



Real possibilities of methane capturing and its utilization

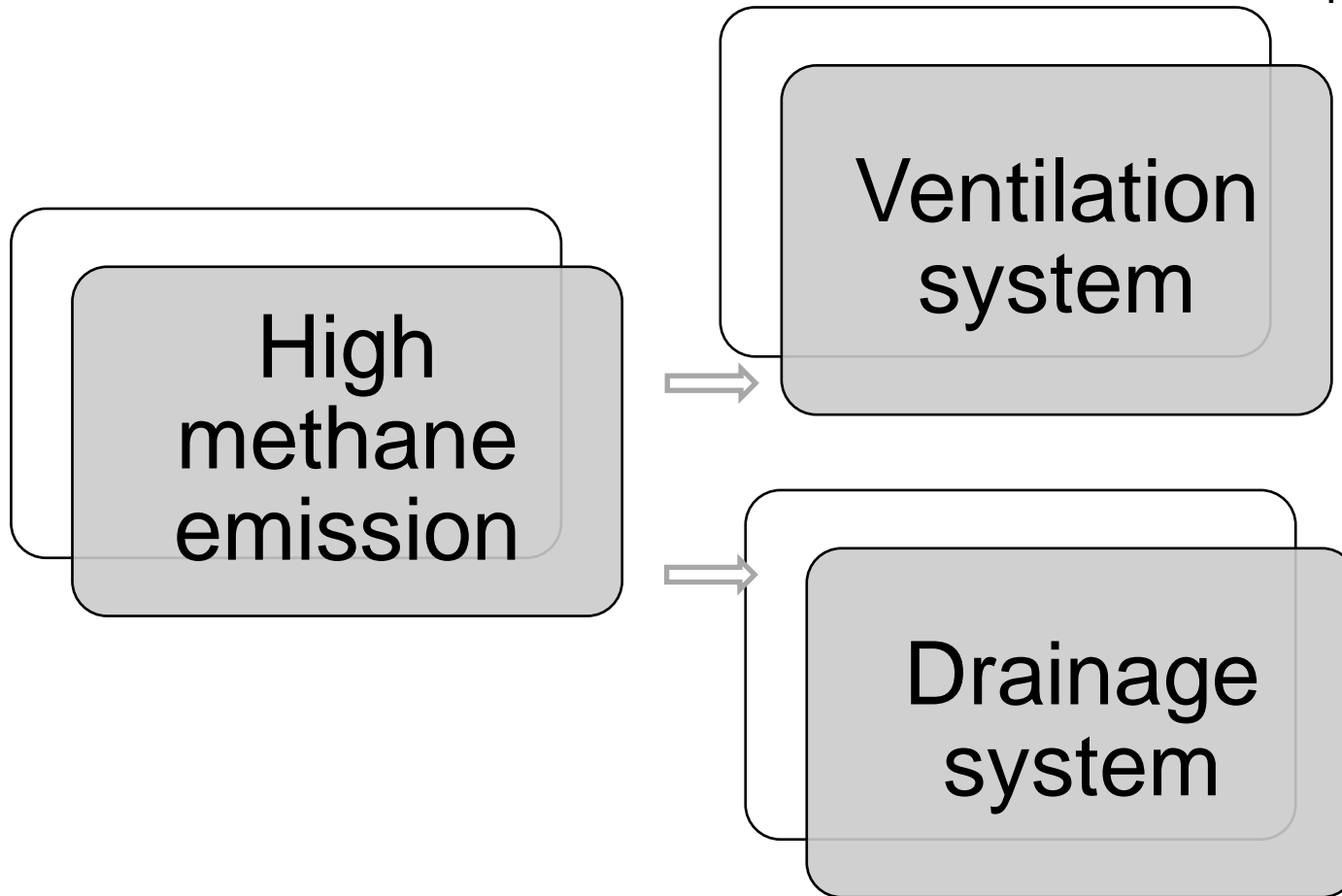
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Methods of reducing high methane emission in to the excavation



The percentage of methane released to the atmosphere - 63%



Drainage efficiency - 37%



The methane hazard in hard coal mines determines the increase in the costs of coal extraction, which is related to the financial outlays incurred for the prevention and combating of this threat.



Significant costs are generated by the necessity to carry out **methane drainage**.



On the other hand, methane captured in methane drainage systems can be an energy carrier that, if properly managed, can cover the costs of capturing and even bring additional profits.

Methane drainage



Methane drainage is carried out for safety reasons or for technological reasons

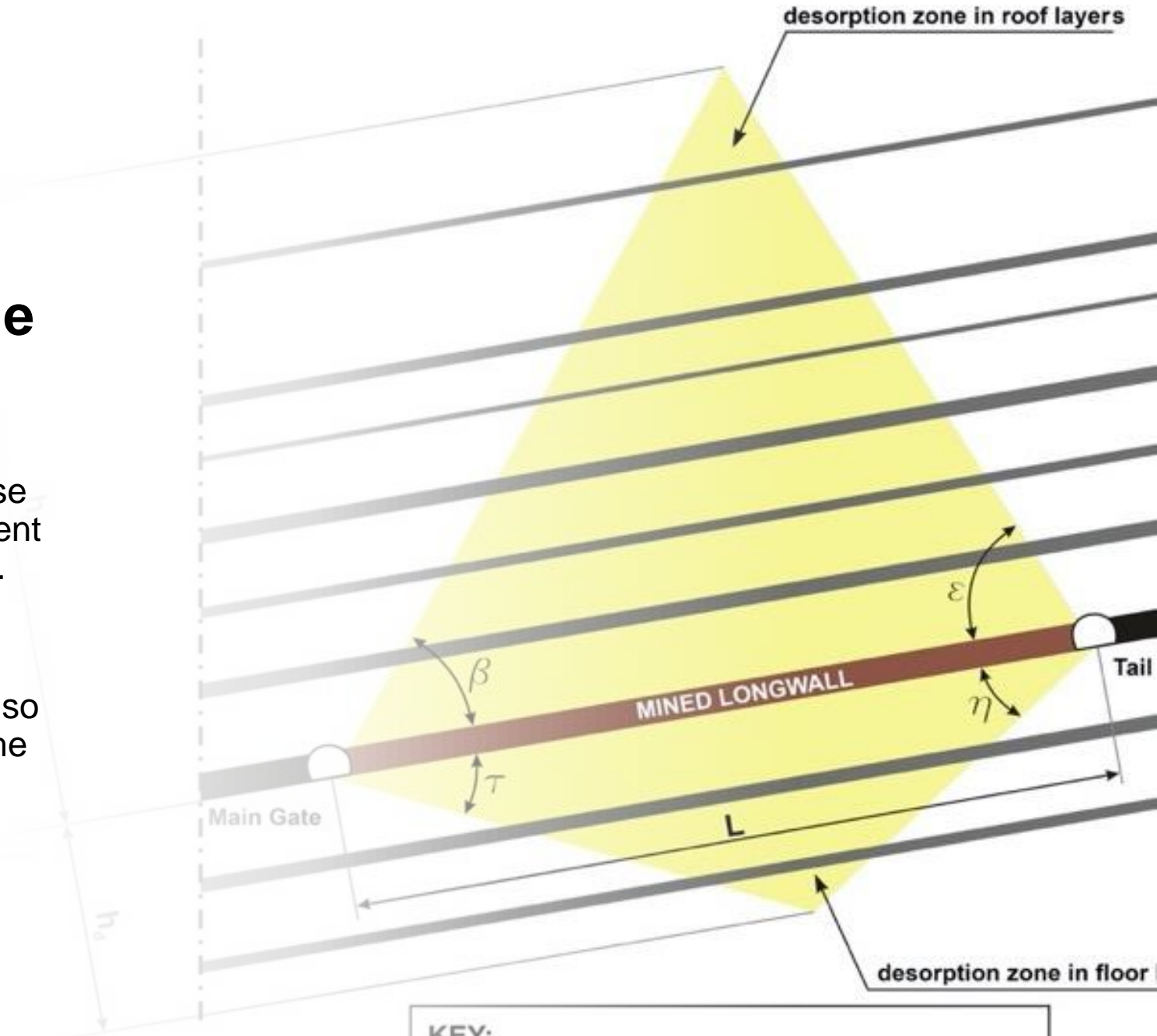


Intake of a part of the methane to the methane drainage system results in lower gas emissions to the mine workings.



The idea of methane drainage

- Typically, the amount of release depends on the original gas content in the seam (methane content).
- The degree of release from individual coal seams depends also on the volume of production in the longwall working.



KEY:

L - longwall length, m

α - slope angle of mined seam, deg

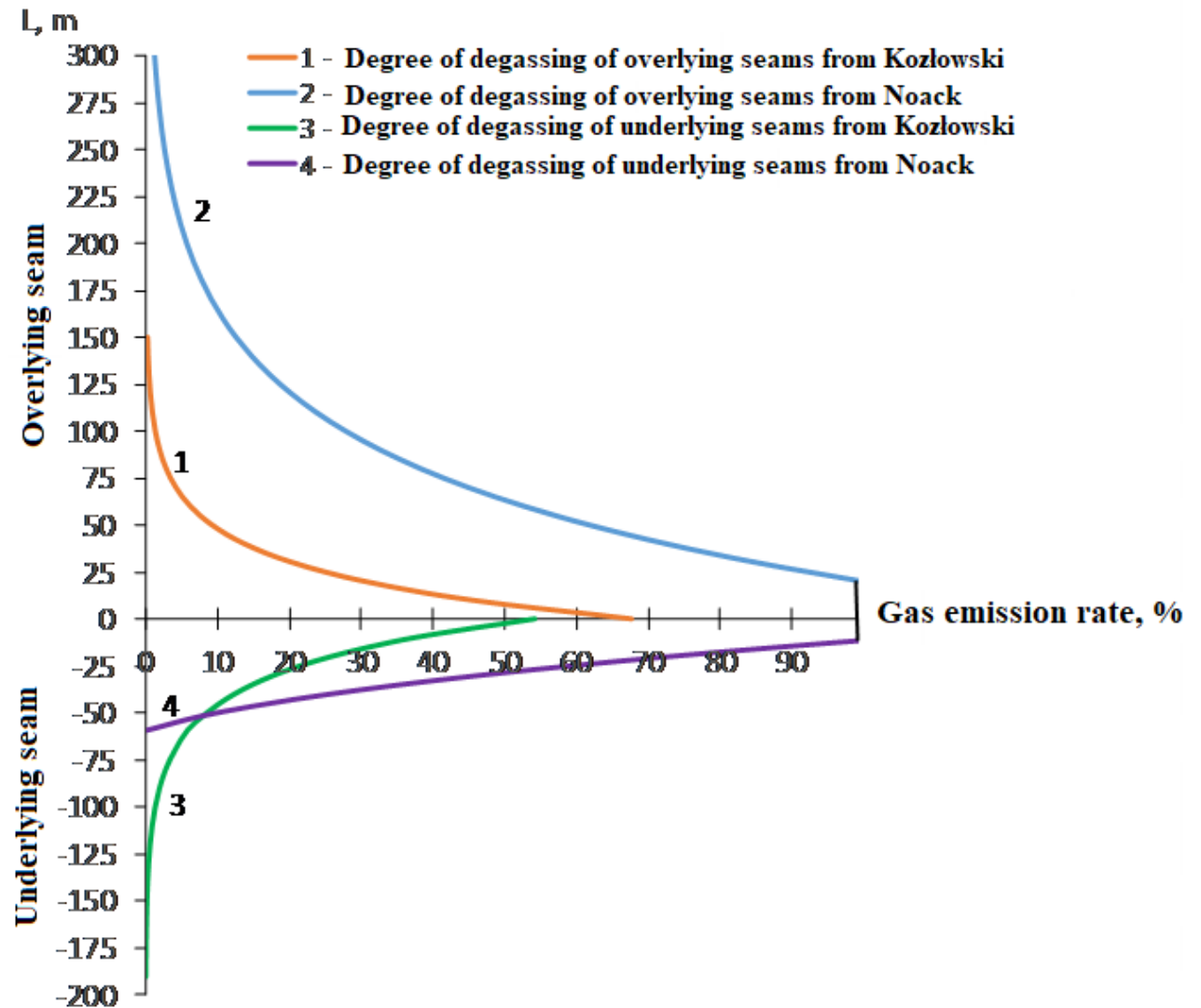
$\beta, \varepsilon, \tau, \eta$ - angles of desorption zone scope, deg

h_0 - desorption zone scope in roof layers, m

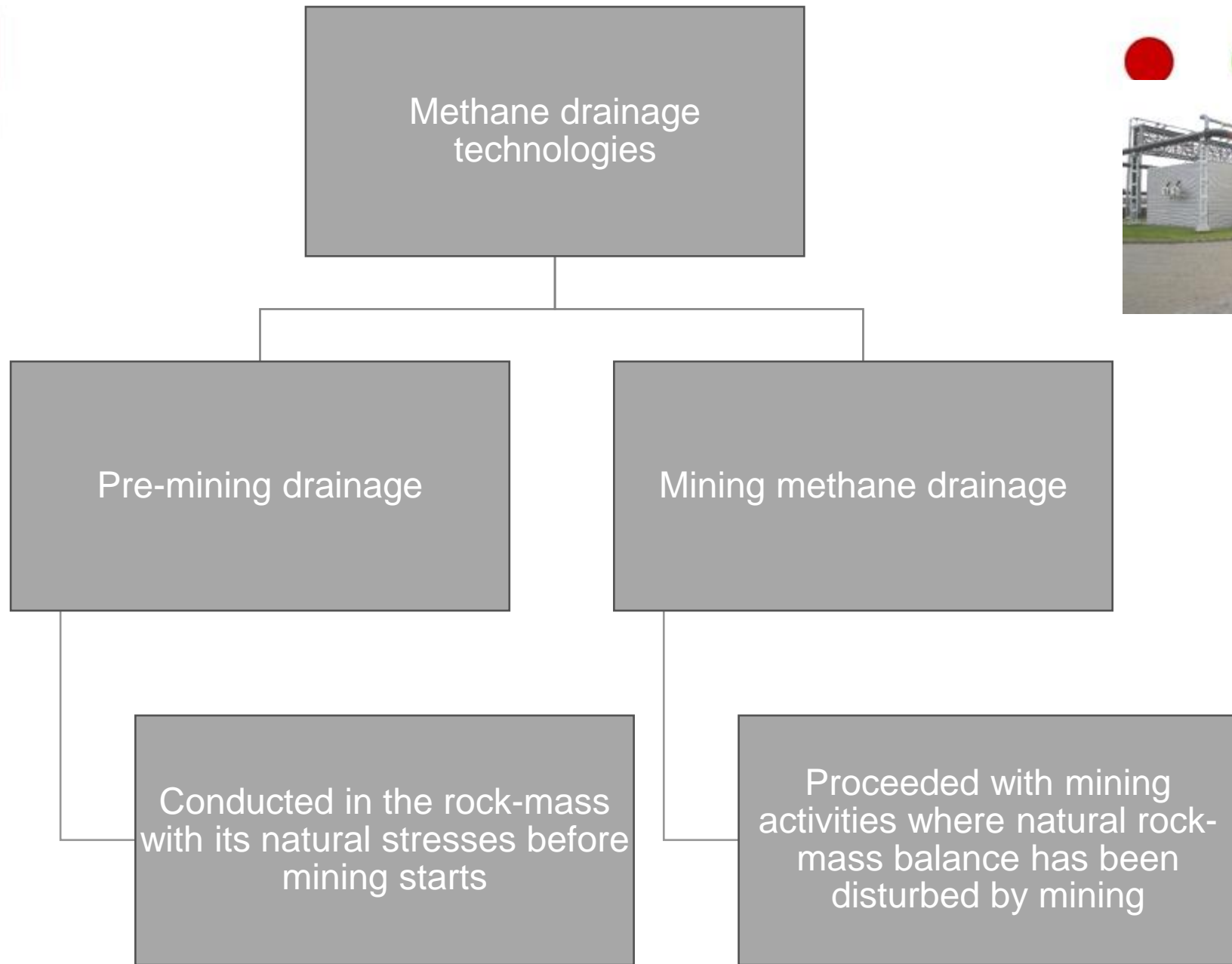
h_d - desorption zone scope in floor layers, m

Degasification curve for seams affected by mining

The mining and geology conditions found in a given coal basin influence the degree of methane drainage of seams disrupted by exploitation

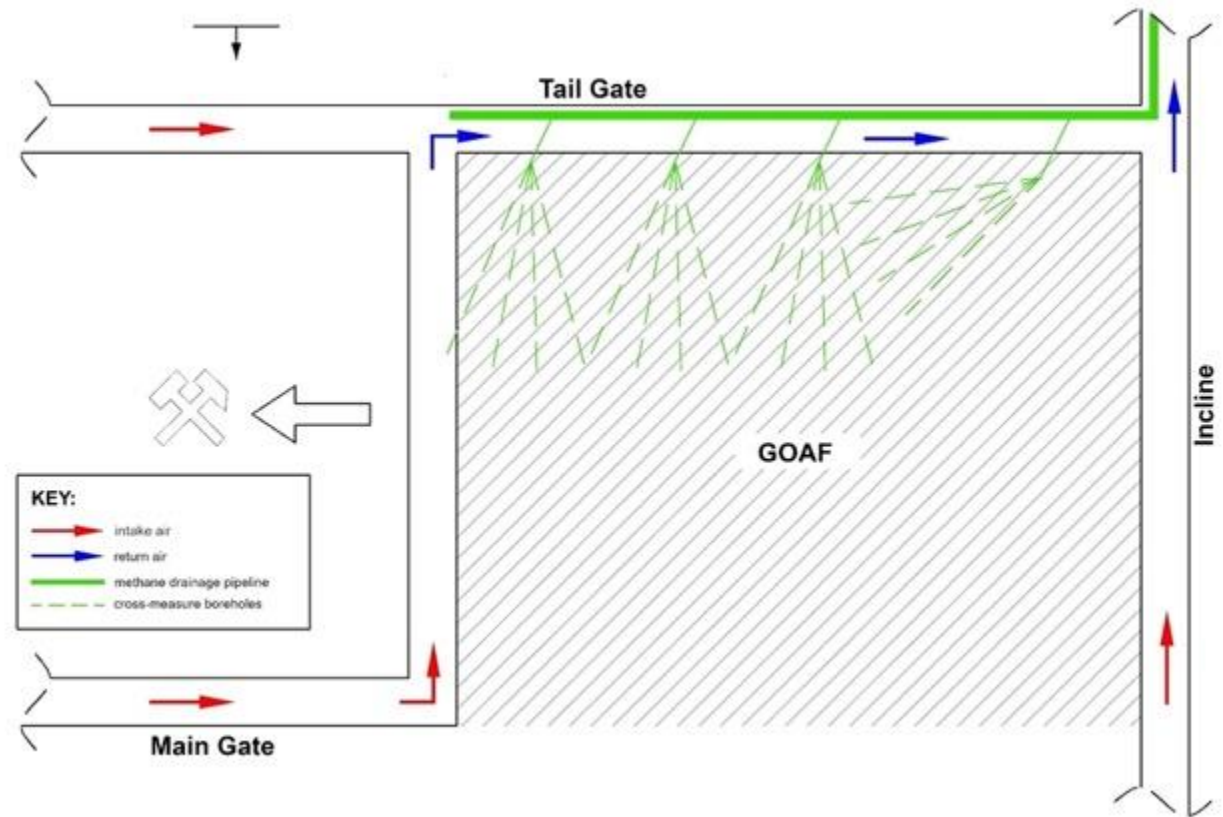


It possible to identify the degree of seam degasification affected by mining, according to Noack (1998) and Kozłowski (1982).



Methane drainage systems used

- The general principle of methane capturing consists of draining it from the rock-mass and isolated goafs through specially designed boreholes.
- Then the gas is discharged via a separate pipeline network on the surface, using the low pressure generated in a methane drainage station.





Average drainage efficiency of mining excavations

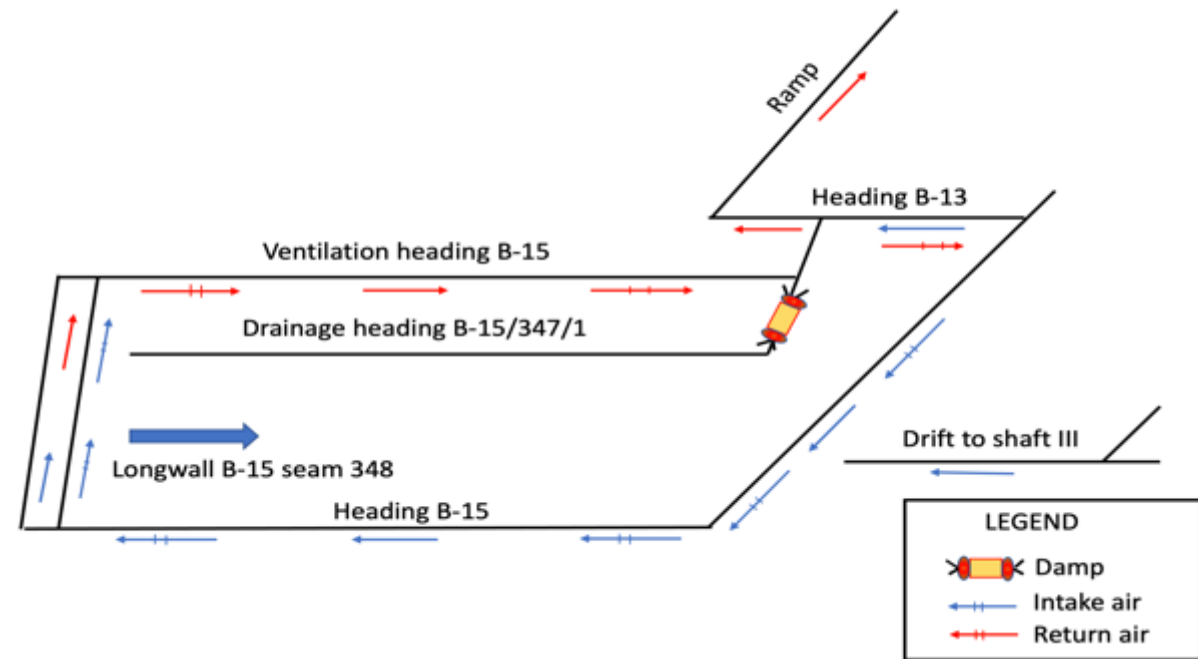


Breakdown	Total absolute methane- bearing capacity around longwall mining panel, m ³ CH ₄ /min									Average drainage efficiency, %
	<10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	>80	
Longwall panels with U ventilation system	38.5	39.0	40.6	38,3	48.8	64.0	-	-	-	41.2
Longwall panels with the Y ventilation system	33.8	43.7	52.4	56.1	49.9	46.2	57.9	-	-	48.7
Longwall panels with parallel tailgates	-	-	58.0	60.1	62.2	64.2	64.5	68.3	71.5	63.9
Longwall panels with the overlying drainage gallery	49.0	58.6	60.2	62.6	68.4	64.7	68.6	68.8	76.0	63.4

We can capture approximately 48.16 m³/min, which still gives us VAM at the level of 21.84 m³/min.



Example of methane drainage



Seam	Forecasted methane release, m ³ /min	Output Mg/d	Face adva m/d
S-1 (do 100m)	60.22	2200	3.1
S-2 (100 – 200m)	59.38	1800	2.5
S-3 (200 – 300m)	59.38	1800	2.5
S-4 (300 – 400m)	59.38	1800	2.5
S-5 (400 – 500m)	61.22	2200	3.1
S-6 (500 – 600m)	60.22	2200	3.1
S-7 (600 – 700m)	60.02	2500	3.5
S-8 (700 – 800m)	60.98	2800	3.9
S-9 (800 – 900m)	60.16	2700	3.8
S-10 (900 – 1000m)	60.94	2700	3.8
S-11 (1000 – 1050m)	61.16	2700	3.8

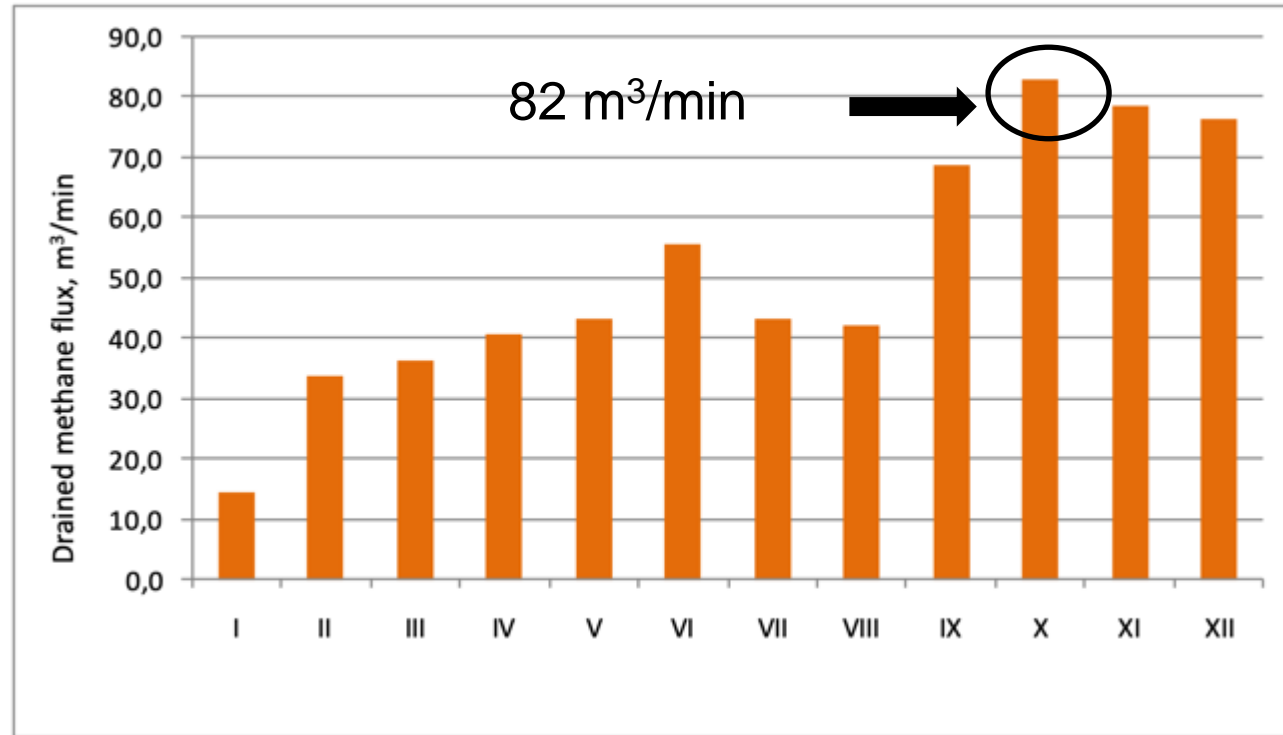


Example of methane drainage

The designed ventilation system for the discussed longwall with methane drainage provided for the capture of 70% of the forecasted methane release, i.e., about 40 m³/min.



VAM around 17.3 m³/min



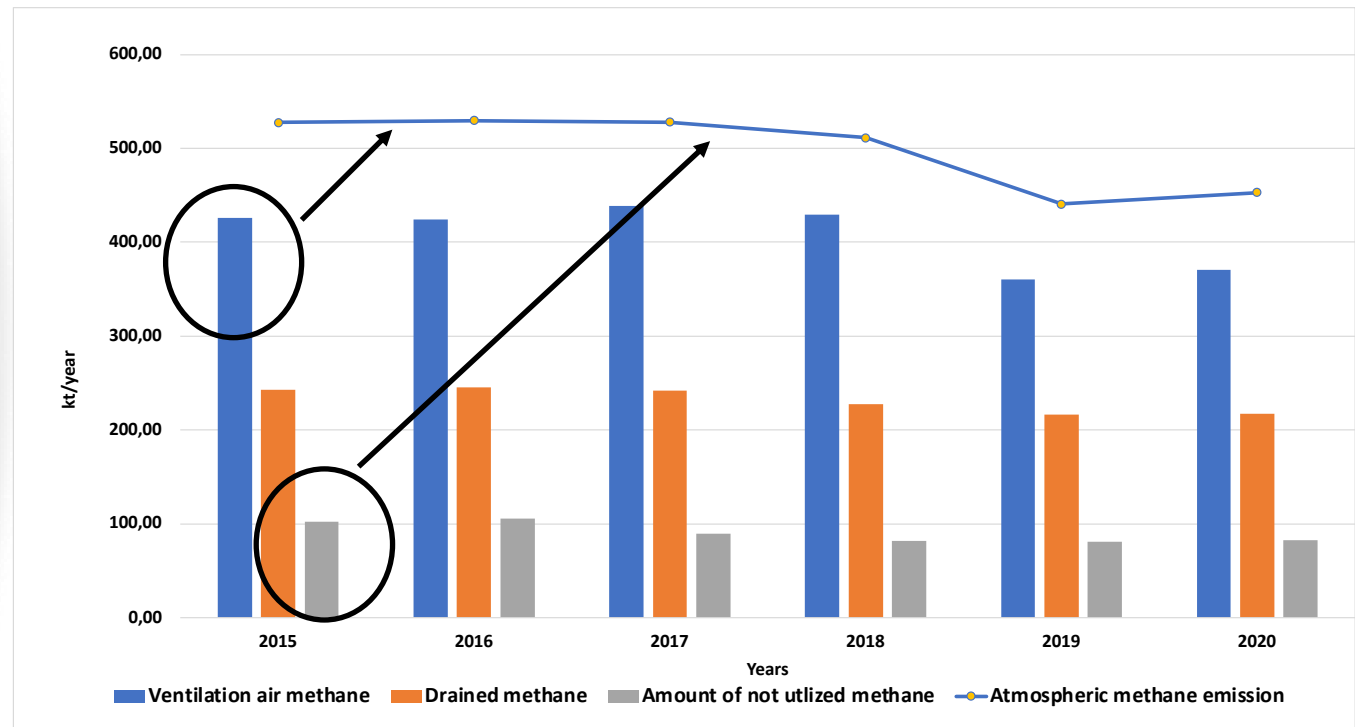
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State of methane emissions in Poland

In 2020, 819.62 million m³ of methane was released from the rock mass affected by mining,

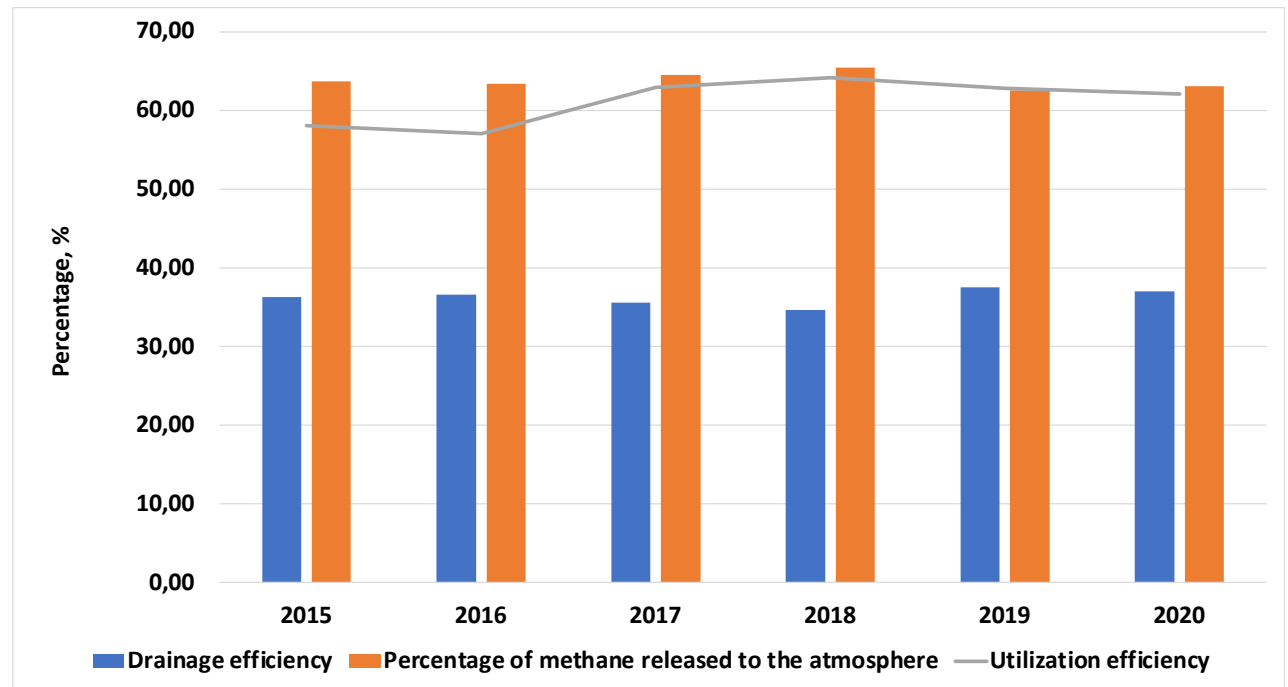
On the average it equals
1530.9 m³/min.

In 2015–2020, this amount per tonne of coal extracted (relative methane capacity) fluctuated between 12.9 and 15 m³.

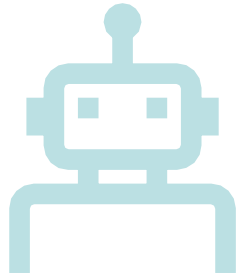


State of methane emissions in Poland

If the amount of undeveloped methane was included in the calculations, the percentage of methane released into the atmosphere would amount to 77%.



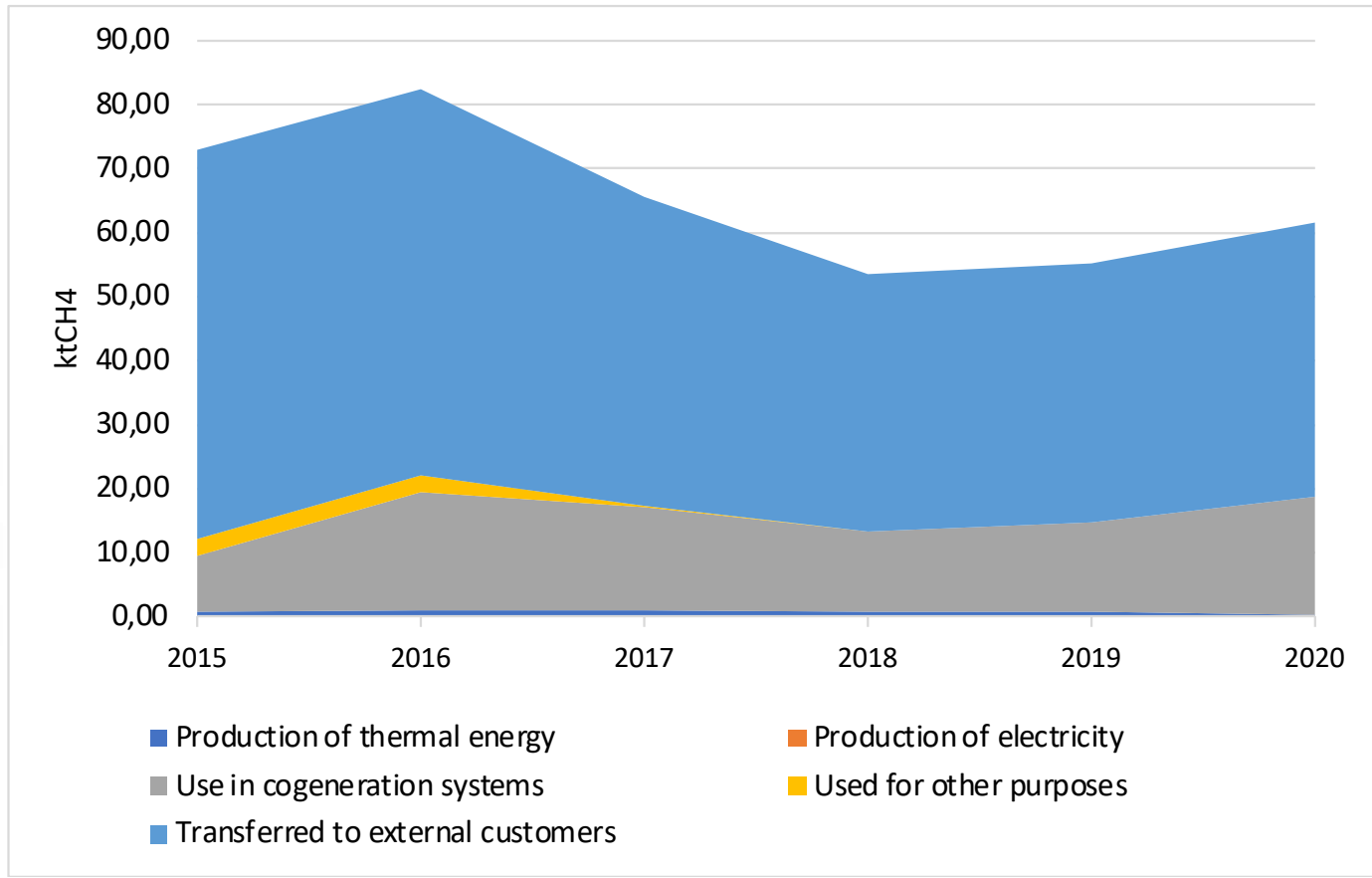
Methane utilization



Captured methane may be a full-fledged fuel used in various technological solutions.

- Energy use:
 - heat production (heating and technological needs),
 - electricity production,
 - combined systems (generation of electricity, heat, cold),

Utilization of methane at JSW S.A. from 2015 to 2020



- Gas transmission to external recipients.
- Production of network gas.
- Gas liquefaction.



The effects of drained methane utilization

Increase in methane utilization for energy production in high-efficiency cogeneration systems, in 2019

allowed its **atmospheric emissions** to be reduced by approx. 76.9 million m³ (approx. 3% more compared to 2018).

The effects of drained methane utilization

- It is assumed that pro-ecological activities will reduce methane emissions to the atmosphere by 80 million m^3 of CH_4 , which gives about 1.6 million MgCO_2eq .
- By 2025 investments implemented by the JSW S.A. will allow using the entire drained methane economically.





Technical possibilities of using VAM technologies



Methane bearing
capacity
190m³/min

Drained
methane 65
m³/min

VAM
125 m³/min



Technical possibilities of using VAM technologies



VAM
125 m³/min

Air flux 50000
m³/min

Methane
concentration at
the level of 0,1-
0,4 %



Technical possibilities of using VAM technologies



VAM technologies

Real ventilation shaft

