



COALBED METHANE REVISITED A POSSIBLE ALTERNATIVE UTILIZATION OF OUR HARD COAL RESOURCE



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MECSEK COAL MINING:

Largest coal basin with hard coal in Hungary,
min production since 1782

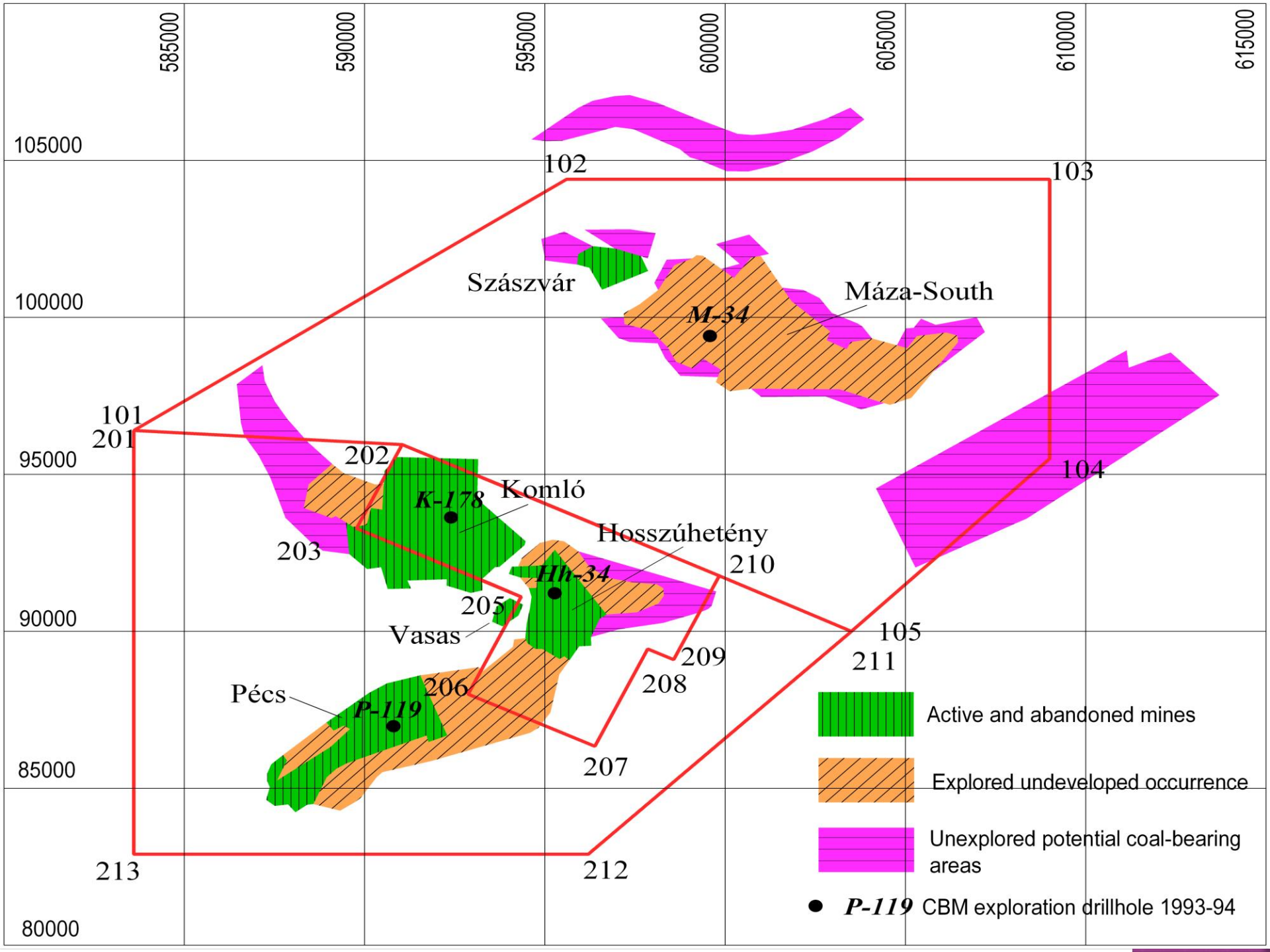
Three main mining centres:

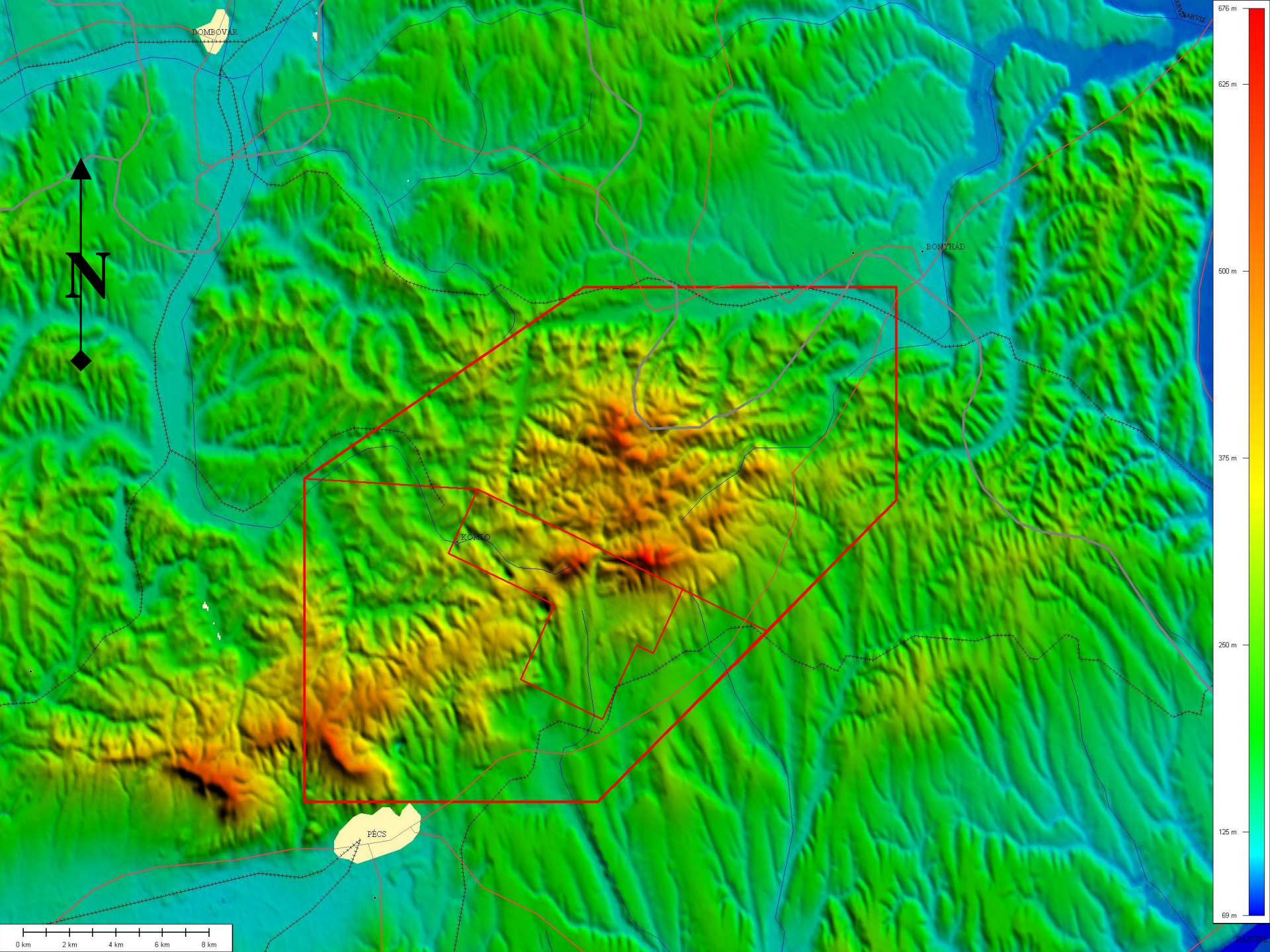
- Pécs-Hosszúhetény,
- Komló,
- Szászvár.

Annual historic coal production:

- 2,5-4 Mtpy
- 0,7 Mtpy(2003).

Indicated and inferred resources amounts to 980 M
tonnes.





DOMBÓVÁR

BONYHÁD

BONYHÁD

PÉCS



EXPLORATION AND HISTORIC DATA:

- Methane outbursts and explosions since the 19th century.
- Pre-production gas draining became a routine measure in the 1980s. The gas was collected and used for district heating.
- CBM potential has been recognised at the 1980s.
 - 118 Bn m³ in-place gas resource by USGS-HGS
 - Methane Master initial - unsuccessful exploration 4 holes
 - AFKI estimation 2005: 20 % recovery - 28,5 Bn m³

- Possible causes of Methane Master failure
 - Unsuitable drilling method (rotary instead of core),
 - Delayed sampling (after several weeks of drilling)
 - Drilling in overpressured zone (Maza 34)
 - Unknown stress field, no information about cleats
 - Fracturing with CO₂ - this becomes supercritical in the depth of fracturing

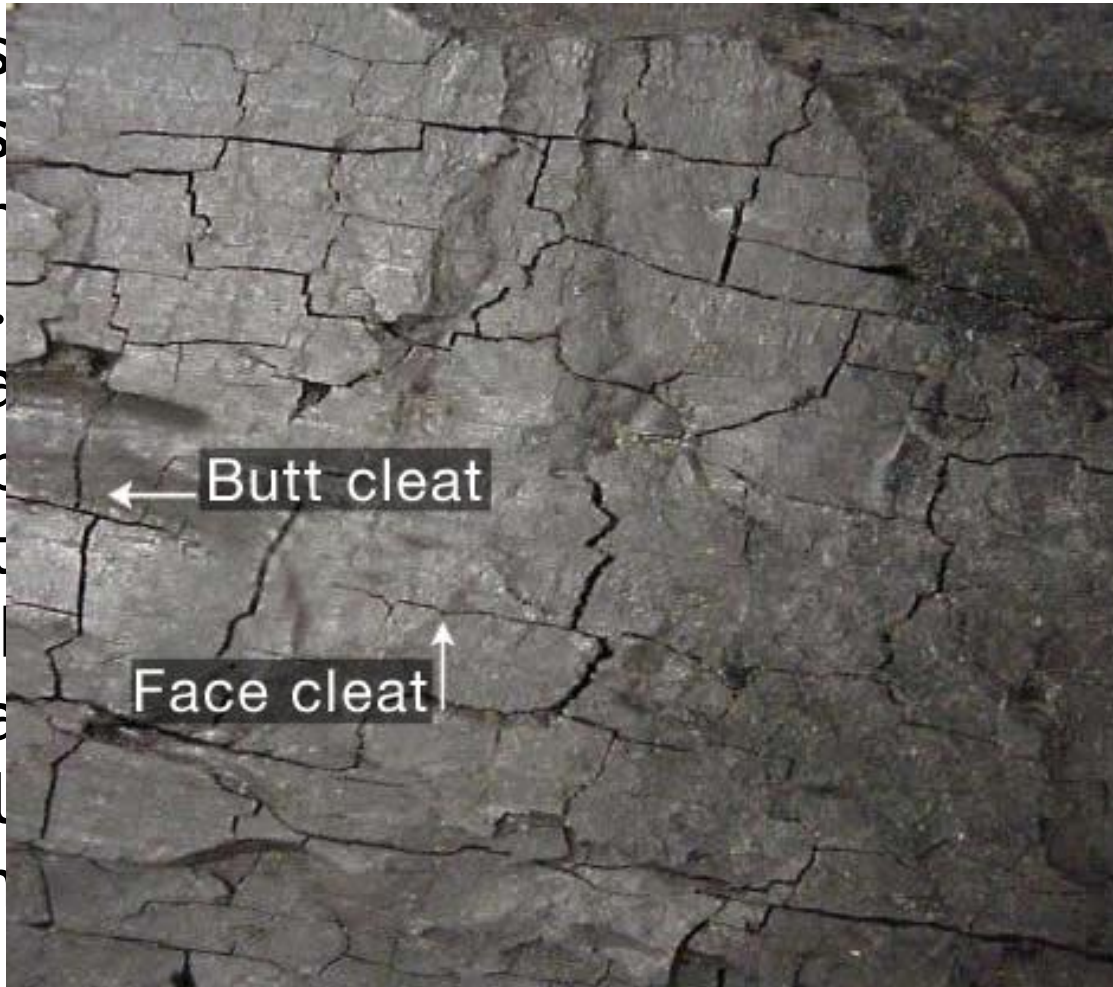
- Research informations
 - 90% of methane is chemically absorbed
 - Nitrogen or carbon-dioxide could be efficient in mobilization,
 - methanol frac fluid can be efficient since it decomposes coal structures

RESEARCH SUMMARY:

- ◉ In the pores of coal 92-98 % of the gas is sorbed, 2-8 % is free gas
- ◉ The coal specific surface is 200-350 m²/g
- ◉ The pore structure of coal consists of 0.4-0.5 nm pores (the methane molecule is 0.42 nm): micropores (10 nm) and mesopores (10-50 nm) ,
- ◉ Characteristic methane content is 50 m³/tonne (Somos L. 1991, Kiss J. 1995), but may reach 150 m³/tonne
- ◉ The gas pressure is 20-100 bar
- ◉ The total porosity is 2-15%

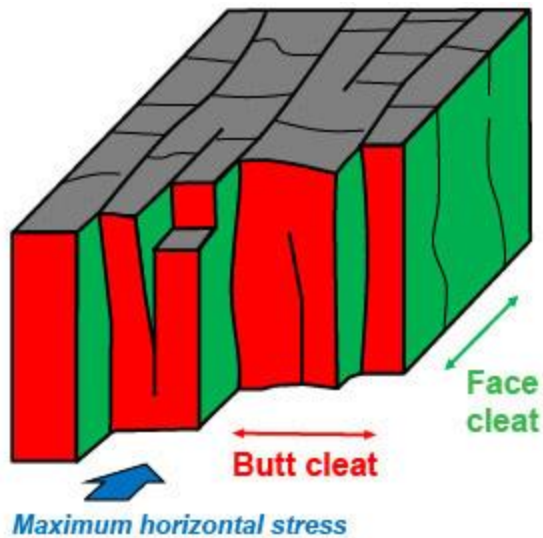
SECONDARY POROSITY - CLEATS

- Coal seam cleats system. face a than b anisot this p increa The fl dependen width



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- Face cleat is parallel with the maximum compressive stress direction during coalification



<https://www.uky.edu/KGS/coal/coal-mining-geology-fracture-cleat-in-coal.php>

COAL RESOURCE:

HGS (2004) coal:

- ⊙ Explored area 50 sq.km,
 - Total area 70 sq.km.
 - Average altitude of surface 300 m asl.
 - 1,6 Bn tonnes coal resource (800 m from the surface),
- ⊙ Unexplored:
 - 3,0-3,3 Bn tonnes (down to 1500 m)

Methane quality:

- Methane in gas: 95%
- Hydrogene content: 0.005%
- Inert gas: 4%
- CO₂: 0.8%
- Heating value: 36000 kJ/kg

VOLUMETRIC ESTIMATES:

1. Kiss J.(1995)

- Prognostic gas resource: 149,600 Bn cu.m
- Area under study: 70 sq.km
- Assumed gas yield: 75 cu.m/tonne

2. Somos L. (1991)

- Studied more than 200 boreholes
- Area under study: 70 sq.km
- The resource:

<i>Coal seam vertical thickness</i>	30 m
<i>Specific density:</i>	1.5 t/cu.m
<i>Specific gas content in place</i>	50 cu.m/t
<i>Recoverable gas content</i>	39 cu.m/t
<i>Gob gas (free gas in mined-out areas):</i>	16 cu.m/t

In place gas may occur only under 300 m asl.

Gob gas mainly between 0 and 300 m asl.

IN-PLACE GAS RESOURCE ESTIMATION RESULTS

- First estimation was made using 38.889 m³/t specific gas yield in virgin coals, and 15.556 m³/t specific gas yield as gob gas.

Az eredeti becslés eredménye:

- In place gas resource : 102,6 Bn cu.m
- Gob gas: 10,2 Bn cu.m

In-place coal and natural gas until 1500 m depth

- In place coal: 3,3 Bn tonnes
- Sorbed and free gas 131,9 Bn cu.m
- GOB gas: 10,6 Bn cu.m
- Total gas: 142,5 Bn cu.m

- Challenges:
 - Complicated structure
 - Unknown cleat system
 - Unknown hydrology
 - Unknown desorption kinetics

RECOVERABLE GAS:

(Recovery factor AFKI = 0.2)

- ◉ Coalbed methane: **26,4 Bn cu.m**
- ◉ Gob gas: **2,1 Bn cu.m**
- ◉ Total gas resource: **28,5 Bn cu.m**

The first 10 conventional Hungarian natural gas occurrences :

1.	Algyő:	12,7 milliárd m ³
2.	Hajdúszoboszló:	1,5 milliárd m ³
3.	Pusztaföldvár:	1,7 milliárd m ³
4.	Üllés:	2,8 milliárd m ³
5.	Szank:	0,7 milliárd m ³
6.	Szeghalom:	0,8 milliárd m ³
7.	Nagykörű:	2,6 milliárd m ³
8.	Mezősas:	3,3 milliárd m ³
9.	Kisújszállás:	0,8 milliárd m ³
10.	Lovászi:	0,2 milliárd m ³
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Total amount:		27,1 milliárd m³

