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Strategy of development of the Coal mine methane (CMM) degasification and utilization as an alternative source of energy

Igor Yashchenko

Ministry of Energy and Coal Industry of Ukraine

Member of UNECE Group of Experts on Coal Mine Methane

igor.yashchenko@mev.gov.ua

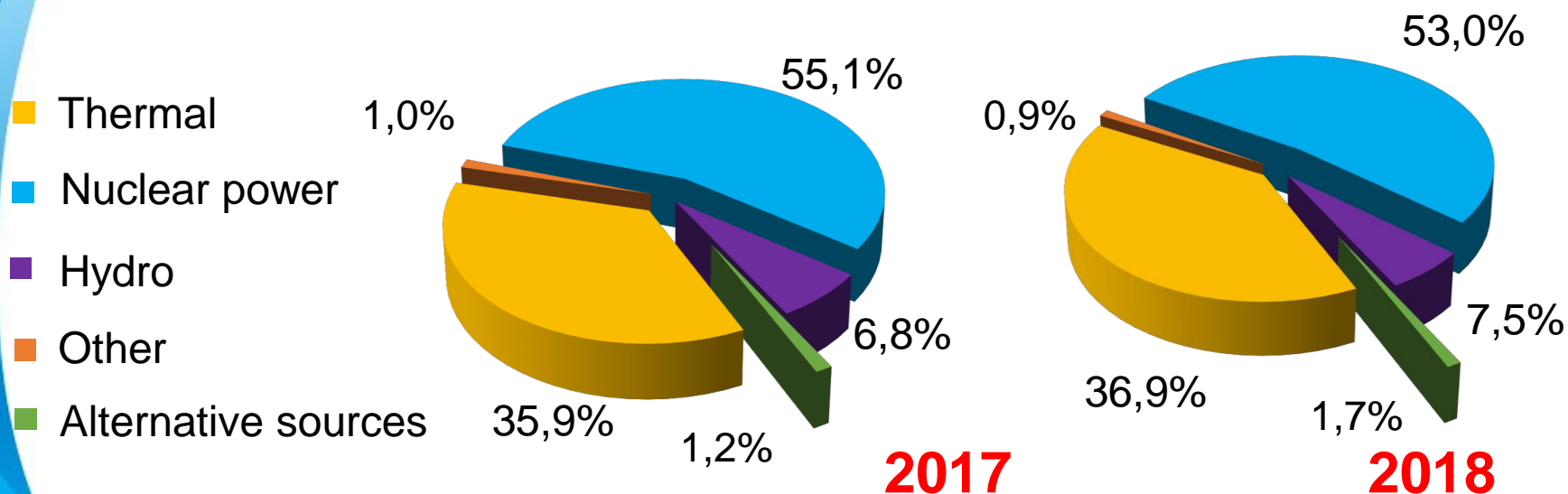
Energy Strategy of Ukraine

In order to determine the Ukrainian energy sector strategy development, the Government of Ukraine has developed and approved the Energy Strategy of Ukraine for the period until 2035. The name of the program speaks for itself - "Safety, energy efficiency, competitiveness."

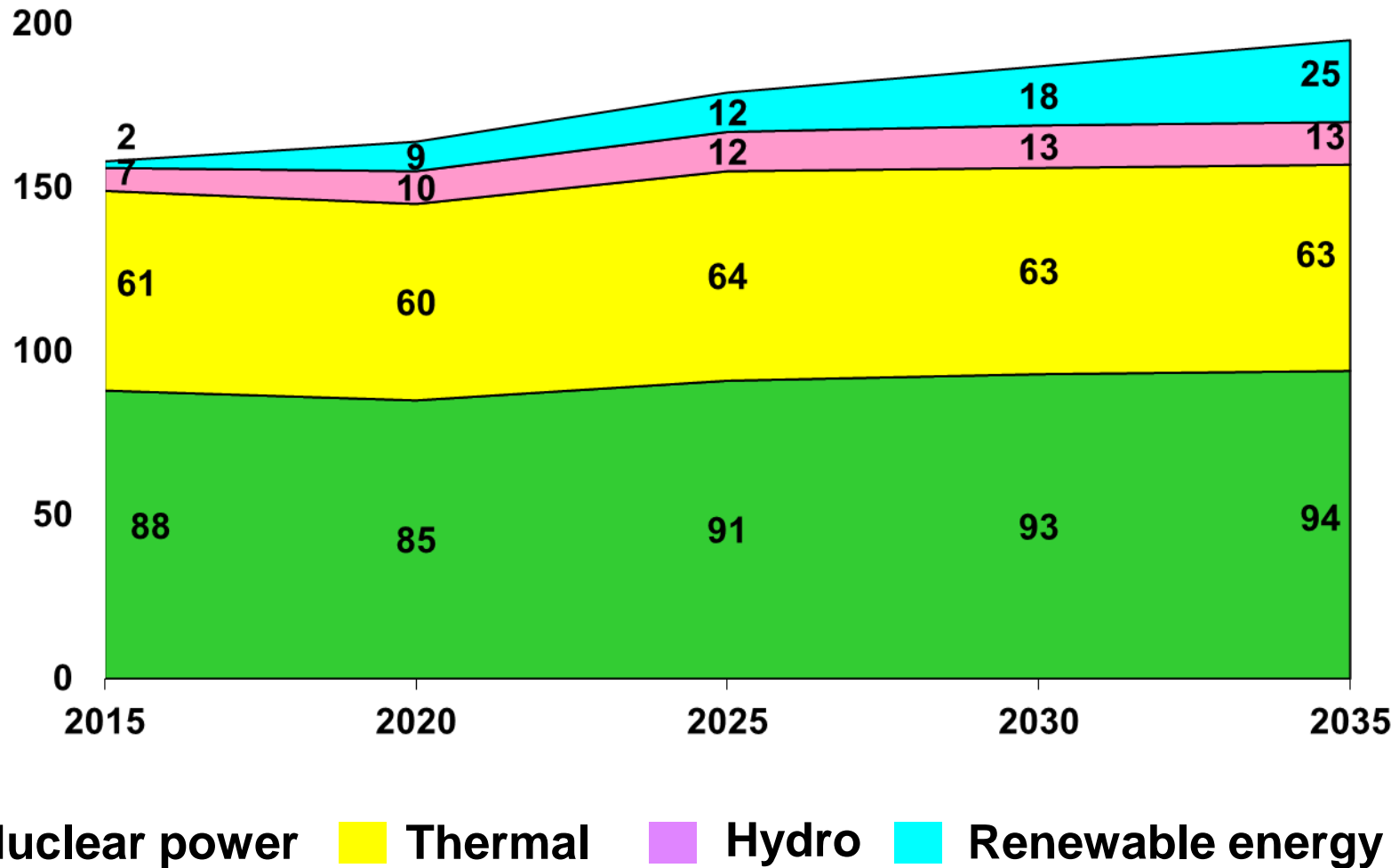
Electricity production by energy source

The amount of electricity generated by Ukraine's power plants was 159.35 billion kWh in 2018, which is 3.85 billion kWh (2.5%) more than in 2017.

The largest part in the electricity generation is made up by nuclear energy - 53%, thermal power plants – 36.9%, the main raw material of which is coal mined in the mines of Ukraine; hydropower and alternative sources – 10.1%, including alternative sources - 1.7%.

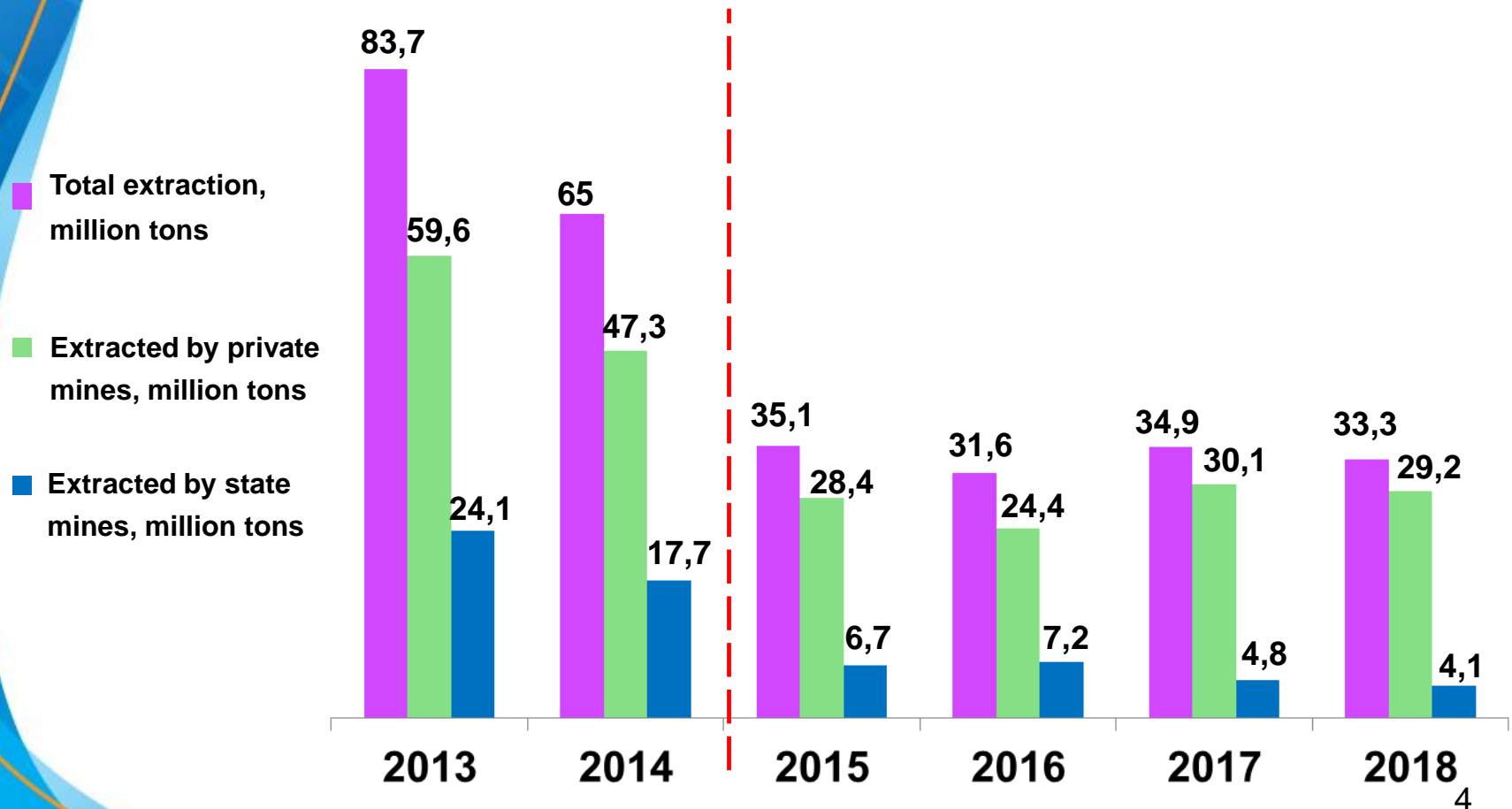


Electricity production forecast to 2035, billion kWh

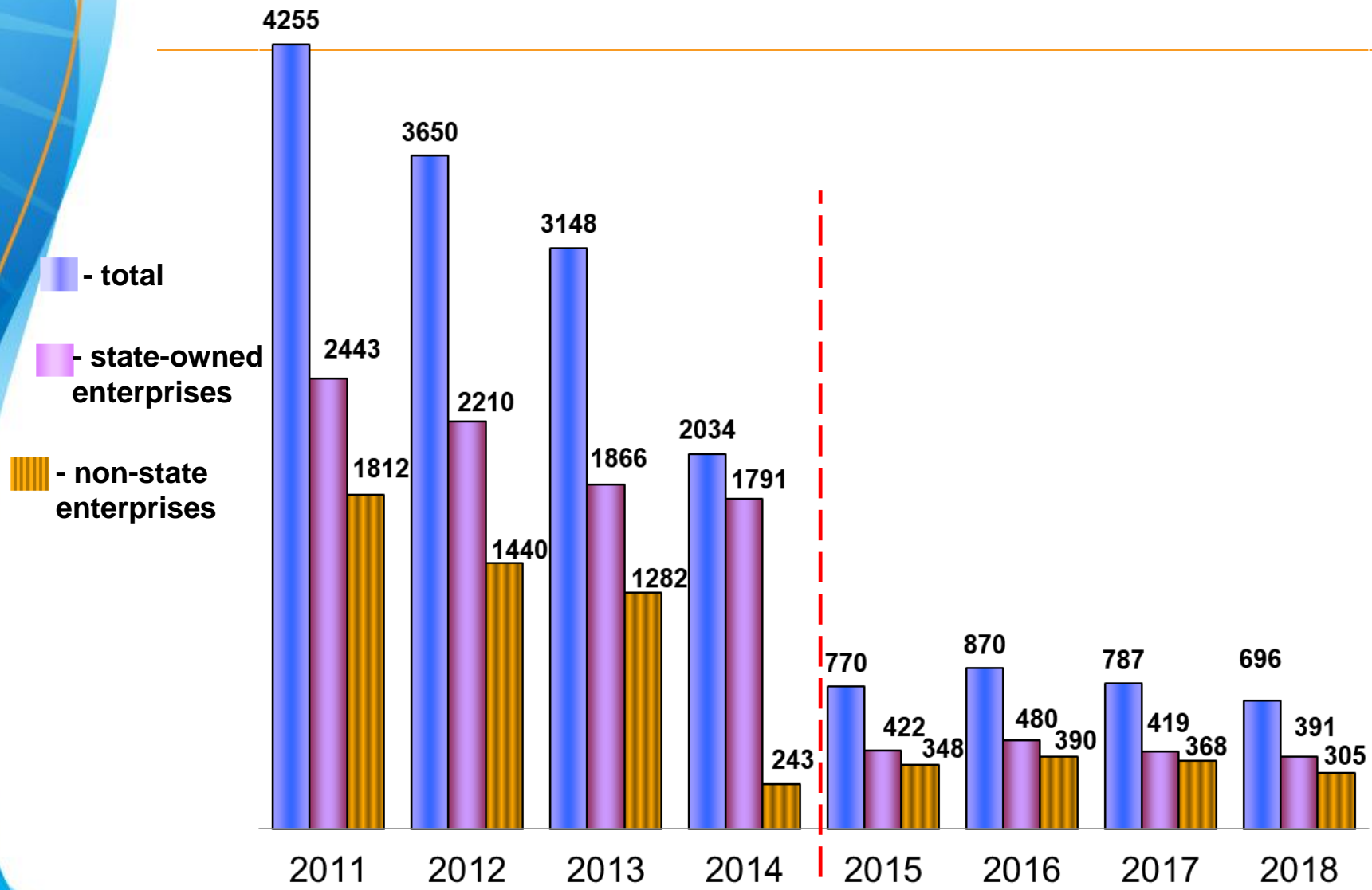


Coal extraction in Ukraine for the last 6 years

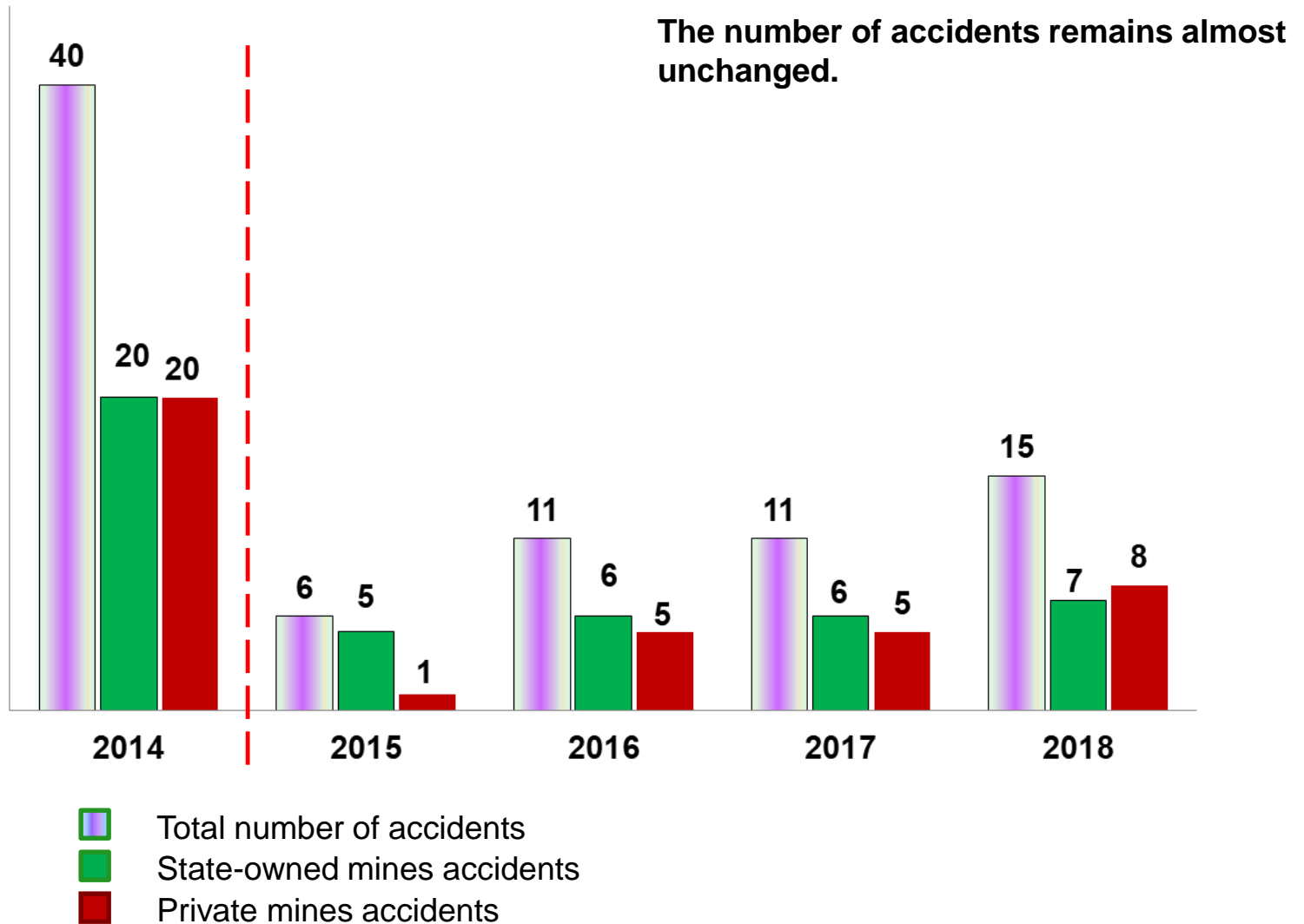
In recent years, coal production has reached 32-35 million tons, of which 85% (25–30 million tons) are mined by mines of non-state ownership and 15% (4–5 million tons) by state-owned mines.



Industrial injury rate dynamics in the Ukrainian coal industry



Number of mine accidents (methane explosions, coal outbursts, fires) that have resulted in miners' deaths



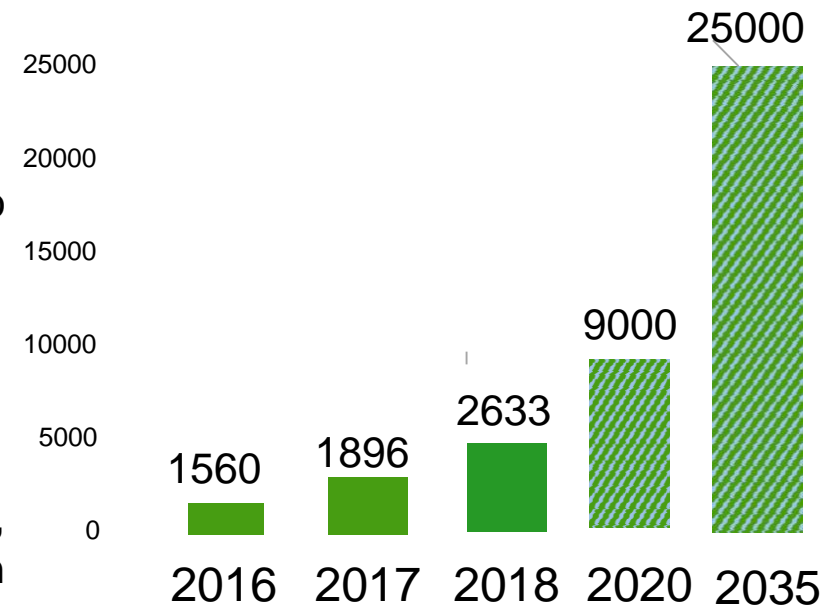
One of the main tasks of the Energy Strategy is to increase the part of the renewable energy

One of the tasks defined by the Energy Strategy is to increase the part of renewable energy in the energy balance of Ukraine: up to 12% by 2025 and up to 25% by 2035.

The production of electricity using alternative energy sources - wind, solar and energy from biomass, - has increased to 2633.0 million kWh in 2018, which is 737 million kWh (38.8%) more than in 2017 and which is 1073 million kWh (59.3%) more than in 2016.

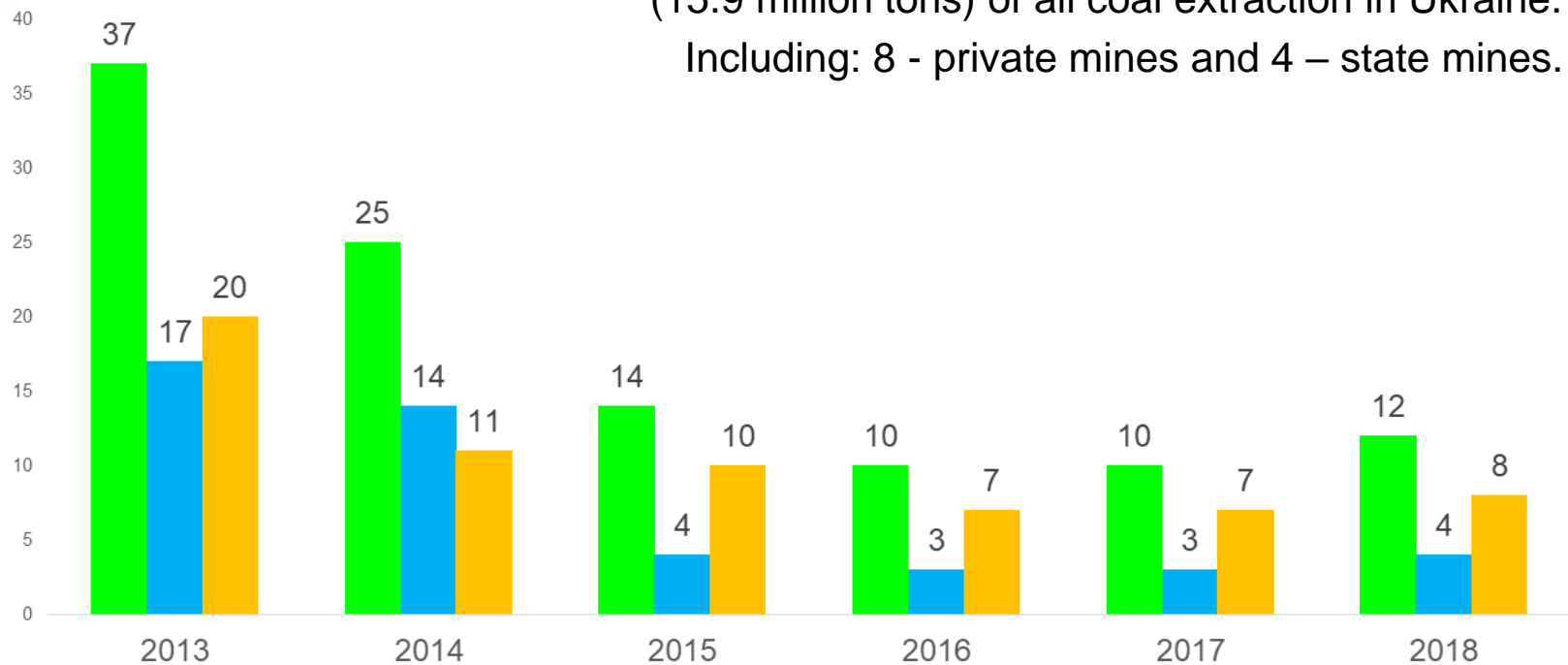
The growth is planned to 9 billion kWh in 2020 and 25 billion kWh in 2035.

Renewable energy in the energy balance of Ukraine, million kWh for 2016 – 2035



Number of mines that used degassing for the period of 2013 - 2017

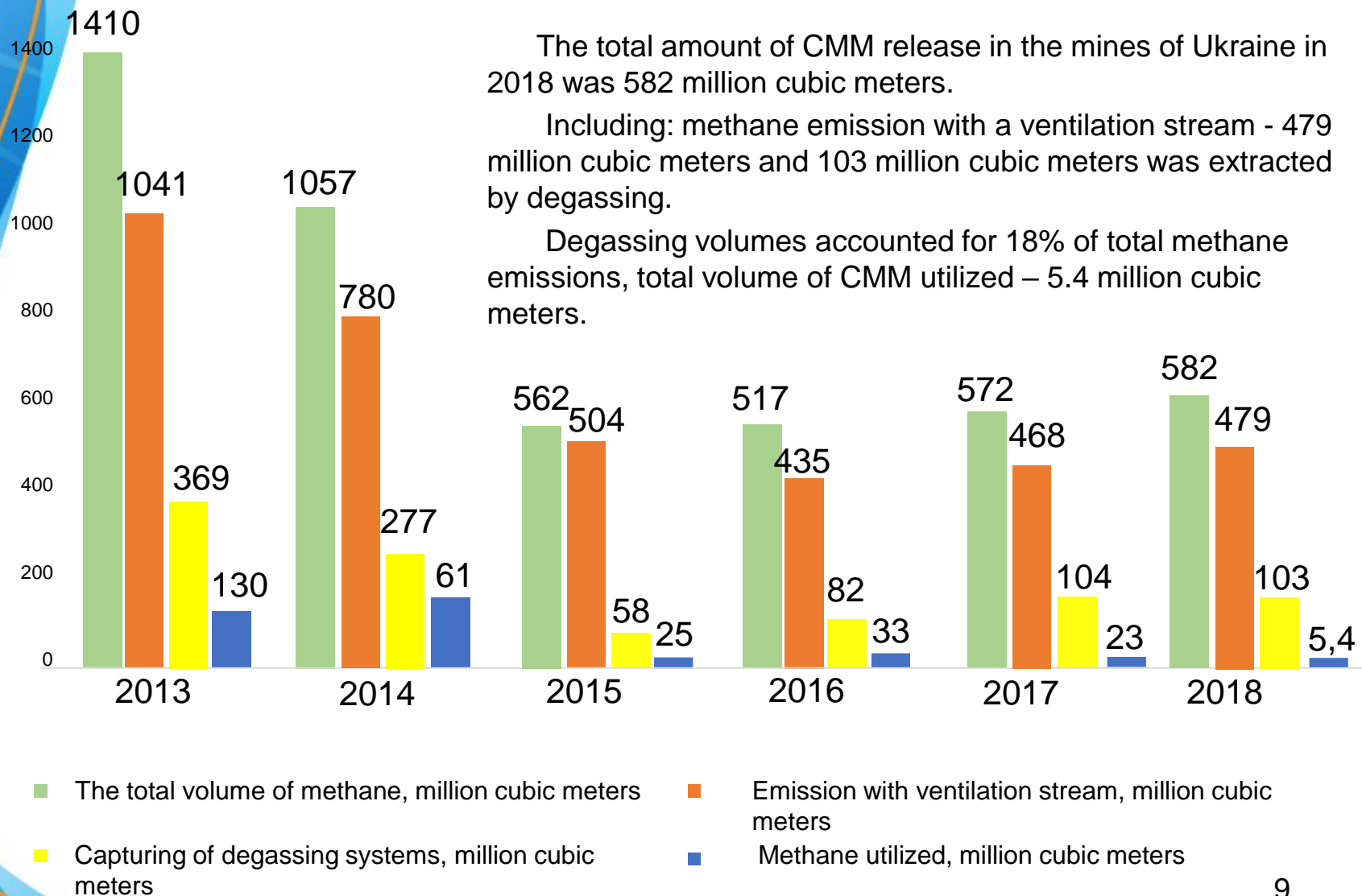
Degasification was applied at 12 mines in 2018, their total coal extraction amounted to 48% (15.9 million tons) of all coal extraction in Ukraine. Including: 8 - private mines and 4 – state mines.



- Total number of mines that use degassing
- State mines
- Private mines

CMM as an alternative source of energy

Efficiency of ventilation, degassing and utilization of CMM for 2013-2018

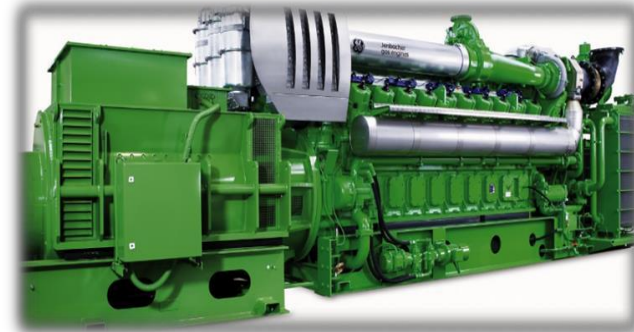


Implementation of the largest projects for CMM degassing and utilization

At the moment, several projects have been implemented for the CMM utilization:

- PJSC “Shakhta im. A.F. Zasyadko” (2006) – the largest project in Europe for the CMM utilization with a design capacity of 36 MW of electricity was implemented. Completed: reconstruction of more than 30 km of underground degassing pipelines, construction of a cogeneration station on the surface with an installation of 12 diesel generators JMS 620-G.L., produced by GE Jenbacher (Austria). More than 50% of the annual mine’s electricity consumption was provided - 85-90 million kW per year and 20 million Gcal of thermal energy (the mine is located on a territory beyond Ukraine's control).

- GE “CC “Krasnolymanska” (2008) – the first phase of the project for the CMM utilization has been implemented. Completed: reconstruction of more than 15 km of degassing pipelines, the introduction of complex degasification, the acquisition of modern drilling equipment (machines Deilmann-Haniel). As a result of CMM utilization, more than 17 000 Gcal of heat energy is produced every year.



Implementation of the largest projects for CMM degassing and utilization

PrJSC «Donetskstal» - MZ» PJSC «Pokrovskoe» – the first phase of the CMM utilization project was implemented. Completed: reconstruction of more than 20 km of degassing pipelines, application of complex surface and underground degassing, construction of a cogeneration station with the installation of 6 diesel generators JMS620-G.L., produced by GE Jenbacher (Austria), modern drilling equipment was purchased. As a result of CMM utilization, more than 52 million kWh of electric power are produced, as well as 32 133 Gcal of heat per year.

Shakhta “Stepova” PJSC “DTEK” Pavlogradvugillya” – the first phase of the CMM utilization project was implemented. Completed: reconstruction of more than 10 km of degassing pipelines and a vacuum pumping station on the surface, acquisition and installation of a flare unit, equipment for CMM combustion in mine boilers.



The most promising mines for the development and implementation of projects for CMM degasification and utilization

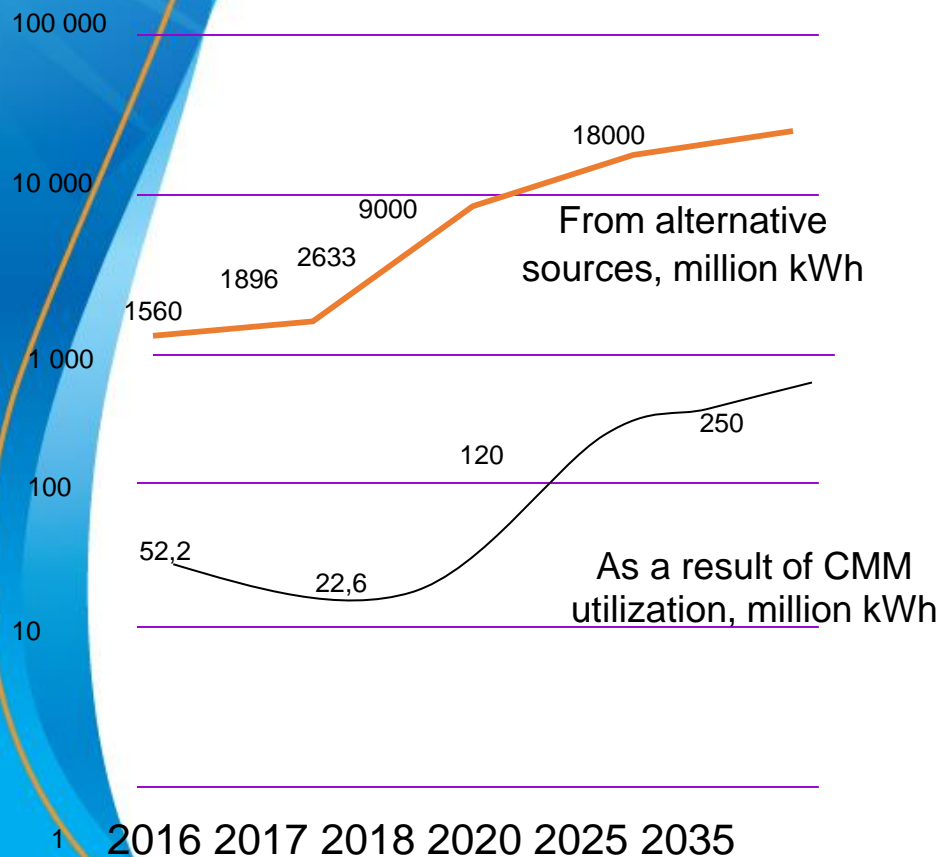
Name of the enterprise	CMM emission, million m ³ per year	CMM captured by degassing systems, million m ³ per year	CMM utilized, million m ³ year
“Shakhta “Kapitalna” SOE “Mirnogradugol”	13,41	3,75	-
Shakhta “Uvileyna” PJSC “DTEK “Pavlogradvugillya”	51,2	20,1	-
Shakhta “Zahidno-Donbasska” PJSC “DTEK “Pavlogradvugillya”	43,81	10,98	-
Shakhta “Stepova” PJSC “DTEK “Pavlogradvugillya”	62,5	19,3	-
Total	170,92	54,13	-

Listed enterprises are attractive for the implementation of projects for CMM degasification and utilization.

In the long term, there exists a real opportunity to increase the volume of degasification at these enterprises from 54 million m³ per year with subsequent disposal.

Prospects for CMM cogeneration

Annual electricity production



The amount of electricity generated as a result of CMM utilization can have a positive dynamics and can sum up to approximately 3% of the amount of electricity generated from alternative sources on early stages.

The fall in the cogeneration volume in 2018 is due to various technical factors.



Changes to legislation aimed at increasing of volumes of CMM degassing and stimulation of its utilization

The Law of Ukraine "On Gas (Methane) of Coal Deposits" provides with a temporary exemption from taxation on profits of economic entities in the extraction and use of CMM.

In the end of 2017 amendments were made to the Tax Code of Ukraine:

The rate of environmental tax on CMM emissions to the atmosphere without utilization was increased by 11.2% to 3.5 US dollars per ton.

Coal mine methane of coal deposits is excluded from the objects of taxation. Thus, the tax rate on the use of CMM as a co-product in coal mining was eliminated. The rate, which existed before, amounted to 28% of the market value per cubic meter, which is equivalent to 74.5 US dollars per ton of methane gas extracted.

Before amendments to the Tax Law, the annual tax on CMM production of PJSC DTEK PJSC "Pokrovskoye" LLC, whose degassing amounted to 19 thousand tons (24 million cubic meters) in 2017, was equal to 36.6 million UAH or 1.4 million US dollars

The main goals and objectives of the Center for Alternative Energy Sources

- Generalization, analysis and systematization of accumulated experience on the degassing technology of coal seams of mines in Ukraine and its effectiveness
- Summarizing and analysis of global practices of methane gas degassing technology and utilization
- Development of projects for the degassing and utilization of methane gas
- Consulting services for the introduction of advanced technologies for the degassing and utilization of methane gas in the mines of Ukraine
- Creation of catalogs and electronic database of geological characteristics of coal seams and best practices for degassing and disposal
- Coordination of coal mining enterprises in the field of degassing and utilization of methane gas
- Taking part in the development of laws and regulations in the field of degassing and utilization of methane gas
- Exchange of best practices in the field of degassing and utilization of methane gas
- Coordination of scientific developments in the field of improvement of technologies for degassing and utilization of methane gas
- Coordination of projects, grants, investments for coal-mining enterprises of Ukraine in the field of degassing and utilization of methane gas
- Training of staff of coal-mining enterprises in Ukraine best practices in the field of degassing and utilization of methane gas



Thank you for your attention!

**We invite you for cooperation in methane
utilization projects**

IGOR YASHCHENKO

igor.yashchenko@mev.gov.ua