XXX Międzynarodowa Konferencja Naukowo-Techniczna Górnicze Zagrożenia Naturalne

Advanced methane drainage strategy employing underground directional drilling technology for major risk prevention and greenhouse gases emission mitigation

<u>DD-MET Closure Session</u>

Challenges of reducing methane emissions from mines in terms of climate protection - alternative methods of methane capture

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methane - a threat to the environment and mininig industry

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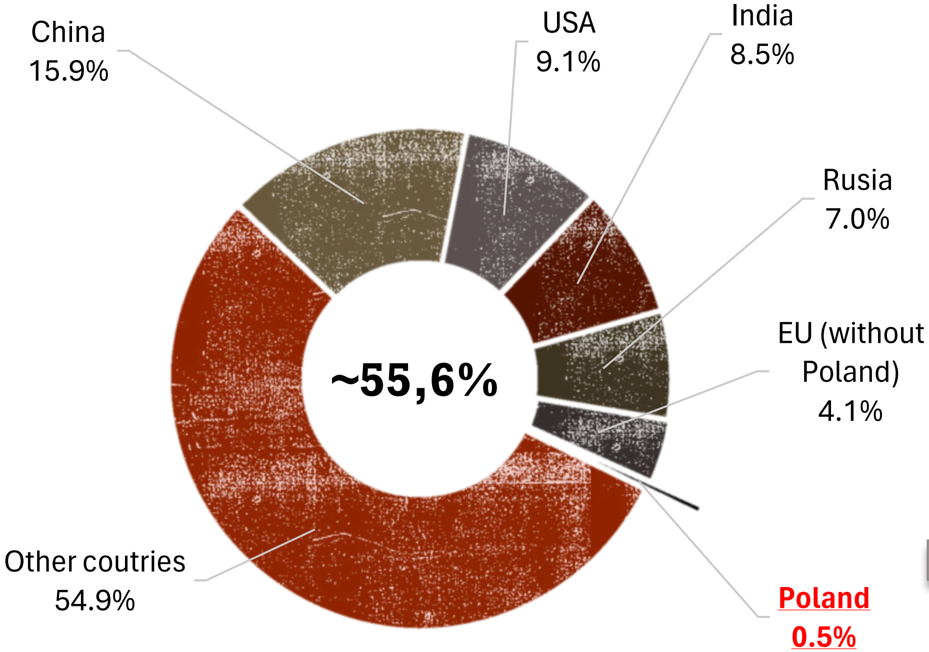
~630 mil kt
Global emission

~350 mil kt
Anthropogenic emissions

~280 mil kt
Natural source emissions

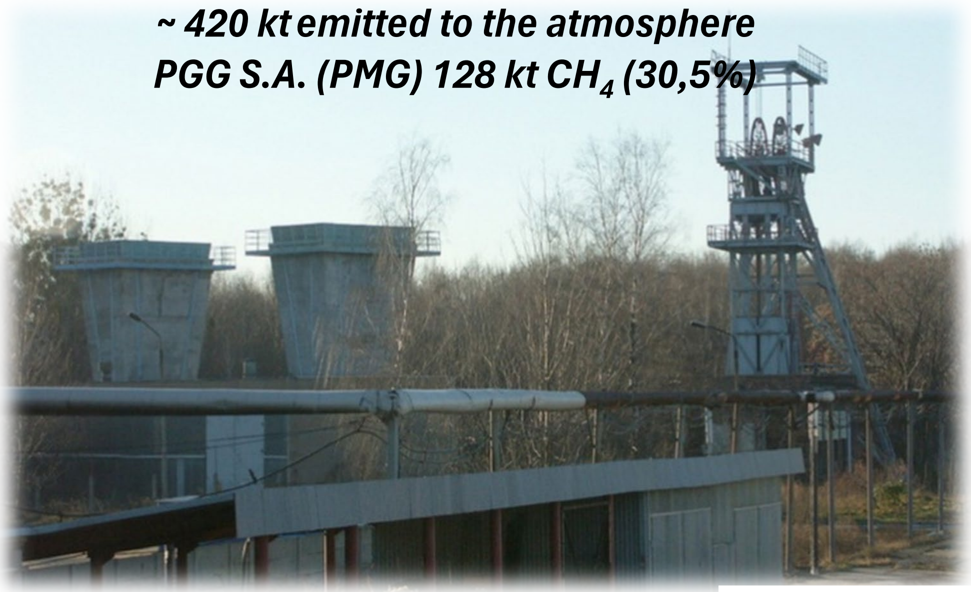
methane GWP – x 28 CO_2 (age period) or x 86 CO_2 in short time (20 yers period)

anthropogenic emissions pie chart



Source.: IEA

Polish mining sector (hard coal only) ~0,1%
(data for 2022)



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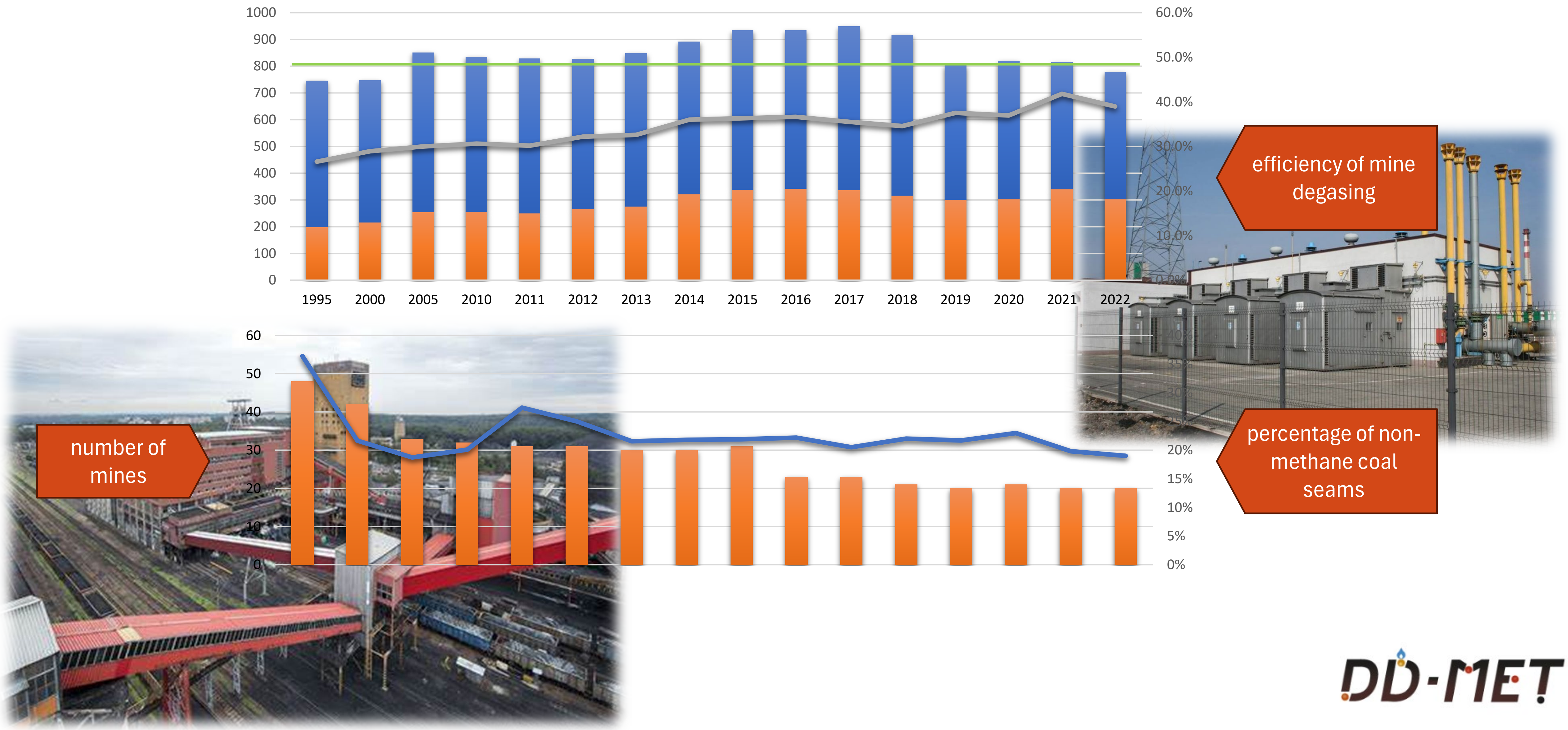
amount of methane captured and the efficiency of mine degasing



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challenges vs. main problems for mining sector

major objectives

- reducing GHG emissions
- improve safety against methane

other objectives

- reducing costs
- increase in gas volume

PE regulation

- trying to meet the methane emission requirements

improve and develop degasing system

$$\boldsymbol{Methane\ volume = f(r, n, p, \Delta p, m, t, \ldots, A, D)}$$

Technical parameters, acccountable parameters ($r, n, p, \Delta p, m, t, \ldots$)

Non-technical parameters (experience, knowledge) (A, D)

The choice of design tools, drainage system, experience and knowledge is the challenge, not the rock mass.

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being processed EU regulation on methane emissions reduction in the energy sector possible scenarios (main problems for mining sector)

➲ *Drainage stations (ordinary operation)* ➘

ban on venting and flaring	*ban on venting only (flaring is possible)*

➲ *Coal mines – exhaust shafts* ➘

ventilation emission limit of 0.5t/kt for each mine from 2027	*ventilation emission limit of 5t/kt per a mine operator from 2027 and 3t/kt from 2031*

opportunities

- increase safety
- increase coal productivity
- extra gas for energy
- climate protection

risks

- increase expenses
- faster phase-out path
- social problems

real effectiveness of coal face methane capture and challanges for mining sector

Vent system	Methane capture eficiency, %									
Methane bearing capacity, cu. m	up to 10	10 – 20	20 – 30	30 – 40	40 – 50	50 - 60	60 – 70	70 – 80	above 80	**average**
U	38,5	39,0	40,6	38,3	48,8	64,0	-	-	-	**41,2**
Y	33,8	43,7	52,4	56,1	49,9	46,2	57,9	-	-	**48,7**
U with drainage gate	-	-	58,0	60,1	62,2	64,2	64,5	68,3	71,5	**63,9**
Y – parallel gate	49,0	58,6	60,2	62,6	68,4	64,7	68,6	68,8	76,0	**63,4**

Source: N.Szlązak, J.Swolkień, AGH

requirements:

- ➦ increasing the efficiency of methane capture for the U and Y ventilation systems
- ➦ reduce methane emissions to the workings environment

obstacles:

- ➦ limited possibility of increasing the number of drainage wells
- ➦ geological conditions

possible solutions:

- ➦ shorter longwall lengths
- ➦ limitation of coal production
- ➦ **use of alternative possibilities - LRDD wells – objective goal of project**

LRDD - what benefits may it offer?

economic aspect

- possibility of replacing a drainage pit or reducing the cost of degasing
- increase the concentration of captured gas
- increase the total volume of captured gas
- increse productivity (coal output)

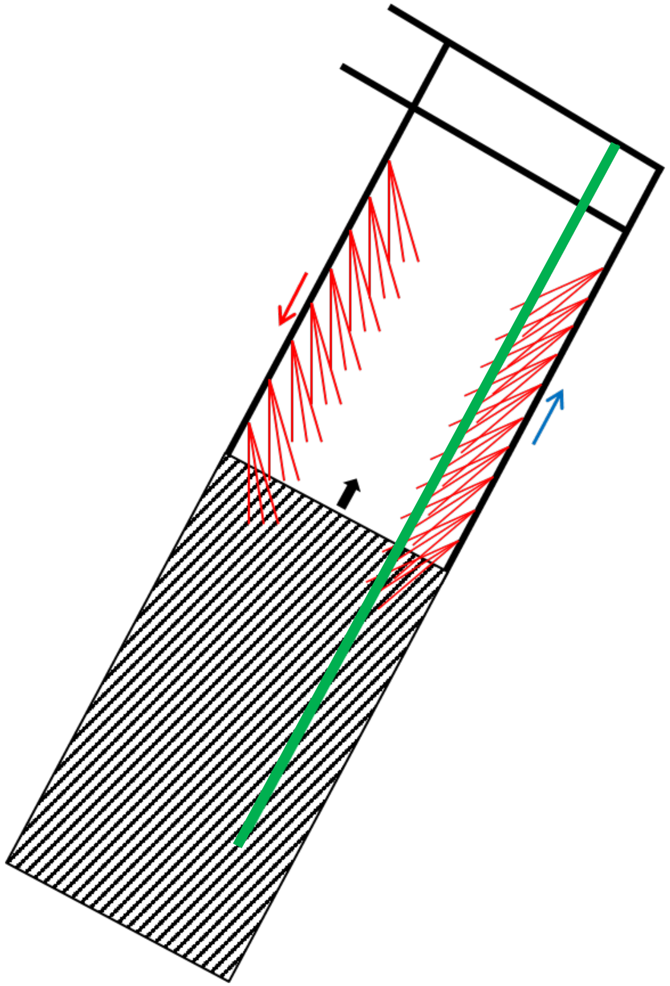
safety aspect

- stable methane capture volume,
- reduction of venting methane content venting in working areas
- reducing the negative impact of methane on the environment

technical aspect

- gathering experience and drawing practical conclusions for using LRDD wells
- development of technology
- simplifying the drilling operation
- possibility to reach areas (goafs) which cannot be reached by workings or simple boreholes

praktical application of LRDD wells – study case nº 1

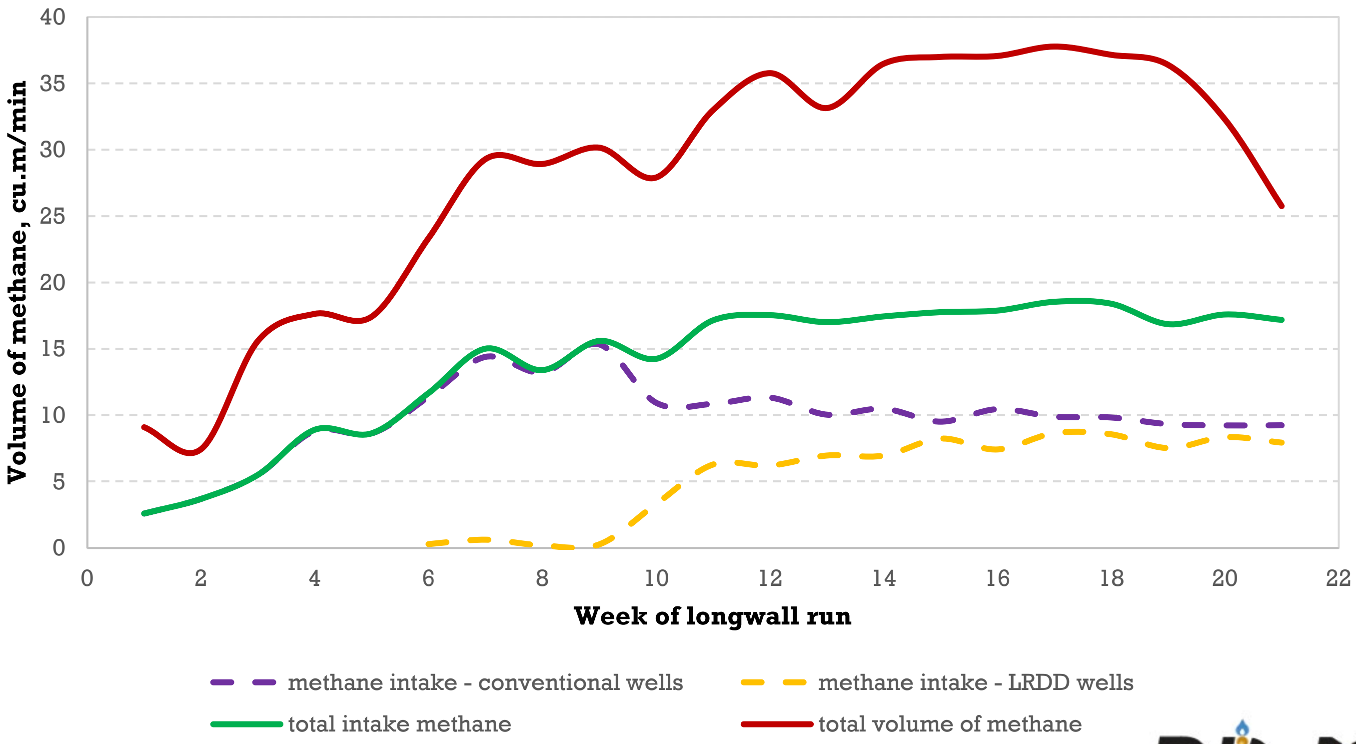


During longwall operation

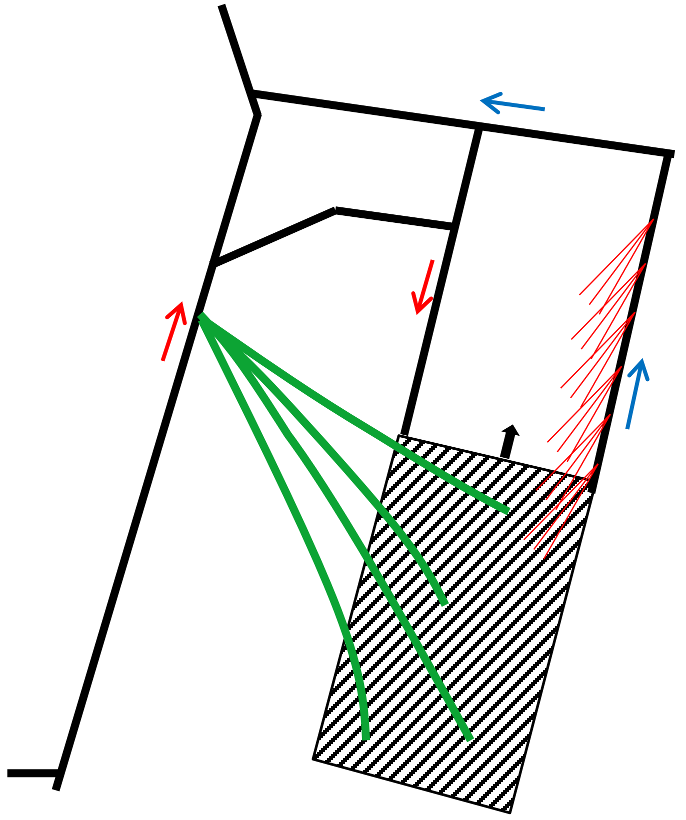
- average methane intake - ca. 430 m³/h
- maximum methane intake - ca. 580 m³/h
- methane concentration - up to 96%
- total methane volume intake - ca. 1,3 mil m³
- no. of working wells – only 1
- distance between wells and seam's roof - ca. 43 m

End-of-life operation

- average methane intake - ca. 190 m³/h
- methane volume intake - ca. 2,2 mil m³
- methane concentration – up to 86%
- time life – 20 months



praktical application of LRDD wells – study case nº 2

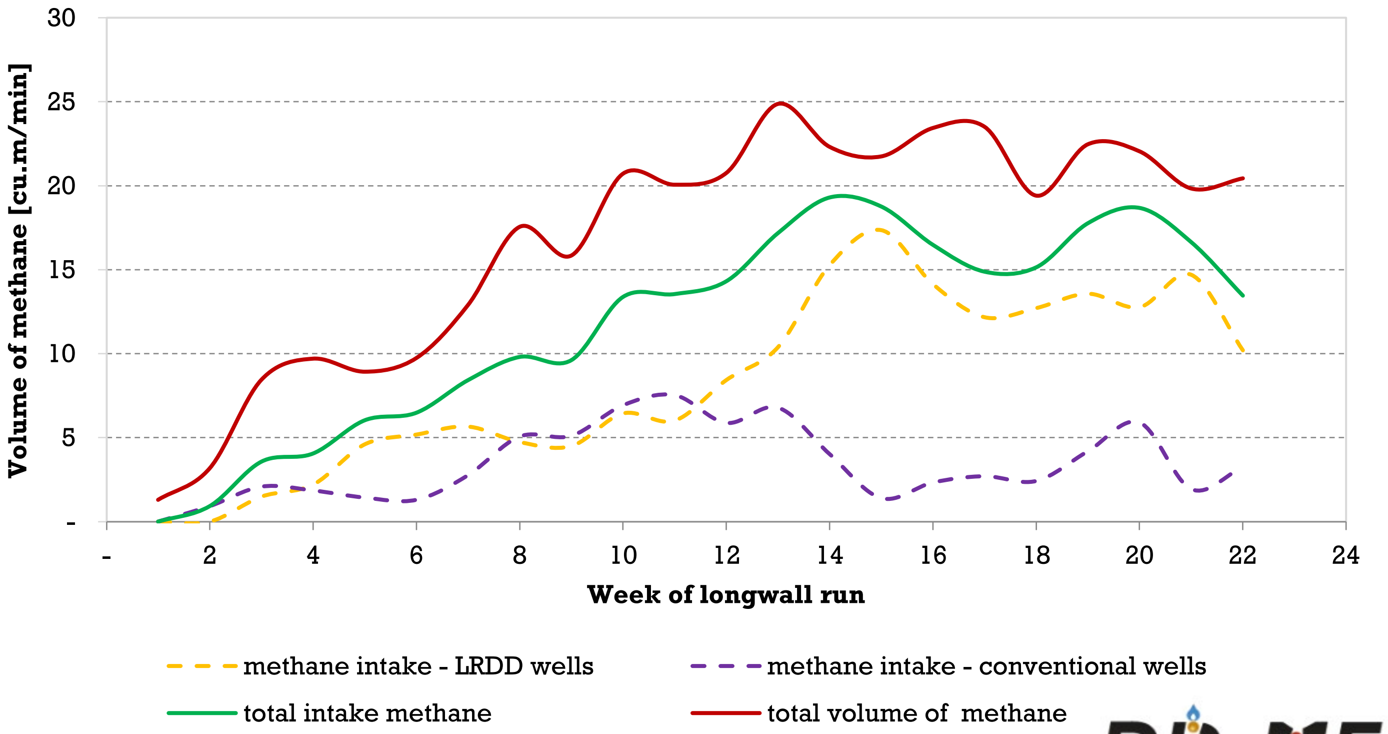


During longwall operation

- average methane intake - ca. 810 m³/h
- maximum methane intake - ca. 1 020 m³/h
- methane concentration - up to 90%
- total methane volume intake - ca. 1,8 mil m³
- no. of working wells - 3 to 4 at once
- distance between wells and seam's roof - ca. 20-35 m

End-of-life operation

- average methane intake - ca. 180 m³/h
- methane volume intake - ca. 1.5 mil m³
- methane concentration – up to 78%
- time life – 11 month
- after running next longwall - wells are still produductive



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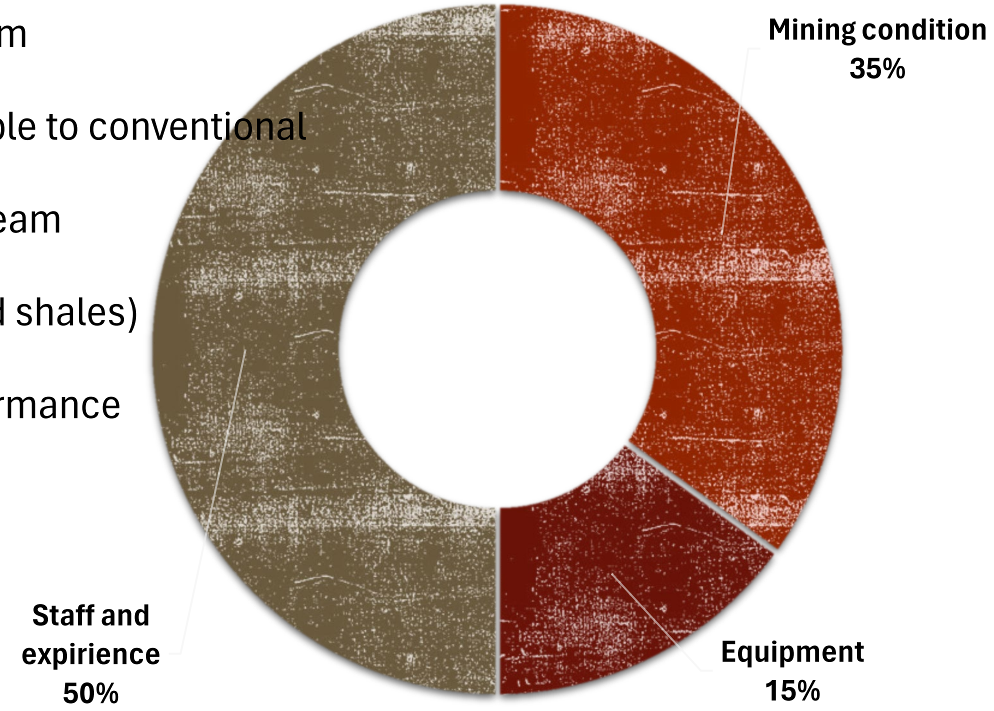
conclusions and advantage / disadvantage of directional wells

- low-effective method compared to drainage well - average level of intake is ca. 5–7 m^3/min
- ensures high concentration of methane – up to 96%
- method not used alone for methane drainage system
- allow to obtain at least 20 to 30% more methane than a typical drainage system
- LRDD wells are cheaper than typical drainage gate (6 – 7 times) and comparable to conventional
- can be the only economically viable method when there is no an upper coal seam
- probably an alternative to drainage galleries in strong rocks (sandstones, sand shales)
- geometric wells arrangement (parallel, fan-shape, others) influence the performance and operating time of holes
- a single LRDD wells cannot replace a drainage gate
- pie chart shows excellence and confidence in success of LRDD+



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Thank you for your attention