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

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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."

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The Strategy defines six main directions:

- A knowledgeable and energy-efficient state
- Energy independence of the Fuel and Energy industry
- Markets development
- Investment attractiveness
- Integration of gas and electric networks into the energy system of the European Union
- Modern management system

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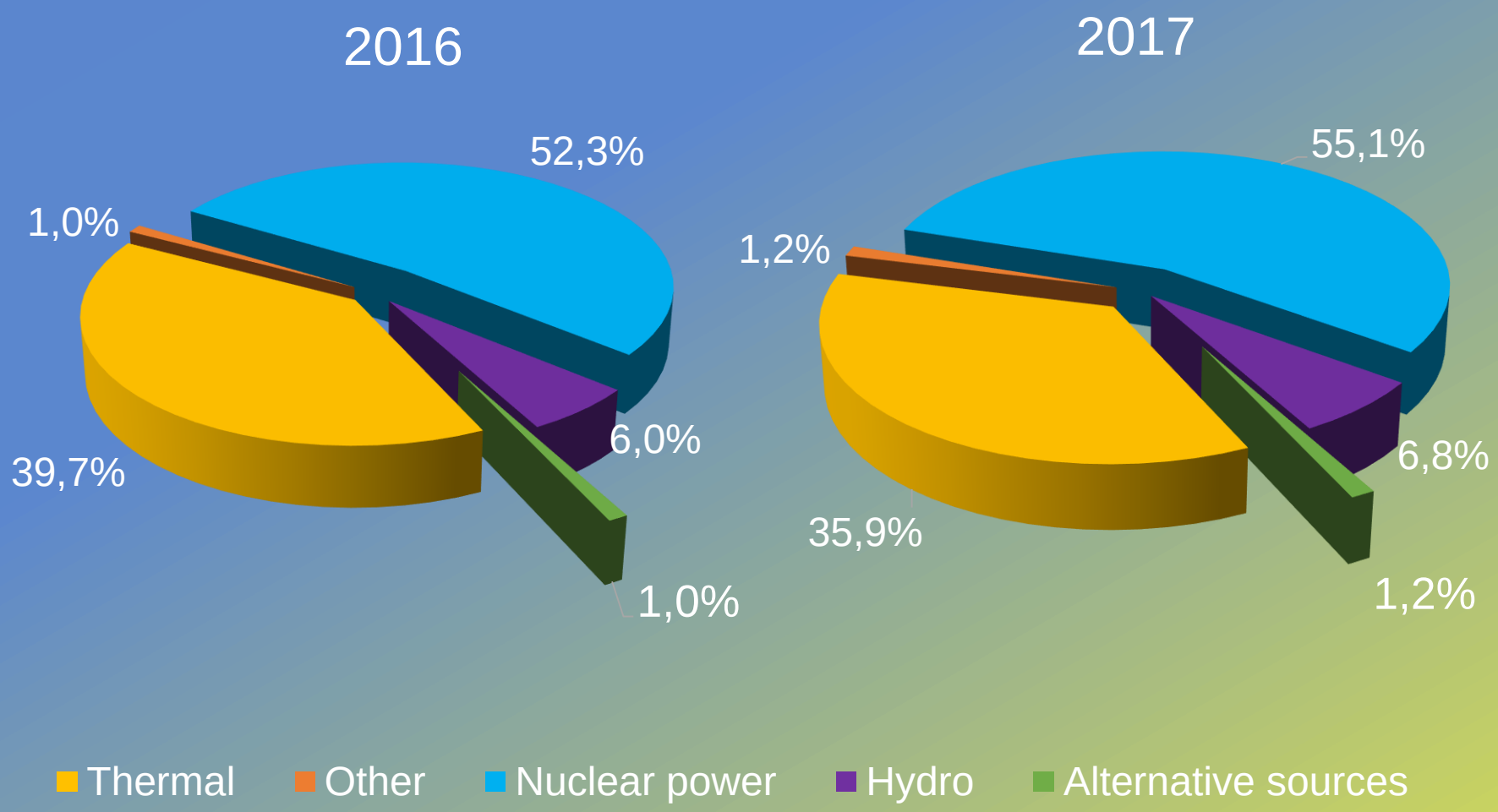
Electricity production by energy source



The amount of electricity generated by Ukraine's power plants was 155.5 billion kWh in 2017, which is 597 million kWh (0.4%) more than in 2016.

The largest part in the electricity generation is made up by nuclear energy - 55%, thermal power plants - 36%, the main raw material of which is coal mined in the mines of Ukraine; hydropower and alternative sources - 8%, including alternative sources - 1.2%.

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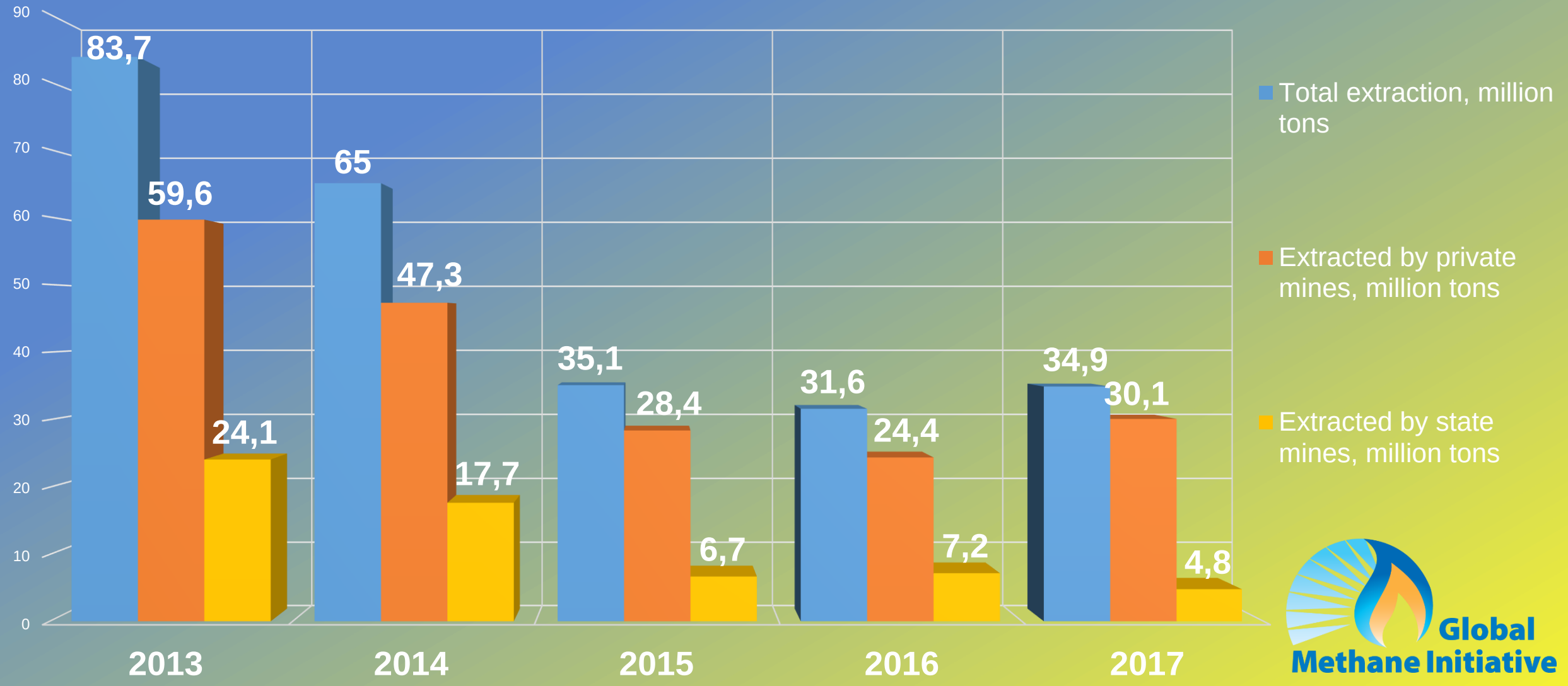
Coal extraction in Ukraine for the last 5 years



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- Coal mining in Ukraine is conducted in the southeastern part (80% of total extraction), as well as in western Ukraine (20% of total extraction).
- Part of the territory of southeastern Ukraine since 2014 has been captured by terrorist groups. 70% of total number of coal-mining enterprises were concentrated in this part .
- Statistics and analysis since 2014 will be presented without taking into account the industrial potential of the seized territory.

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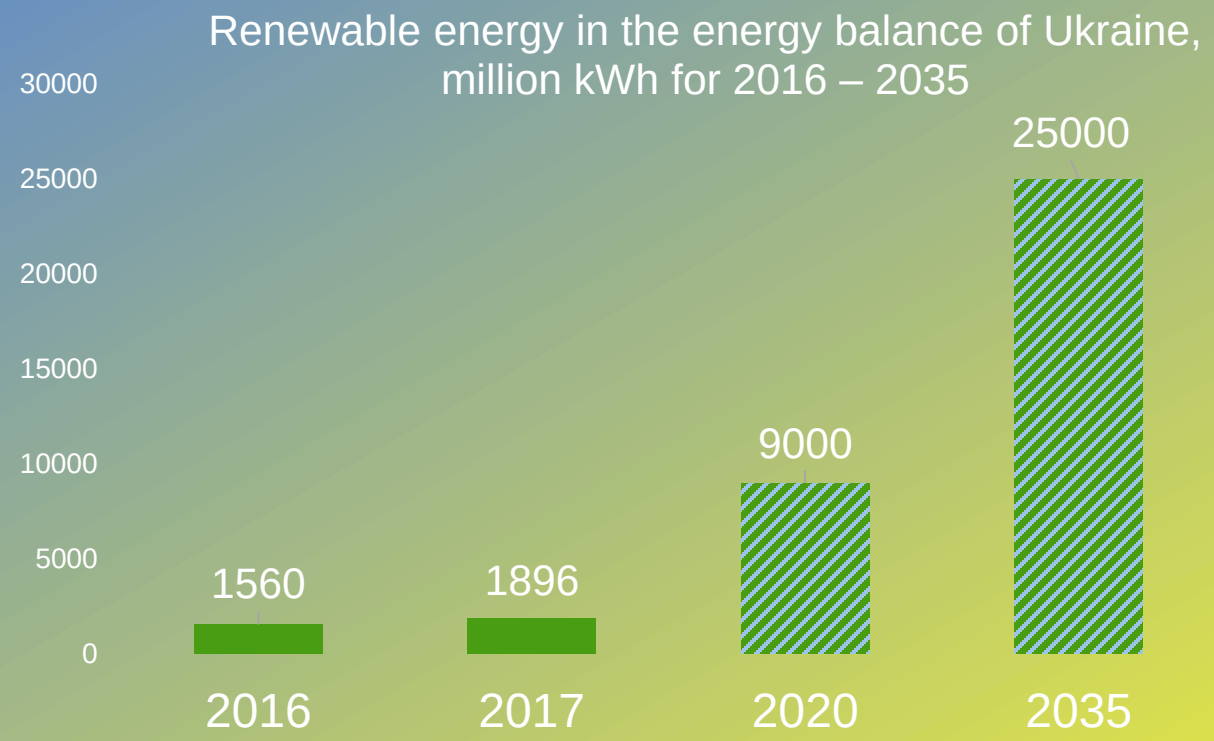
One of the main tasks of the Energy Strategy is to increase the part of the renewable energy

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 1896.3 million kWh in 2017, which is 336 million kWh (21.5%) more than in 2016. The growth is planned to 9 billion kWh in 2020 and 25 billion kWh in 2035.



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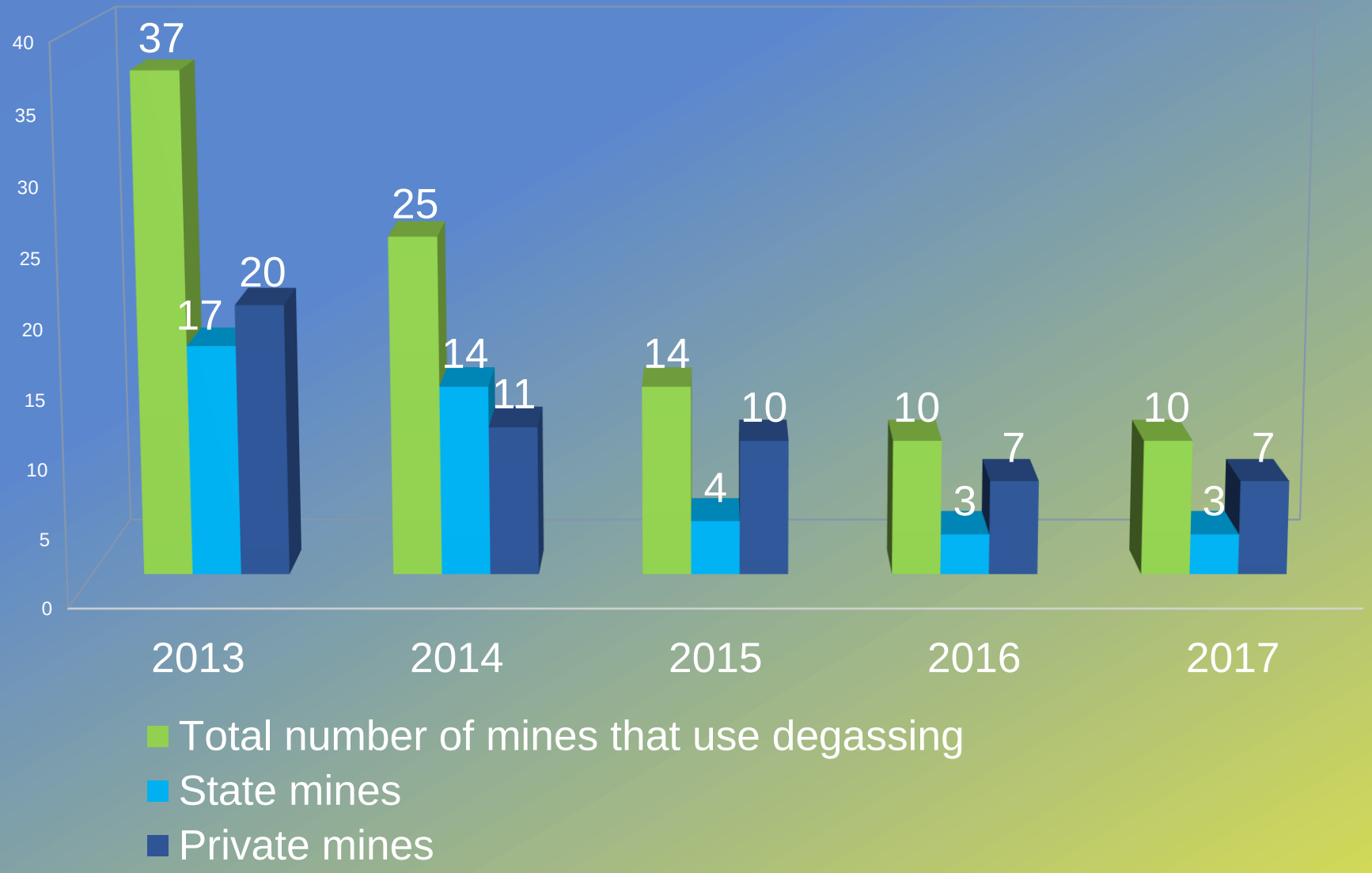
Number of mines that used degassing for the period of 2013 - 2017



Degasification was applied at 10 mines in 2017, Their total coal extraction amounted to 45.4% (15.3 million tons) of all coal extraction in Ukraine.

Including: 7 - private mines and 3 – state mines.

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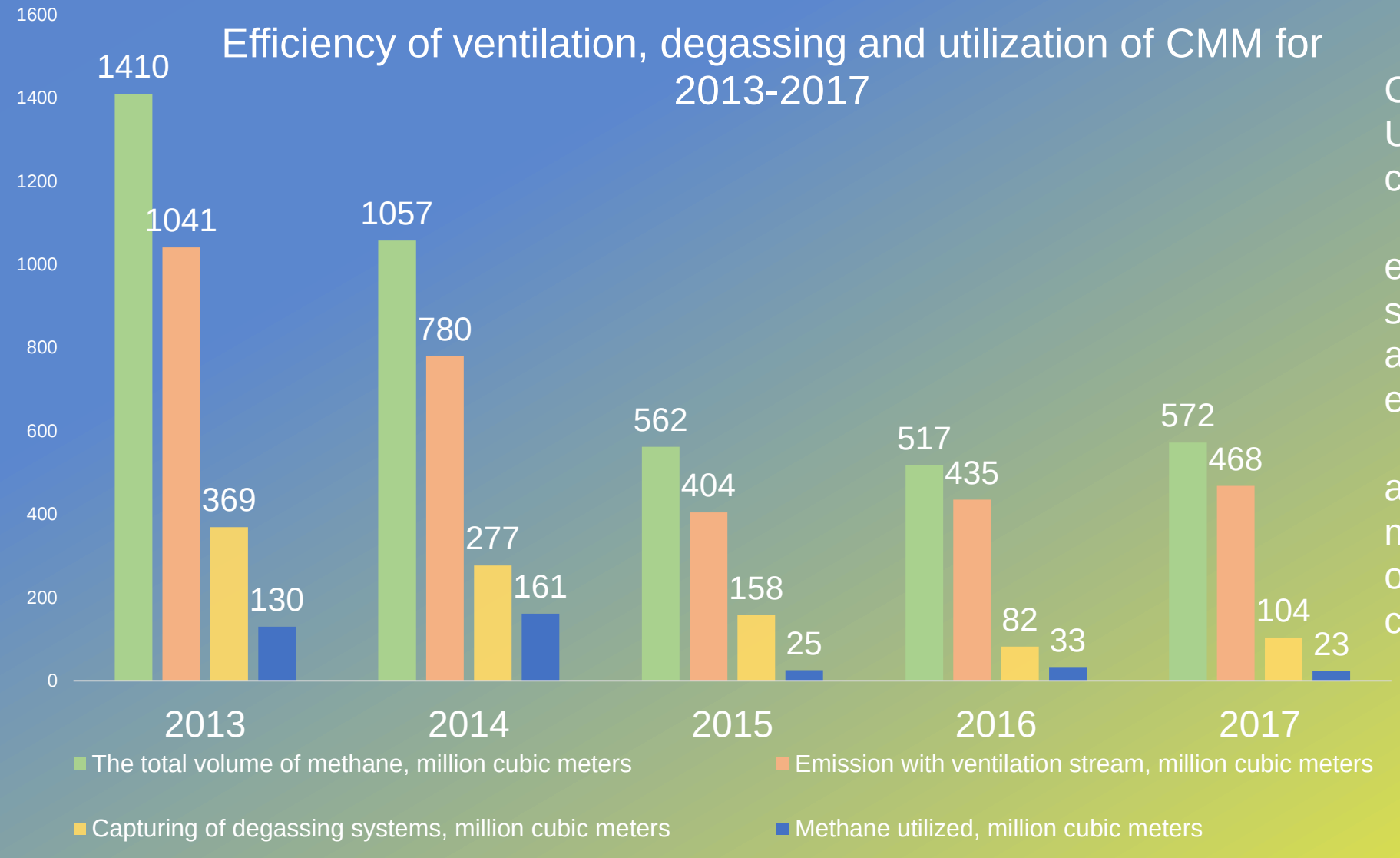
CMM as an alternative source of energy



The total amount of CMM release in the mines of Ukraine in 2017 was 572 million cubic meters.

Including: methane emission with a ventilation stream - 468 million cubic meters and 104 million cubic meters was extracted by degassing.

Degassing volumes accounted for 18% of total methane emissions, total volume of CMM utilized - 23 million cubic meters.

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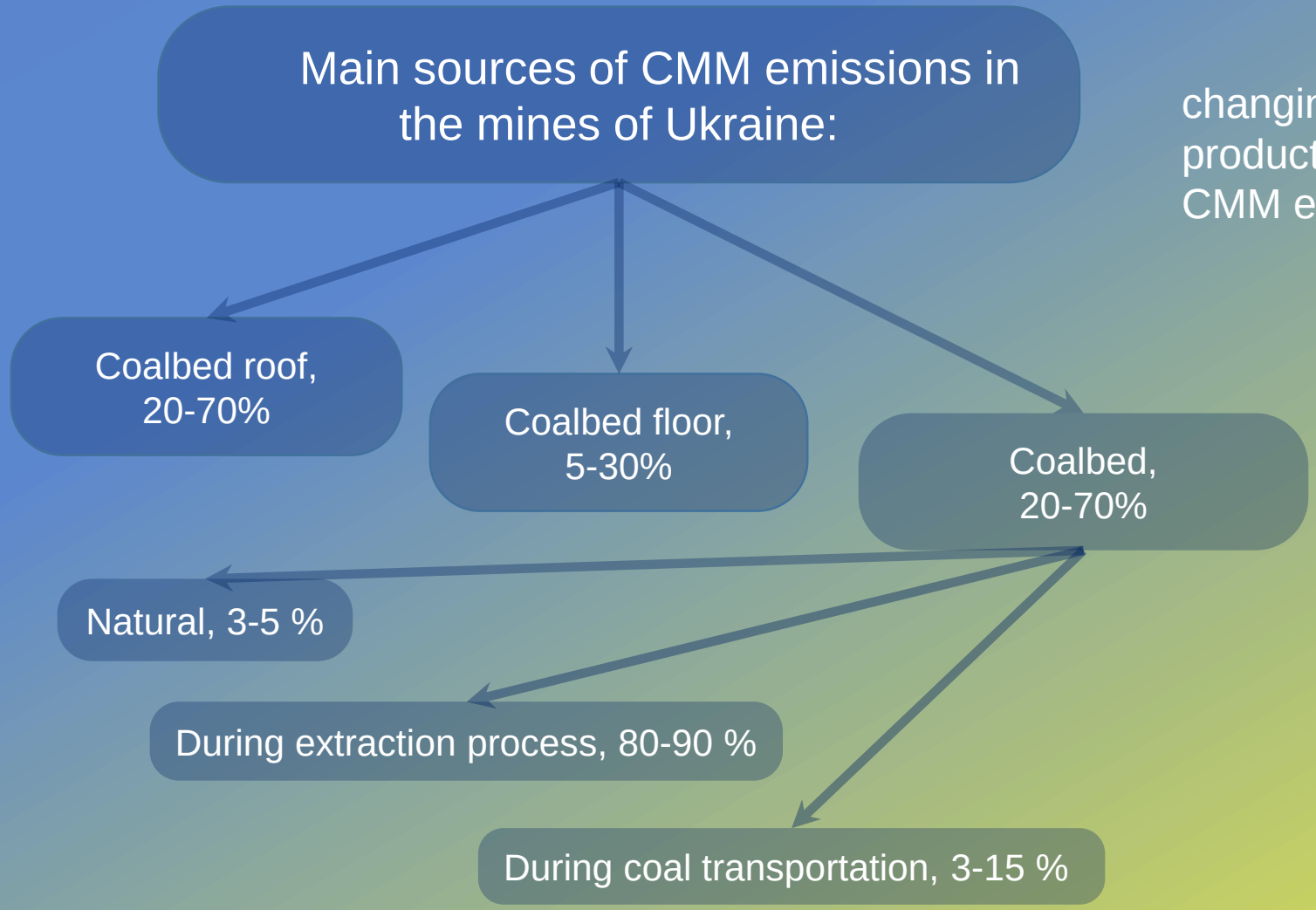
Main sources of CMM emissions at the mines of Ukraine



An increase of the depth of development, changing geological conditions, as well as increasing production in mining areas leads to an increase in CMM emissions.

The largest amount of CMM (30-70%) is concentrated in the goaf of mining sites after coal extraction and can be captured by degassing systems.

At high levels of CMM emissions (> 10 м^3 / min), it is reasonable to apply complex degasification (2 or more methods).

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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.

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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 JMS 620-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.

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

Name of the enterprise	CMM emission, million м^3 per year	CMM captured by degassing systems, million м^3 per year	CMM utilized, million м^3 per year
“Shakhta “Kapitalna” SOE “Mirnogradugol”	15.55	1.69	-
Shakhta “Uvileyna” PJSC “DTEK “Pavlogradvugillya”	57.5	23.0	-
Shakhta “Zahidno-Donbasska” PJSC “DTEK “Pavlogradvugillya”	59.64	11.89	-
Shakhta “Stepova” PJSC “DTEK “Pavlogradvugillya”	11.03	2.36	-
Total	143.72	38.94	-

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 39 million м^3 per year to 60 million м^3 per year with subsequent disposal.

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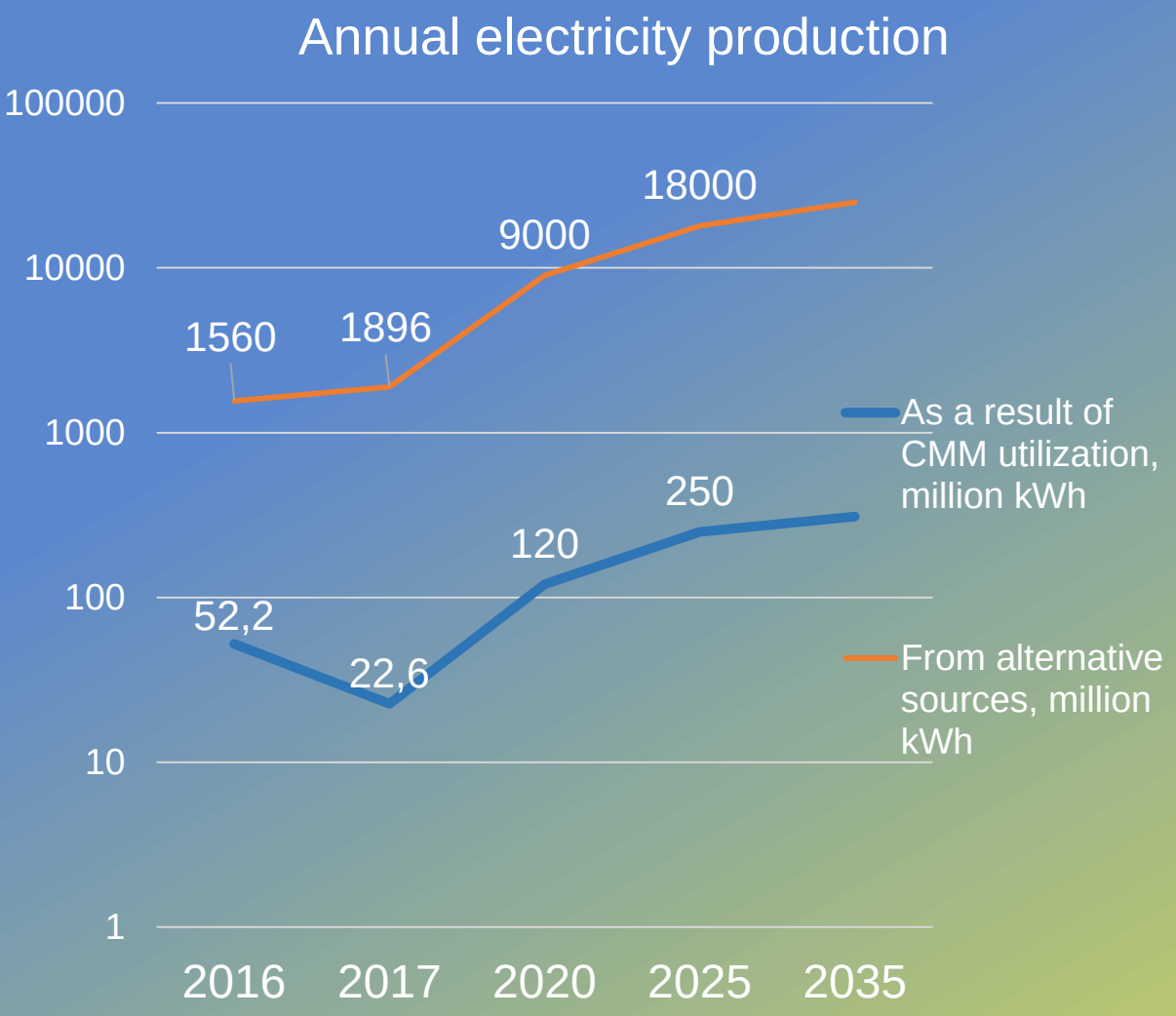
Prospects for CMM cogeneration



The amount of electricity generated as a result of CMM utilization can have a positive dynamics and can sum up to approximately 10% of the amount of electricity generated from alternative sources on early stages.

The fall in the cogeneration volume in 2017 was due to the legislative non-regulation of taxation issues for the use of CMM.

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Legislation

System-forming laws:

- The Subsoil Code of Ukraine (*27.07.1994*);
- Mining Law of Ukraine (06.10.1999);
- Law “On Oil and Gas” (12.07.2001);
- Law “On Energy Saving” (*01.07.1994*);
- Law “On Electric Energy Market” (*13.04.2017*);
- Law “On Alternative Sources of Fuel” (*14.01.2001*);
- Law “On Alternative Sources of Energy” (*20.02.2003*);

Laws containing stimulating and regulating mechanisms for CMM from coal deposits :

- Law “On Coal Mine Methane of Coal Deposits” (*21.05.2009*);
- Law “On Combined Production of Thermal and Electric Energy (Cogeneration) with the Use of Resetting Energy Potential” (*05.04.2005*);
- Tax Code of Ukraine (*01.04.2012*);
- Safety Rules at the Mining Sites (*22.03.2010*).

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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.

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Establishing of the Centre for Alternative Sources of Energy

The creation of the Centre is planned on corporate rights with the participation of the following central executive bodies, institutions and private enterprises :

- Ministry of Energy and Coal Industry of Ukraine
- Ministry of Ecology and Natural Resources of Ukraine
- PJSC DTEK
- PrJSC «Donetskstal» - MZ» PJSC «Pokrovskoe»
- IGTM them. Polyakova National Academy of Sciences of Ukraine
- Institute of Geological Sciences of the National Academy of Sciences of Ukraine
- National Mining University "Dneprovska Polytechnic"

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Main tasks and goals regarding CMM degassing and utilization

- Generalization, analysis and systematization of the accumulated experience on technology of degassing of coal seams of mines of Ukraine and its efficiency
- Generalization and analysis of world practices of CMM degassing and utilization technology
- Development of projects for CMM degasification and utilization
- Consulting services on the advanced technologies implementation for CMM degassing and utilization at mines of Ukraine
- Creation of catalogs and electronic database of geological characteristics of coal seams and of the best practices of CMM degassing and utilization
- Coal-mining enterprises' activities coordination in the field of CMM degassing and utilization
- Participation in the development of legislative and regulatory acts in the field of CMM degasification and utilization
- Exchange of best practices in the field of CMM degassing and utilization
- Coordination of scientific research in the field of technology improvement for CMM degassing and utilization
- Coordination of projects, grants, investments for coal-mining enterprises of Ukraine in the field of CMM degassing and utilization
- Training of the personnel of coal-mining enterprises of Ukraine of the best practices in the field of CMM degassing and utilization

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Stages of the Centre for Alternative Sources of Energy establishment

- Consultations, meetings, elaboration of the Common Policy by 01/08/2018
- Elaboration and approval of the General Work Plan by the organizers of the Centre by 01/10/2018
- Preparation of necessary documents for registration; registration of the Centre by 01/01/2019
- Elaboration and approval of the Annual Work Plan, staff formation, signing contracts, etc. throughout 2019

Thank you for your attention!