

Problems of using coal bed methane

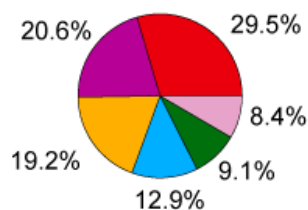
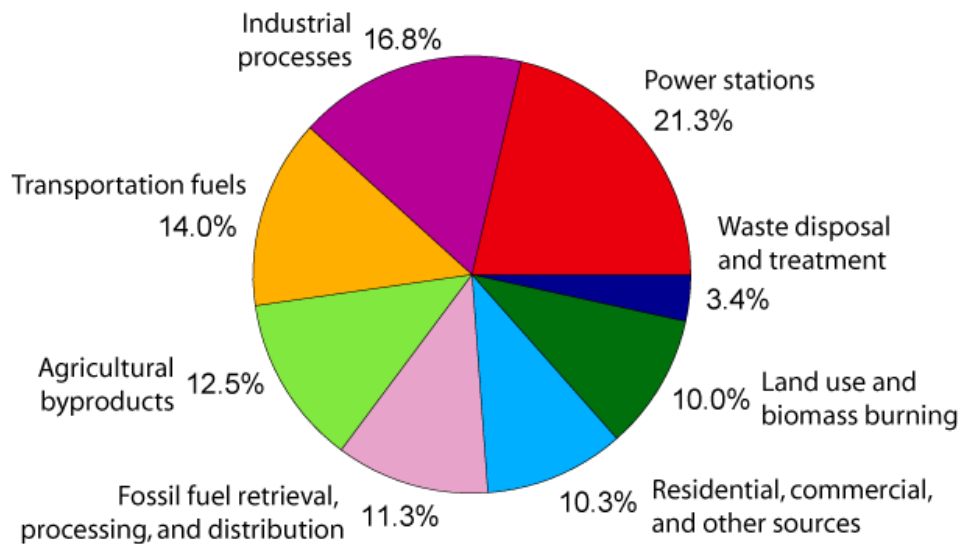


Why methane emissions is a cause for concern?

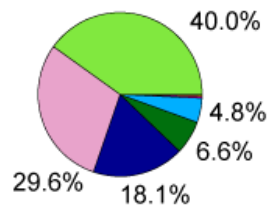
- 100-year period methane is 23 times more powerfully manifested itself as a greenhouse gas than the main emitter - carbon dioxide.
- Over the past two centuries, methane concentrations in the atmosphere have more than doubled, mainly due to human activities.
- The share of methane now account for 18% of global greenhouse gas emissions related to human activity

Greenhouse gas emissions by sector

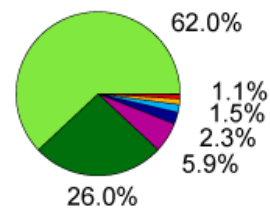
Annual Greenhouse Gas Emissions by Sector



Carbon Dioxide
(72% of total)

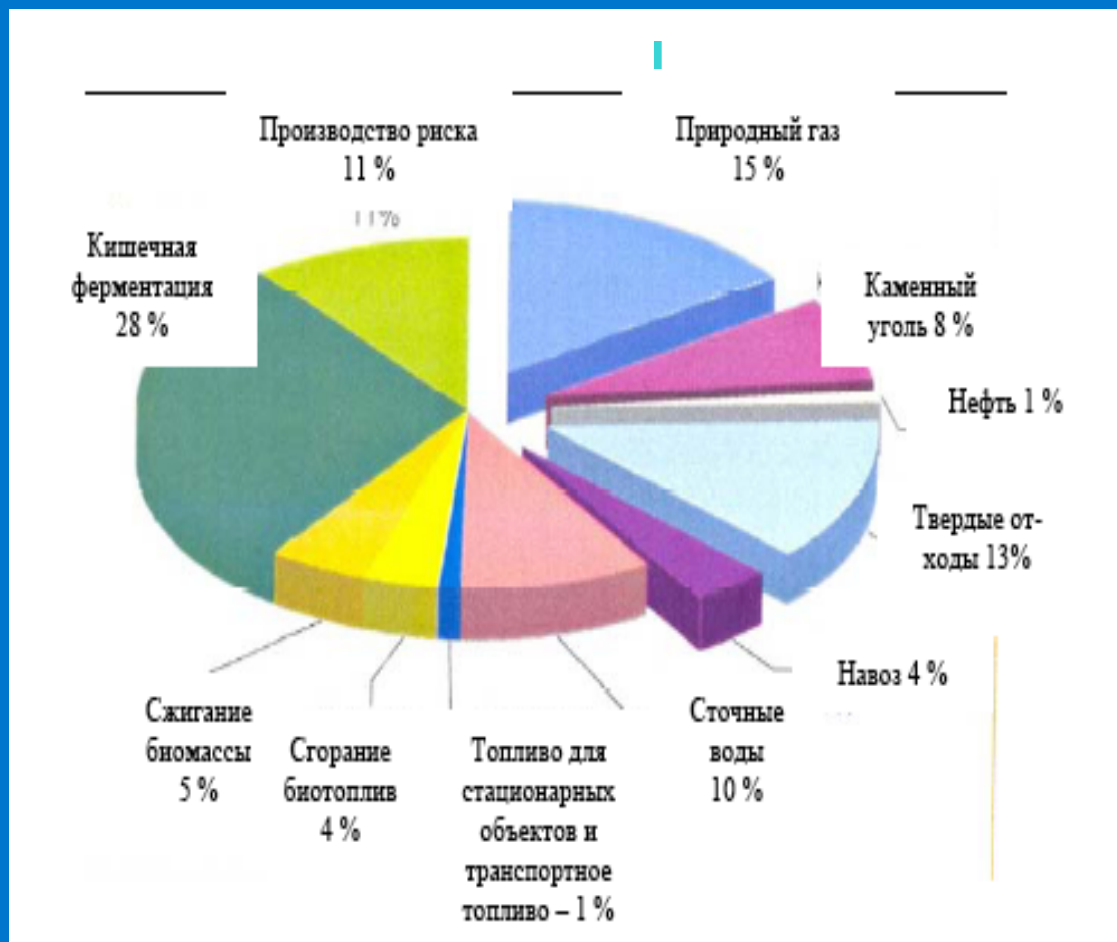


Methane
(18% of total)



Nitrous Oxide
(9% of total)

Global anthropogenic emissions of methane (60% of total global emissions of methane)



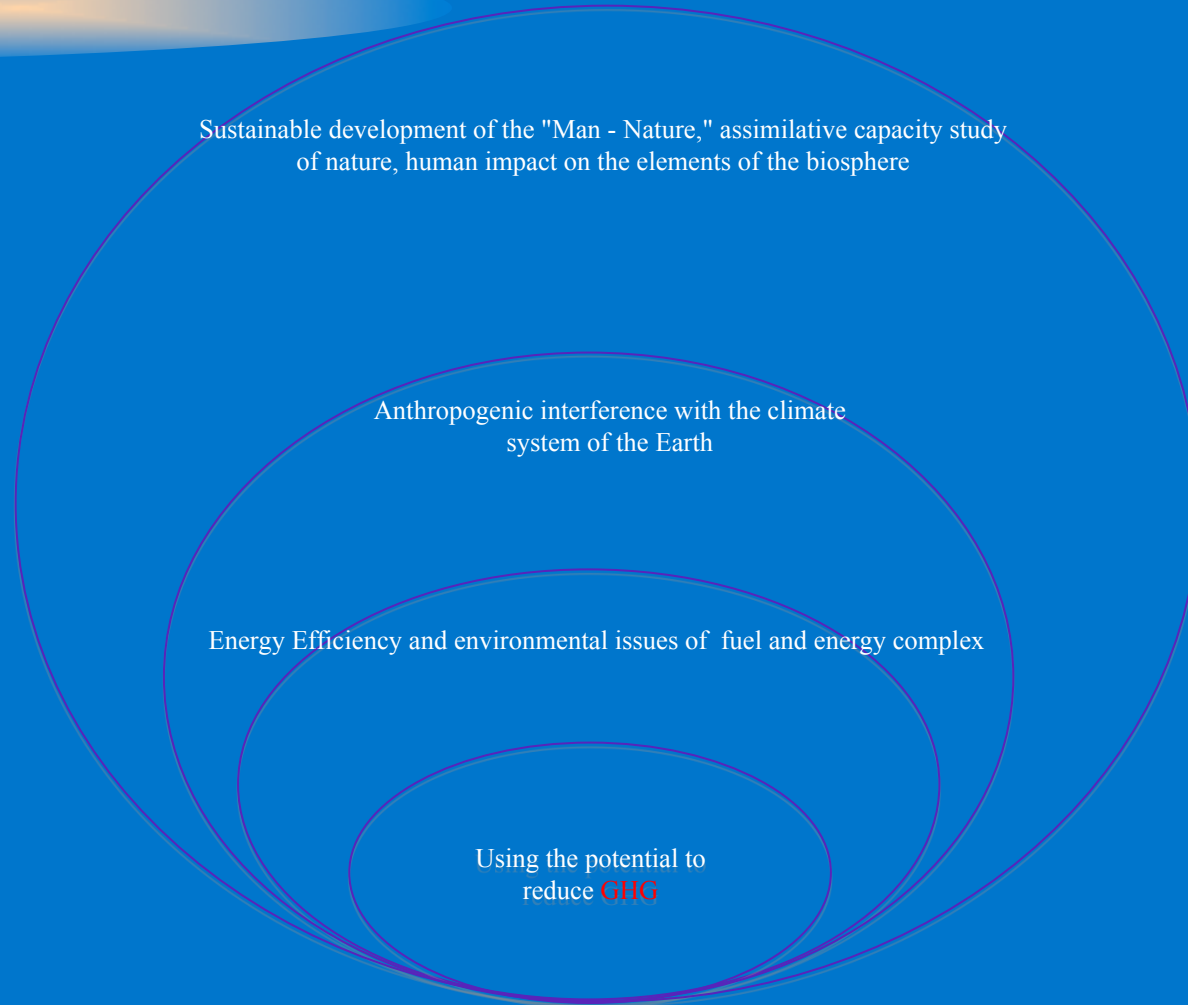
- ✓ China (coal production)
- ✓ United States (dump)
- ✓ Russia (oil and gas production)
- ✓ Ukraine
- ✓ Kazakhstan
- ✓ India
- ✓ Brazil

There are responsible for almost 50% of global anthropogenic emissions of CH₄

Why concentrate on the task of capturing the methane and using it as an energy resource?

- GREENHOUSE EFFECT – methane - a potent greenhouse gas with a short half-life in the atmosphere, thus reducing its emissions may cause significant and relatively rapid effect.
- FUEL-world CBM reserves exceed the reserves of natural gas are estimated at 260 trillion. m³
- ECOLOGY
- SAFETY

The hierarchical subordination of environmental problems at different levels of generalization applied to reduce greenhouse gas emissions



Direction of green economy

- Straight environmental activities (construction of various types of water treatment plants, filters, creation of protected areas, restoration, etc.);
- The development of low-and resource-saving technologies, technological change;
- The restructuring of the economy.

The level of coverage and priority cleaner production

- According to the degree of priority:

First the development of "unnatural" industries and activities.

Measures for environmental protection should be implemented on the basis of alternative or low-waste and non-waste technologies.

- The level of coverage:
differences in three directions

1. Greening
2. production
3. the level of coverage.

The implementation of the restructuring involves the macroeconomic and sectoral levels.

Low-waste and resource-saving technologies are mainly used at the enterprise level (group of companies), and regional levels. Similar to the scope of the direct and environmental measures.

The structural environmental capacity

$$e_a = Na / V = Nr / V + Ns / V = e_r + e_s$$

where e_a - total environmental capacity;

e_r - "rational" environmental capacity;

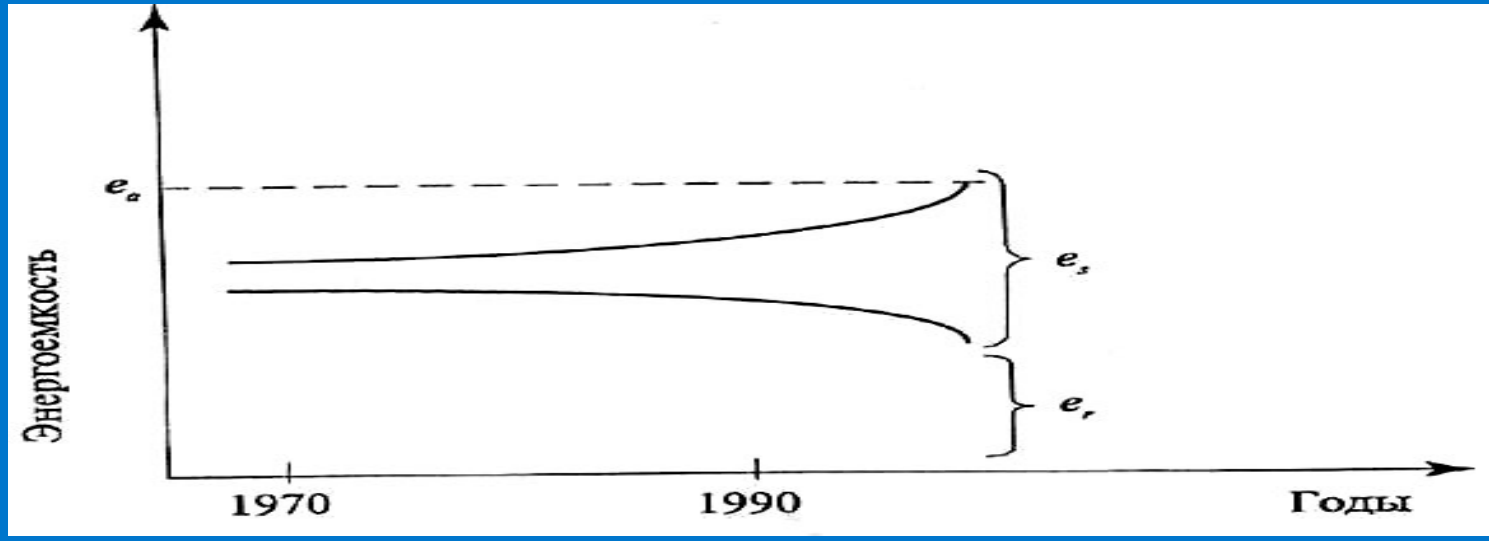
e_s - «structural and technological» environmental capacity;

Na - the total consumption of natural resources (resource);

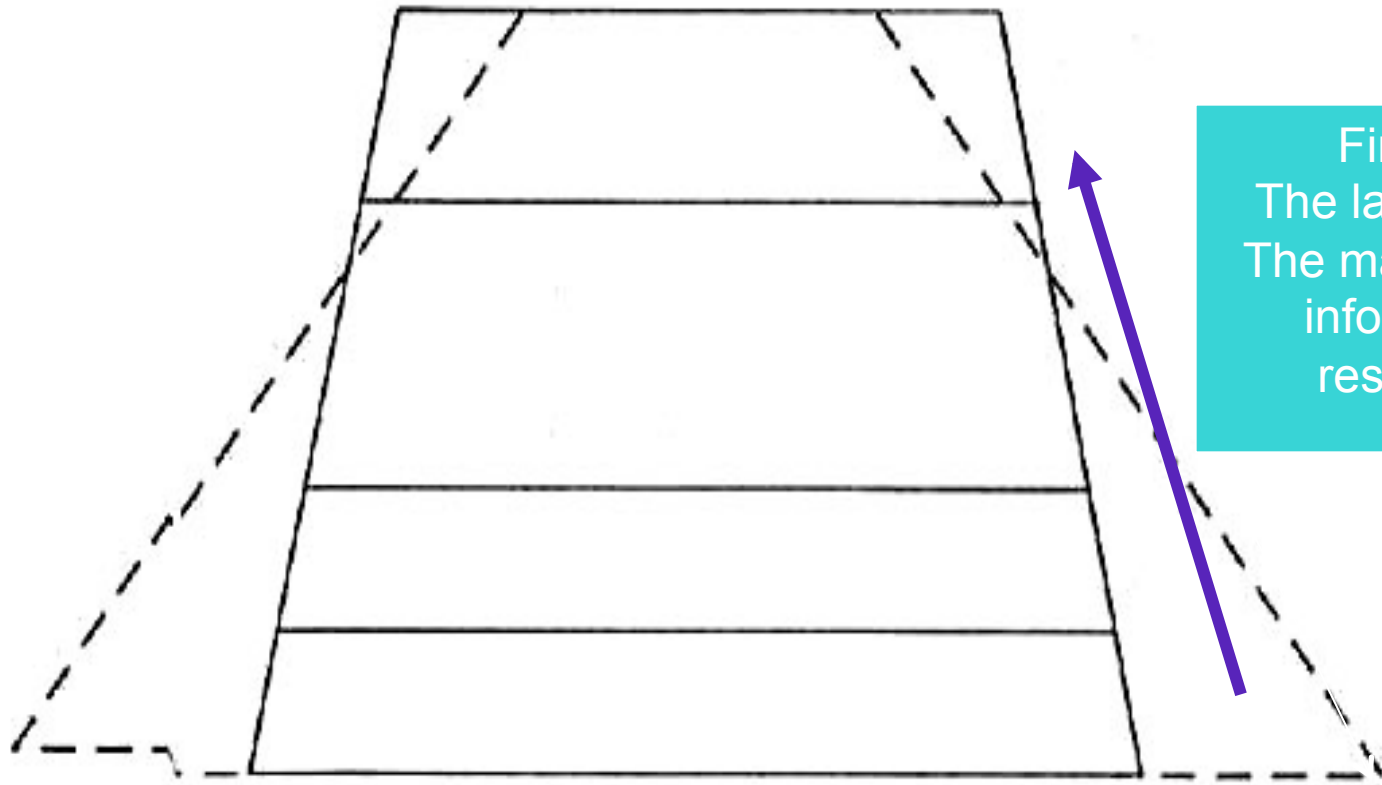
Nr - the volume of sustainable consumption of natural resources (resource);

Ns - volume structural and technological consumption (overconsumption) natural resources (resource);

V - number of total products.



Structural adjustment - implementation of the basic principle of a low-carbon economy



Finance,
The labor(work)
The material and
information
resources

Fuel and energy complex of the country

- the production and processing of fuel (fuel industries)
- electricity,
- transportation of electricity,
- distribution of electricity



Comparative characteristics of the energy production

Indicators	CHP, coal	CHP, gas	HEP	NPP	Solar energy	wind	geothermal	Bio mass
Air emission	100	10-60	-	-	-	-	<5	15-40
water consumption	100	58-63	-	150-175	-	-	-	33-50
discharges to water	100	40	-	<100	4	2	20	40

Coal. Statistics

- ❑ Coal provides 30.3% of global primary energy needs and generates 42% of the world's electricity
- ❑ Coal is the primary fuel for electricity production in the world - a country heavily dependent on coal for electricity production (2009)

The share of coal in electricity generation (2009)

country	%	country	%	country	%
South Africa	93%	Kazakhstan	70%	Morocco	55%
Poland	90%	India	69%	Greece	55%
China	79%	Israel	63%	USA	45%
Australia	76%	Czech Republic	56%	Germany	44%

Proved reserves of coal in 2009 in million tonnes

Country	black coal	brown coal	Total	%
USA	111338	135305	238308	28,9
India	90085	2360	92445	10,2
China	62200	52300	114500	13,9
Russia	49088	107922	157010	19,0
South Africa	48750	0	48750	5,4
Australia	38600	39900	78500	8,6
Kazakhstan	28151	3128	31279	3,4
Ukraine	16274	17879	34153	3,8
Poland	14000	0 _?	14000	1,5

The largest coal producing country

Production of coal per year (million tonnes)

Country	2003	2004	2005	2006	2007	2008	2009	%	How long will the proven reserves (years)
China	1722.0	1992.3	2204.7	2380.0	2526.0	2782.0	3050.0	45.6 %	38
USA	972.3	1008.9	1026.5	1053.6	1040.2	1062.8	973.2	15.8 %	245
Australia	351.5	366.1	378.8	385.3	399.0	401.5	409.2	6.7 %	186
India	375.4	407.7	428.4	447.3	478.4	521.7	557.6	6.2 %	105
EC	638.0	628.4	608.0	595.5	593.4	587.7	536.8	4.6 %	55
Russia	276.7	281.7	298.5	309.2	314.2	326.5	298.1	4.3 %	500+
South Africa	237.9	243.4	244.4	244.8	247.7	250.4	250.0	3.6 %	122
Indonesia	114.3	132.4	146.9	195.0	217.4	229.5	252.5	3.6 %	17
Germany	204.9	207.8	202.8	197.2	201.9	192.4	183.7	2.6 %	37
Poland	163.8	162.4	159.5	156.1	145.9	143.9	135.1	1.7 %	56
Kazakhstan	84.9	86.9	86.6	96.2	97.8	111.1	101.5	1.5 %	308
world production	5,187.6	5,585.3	5,886.7	6,195.1	6,421.2	6,781.2	6,940.6	100 %	119

The main directions and results of the impact of coal enterprises on the environment

Environment	The direction of impact	Result of the impact
Air	Organized and unorganized emissions of harmful substances into the atmosphere	Dust pollution and air pollution in the work area and adjacent areas. Reduced service life of buildings and equipment. The increased incidence of living organisms
Water	Drainage of the field. Liquidation or transfer of surface water bodies and watercourses. Reset mining, quarrying and water drainage. The unit water intakes for industrial and household needs	The depletion of groundwater and surface water. Violation of the hydrogeological and hydrological regimes territories. Deterioration in the quality and pollution of the water basin. The disappearance of small rivers and streams
land resources	Conducting excavations for various purposes. The construction of waste dumps, slime storage and utilities. Industrial and Civil Construction	The degradation of the earth's surface and the formation of man-made terrain. Reduction in acreage and productivity of land. Strengthening erosion. Pollution and salinization of soils. Deterioration of living conditions of living organisms
mineral resources	Extraction of minerals and related minerals. Excavation of overburden. Drainage of the rock mass. Spontaneous combustion of fossil fuels and uglevmeschayuschih rocks. Disposal of wastes and harmful substances. Discharge of sewage	Depletion of mineral resources. Violation of the geological structure and geodynamic state of the rock mass. Reducing and depletion of groundwater. Subsurface contamination. Acceleration of karst processes. Loss of minerals in the mining and milling

«A Problem– Decision»

- Outlook -

Coal will occupy a significant place in the energy balance of the country.

- A Problem-

- ✓ Mining: an impact on all elements of the biosphere
- ✓ Burning: A significant amount of low-grade high-ash coal.

- Decision –

- ✓ Mining: the integrated use of mining waste
- ✓ Burning : the use of innovative coal technologies

Fuel Combustion under a licence from Central Compressor Station (CCS).



The amount of methane released during a coal mining

- natural methane content of solid fuel
- brand name of solid fuel
- reservoir depth
- Mining and geological features of the deposit
- development system recovery.

The methane emissions from production, processing and transportation of coal

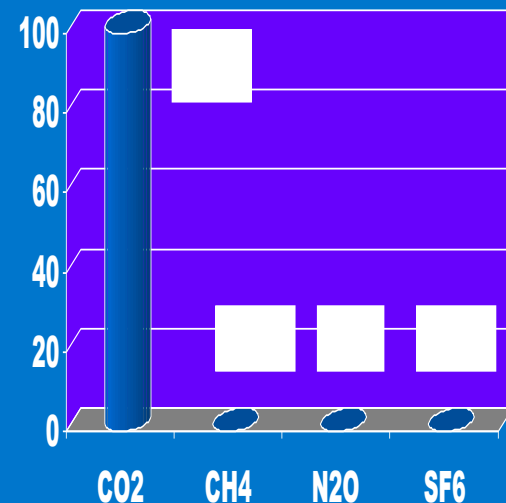
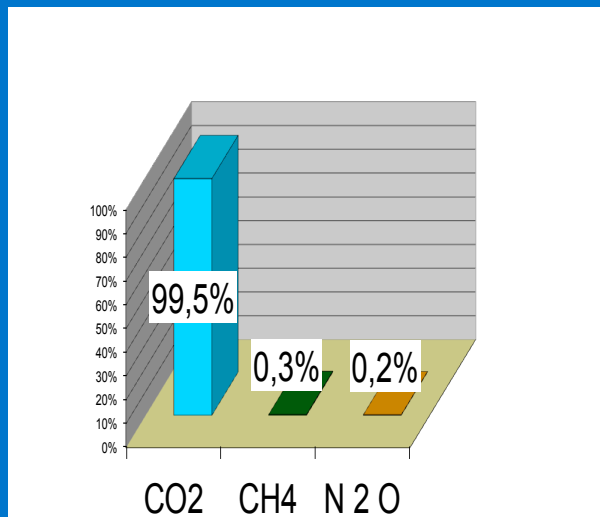
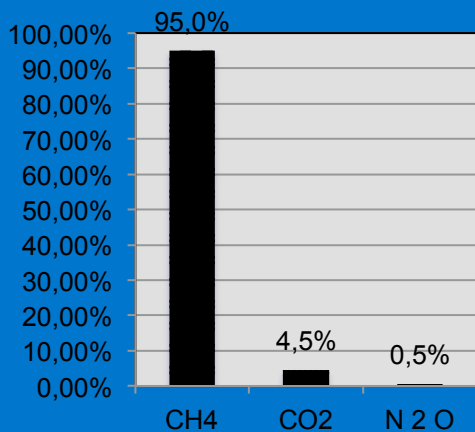
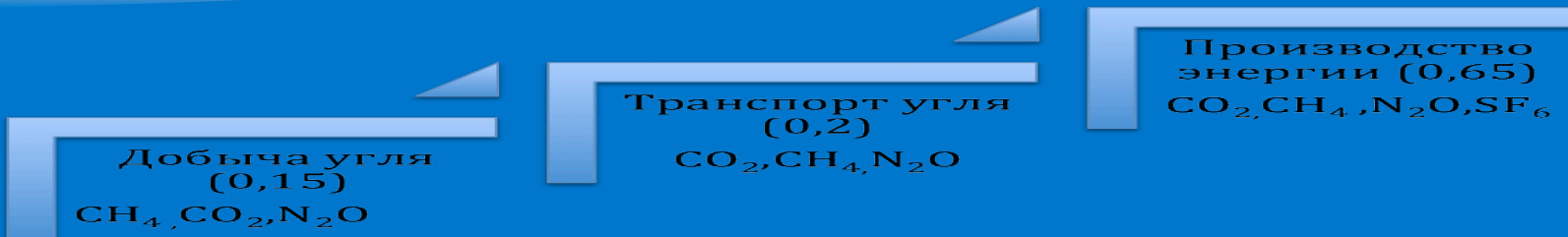
Total emission = Emission during underground extraction of coal mining + Emission during coal open-pit + Emission at follow-up? - The amount of methane recovered and used.

The coefficients of methane emissions , m^3/T

	The coefficients of emissions	
<i>Type of activity</i>	underground extraction	open-pit
Output	10 – 25	0,3 - 2,0
<i>Transportation and processing</i>	0,9 - 4,0	0 - 0,2

The specific contribution of greenhouse gases in the system

"Extraction, transport - the burning of coal"



Characteristics of methane as fuel

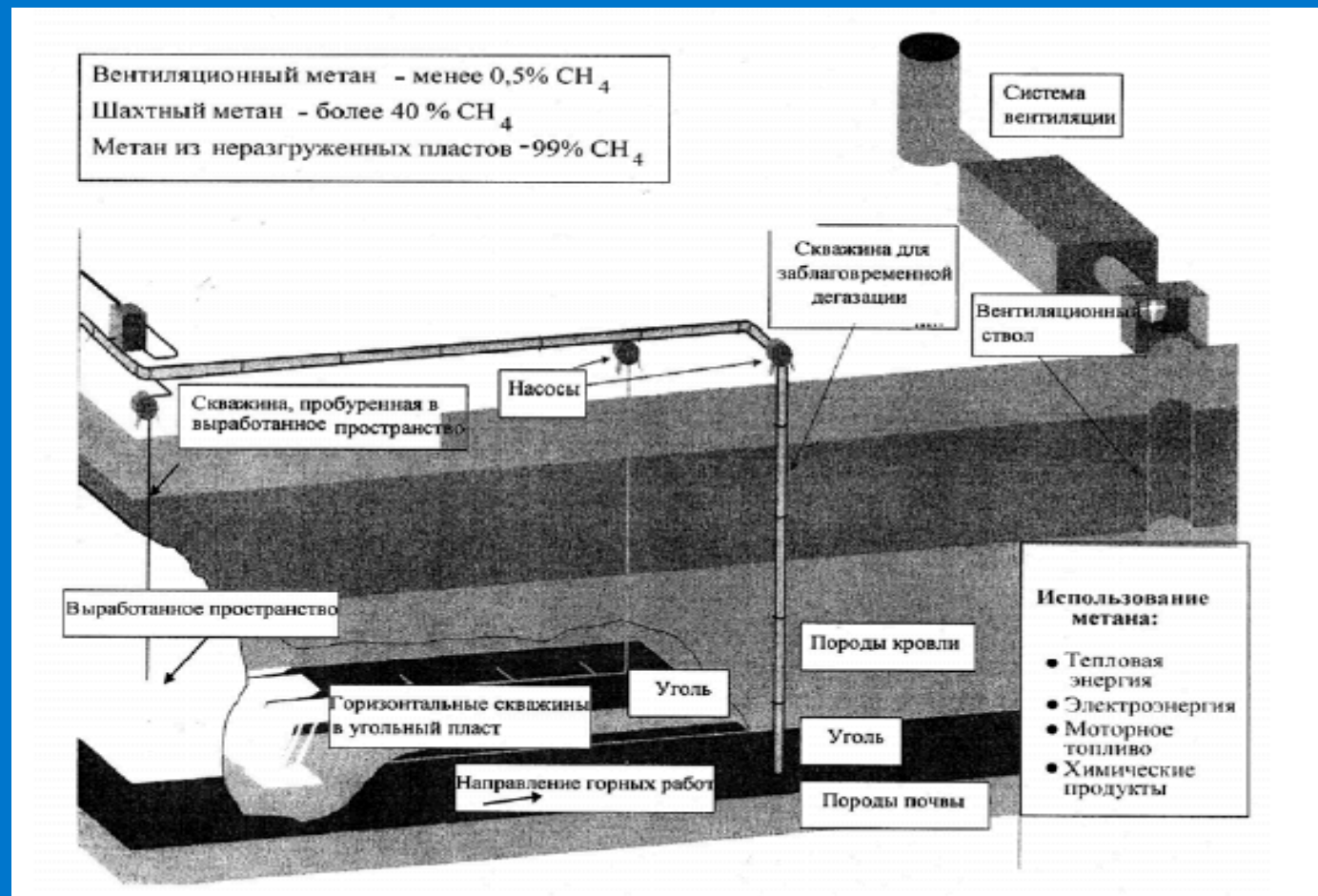
- ❑ coalmine methane is a valuable secondary energy resource
- ❑ The composition of coal mine methane gas present in the undisturbed coal-bearing array at depths of modern development, and natural gas, some gas fields almost the same:
 - ❖ CH₄ content in coal mine methane is 97 – 99%, in natural gas - 95 - 99%;
 - ❖ the content of other hydrocarbons comes to 0.1% in natural gas - 0.05 - 3;
 - ❖ H₂ content in the coal mine methane is 0.1% for natural gas - not available;
 - ❖ CO₂ content is 0.3% of the natural gas - 0.18 - 1.2;
 - ❖ content of inert gases is 1 - 2.6, in the natural gas - 0.4 - 3.
 - ❖ The calorific value of coal mine methane and natural gas are also almost the same.

Technology of methane extraction.

International terminology .

- **VAMI-Ventilation Air Methane** (Methane outgoing air flow, the concentration of methane in air of less than 1%)
- **CSMI-Coal Seam methane** (Methane from coal seams existing mines, the concentration of 25-60%)
- **CMMI-Coal Mine Methane** (Methane from abandoned coal mines, concentration - 60-80%)
- **CBMI-Coal Bed Methane** (Methane unloaded coal seams extracted by wells drilled from the surface, the concentration of more than 95%)

Methods of extracting methane from existing mines



The experience of countries in utilization of coal mine methane

- VAMI - The use of methane venting

Australia

implemented the technology to generate electricity from the outgoing air flow in the combustion of low concentrated methane (volume concentration of 0.3-0.8%) in the burners.

Mine air flow rate of 255 thousand m³ can give about 5 MW of electricity

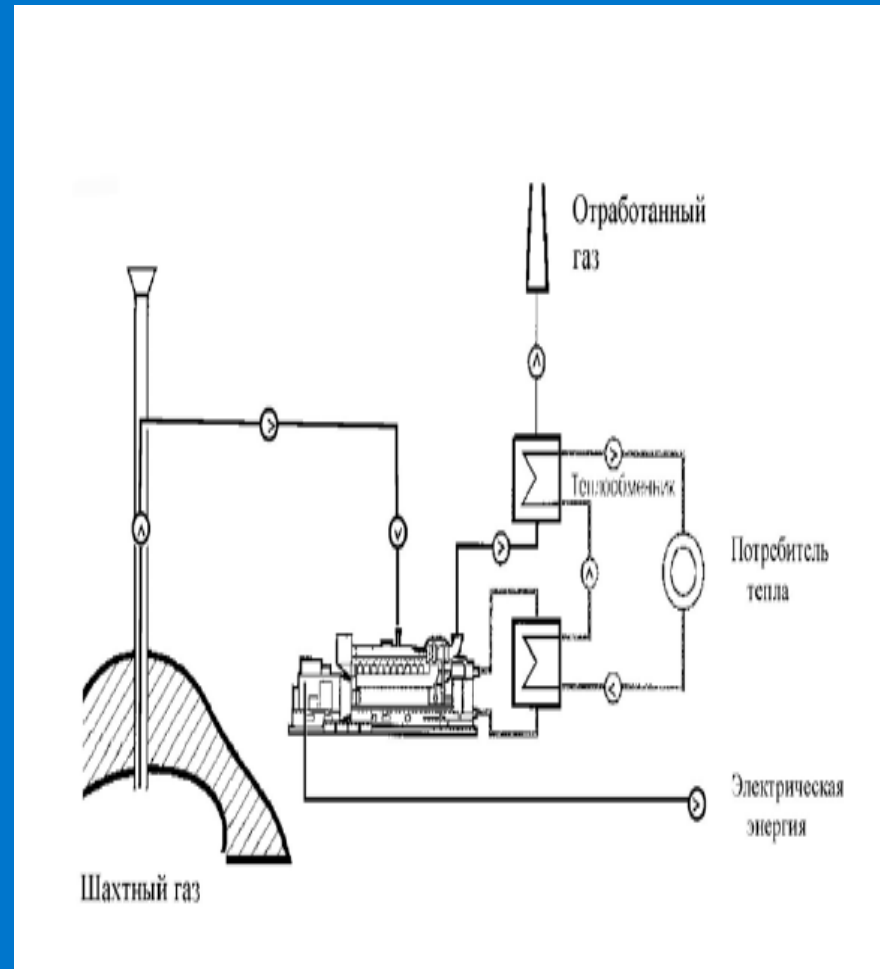


The experience of countries in utilization of coal mine methane

CSMI - Methane from coal seams operating mines

Germany receives electrical power through the implementation of projects to generate electricity from methane exceeds 120 MW.

Germany advances - the state technical policy that encourages the development of new environmentally friendly energy source - the source of electricity and heat.



The experience of countries in utilization of coal mine methane

- **CMMI - Extraction of methane from abandoned mine**

(in goafs remains a significant amount of methane projected volumes of methane in the goaf is 2-3 times higher than the volume of gas released during production).

Experience in England, Germany, France, Belgium and other countries has shown that the intensity and volume of extraction of methane from abandoned mine workings and waste horizons are so great that its use as an energy source is economically justified.

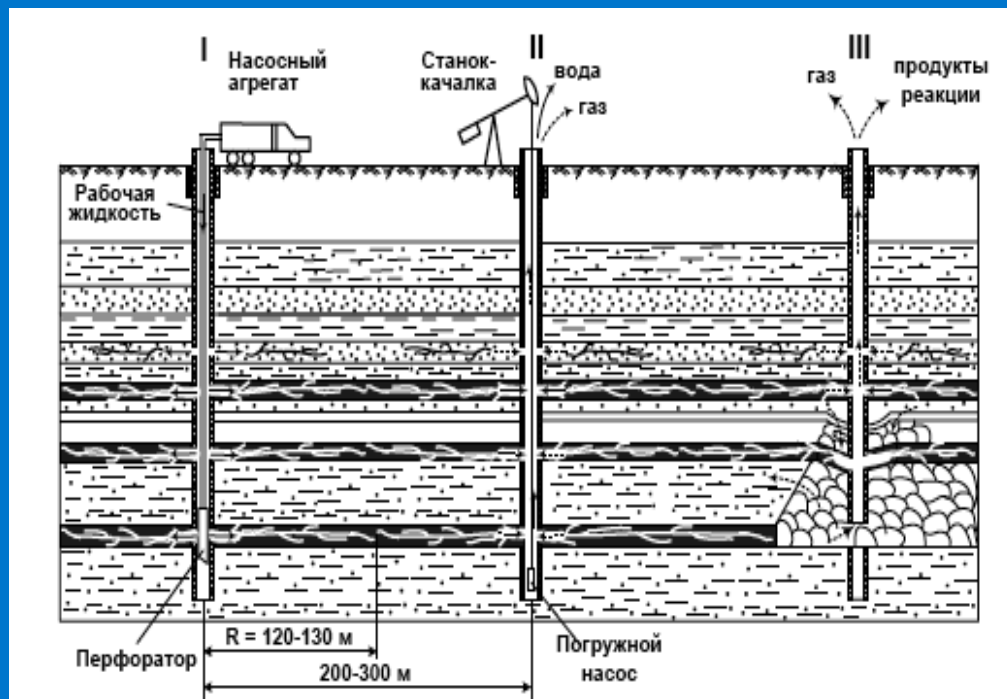
Australia (from 1942 for 25 years, recovered 365 million m³ worth more than \$ 40 million)

Germany (s1959 to 1985 extracted 265 million m³ in the amount of 29.1 million dollars)

France (from the late 1970s, recovered 55 million m³ in the amount of 6.5 million dollars)

The separation of methane

- СВМИ-
methane from
unloaded coal
seams,
extracted
through wells
(USA, Australia, etc)



U.S. initiate partnership methane M2M (2004 z)

- *partnership Goals :*

- To promote cooperation with the private sector, research organizations, development banks, and other applicable government agencies and non-governmental organizations.
- Identify cost-effective opportunities for the involvement of the recovered methane into energy production and to determine the potential financial mechanisms to support investment.

Field of interest Partnerships - dumps, coal mines and oil and gas systems.

In partnership includes **16 countries**: Argentina, Australia, Brazil, Canada, China, Colombia, India, Italy, Japan, Mexico, Nigeria, South Korea, Russia, Ukraine, United Kingdom, United States.

The partnership expects to reducing methane emissions by 2015 to 50 million tonnes of CO₂ equivalent.

The problem of methane in the modern mining industry

- safety and economics of coal mining;
- energy use of methane;
- environmental problem of methane associated with the receipt of methane into the atmosphere during mining operations

**Thank you
for
attention!**