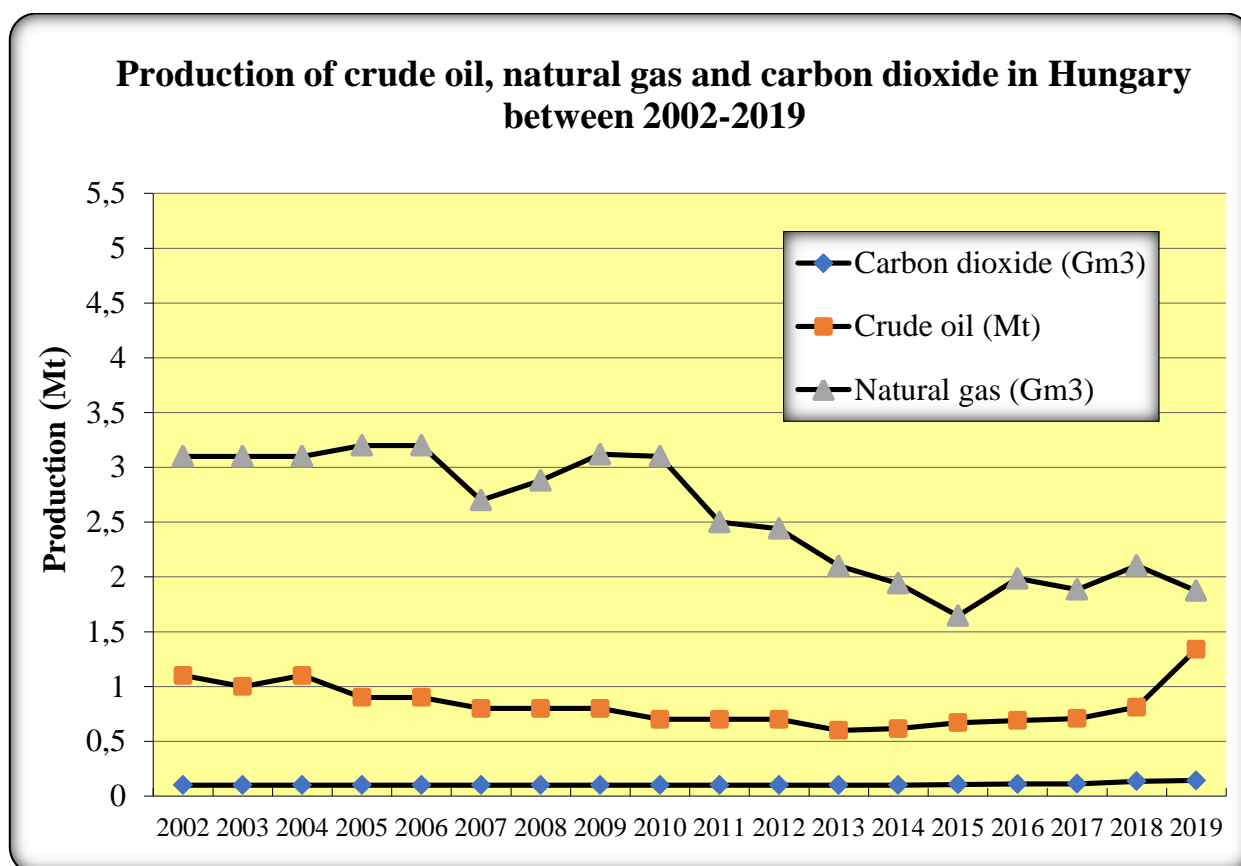
The geological and extractable resource of carbon dioxide gas has slightly decreased and production has increased with 6,9 M<sup>3</sup> - comparing with data in last year.

Geological resources of hydrocarbons and carbon dioxide of Hungary are shown in Table 4.

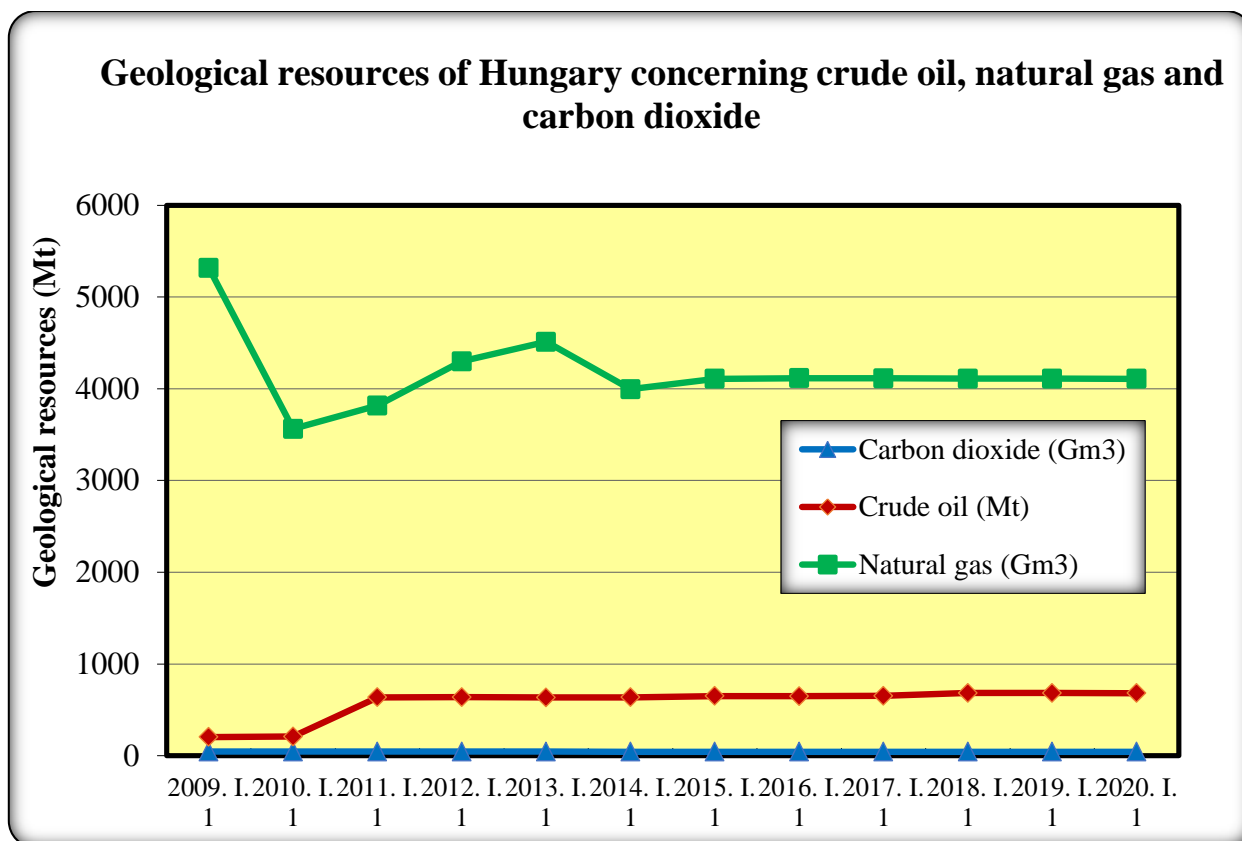
	Geological resources in place as of 1 January 2020
Crude oil (Mm <sup>3</sup> )	810.54
Natural gas (Gm <sup>3</sup> )	4 108.65
CO <sub>2</sub> gas (Gm <sup>3</sup> )	44.40

**Table 4. Geological resources of hydrocarbons and carbon dioxide of Hungary**

Production and geological resources of the past few years are presented graphically in Figure 2. and 3.



**Figure 2. Production of crude oil, natural gas and carbon dioxide in Hungary between 2002-2019**



*Figure 3. Geological resources of Hungary concerning crude oil, natural gas and carbon dioxide*

## Ores

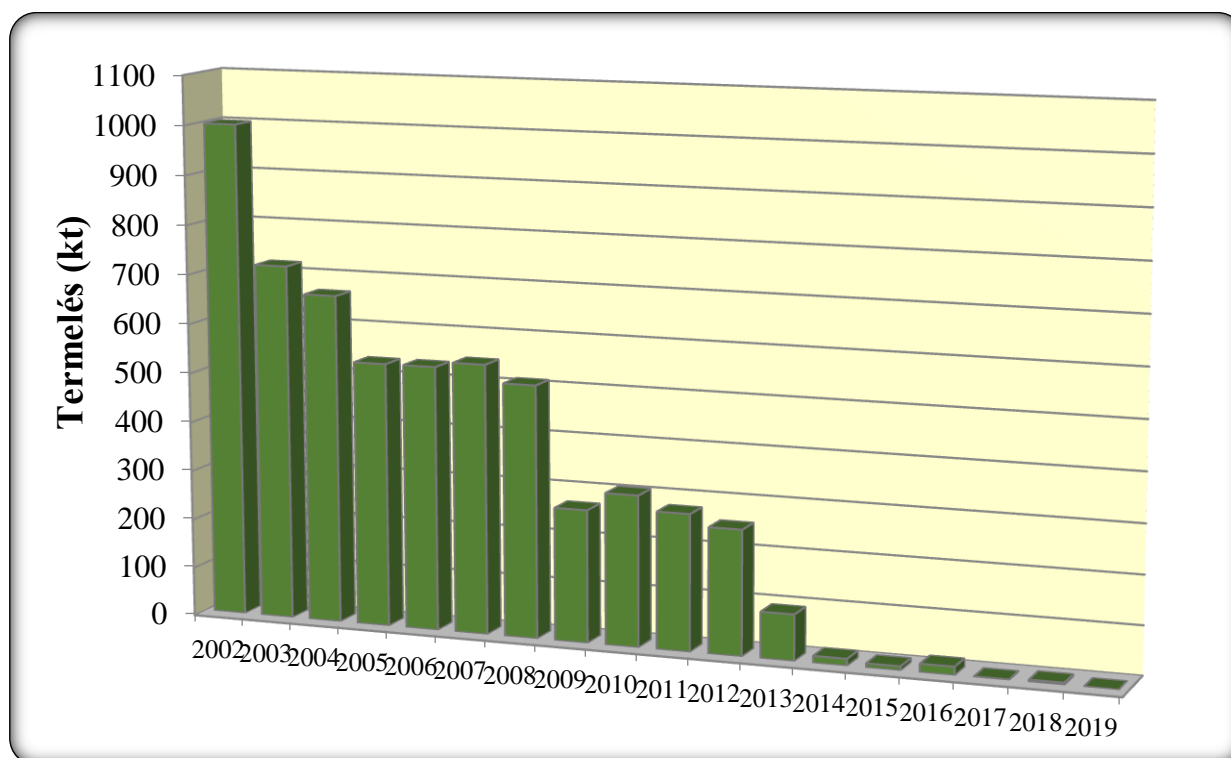
Ore mining in Hungary decreased significantly in the past few years. There was only a single mine producing bauxite in 2016, the production of manganese ore (Úrkút) terminated in mid 2016. The geological ore resources as of 1 January 2020 may be seen in Tables 5 and 6, the production of bauxite from the past few years is in Figure 5.

	Geological resources (Mt)
<b>Iron ore</b>	43.15
<b>Lead-zinc ore</b>	90.8
<b>Copper ore</b>	781.2
<b>Precious metal ores</b>	36.6
<b>Uranium ore</b>	31.48

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

	Geological	Exploitable	Geological	Exploitable	Production	Production
	resources (Mt)		resources (Mt)		(Mt)	(Mt)
	1 Jan 2019		1 Jan 2020		2018	2019
<b>Bauxite</b>	124.0	79.8	124.0	79.8	0.004	0
<b>Manganese ore</b>	78.9	52.0	78.9	52.0	0	0

*Table 6. Bauxite and manganese ore resources of Hungary, production in 2018 and 2019*



*Figure 4. Bauxite production in Hungary in the past few years*

## Non-metallic mineral raw materials

Non-metallic mineral raw materials are recognized as more than 60, solid mineral types (of various geological age and generation, except fuels and ores) used in many areas of national economy.

The total recognized non-metallic geological resource is 11,164 Mm<sup>3</sup> from which 6,518 Mm<sup>3</sup> is exploitable. The present resources are split between 3,334 deposits. Based upon utilization, non-metallic mineral raw materials are classified into 7 main raw material categories as follows:

1. **Industrial minerals (selected):** such as alginite, fire- and acid proof clay, industrial and glass sand, different quality limestones and dolomites, kaoline, etc.; main users are: chemical industry, metallurgy, ceramics industry, agriculture, building/construction industry (facing plasters, insulating materials).
2. **Peat, paludal mud, paludal lime**
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 users are: building/construction (material) industry, transport, water engineering, sculpture.
5. **Sand for building industry**
6. **Gravel for building industry:** concrete component, basic material for road construction.
7. **Raw materials for ceramics industry:** main users are: brick-, tile- and porcelaine factories, small ceramics industry.

Main raw material category	Geological resources in place /million m <sup>3</sup> /		Exploitable resources /million m <sup>3</sup> /		Production in 2018	Production in 2019
	1 Jan 2019	1 Jan 2020	1 Jan 2019	1 Jan 2020	1000 m <sup>3</sup>	1000 m <sup>3</sup>
<b>Industrial minerals (selected)</b>	1 714.33	1 711.56	525.84	524.44	1 382.56	1 314.46
<b>Peat-Paludal mud-Paludal lime</b>	538.21	538.08	305.03	304.83	141.99	130.62
<b>Raw materials for cement and lime industry</b>	1 134.16	1 132.82	566.20	564.86	1 278.48	1 337.19
<b>Raw materials for building and decoration stone industry</b>	2 027.14	2 067.45	1 318.09	1 357.13	6 318.88	7 632.82
<b>Sand for building industry</b>	867.79	953.99	627.49	710.42	7 387.90	6 534.03
<b>Gravel for building industry</b>	3 640.33	3 656.40	2 315.22	2 326.18	17 681.87	20 861.58
<b>Raw materials for ceramics industry</b>	1 006.73	1 031.41	651.61	673.77	1 360.48	1 646.05
<b>Others</b>	59.76	72.60	46.68	56.42	2 321.71	1 519.08
<b>Non-metallic raw materials in total</b>	<b>10 988.45</b>	<b>11 164.30</b>	<b>6 356.15</b>	<b>6 518.05</b>	<b>37 873.9</b>	<b>40 975.82</b>

**Table 7. Non-metallic resources of Hungary, with production**

The production of non-metallic raw materials in 2019 is increased by 3.1 million m<sup>3</sup> as prepared to the previous year.

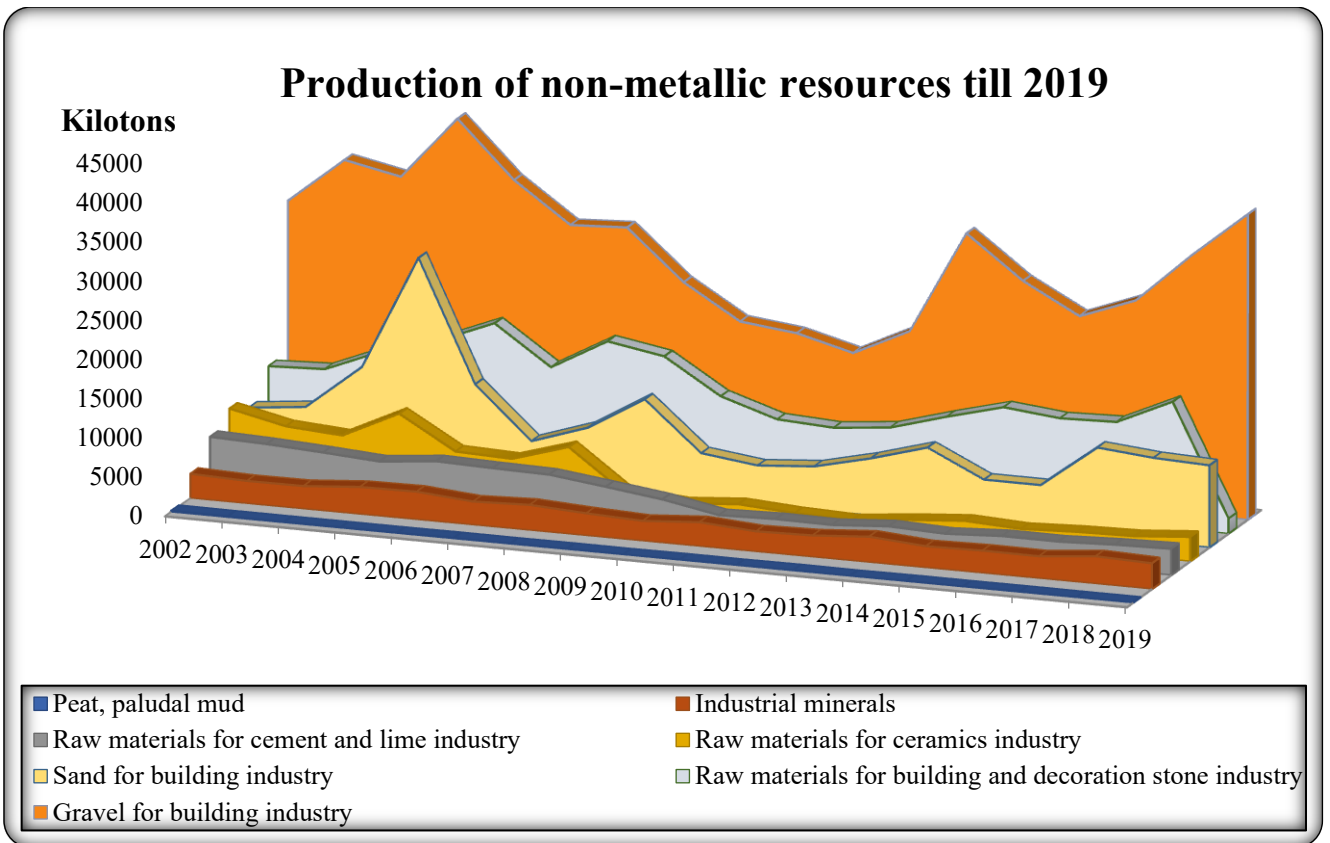


Figure 5. (Cumulated) production of non-metallic raw materials in Hungary in the past few years

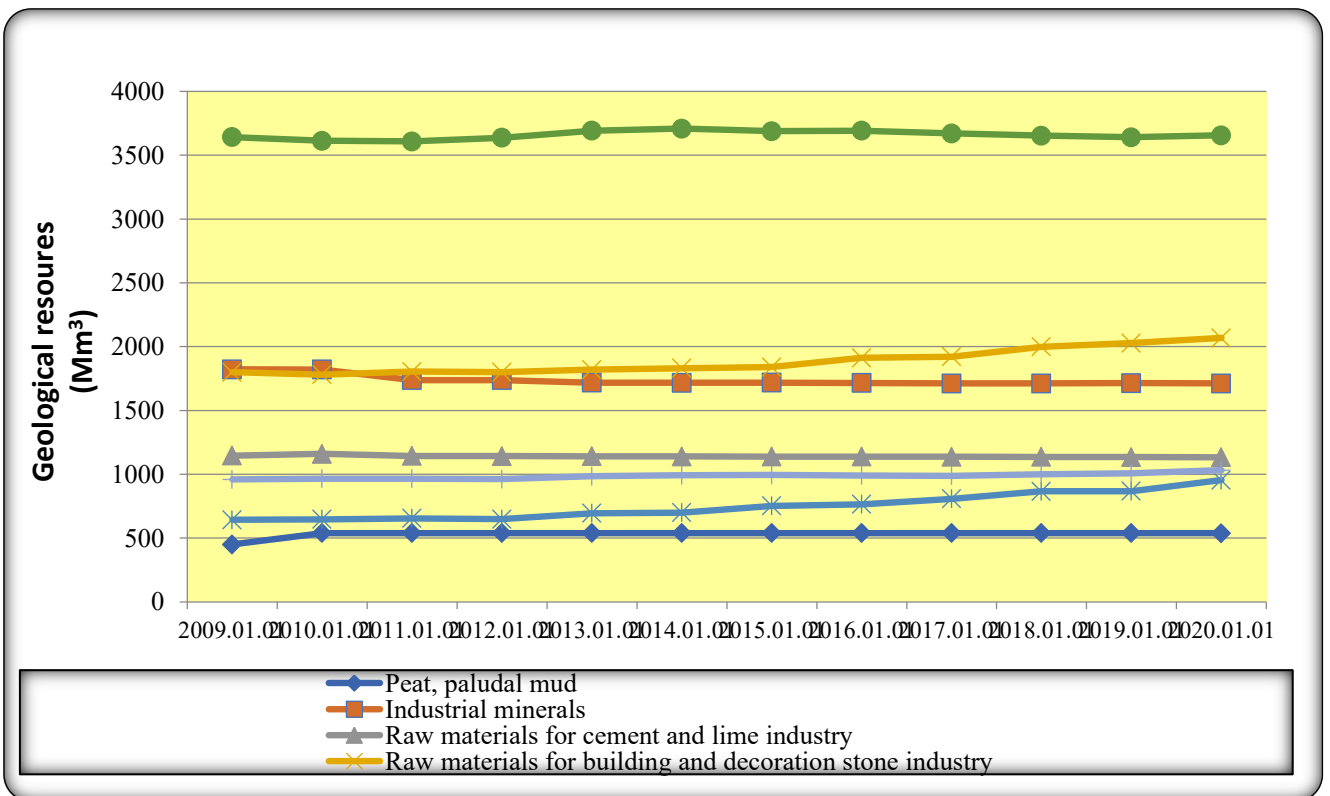


Figure 6. Geological resource of non-metallic raw materials in Hungary



## Geothermal energy

Geothermal energy is a plus heat quantity stored in geological formations as a result of their higher temperature as compared to the superficial average temperature. In Hungary the value of geothermal gradient is 5 ° C/100 m on average which is one-and-the-half times higher as the world average. The superficial average temperature is about 11 ° C. Considering the before-mentioned geothermal gradient, the temperature of rocks in 1 km depth is 60 ° C, in 2 km depth is 110 ° C, together with waters stored within. The reason 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 other areas). Thus the hot mantle is closer to the surface. The reason is that the Earth's crust is thinner in the Pannonian basin (24-26 km, 10-15 km thinner as compared to other areas) than the world average, thus the hot mantle is closer to the surface. The measured thermal flow values are also one-and-the-half times higher (90,4 mW/m<sup>2</sup>) as the European average (60 mW/m<sup>2</sup>). Geothermal gradients are higher on the southern part of Transdanubia and the Hungarian Great Plain than the national average, while the lowest on the north-western part of Hungary and the mountainous areas.

Pursuant to Government decree No. 54/2008.: "Geothermal energy: The inner thermal energy of Earth's crust which can be utilized for energetic purposes. Geothermal energy is recovered by either the transfer of fluids or gases above 30 ° C (geothermal fuels), direct exploitation of such fuels or reinjection." The exploited volume and recovered energy in total reported to the Department of Mining and Royalty Income Affairs of the Mining and Geological Survey of Hungary are as follows:

Exploited volume : **36,973,203 m<sup>3</sup>**

Recovered energy : **4,175,889 GJ**

The National Registry of Mineral Raw Materials and Geothermal Resources also keeps records of geothermal resource/reserve, geothermal protective pillars, facilities utilizing geothermal energy as well as volume of exploited and utilized geothermal energy. Some data of the borehole database (facility identifier /rokarec/ and EOY coordinates /RX, RY/) were added to the records on facilities in 2018. The completion of registries - except geothermal energy resource - was done for 2010-2019. based on data sheets submitted by the licensees utilizing geothermal energy.

Exploited energy for other purposes (non-mining royalty) for 2010-2019: **85,683,665 GJ**  
Utilized energy for other purposes for 2010-2019: **30,683,665 GJ**

## Waste rock/waste

Upon an obligation from the European Union, there is an obligation for servicing data pursuant to paragraph (3) of Section 14 of Ministerial decree No. 14/2008. on mining wastes in case of any change in mining waste. We started to register all data in 2009. referring to any changes either in volume or in

quality. At request, mining entrepreneurs - in the frame of annual data delivery - submit data on waste rock and waste generated in the reference year, sorting them in different groups.

### National cumulated data for 2019 as of 01. 01. 2020

Volume of deposited material either in depository or in tailing pond (thousand m<sup>3</sup>)

on 1 January 2019	67962.6
on 31 December 2019	68447.1

Humiferous topsoil (thousand m<sup>3</sup>)

Sold upon an authority permit	21.6
Used for land remediation in mine	631.5
Deposited (with earlier volume)	2903.5
<b>Total extracted volume in the reference year</b>	<b>1776.8</b>

Total volume used for backfilling and land remediation (thousand m <sup>3</sup> )	52548.9
From previous year	603.4
In the reference year	51946.2

**WASTE ROCK/WASTE** in total (thousand m<sup>3</sup>)

	<b>Inert</b>	<b>Non-inert, non-hazardous</b>	<b>Hazardous</b>
Sold upon a permit from the Mining Authority	930.4	0.0	
Deposited in waste heap/tailing pond	842.0	284.6	0
Red mud deposition in temporary depository	0	0	0

Total volume of generated drilling mud (thousand m<sup>3</sup>)

on 1 January 2019	1103.2
on 31 December 2019	1132.5*

*\* out of this 736.8 thousand m<sup>3</sup> were generated in 2008*

Total volume of drilling mud in the reference year (thousand m<sup>3</sup>)

	<b>Inert</b>	<b>Non-inert, non-</b>	<b>Hazardous</b>	<b>Total</b>
Deposited in-self managed mud treatment facility	-	-	-	-
Deposited in external waste facility (deposed), or recycled	28.1	0.6	0.6	29.3
<b><i>IN TOTAL</i></b>	28.1	0.6	0.6	29.3