

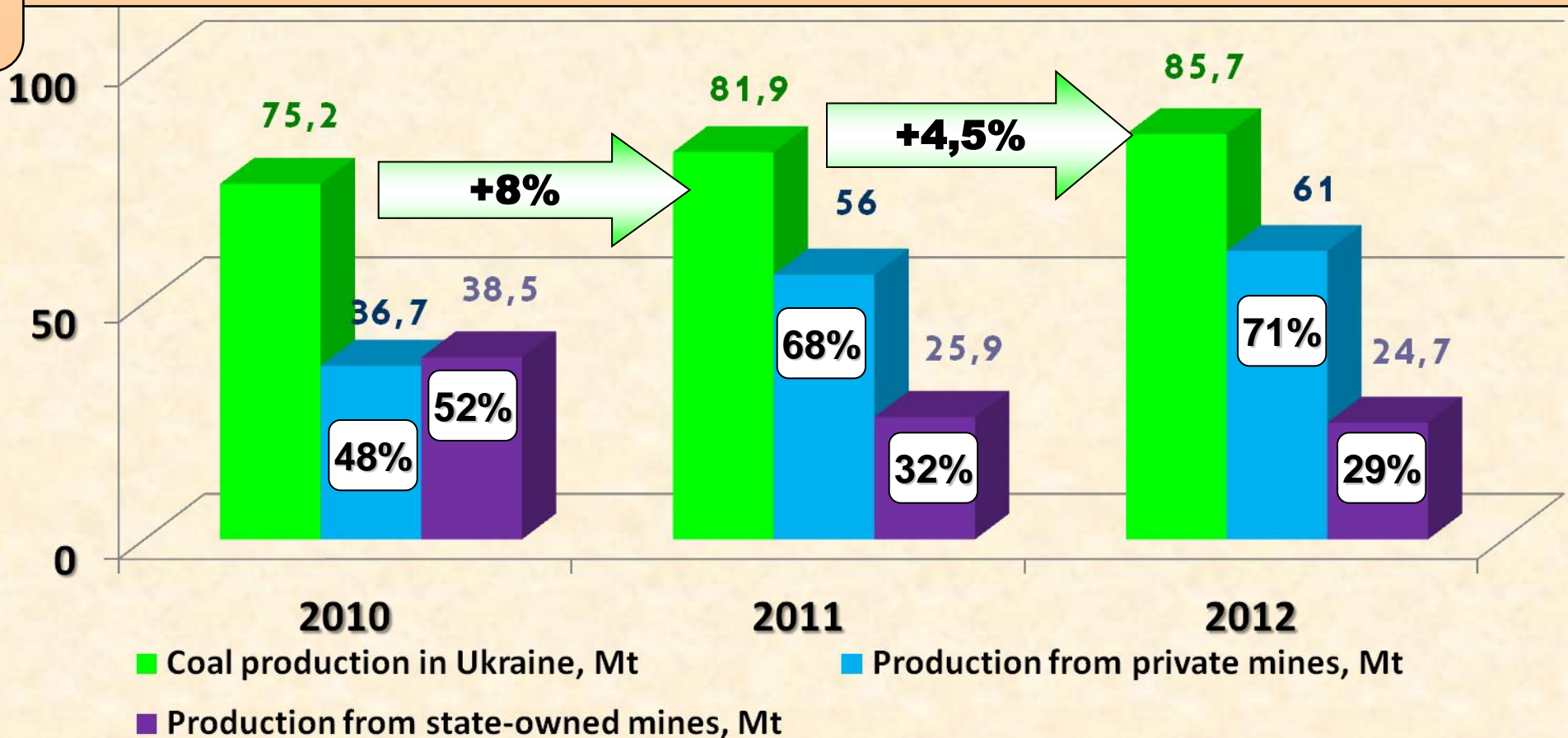
**STATE POLICY OF UKRAINE
IN CAPTURING AND UTILIZING
COAL MINE METHANE**

IGOR YASHCHENKO

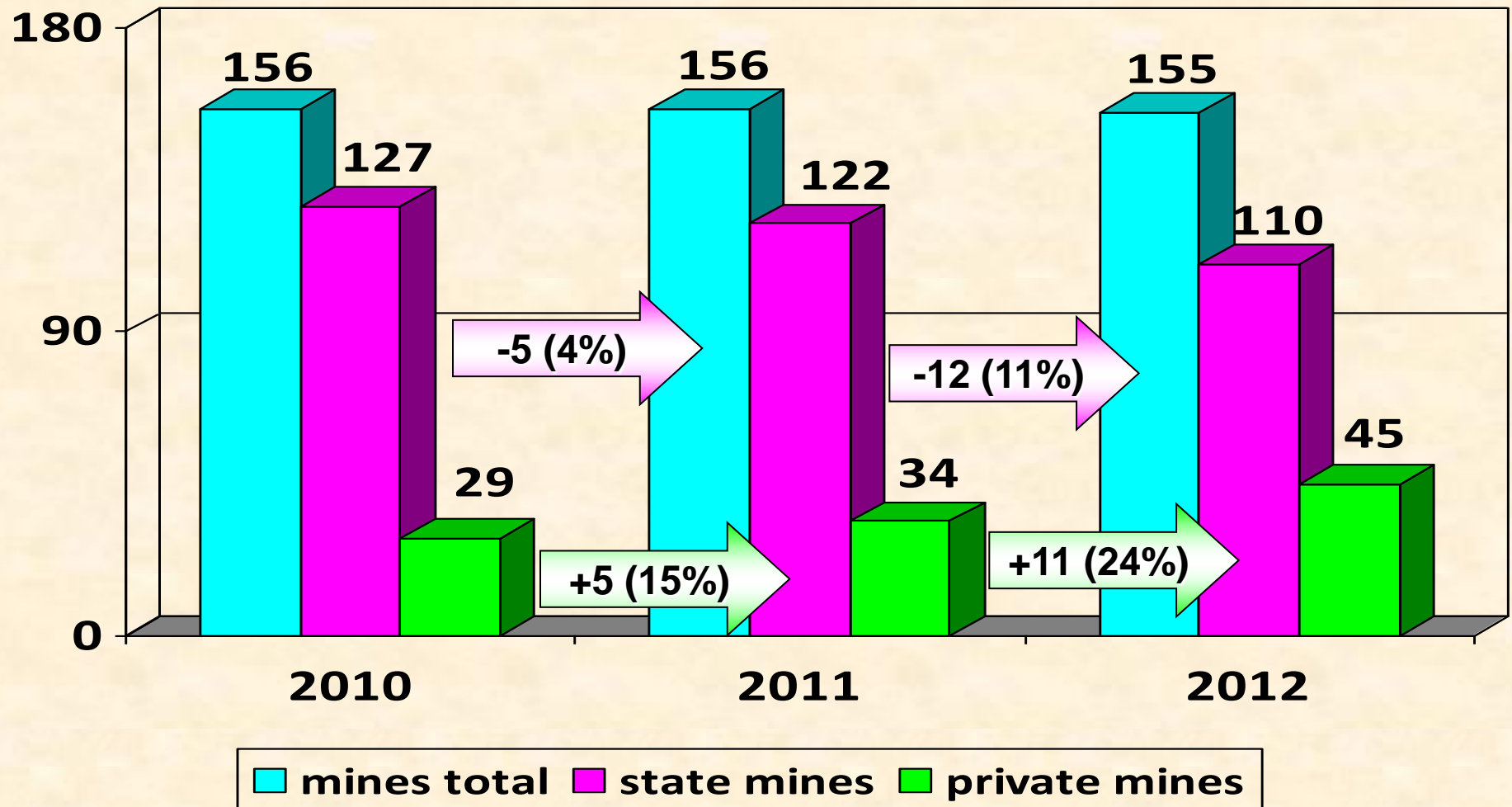
MINISTRY OF ENERGY AND COAL INDUSTRY OF UKRAINE

Coal production from Ukrainian mines has grown steadily over the recent years. In 2012 level of production totaled 85.7Mt. Production from the mines which are not owned by the state is increasing with each year and now accounts for 71% in total coal production balance, while that from state-owned mines – for 29%

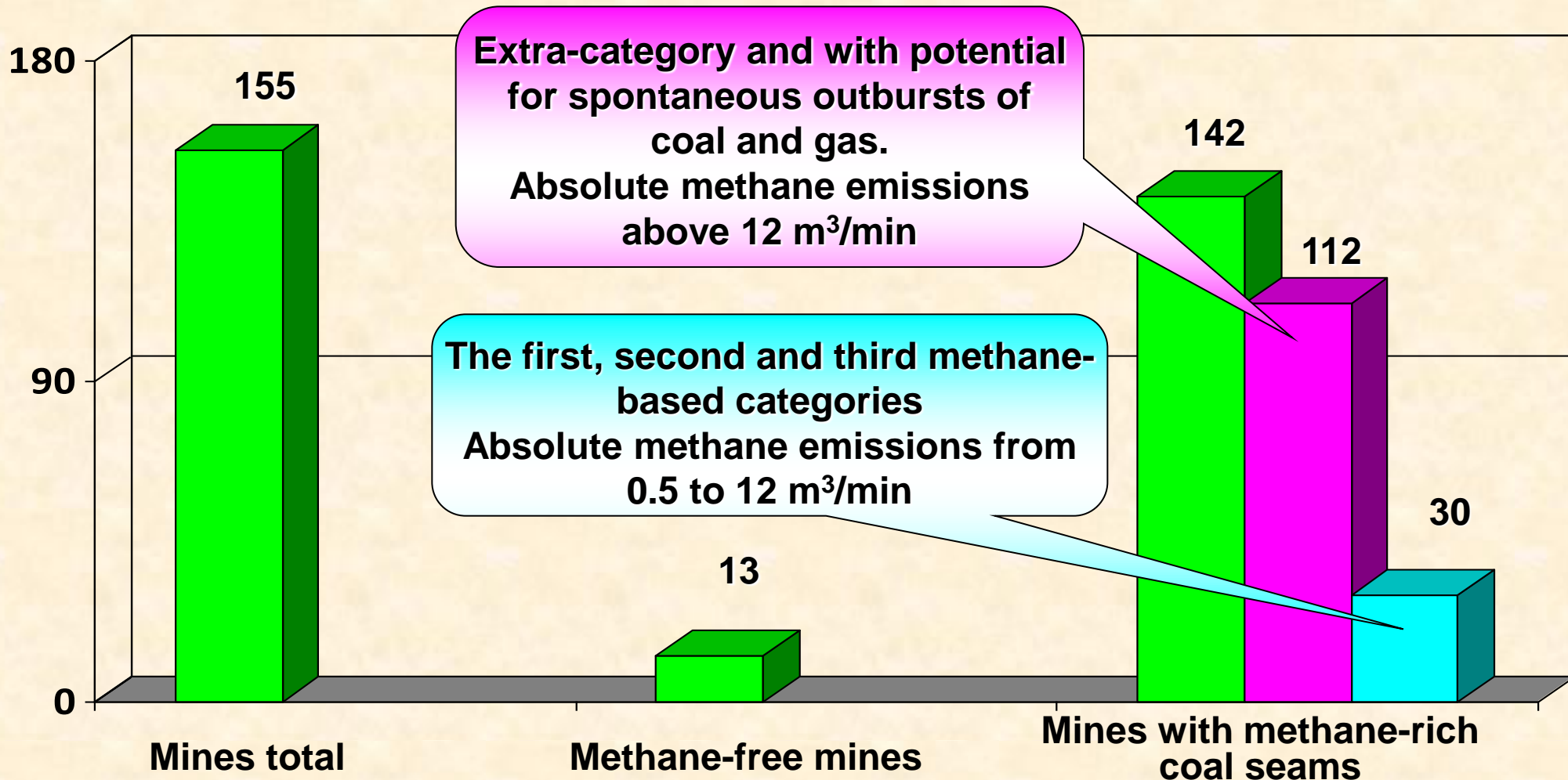
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Within the framework of the Energy Strategy of Ukraine, the coal industry development programme until 2030 foresees further decrease of state ownership of coal mines with their transfer to leasing, concession or private ownership. Thus, over the last two years the number of private mines grew by 55% (from 29 to 45), and of state ones reduced by 15% (from 127 to 110).

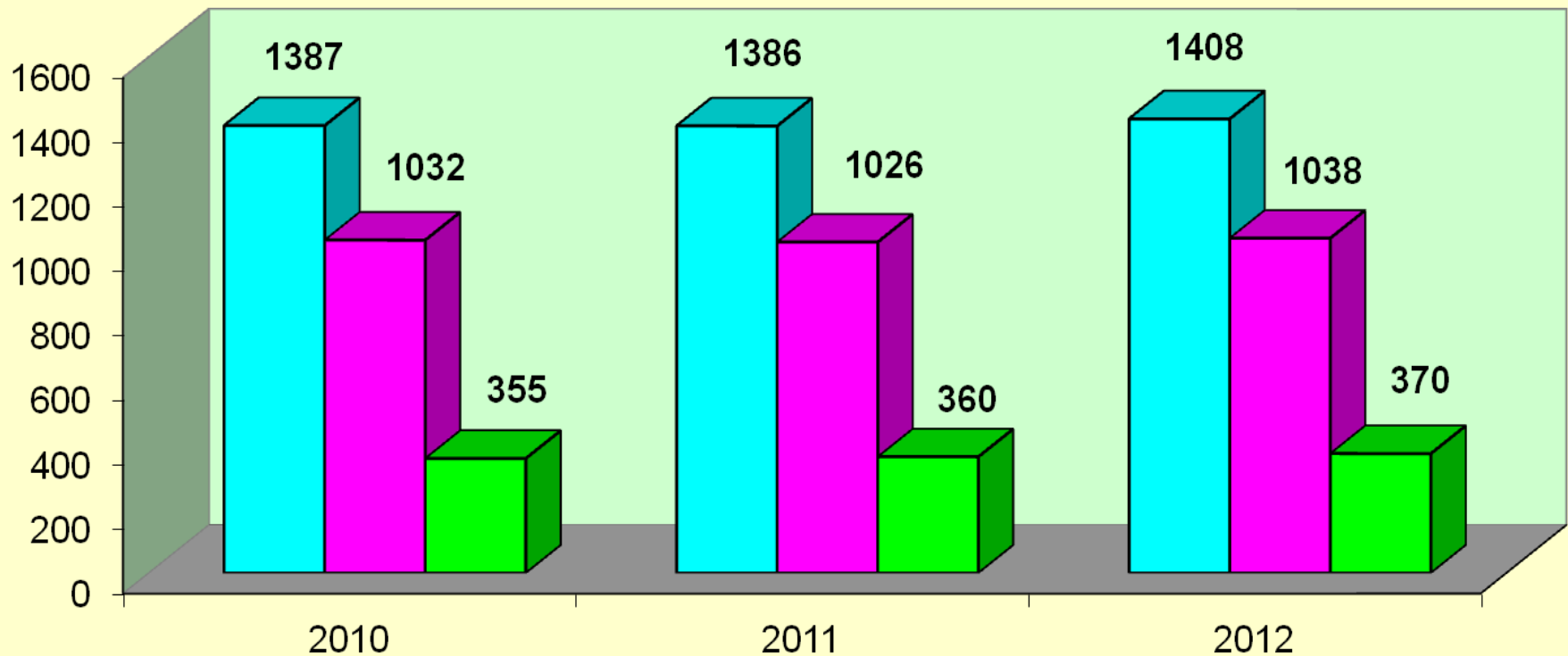


Coal in Ukraine is produced by 155 large mines, 142 of which (91%) have methane-rich coal seams (30 mines have absolute methane emissions between 0.5 and 12 m³/min, and 112 mines – over 12 m³/min and potential for spontaneous outbursts. These mines in 2012 produced over 60 million tonnes of coal, or 68% of total production).



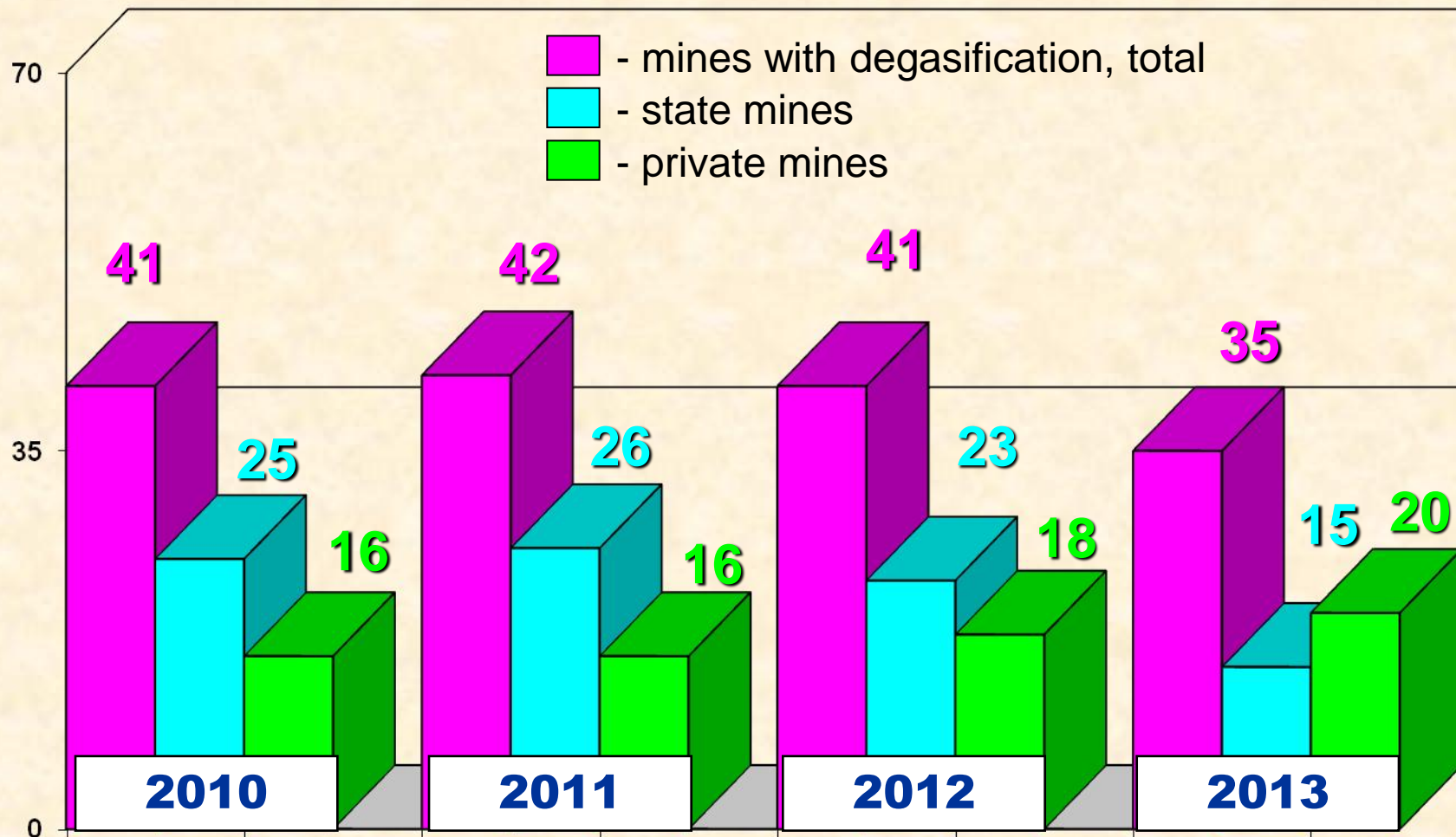
Volume of methane emissions from mines is about 1400 million m³/year. Coal production process is accompanied by natural methane gas emissions into mine ventilation system in approximate amount of 1000 million m³/year. Degasification recovers 370 million m³/year, or about 25% of total methane emissions

- Total amount of gas methane, million m³
- Emissions with ventilation air, million m³
- Capture by degasification systems, million m³



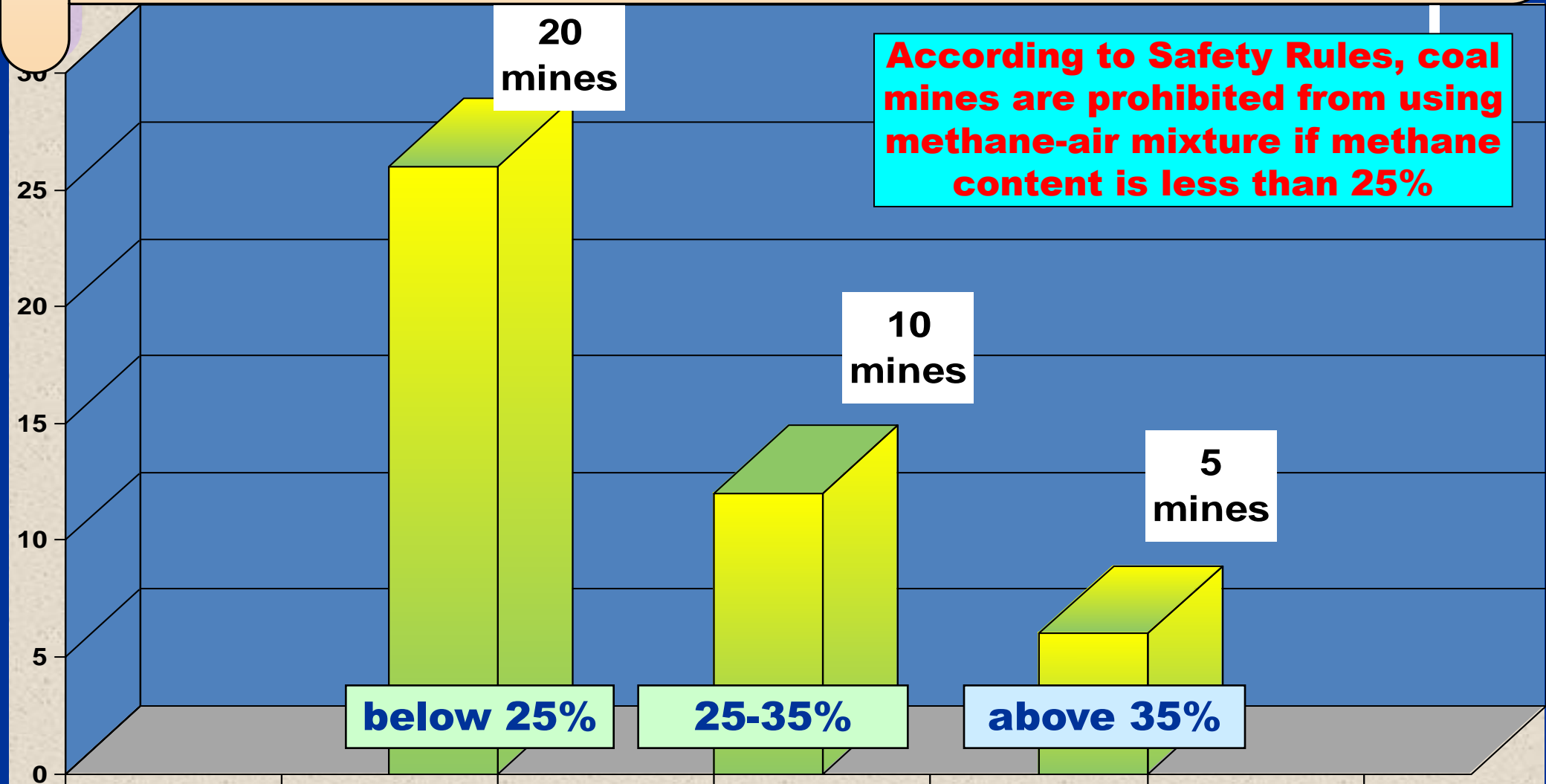
Currently degasification is performed at **35** mines that account for **40%** of total coal production in Ukraine, including **20** mines not owned by the state, with annual production of **28.6** million tonnes, and **15** state mines with annual production of **10.5** million tonnes.

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Only for 15 mines of 35 mines that perform degasification, methane content in the mixture exceeds 25%, while for 20 mines it is less than 25%, which prevents further use of methane

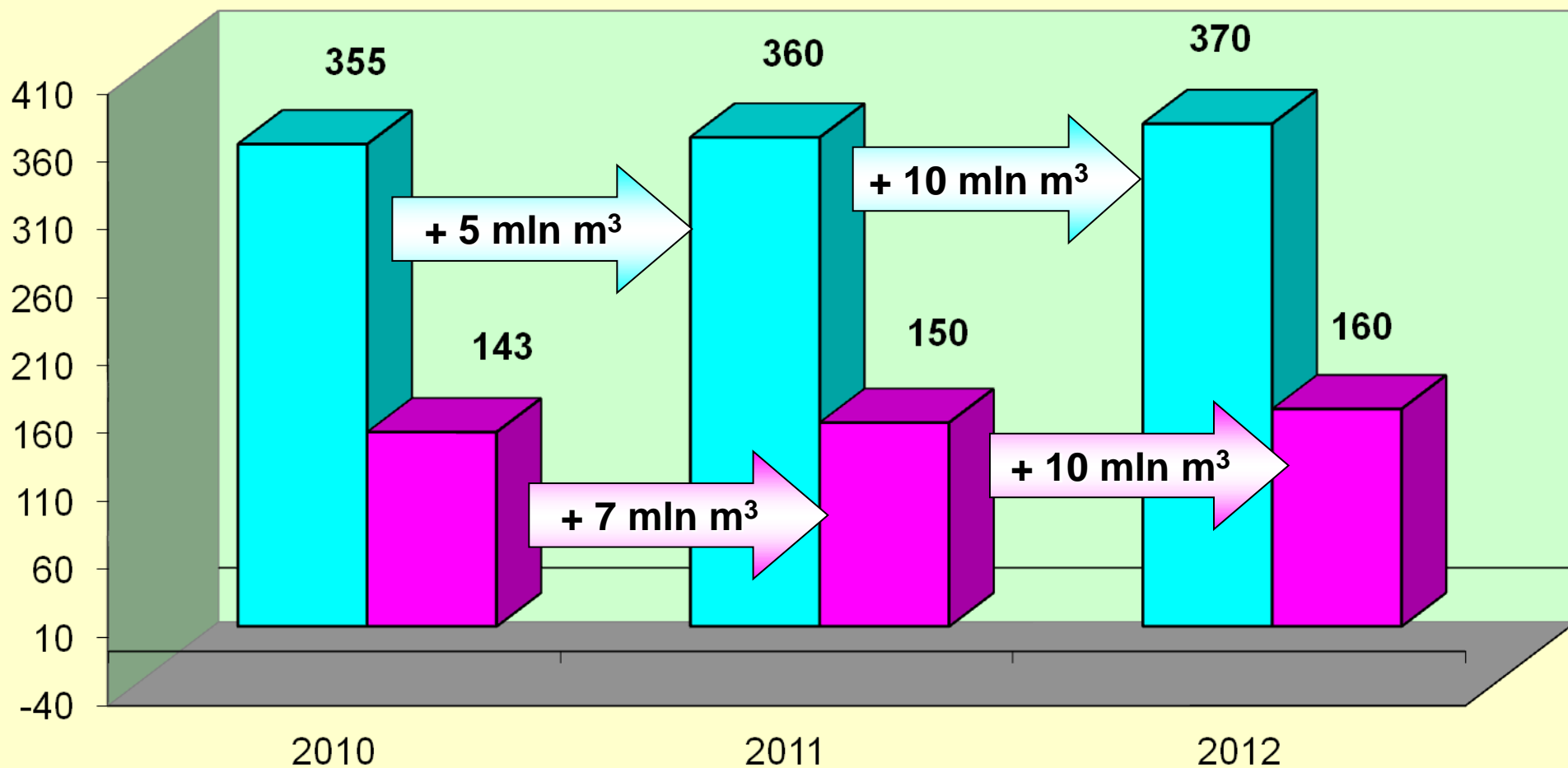
According to Safety Rules, coal mines are prohibited from using methane-air mixture if methane content is less than 25%



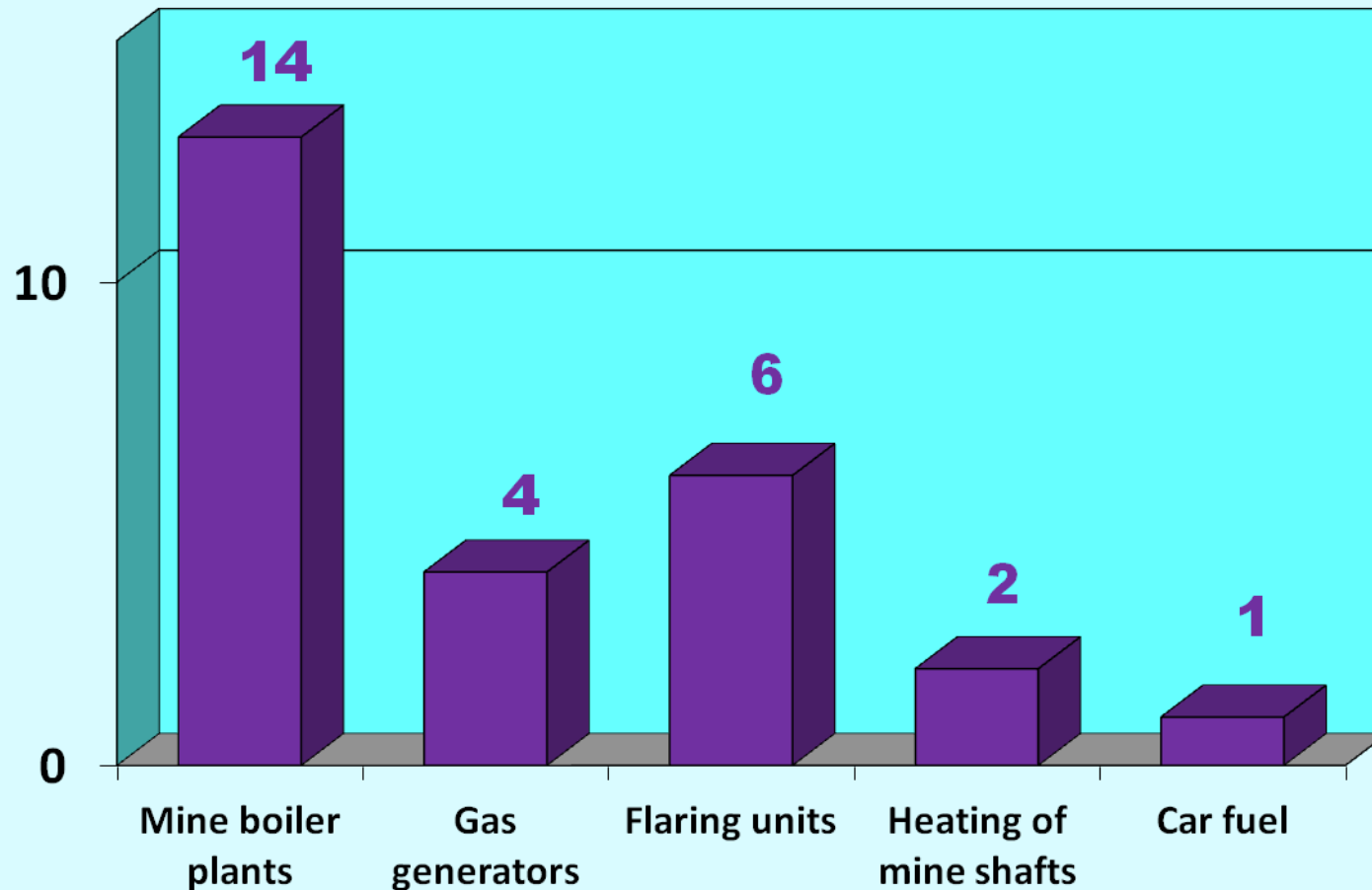
Out of 370 mln m³ of gas methane captured annually by degasification systems, about 130-160 mln m³, or 40-50%, are further utilized. In 2012 this figure was 160 mln m³

■ Capture by degasification systems, mln m³

■ Utilization, mln m³



Captured methane gas is utilized in the following way: for mine boiler plants – 14 mines, for gas generators – 4 mines, flared – 6 mines, for heating of mine shaft – 2 mines, as a car fuel – 1 mine



■ Mine boiler plants ■ Gas generators ■ Flaring units ■ Heating of mine shafts ■ Car fuel

The table presents the data on implementation of methane degasification and utilization projects in 2012 for major coal mining companies of Ukraine

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| Company | Methane emissions, m ³ (total) | Methane captured by degasification systems, m ³ | Methane utilized, m ³ (in 100% CH ₄ calculation) | Methane degasification and utilization project results | | |
|-------------------------------------|---|--|--|--|---------------------|--|
| | | | | Electricity produced, million kWh | Heat produced, Gcal | Atmospheric emissions reduction, thousand tonnes of CO ₂ equivalent |
| PJSC Zasyadko coal mine | 80 627 040 | 50 562 720 | 20 317 776 | 65.7 | 31 836.1 | 340.4 |
| PJSC Pokrovske mine office | 132 976 800 | 42 047 960 | 23 647 900 | 22.2 | 20 845.2 | 99.088 |
| PJSC Donbass mine office | 63 087 760 | 37 896 000.0 | 32 894 000 | 17.23 | 79 373.0 | 499.9 |
| PJSC DTEK mine Komsomolets Donbassa | 137 002 900 | 31 100 000.0 | 11 491 660 | - | - | - |

Information on comprehensive methane utilization project of PJSC Pokrovske Mine office

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The project includes construction of a cogeneration plant with 36.5 MW electric capacity (18.2 MW of the first stage at the principal production site – *in operation*; 18.3 MW of the second stage at VPS-2 production site is planned to be commissioned in the IV quarter of 2015);

Estimated cost of the 36.5 MW cogeneration plant construction project exceeded UAH 420 million, including more than UAH 190 million for the first stage and about UAH 230 million planned for the second stage.

In order to cope with methane emissions before construction of the cogeneration plant, a HOFGAS-LFL 4c 9000 flaring unit was put into operation in November 2010, which in 2012 flared 1.3 million m³ of methane (in 100% CH₄ calculation).

Currently, the first stage of the cogeneration plant is operating at the principal production site, which includes six Jenbacher JMS-620 units (total electric capacity – 18.2 MW, heat generating capacity -- 17 MW).



Information on comprehensive methane utilization project of PJSC Pokrovske Mine office

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Newly installed equipment covers over 50% of the company's electricity consumption and 77% of the heat required at the principal production site. Own electricity is seven times cheaper than that on state tariffs, and the heat is ten times cheaper than that supplied by utilities. The savings are also due to advanced cogeneration technology with fuel use efficiency higher by 35%. Pollutants emission levels comply with EU requirements.

Only in 2012 PJSC Pokrovske Mine office utilized about 23.6 million m³ of methane (in 100% CH₄ calculation).

Finance obtained from the sales of emission reduction units is used for renovation and upgrading of underground and above-ground degasification systems, further reduction of energy intensity in production processes and mitigation of adverse environmental impacts.

Insufficient level of both degasification and further utilization of gas methane is determined by the following reasons:

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- 1. Lack of proven technologies for preliminary coalbed degasification by means of surface-based drilling and hydraulic fracturing.**
- 2. Low storage capacity of coal-surrounding rocks. Permeability of sandstones is less than 0.1 mD (millidarcy), porosity of sandstones is on average 5-6%.**
- 3. Low production speed in mine faces (less than 1000 tones/day), leading to slow mine face progress.**
- 4. Insufficient use of advanced technologies and equipment for underground degasification.**
- 5. Inadequate capacity of the majority of mine degasification systems due to low pipeline diameters (250 – 350 mm).**
- 6. Lack of operating degasification control equipment needed for maintaining degasification parameters, first of all, methane content (higher than 25%) and production rate.**
- 7. Gaps in legislative and regulatory acts related to promotion of investments and preferential taxation.**

Introduction of coal methane into general fuel and energy balance of Ukraine will contribute to solving a large number of tasks:

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✓ Social:

- Improving the safety of mining works in the coal industry and, consequently, reducing the number of fatal accidents and injuries due to lower risk of outbursts in mines;
- Creating additional jobs due to development of gas production and, through this, reducing social tension in coal producing regions.

✓ Economic:

- Reducing the costs of coal production;
- Increasing coal production levels;
- Reducing the costs connected with emergency situations at mines;
- Creating a new energy industry in Ukraine based on methane capturing and utilization;
- Reducing the expenditures on natural gas purchase and transportation from abroad and from gas producing regions of Ukraine;
- Providing the opportunity for coal mine methane use for electricity generation (diesel generators, gas turbines, internal combustion engines);
- Using coal mine methane as a feedstock for other industries (metallurgy, fertilizers, methanol);

✓ Environmental:

- Improving environmental situation due to lower atmospheric emissions of methane – the second most important greenhouse gas – by coal producing companies in Donbass.

Current state of legal and regulatory framework

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Legal and regulatory framework addressing administrative, social and legal relations arising in coalbed methane use issues has been developed to significant extent

Current legislation directly regulating and forming the state policy consists of individual laws and by-laws

**LEGISLATIVE AND NORMATIVE ACTS
THAT REGULATE PRODUCTION,
DEGASIFICATION AND UTILIZATION OF COAL
MINE METHANE GAS**

- **Code of Ukraine «About the subsoil» (*from 27.07.1994 from 16-10-2012*);**
- **Law of Ukraine «On coalbed methane» (*from 21.05.2009*);**
- **Law of Ukraine «On Alternative energy sources» (*from 20.02.2003*);**
- **Tax Code of Ukraine (*from 01.04.2012*);**
- **Coal Mine Safety Rules (*from 22.03.2010*).**

Major legislative initiatives aimed at amending regulatory and legislative acts

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- 1. It is necessary to make clear distinction between the two concepts: methane capture by a mine's above- and underground degasification units in the process of coal production, and methane gas production by industrial methods on the free areas of coal deposits.**
- 2. It is necessary to introduce preferential taxation for the period until 2030, in order to stimulate development of methane use projects, first of all for the methane obtained by mines from degasification in the process of coal production.**

Thank you for your attention!

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