COAL MINE METHANE IN UKRAINE:

OPPORTUNITIES FOR PRODUCTION AND INVESTMENT IN THE DONETSK COAL BASIN

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ABBREVIATIONS AND TERMS

atm	Atmospheres
CIS	Commonwealth of Independent States
°C/100 m	Degrees Celsius per 100 meters
CO_2	Carbon dioxide
daf	Dry ash free
Gcal	Gigacalories = 10^9 calories
m^3/tonne	Cubic meters per tonne
mD	MilliDarcy = 10^{-3} Darcy
MPa	MegaPascal = 10^6 Pascal
MWh	MegaWatt hour = 10^6 Watt hour
oblast	Largest Ukrainian territorial administrative unit (region), subordinate to the State. There are 24 oblasts in Ukraine.
Ohm·cm	Ohm·centimeters
rayon	Administrative unit (district) subordinate to oblast
km^2	Square kilometer
tonnes/day	Metric tonnes per day
CBM	Coalbed methane. Methane contained in coal seams and the rock strata surrounding the coal seams.
CMM	Coal mine methane. Methane contained in coal seams and the rock strata surrounding the coal seams in reserve areas that have been assigned to specific mines.

1.0 INTRODUCTION

1.1 Purpose of the Handbook

The purpose of this handbook is to introduce twenty-nine Ukrainian coal mines that have been determined by the authors to have the highest potential for commercial coal mine methane development projects. The information provided about these mines should allow prospective developers to make a preliminary assessment of future opportunities in Ukraine.

Ukraine has a vast untapped coalbed methane energy resource. Geologic exploration by Ukrainian resource professionals confirm the magnitude of the reserves, but only minimal commercial development and utilization have taken place.

1.2 Mine Selection Criteria

The mine selection process analyzed 1998 and 1999 data and information from all of the coal mines in Ukraine. The twenty-nine mines equal or exceed the following criteria:

- mine annual production exceeding 250,000 tonnes per year,
- specific methane content in the coal greater than 20 cubic meters per tonne,
- coal reserve base sufficient for a remaining mine life in excess of ten years, and
- the mine has not been selected for closure.

1.3 Importance of Coalbed Methane in Ukraine

Commercial development and utilization of coalbed methane/coal mine methane (CBM/CMM) in Ukraine will have many positive benefits for the economy, the environment, and the coal industry. A fully implemented CBM/CMM development program will result in the following:

- creating an alternative energy source that would mitigate Ukraine's dependence on imported fuel, primarily natural gas from Russia and other CIS countries;
- reducing the amount of methane, a potent greenhouse gas that Ukrainian coal mines release to the atmosphere; and
- improving coal mine safety, coal mine employee health, and productivity.

In 1999, the Cabinet of Ministers of Ukraine drafted a national energy program for 2000 to 2010. This program includes a set of goals for the energy sector to achieve a more balanced supply/demand situation through a combination of alternative energy sources and energy efficiency programs. One of the goals is to have eight billion cubic meters of CBM, including CMM, produced per year by the year 2010.

1.3.1 Coalbed Methane as an Alternative Fuel Source

The large-scale capture and utilization of CBM could contribute greatly to meeting Ukraine's energy requirements. Ukraine currently consumes approximately 75 billion cubic meters of natural gas on an annual basis while only producing approximately 18 billion cubic meters from domestic sources. This shortfall of approximately 57 billion cubic meters per year is imported from Russia and other CIS countries, creating a serious increase in foreign debt. Ukraine receives 30 billion cubic meters of natural gas from Russia each year as compensation for transporting Russian natural gas to Europe through pipelines located in Ukraine. The remaining 27 billion cubic meters of natural gas is sold to Ukraine at $80 per thousand cubic meters, thus creating a negative balance of trade in excess of $2 billion per year.

Increasing domestic standard natural gas and oil production is not an economically feasible option for Ukraine. Under the Soviet Union, the larger and shallower natural gas and oil reserves were depleted, leaving small, deep, and expensive reserves, and Ukraine does not have the vast capital resources that would be required to develop them.

It is clear that the gas produced from a commercial CBM development project would have a ready market that would improve the economic conditions in Ukraine.

1.3.2 Environmental Benefits of Using Coal Mine Methane

Methane is one of a number of gases that scientists believe contribute to the greenhouse effect, the trapping of heat in the Earth's atmosphere. The extent to which any given greenhouse gas traps heat is measured relative to the heating effect of carbon dioxide. Methane is estimated to be 21 times as potent as carbon dioxide in trapping atmospheric heat over a hundred-year period. Methane and other greenhouse gases are released to the atmosphere through various natural processes and through many human activities, such as the mining of coal.

Capturing and utilizing CMM in Ukraine can significantly reduce the amount of greenhouse gas that coal mines now emit into the atmosphere. During 1999, Ukrainian coal mines generated approximately 2,060 million cubic meters of methane. Through degasification systems, the mines captured approximately 257 million cubic meters of methane (13% of the total generated) but used only 79 million cubic meters of the captured methane. Thus

Ukrainian coal mines emitted approximately 1,981 million cubic meters of methane into the atmosphere. Not only is this a waste of a vitally needed energy source but also a significant contribution to the greenhouse gas effect.

The development of CMM projects in Ukraine can reduce the amount of gas coal mines emit into the atmosphere. In addition, Ukrainian coal mines could be considered sources of valuable carbon credits. As of July 2000, over $30 million of carbon credit transactions have taken place on a worldwide basis. The total potential market for carbon trading could reach in excess of $10 billion by the year 2010. Thus far, the monetary values of cabon credit trades have been only a fraction of the cost of a greenhouse gas emissions reduction project. However, there is not yet a consensus among economists on the total mitigation costs that should be included in the carbon credit transaction. In comparison with CMM development projects in the U.S., CMM mitigation costs in Ukraine may be considerably lower.

1.3.3 Coal Mine Methane as a Health and Safety Issue

The development of CMM projects at coal mines in Ukraine can greatly reduce mining accidents and fatalities. In 1999, Ukraine coal mines experienced 296 fatalities, or 3.7 deaths per one million raw tonnes of coal produced. This fatality rate is one of the worst in the world. Many of the fatalities are the result of outbursts caused by high gas content or explosions caused by the ignition of explosive concentrations of methane. Premining degasification of the coal reserves, through drilling of vertical wells and utilizing enhanced underground degasification systems, would greatly reduce the accident and fatality rates in Ukrainian coal mines. In addition, removal of the methane from the mines will increase productivity by reducing the number of mine slowdowns or shutdowns due to high methane levels. CMM development projects can reduce coal mine accidents and fatalities and at the same time reduce mining costs by increasing productivity.

2.0 COAL MINE METHANE AND THE COAL INDUSTRY

2.1 Introduction

The problems of the coal industry of Ukraine are well documented and will influence the business structure of any proposed CMM development project. It is necessary to be aware of some of the nuances of the Ukrainian coal industry to properly assess the viability of a potential CMM project. In particular, such issues as the relationship between the project and the coal mine, ownership of the resource, sales and use of the methane, payments for methane sales, and current practices of methane capture and utilization will all influence the business structure of a viable CMM development project.

2.2 Structure of the Coal Industry

At the end of end of 1999, Ukraine had 244 active coal mines that consisted of 241 underground mines and three surface mines. Collectively, these mines produced 81 million raw tonnes during 1999, which resulted in approximately 63 million tonnes of salable product. All of the coal mines in Ukraine are owned by the State and are under the jurisdiction of the Ministry of Fuel and Energy. Subordinate to the Ministry, all but four mines are organized under twenty-three holding companies. Each holding company has between eight and twelve coal mines, grouped by physical proximity or for the purpose of sharing certain assets. The four mines that are not part of holding companies are categorized as independent mines, but are still under the jurisdiction of the Ministry of Fuel and Energy. One of the mines profiled in this Handbook, the independent Komsomolets Donbassa Mine, has initiated the process of listing the sale of their shares with a goal of selling 100% of the shares to investors.

It is important for a potential investor to determine the business structure of a coal mine prior to exploring a new CMM project. A coal mine must have the authority to enter into a business arrangement for a project to proceed. The ultimate authority lies with the Ministry of Fuel and Energy, but the support and concurrence of the mine and holding company (if the mine is not independent) is essential for the project to proceed.

A project developer must establish and maintain a strong working relationship with the coal mine. The project must work with the mine to stay abreast of the current coal production, advancement of development works, and plans for the future areas of development. However, with the host of economic, social, and political issues currently found at Ukrainian coal mines, a CMM developer may wish to structure the project to properly address these issues.

2.3 Ownership of the Resource

As previously stated, the coal mines and the coal resources are owned by the State. The coal reserves are assigned and licensed by the State to individual mines. The CMM reserves are also owned by the State, necessitating a separate license to develop this resource. Many coal mines have already received a CMM license from the State. A project developer must determine the status of any CMM license agreements before proceeding. Current Ukrainian laws on licensing of resources allow for a development license for a five-year period with certain development requirements before a production license can be obtained for the

project. Both the development and production licenses include a fee to be paid to the State for the capture and sale of the resource.

2.4 Current Methane Capturing Practices In Ukraine

Mine degasification or drainage systems remove the gas from coal-bearing strata before, during, and after mining, depending on the particular needs of the mine. Degasification allows mines to minimize ventilation costs, reduce mining delays, and enhance mine safety. Mines degasify by employing three major types of wells: vertical wells drilled from the surface, underground horizontal boreholes drilled along the mined coal seam, and cross-measure boreholes drilled through the coal seam and surrounding rock. Each degasification technique has specific features in terms of methane extraction.

Vertical wells are drilled in advance of mining to recover gas with high content of methane, often over 95 percent. Vertical wells can be drilled from the surface into actively mined coal seams and surrounding rock strata. Often, if the area is very gassy, such wells are used to remove methane from the coal and surrounding rock strata five to ten years in advance of mining. Vertical wells drilled in advance of coal mining can recover up to 70 percent of the methane contained in coal seams. Vertical wells can be converted to gob wells to extract gas from the fracture zone caused by the collapsed strata after mining passes. Independent gob wells are drilled from the surface to a point 3 to 20 meters above the target zone. Gob wells often produce gas with methane content of 20 to 80 percent. Currently in Ukraine there are only two projects that utilize vertical well drilling to release and capture methane in advance of mining.

Horizontal boreholes are drilled inside the mine to drain methane from unmined areas of blocked-out longwall panels. In the United States horizontal boreholes are typically 120–240 meters long, and in some cases they are over 1,000 meters long; however, in Ukraine they are typically 30 to 50 meters. Generally, these wells recover gas that contains over 95 percent methane. However, their drainage efficiency is lower compared to vertical wells and is typically within the range of 10 to 50 percent.

Cross-measure boreholes are most common in Ukrainian mines. These boreholes are drilled at any angle through the coal seam being mined to degasify the rock strata above and below the coal seam. Cross-measure boreholes often produce gas with methane content between 30 and 80 percent, and their drainage efficiency averages 20 percent.

Degasification wells and boreholes are linked to a centralized vacuum pump or a compressor station by a system of connected pipelines. Because mines operate at deep levels in Ukraine and have little funds, the drainage systems often have multiple leakage points, resulting in lower methane content in the gas stream.

2.5 Methane Utilization in Ukraine

Of the 1,981 million cubic meters of CMM generated by Ukraine coal mines in 1999, approximately 13 percent was extracted through degasification systems, and only four percent was utilized. At present, 52 mines in Ukraine have degasification systems, and only 11 mines utilize methane for their needs. At the mine level, the principal application of methane is as a substitute for coal in mine boilers.

While this is the situation today, with proper development CMM could be used for many other productive purposes. Ukraine is heavily dependent on imported natural gas; therefore, any additional domestic source of this fuel could bring this country's economy closer to self-sustaining. The government of Ukraine has instituted several initiatives, namely the National Energy Conservation Program and the Program of Reducing Natural Gas Consumption, that include CMM projects. However, only a few selected efforts have been implemented so far due to the lack of funding.

In Section 5 of this handbook, the profiles of each of the selected twenty-nine coal mines contain information regarding the number of boilers, size of boilers, and the amount of heat consumed per year at each mine. Technical parameters of the boilers are given in Figure 4. This boiler information can be used to determine the amount of methane that could readily be purchased, traded, or consumed at the mine site. In addition, there are two locations in Ukraine that utilized captured coalbed methane as vehicle fuel for fleets of trucks, buses, and cars. Although this is not anticipated to be a large market for a new project, it could be considered as an additional option in structuring a financial arrangement with a coal mine.

The two largest markets for the methane produced from a new CMM project would be the sale of pipeline quality gas and in the generation of electricity. As previously noted, Ukraine is heavily dependent upon imported gas, and a ready market is in place to receive any newly produced gas. Also, production of electricity from captured methane is relatively inexpensive and could be sold to the mine, to the local community, or to the electric grid system.

Historically, Ukraine has experienced a poor record of cash collections from customers for natural gas and electricity sales. However, during the first six months of 2000, this trend has reversed and cash collections have dramatically increased due to consumers being shut off for nonpayment. Cash collections in the electricity sector have risen to 46 percent during the first six months of 2000, as compared to a low of 17 percent during the worst month of 1999. The Ukrainian

government has established a goal of 50 percent cash collections by the end of 2000 with continued increases in the following years.

3.0 COALBED METHANE LAWS AND REGULATIONS

3.1 Introduction

Since Ukraine's independence in 1991, it's laws and regulations have been in a state of flux as the nation moves from the Soviet-style administrative economy to one more market oriented. An investor should conduct a complete review of the existing and new laws and decrees prior to investing in a CBM/CMM development project in Ukraine. A general overview of the legislative and approval processes is provided below.

The government of Ukraine has an executive branch that consists of an elected President, an appointed Prime Minister, and several Deputy Prime Ministers. The Deputy Prime Ministers provide an oversight role to different sectors of the economy. The executive branch of the government and its agencies are authorized to issue decrees that often are as legally binding as laws passed by the legislative branch. The legislative branch, the Verhovna Rada, is composed of elected members from geographic constituencies of the nation, and is empowered to pass laws for the country.

3.2 Key Government Agencies

Development of a CBM/CMM project in Ukraine will require working with a host of government agencies at the national, regional *(oblast)*, and municipal levels. In this section, key organizations at the national level are identified that could, by passing laws, decrees and regulations, have an effect on the implementation of a CBM/CMM project. It should be noted that the government of Ukraine is currently going through a general reorganization, and therefore this list of key agencies is subject to change.

- The President of Ukraine
- The Prime Minister of Ukraine
- Deputy Prime Minister, Fuel and Energy
- Ministry of Fuel and Energy
- Ministry of Ecology and Natural Resources
- Ministry of Labor and Social Policy
- Ministry of the Economy
- Ministry of Finance
- State Oil and Gas Committee
- State Committee on Geology
- State Committee on Energy Conservation
- National Academy of Science

In addition to these organizations at the national level, the development of a CBM/CMM project will require the coordinated efforts of the oblast and local municipal administrations. Often, approvals for local requirements must be obtained from the regional and municipal administrations during the project development cycle.

3.3 National Legislative Issues

During 1998 and 1999, the development of CBM in Ukraine has become a high profile issue. Significant laws and decrees by the executive branch and the Supreme Rada have been introduced during this timeframe that could have a positive impact on CBM/CMM development projects. Two of the most significant enactments have been the passing of Production Sharing Agreements (PSA) and the establishment of Free Economic Zones (FEZ). The PSA, although it has not been tested for CMM, establishes a set of binding legal and civil commitments by both the investor and the government regarding the development of natural resources in Ukraine. These commitments were established to guarantee certain standards of operational, institutional, and financial performance throughout the term of the PSA. In 1998, a law establishing FEZ status to the Donetsk Region was passed. The law provides for various tax incentives to attract investment into the region.

Numerous other laws and enactments have been drafted that will enhance the legal and tax issues regarding CBM/CMM development. However, before making an investment decision in Ukraine, any project developer who is interested in a CBM/CMM project is strongly advised to review the current status of all laws and acts that could impact the proposed project.

4.0 COALBED METHANE RESOURCES OF THE DONETSK BASIN

4.1 Introduction

As with any natural resource project, a CMM development project will require a site-specific geological review and analysis. During the initial evaluation period, an understanding of the geological conditions of the area is important.

The Donetsk Basin (commonly referred to as the Donbass) is located in the southeastern part of Ukraine, extending into the territory of Russia. Geologically, the Donetsk Basin represents a large bending flexure that covers an area of approximately 60,000 square kilometers. The coal is from Carboniferous deposits with over 330 identified coal seams to a depth of 1,800 meters. However, only a hundred seams of that number

are considered mineable due to seam thickness or depth constraints.

4.2 Overview of Geology

In general, the Donetsk Basin is bounded on the north and southwest by outcrops of the bottom coal seams. The eastern boundary is represented by a general pinch-out of the coal seams, and the southern boundary by Priazovsky crystalline rocks. To the northwest of the basin, a general depression of the coal beds can be found that reaches the depth of 1,800 meters.

In Ukrainian terminology, the coal-bearing area of the Donetsk Basin is commonly divided into several geological/industrial districts with each of them having its own specific geological traits (Nedra 1972).

4.2.1 Geological Profile of the Donetsk Basin

The Donetsk Basin is characterized by wide tectonic diversity. The outcropping area of the Donetsk Basin is mostly folded with the central portion composed of large linear structures. The northern and southern borders of the basin contain many minor folds and faults. Thrusts are typical for the northern part of the basin, and slip faults occur primarily in the south. Folding that stretches under the Mesocenozoic cover of the coalfield's periphery becomes less frequent in the slopes of the platform where interrupted small-amplitude quaquaversal folds still occur. The slopes are flat monoclines with some slip faulting.

The Donetsk Basin area is subdivided into seven geological zones, according to types and sizes of folds and discontinuities (Nedra 1972):

- the southwestern platform monoclinal zone;
- the western zone, where flexures can be found that are sinking and gradually level out toward the Dnieper-Donetsk Depression;
- the southern zone, with minor folds combined with faults of different types and sizes, including transverse faults and flexures;
- the central zone, having large folds;
- the northern zone, with minor folds and a system of powerful local longitudinal thrusts and some auxiliary medium to small thrusts; and
- the northern monoclinal zone.

4.2.2 Geological Description of Coal Resources

The thickness of coal formations within the Donetsk Basin increases from the flanks of the bending flexure toward its center, in a southeastern direction. The coal-bearing strata show multiple rhythmical intermittence of marine, continental, and transitional facies. On a stratigraphic column of Carbonic rock, the development of many groups of fauna and flora can be seen, as well as the cyclic structure of coal-bearing strata with easily identifiable specific bed combinations of coal seams and limestones (See Fig. 2) (Nedra 1972).

To a maximum depth of 1,800 meters, the coal seams of the Donetsk Basin total 330 in number; 200 of them are less than 0.45 meters, and 130 seams are over 0.45 meters thick. The thickness of coal seams currently being mined is in the range of 0.6 to 0.8 meters. Seams in excess of two meters are rarely found. The coal reserves of the Basin are deposited unevenly with a majority of the reserves being contained in 35 seams. Of these, 27 seams belong to the Middle Carbonic, and 8 seams to the Upper Carbonic. It should be noted that only one of the Upper Carbonic seams is commercially mineable.

The coal series of the Donetsk Basin area are unique for their nonuniform bedding. Therefore, the coal-bearing strata of the Lower Carbonic occur along the southwestern flank of the Donetsk bending flexure, where recoverable coal reserves are concentrated within a contour interval of 400 to 500 meters. The coal seams are clustered in groups with the interval between such groups ranging from 30 to 80 meters. Within each group, individual seams generally have intervals between them that range from 3 to 20 meters.

The entire Donetsk Basin is underlain by Middle Carbonic coal seams. The number of mineable coal seams and coal-bearing beds tends to gradually decrease from the western towards the eastern and northern sections of the basin. The distance between coal seams in this area typically ranges from 20 to 40 meters. The highest concentration of coal seams is found in the C^6_2 suite, whose western portion is 170 to 250 meters thick and contains up to eight mineable coal seams. Similar conditions can be found in the upper section of the C^5_2 suite. The aggregate thickness of principal coal-bearing Middle Carbonic strata ($C_2^3 – C_2^7$ suites) ranges from 1,500 to 3,000 meters. Due to the nonuniform thickness of coal seams, the number of mineable seams, even in the best mining areas, never exceeds 30 to 50 seams.

Donetsk Basin coal resource professionals estimate that the basin contains 231 billion tonnes of coal reserves, including 170 to 180 billion tonnes of reserves that are classified as recoverable, i.e. located at the depths of 500 to 1,800 meters and in seams that are greater than 0.3 meters thick. In terms of coal rank, the coal in the Donetsk Basin ranges from lignite to highly metamorphized bituminous. The total mass of dispersed organic matter in rocks and coal layers reaches 1,680 billion tonnes, which includes 1,210 billion

tonnes within a depth of between 500 and 1,800 meters (Zaidenvarg 1993).

4.3 Coalbed Methane Resources in Coal Seams

Coal metamorphism in the Donetsk Basin has led to the formation of a significant methane resource, which by estimates provided by Ukrainian and Western CBM professionals, could be as high as 117 trillion cubic meters. The distribution of gaseous hydrocarbons in the coal series was affected by geologic conditions that existed at the time the CBM resource was formed. These conditions resulted from a combination of paleotectonic, paleochemical, paleobiochemical, and other variable factors (Zaidenvarg 1993).

CBM deposits were formed in the Donetsk Basin during two different phases. During the first phase, the formation of primary vertical gas deposits was complete in the Upper Paleozoic. This occurred before the inversion of the vertical movements in the bending flexure, resulting from an intensive gas-generating process that was combined with massive sedimentation. Consequently, this geologic section includes three main gas zones that are located in the following succession, begining from the surface:

- zone of predominantly sorbed gases,
- zone of predominantly free gases associated with dispersed organic matter, and
- zone of metamorphic demethanization.

The second phase in formation of CBM deposits occurred in Carbonic rocks at the time, when the geologic bending flexure was developed, beginning with an inversion. Given the complex nature of inversion and exposure of the coal-bearing mass, the process of gas migration prevailed over the process of its generation during this phase. This contributed to intensive redistribution of gases in sedimentary rocks, and to the destruction of initial gas deposits. As a result, the initial gas deposits were transformed into the vertical and areal gas zones that we see today (Brizhanev 1987).

In most of the Donetsk Basin the amplitude of ascending movements that were characteristic for inversion ranged from 4 to 11 kilometers. These movements caused an outcropping of coal beds that had been deposited in all three zones of initial vertical gas zoning during the time of sedimentation. At the same time, a gas-weathering zone was formed within the uppermost part of the geologic section.

The gases that are retained in the coal seams are mostly methane with minor quantities of ethane, nitrogen and carbon dioxide. The heavier hydrocarbons are primarily retained in coals with a medium degree of metamorphism. High-rank anthracite retains primarily nitrogen and carbon dioxide and insignificant quantities of methane. Trace gases, such as butane, pentane, hexane, heptane, hydrogen, hydrogen sulfide, helium, argon, neon, krypton, and xenon, are also present in the coal seams.

In bituminous and anthracite coals, tiny pores with a diameter of less than 10^{-8} meters are commonly found. The surface area of these pores may reach several hundred square meters per cubic centimeter of coal matter, which explains its high adsorption activity. The adsorption activity and, consequently, the gas content in the coal metamorphic series increase from longflame coals (See Figure 3) to low-metamorphized anthracites. Therefore, the gas content of coking coal, lean-coking coal, and lean coal is generally from 20 to 25 cubic meters/tonne daf while that of anthracites, with a specific logarithmic electrical impedance of 4.45 to 5.85 Ohm·cm, would be higher, typically in the range of 40 to 45 cubic meters/tonne dry-ash-free (daf) (Brizhanev 1987; Airuni 1990).

By various Ukrainian assessments, the coal seams that are greater than 0.3 meters thick, and within the depth of 500 to 1,800 meters, contain between 1,400 and 2,500 billion cubic meters of adsorbed CBM; this includes 855 billion cubic meters that are deposited within the principal geologic/industrial districts (see table below) (Kosenko 1980; Zaidenvarg).

CBM Resources in Coal Seams

Principal Geologic/Industrial Districts	*Number of Coal Seams*	*CBM Resource in Coal Seams, billion m^3*
Krasnoarmeisky	33	231.5
Donetsko-Makeevsky	59	202.1
Tsentralny	46	84.8
Torezsko-Snezhniansky	39	37.5
Lisichansky	25	22.5
Lugansky	39	47.5
Almazno-Marievsky	53	81.2
Krasnodonsky	24	56.2
Bokovo-Khrustalsky	31	40.1
Seleznevsky	32	51.9
Total:		855.3

The density of the estimated CBM resources in coal seams is rather high. Therefore, in the southwestern part of the Donetsk Basin, the average density, as estimated by DonetskGeologia (a Ukrainian geologic exploration company) and Raven Ridge Resources, Inc. (a US company), ranges from 90 to 107 million cubic meters per square kilometer (see table below).

Area	Area, km^2	DonetskGeologia Resources, billion m^3	DonetskGeologia Density, million m^3/km^2	Raven Ridge Resources Resources, billion m^3	Raven Ridge Resources Density, million m^3/km^2
Dobropolsko-Krasnoarmeiskaya	963	76.4	79.3	101.0	104.9
Grishino-Andreyevskaya	557	18.2	32.7	29.7	53.3
Yuzhno-Donbasskaya	530	57.2	107.9	58.5	110.4
Donetskaya	293	44.5	151.9	46.5	158.7
Makeevskaya	246	35.9	145.9	42.0	170.7
Total	2,589	232.2	89.7	277.7	107.3

4.4 Coalbed Methane Resources in Surrounding Rock Strata

Current redistribution of gases in carboniferous strata depends upon the changes in the reservoir properties of the surrounding rock. Catagenetic transformations of sediment rocks are accompanied by continuous decreases in their porosity and permeability, which is clearly demonstrated by the sandstones. However, gas permeability can change significantly as a result of excessive zonal fracturing that may develop in sandstones of the same facies. In the Donetsk Basin, microdeposits and local accumulations of free gas are typical for the fractured zones. From the data gathered from gas leaking into underground mine workings, it is assumed that fracturing influences the process of free gas accumulation in the coal-bearing strata.

Geologic zoning for CBM, which is presented below, is based on the analysis of revised vertical and areal zoning, the data on reservoir properties of surrounding rock, and information available on gas deposits, microdeposits, and local accumulations of free gaseous hydrocarbons. From these data, four specific zones have been identified (Airuni 1990; Brizhanev 1987; Pudak 1996; Zaidenvarg 1993):

- Zone I occurs in carboniferous strata containing coals ranked as long-flame, gas, and some fat coals. In this zone, recoverable gas reserves and local gas accumulations are commonly found that are associated with gas reservoirs of porous and porous-fractured types. Zone I deposits are located in the southern and western parts of the Donetsk Basin, the geologic/industrial districts of Lisichansky, Krasnoarmeisky, and Millerovsky, and the depressions of Bakhmutskaya, and Kalmius-Torezskaya.
- Zone II is customarily noted for sedimentary rocks surrounding the coal seams ranked as fat, coking, and lean-coking. This zone typically contains microdeposits and local hydrocarbon accumulations that are associated with the gas reservoirs of fractured-porous and fractured types. The zone's distinct feature is the high level of gas content found in the coal seams and surrounding rock strata. This zone includes coal deposits within the geologic/industrial districts of Donetsko-Makeevsky, Tsentralny, Seleznevsky, Almazno-Marievsky, and Krasnodonsky.
- Zone III is associated with carboniferous strata that contain lean ranked coals and low ranked anthracites with specific logarithmic electrical impedance greater than 2.5 Ohm·cm. In this zone both the coal seams and surrounding rock strata have low gas storage capacity. Therefore, local gas accumulations occurring in fractured-type reservoirs that were formed by tectonic disturbances are commonly found. The Zone III gas deposits are located in the Torezsko-Snezhniansky and Bokovo-Khrustalsky geologic/industrial districts.
- Zone IV is characterized by the total absence of gaseous hydrocarbons. Typical conditions are carboniferous strata containing high-ranked anthracites with specific logarithmic electrical impedance less than 2.5 Ohm·cm. The Zone IV includes all of the Dolzhano-Rovensky district and also occurs in the central and eastern parts of the Bokovo-Khrustalsky and Torezsko-Snezhniansky geologic/industrial districts.

From studies conducted by Ukrainian CBM professionals, the CBM resources of the Donetsk Basin are found in the following states:

- free gas, contained within pores and fractures of surrounding rock strata,
- sorbed gas, contained in dispersed organic matter and coal layers, and
- dissolved gas, contained in water and gas saturated sandstones.

The formation of free gas accumulations in the surrounding rock strata was largely dependent upon the location of the fractured zones. According to Ukrainian geological survey data, there are more than 30 coalbed

methane deposits located on the periphery of the Donetsk Basin. The deposits contain free gas reserves of 180 billion cubic meters and proven reserves of 60 billion cubic meters.

An evaluation of a CBM reserve for potential development will require a site-specific geological evaluation.

5.0 PROFILES OF SELECTED COAL MINES

This section of the handbook contains data and information concerning 29 Ukrainian coal mines that are located in the Donetsk Basin (See Map 1). These particular mines are the most promising candidates that CMM developers should consider for commercial development of CMM projects in Ukraine. The authors of this handbook assembled mine-specific CMM information from all Ukrainian coal mines for the period between 1990 and 1999. The 29 coal mines profiled in this handbook equaled or exceeded the following criteria:

- mine annual production in excess of 250,000 raw tonnes per year,
- specific methane content in the coal greater than 20 cubic meters per tonne,
- coal reserve base sufficient for a remaining mine life in excess of ten years, and
- the mine has not been selected for closure.

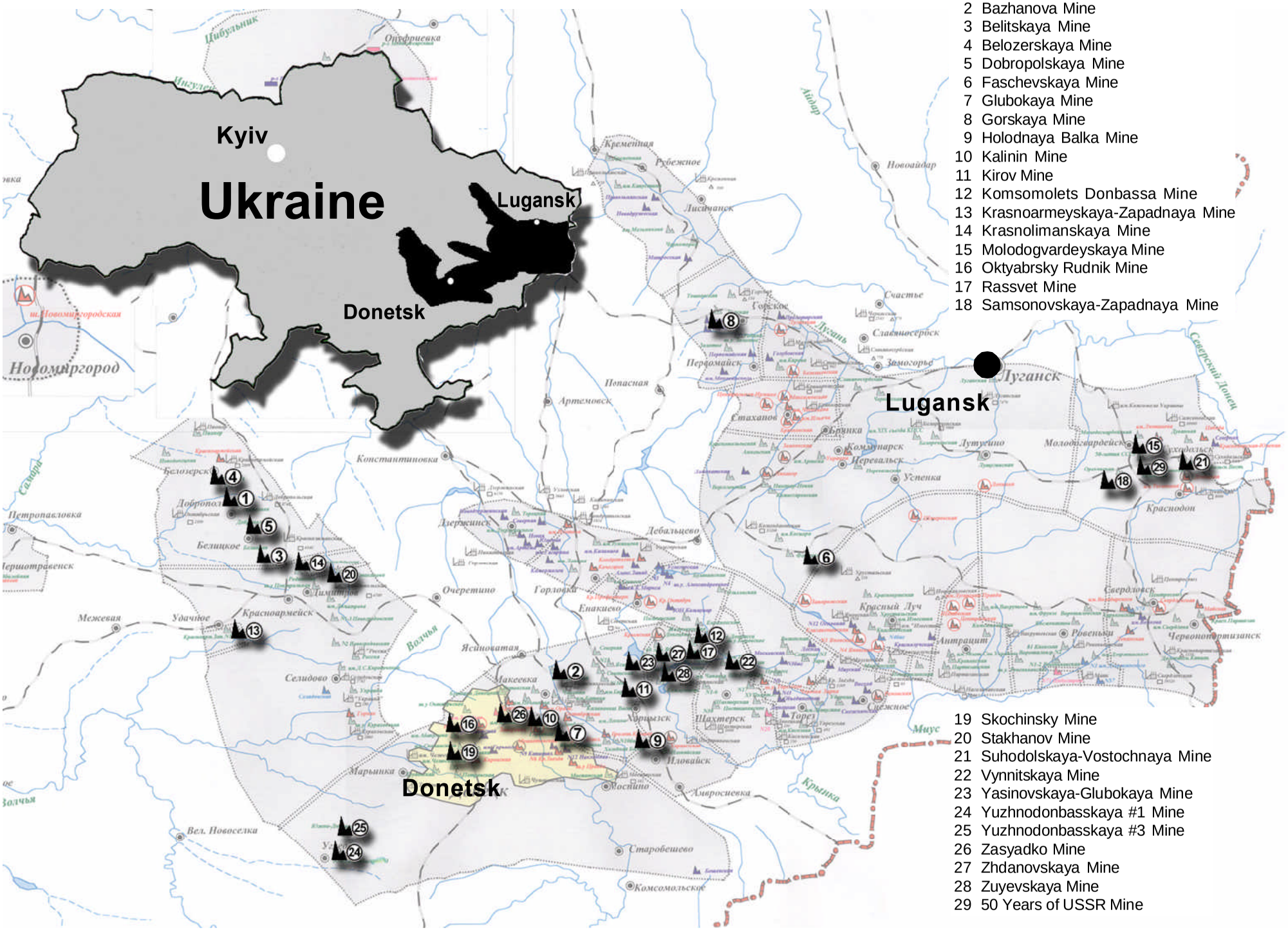
After completing the selection of these 29 mines, data and information forms were prepared for distribution and review. With the assistance of the Ministry of Fuel and Energy, Makeyevka Mine Safety Institute, the Alternative Fuels Center, and each of the selected coal mines and associations, the forms were completed and returned. Where possible, independent verification of the data and information was conducted for each of the mines.

Presented in the handbook are sufficient detailed data and information for a potential developer to determine a first level of interest to proceed. However, additional data and information will be required to complete a detailed business plan to assess the economic viability of a particular project. It should be noted that the 29 mines were selected by the set of standards above to identify the mines with the greatest potential for CMM development, and that this list of mines is not inclusive of all of the potential areas that could be considered for a commercially developed CMM project in Ukraine.

Each mine profile contains the following data and information:

- General Overview
- Table 1: General Information
- Table 2: General Geologic Information
- Table 3: Geologic and Mining Conditions
- Table 4: Coal Production, Methane Emissions, and Degasification 1990–1999
- Table 5: Degasification Parameters
- Chart 1: Coal Production and Total Methane Emission Trends.
- Chart 2: Methane Emissions
- Chart 3: Coal Production and Specific Methane Emission Trends

Map 1: General Mine Location Map



1 Almaznaya Mine
2 Bazhanova Mine
3 Belitskaya Mine
4 Belozerskaya Mine
5 Dobropolskaya Mine
6 Faschevskaya Mine
7 Glubokaya Mine
8 Gorskaya Mine
9 Holodnaya Balka Mine
10 Kalinin Mine
11 Kirov Mine
12 Komsomolets Donbassa Mine
13 Krasnoarmeyskaya-Zapadnaya Mine
14 Krasnolimanskaya Mine
15 Molodogvardeyskaya Mine
16 Oktyabrsky Rudnik Mine
17 Rassvet Mine
18 Samsonovskaya-Zapadnaya Mine
19 Skochinsky Mine
20 Stakhanov Mine
21 Suhodolskaya-Vostochnaya Mine
22 Vynnitskaya Mine
23 Yasinovskaya-Glubokaya Mine
24 Yuzhnodonbasskaya #1 Mine
25 Yuzhnodonbasskaya #3 Mine
26 Zasyadko Mine
27 Zhdanovskaya Mine
28 Zuyevskaya Mine
29 50 Years of USSR Mine

Name of Mine	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year	Total Minable Reserves, thousand tonnes	Methane Content in Coal, m^3/tonne of daf coal	Total Methane Resource, billion m^3		
	Ventilation	Degasification	Total Emissions							Coal Seams	Satellite Seams	Sandstone
Almaznaya	10.93	0.21	11.14	0.00	11–12	20.50	543.20	73,138	25.5	1.70	N/A	32.9
Bazhanova	22.92	13.25	36.17	9.88	60.0	31.08	1,136.80	58,677	20.0	1.60	N/A	59.4
Belitskaya	3.08	2.05	5.13	0.00	7.8	22.53	227.70	68,200	12.5	2.20	2.10	N/A
Belozerskaya	7.99	1.79	9.78	0.00	22.0	24.76	395.50	80,414	15.0	1.60	0.90	33.2
Dobropolskaya	9.20	0.79	9.99	0.00	3.2	8.23	1,213.00	58,591	16.0	1.70	4.40	N/A
Faschevskaya	11.97	1.55	13.52	0.00	12.0	47.55	284.90	12,959	30.0	0.70	2.50	N/A
Glubokaya	33.40	7.90	41.30	5.41	42.0	59.66	692.60	23,378	32.0	1.40	0.41	9.1
Gorskaya	8.24	0.00	8.24	0.00	N/A	32.58	252.90	46,548	16.0	2.00	N/A	N/A
Holodnaya Balka	29.40	15.70	45.10	12.62	66.0	74.08	608.80	51,346	17.9	1.80	5.80	N/A
Kalinin	44.57	2.94	47.51	0.00	22.0	143.66	330.70	14,914	23.6	0.70	1.10	1.8
Kirov	8.41	7.31	15.72	0.00	33.0	16.40	958.10	23,662	30.0	0.90	0.20	11.1
Komsomolets Donbassa	116.81	11.56	128.37	4.20	30.0	93.43	1,373.90	137,449	25.0	5.50	1.50	N/A
Krasnoarmeyskaya-Zapadnaya	78.73	12.40	91.13	0.00	30–38	25.0	3,137.50	79,449	25.0	1.90	5.40	N/A
Krasnolymanskaya	40.21	21.56	61.77	0.00	19.5	18.93	3,263.75	85,024	25.0	2.10	1.90	13.6
Molodogvardeyskaya	10.38	4.23	14.61	0.00	19.6	27.28	535.60	63,600	22.0	0.50	0.10	N/A
Oktyabrsky Rudnik	12.30	1.26	13.56	0.00	6.0	40.20	337.22	97,512	20.0	3.70	1.40	N/A
Rassvet	36.11	5.26	41.37	0.00	20.0	116.44	355.30	14,315	32.0	1.50	0.20	N/A
Samsonovskaya-Zapadnaya	N/A	N/A	N/A	N/A		N/A			30.0	4.70	0.20	N/A
Skochinsky	34.6	3.99	38.59	0.00	38.0	49.15	784.70	144,433	21.0	13.27	5.63	26.96
Stachanova	35.45	16.78	52.23	0.00	42.0	33.51	1,558.50	139,717	15.0	4.0	0.90	22.3
Suhodolskaya-Vostochnaya	52.50	7.10	59.60	0.00	15.0	286.50	208.00	157,402	29.9	4.00	2.80	N/A
Vinnitskaya	3.80	3.20	12.00	0.00	22.0	37.24	322.20	14,683	38.0	0.60	0.40	1.8
Yasinovskaya-Glubokaya	19.88	1.84	21.72	0.00	18.0	65.46	331.80	41,453	25.0	1.50	N/A	1.1
Yuzhno-Donbasskaya #1	15.38	1.89	17.27	0.00	13.5	15.24	1,133.40	69,317	21.0	1.10	0.60	2.5
Yuzhno-Donbasskaya #3	15.27	2.89	18.16	0.00	25.0	14.83	1,224.90	156,928	16.0	3.40	2.50	4.1
Zasyadko	79.10	30.60	109.70	12.36	30.0	36.20	3,027.00	96,308	23.0	3.90	0.80	12.9
Zhdanovskaya	12.98	2.26	15.24	0.00	17.2	30.35	502.10	43,276	35.0	2.00	0.40	4.1
Zuevskaya	33.00	3.10	36.10	0.00	30.5	99.60	362.50	17,394	35.0	0.90	0.30	0
50 Years of the USSR	21.76	0.00	21.76	0.00	N/A	34.36	633.20	11,410	36.0	0.14	0.03	N/A

5.1 Almaznaya Mine

General Overview

The mine is located in the town of Dobropolye in the Donetsk Oblast of southeastern Ukraine and is a part of the Dobropolyeugol Coal Association. The mine has a total employment of 2,447 including 1,656 workers with underground mining experience. A mineral license was issued to the mine by the State Geology Committee of Ukraine (#2015) on November 5, 1999.

The mine has three vertical shafts: a cage shaft and two inclined shafts, one of them used for haulage and the other as a service shaft. Each of the three shafts was driven from the surface to a level of 107 meters. The mine does not have either a coal preparation plant or thermal drying facilities. The mined coal is stored in a warehouse prior to loading into railroad cars.

During 1998, and almost all of 1999, the mine was not producing from the gassy seam l_3, and no degasification programs were performed. Late in December 1999, the mine added a new longwall (#5 North) at the 13YuPU seam at the depth of 550 meters, and started degasing the seam in January 2000. Currently, the mine operates a single pumping unit (VVN150 type) at the operating seam with methane content in the degasification pipeline being measured at 11 to 12 percent.

The mine's mailing address is Almaznaya Mine, Ulitsa Nizovaya, Dobropolye 85000.

Table 1: General Information, Almaznaya Mine

1. Total Mineable Reserves, thousand tonnes	73,138
2. Mineable Reserves, Active Mine Levels, thousand tonnes	73,138
3. Total Mining Area, km^2	31.7
4. Depth of Shaft(s), m	107
5. Mining Capacity, tonnes / day	2,000
6. Annual Electricity Consumption, MWh	41,490
7. Coal Consumers	Dobropolsky and Oktyabrsky coal preparation plants, Zuevsky, Kurahovsky and Uglegorsky thermal power plants
8. Annual Heat Consumption, Gcal	16,584
9. Type(s) of Boilers	Lankashirski – 5 units
10. Boilers Fueled with	Coal
11. Fuel Consumption, winter/summer, tonnes	4,800 / 180
12. Fuel Demand Self-covered by the Mine, percent	69

Table 2: General Geologic Information, Almaznaya Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	5.0 to 25.5
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.7
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	20
Shale, percent	75
Limestone, percent	2
4. Number of Coal Seams Above Currently Mined	15
5. Aggregate Thickness of Seams Above Currently Mined, m	17.3
6. Geologic Phenomena	Faults: Dobropolsky, Karpovsky (amplitude 5–70 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	8 to 10
8. Porosity and Permeability, Sandstone:	
Porosity, percent	8 to 15
Permeability, mD	0.02–1.50
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	1.7
Satellite Seams, billion m^3	N/A
Sandstone, billion m^3	32.9

Table 3: Geologic and Mining Conditions, Almaznaya Mine

	Coal Seam:		
	m_5	l_1	l_3
1. Rank of Coal	High vol bituminous B, C	High vol bituminous B, C	High vol bituminous B, C
2. Seam Thickness, m	1.0	1.4	1.99
3. Pitch, degrees	11	11	11
4. Depth of Mining, m	510	500	505
5. Ash Content:			
Coal in Place, percent	19.5	16.5	11.3
Run of Mine Coal, percent	46.4	42.2	41.0
6. Moisture, percent	6.5	6.4	5.4
7. Sulfur Content, percent	3.3	1.9	1.3
8. Gas Content, m^3 per tonne of daf coal	12.0	5.0	25.5
9. Mining Method	Longwall		
10. Roof Control Method	Cave-in behind Longwall		
11. Panel Width, m	150–250		
12. Mining Equipment			

Table 4: Coal Production, Methane Emissions and Degasification, Almaznaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1991	5.50	7.30	12.80	0.00	N/A	11.31	1,131.50
1992	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1993	12.35	8.99	21.34	0.00	N/A	19.75	1,080.40
1994	6.57	5.47	12.04	0.00	N/A	15.49	777.45
1995	13.56	1.31	14.87	0.00	N/A	22.60	657.00
1996	14.87	1.16	16.03	0.00	N/A	20.43	784.75
1997	17.03	0.21	17.24	0.00	N/A	30.28	569.40
1998	15.03	0.26	15.29	0.00	N/A	26.14	585.00
1999	10.93	0.21	11.14	0.00	11–12	20.50	543.20

Table 5: Degasification Parameters, Almaznaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	4
3. Number of Pumps, 50 m^3/min Capacity	None
4. Number of Longwalls Degassed	1
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	N/A
• Methane Content, percent	N/A
• Methane Capture Rate, m^3/min	0.4
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	N/A

Chart 1: Coal Production and Total Methane Emission Trends, Almaznaya Mine

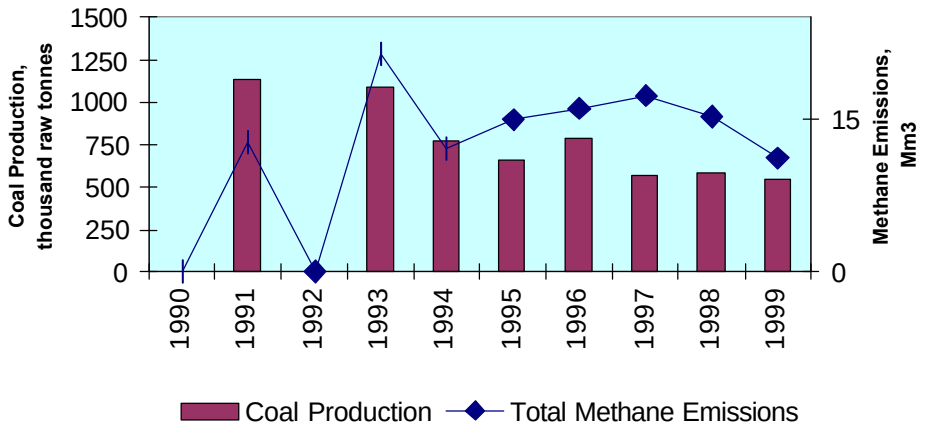


Chart 2: Methane Emissions, Almaznaya Mine

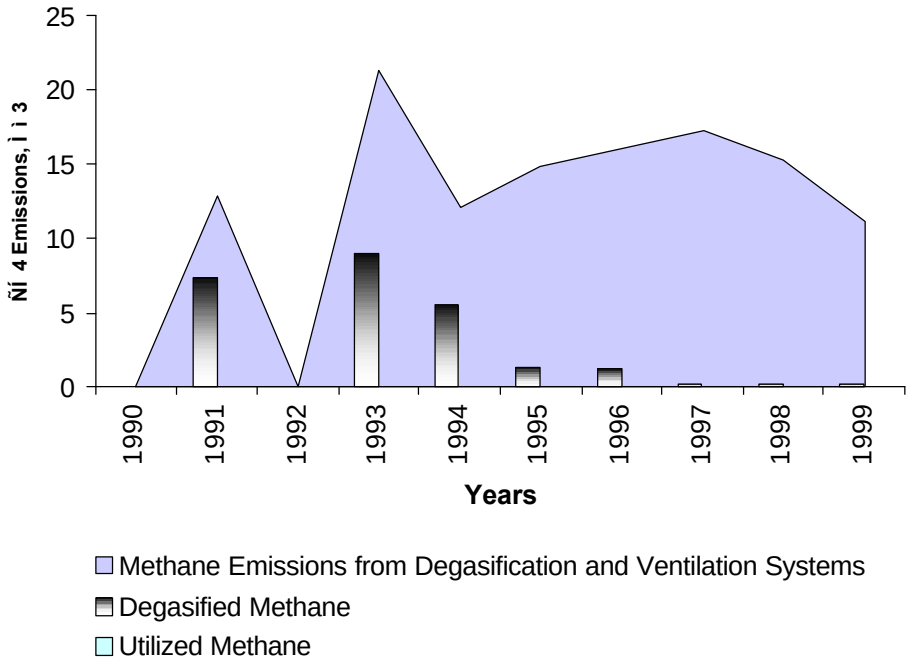
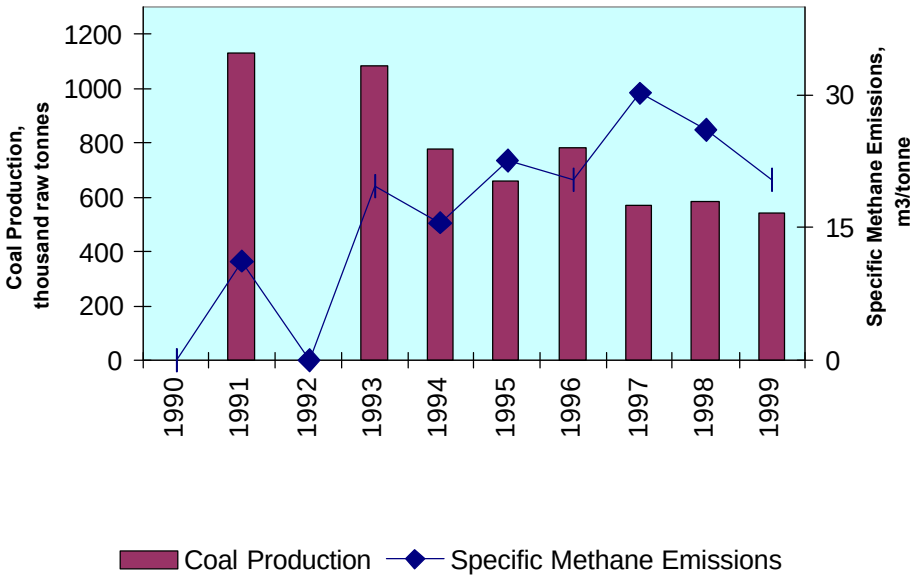


Chart 3: Coal Production and Specific Methane Emission Trends, Almaznaya Mine



5.2 Bazhanova Mine

General Overview

The first stage of the mine became operational in 1957 with a second stage added in 1964. The mine is a part of the Makeyevugol Coal Association.

The mining property is located in the Donetsk and Makeyevka geologic/industrial district in the south-western section of the Donetsk Basin. The property lies within the city limits of Makeyevka (pop. 436,000), which is a major industrial center. The city industries include a total of 19 underground mines, two iron and steel works, several coking plants, and metal manufacturing facilities. Makeyevka is surrounded by large farms.

The surface above the mine is located at the watershed of two rivers; the Krivoy Torets and the Calmius. The terrain is mildly undulating plain that is crisscrossed by multiple gullies and ravines. Elevation ranges from 275 meters above sea level in the east to 175 meters in the west of the property. In the north and northeast, the property is crossed by the Donbass-Seversky Donets Canal. Most of the surface is farmland.

The mine's mailing address is Bazhanova Mine, Makeevka, Donetsk Oblast 83019.

Table 1: General Information, Bazhanova Mine

1.	Total Mineable Reserves, thousand tonnes	58,677
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	19,212
3.	Total Mining Area, km^2	39
4.	Depth of Shaft(s), m	1,000
5.	Mining Capacity, tonnes / day	3,000
6.	Annual Electricity Consumption, MWh	74,400
7.	Coal Consumers	N/A
8.	Annual Heat Consumption, Gcal	N/A
9.	Type(s) of Boilers	DKVR 10/13: 6 units
10.	Boilers Fueled with	Methane
11.	Fuel Consumption, winter/summer	N/A
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Bazhanova Mine

1. Coal Seam Gas Content, Range, m^3/tonne	15 to 22
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.4
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	18
Shale, percent	79
Limestone, percent	1
4. Number of Coal Seams Above Currently Mined	10
5. Aggregate Thickness of Seams Above Currently Mined, m	7.7
6. Geologic Phenomena	Faults: Bezymyanny (amplitude 18–20 m), Zapadny (5–40 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 8
8. Porosity and Permeability, Sandstone:	
Porosity, percent	4 to 6
Permeability, mD	0.05–0.09
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	1.6
Satellite Seams, billion m^3	N/A
Sandstone, billion m^3	59.4

Table 3: Geologic and Mining Conditions, Bazhanova Mine

	Coal Seam: m_3
1. Rank of Coal	High vol bituminous A
2. Seam Thickness, m	1.65
3. Pitch, degrees	5
4. Depth of Mining, m	1,200
5. Ash Content:	
Coal in Place, percent	8.0
Run of Mine Coal, percent	27.7
6. Moisture, percent	0.8
7. Sulfur Content, percent	3.5
8. Gas Content, m^3 per tonne of daf coal	20.0
9. Mining Method	Longwall (1,300–1,400m)
10. Roof Control Method	Complete caving
11. Panel Width, m	200–250
12. Mining Equipment	Mechanized Complexes: 3MK, KD-90

Table 4: Coal Production, Methane Emissions and Degasification, Bazhanova Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasifi-cation	Total Emissions				
1990	42.40	25.60	68.10	16.90	N/A	42.40	1,606.30
1991	37.80	23.90	61.77	16.50	27.80	58.04	1,064.30
1992	35.66	17.92	53.57	15.70	N/A	52.76	1,015.40
1993	40.00	11.40	51.40	11.40	N/A	52.93	971.10
1994	26.54	10.62	37.16	10.62	20.20	46.64	796.70
1995	23.02	8.88	31.90	8.88	16.90	56.97	559.90
1996	20.34	7.25	27.59	7.25	13.80	43.19	638.80
1997	25.07	15.61	40.68	15.61	29.70	36.87	1,103.30
1998	19.45	15.82	35.27	15.80	N/A	31.92	1,105.00
1999	22.92	13.25	36.17	9.88	60.00	31.08	1,163.80

Table 5: Degasification Parameters, Bazhanova Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	1
3. Number of Pumps, 50 m^3/min Capacity	2
4. Number of Longwalls Degassed	3
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	42.0
• Methane Content, percent	60
• Methane Capture Rate, m^3/min	25.2
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	25.2
♦ Summer	16.0
6. Length of Pipeline, m	18,000

Chart 1: Coal Production and Total Methane Emission Trends, Bazhanova Mine

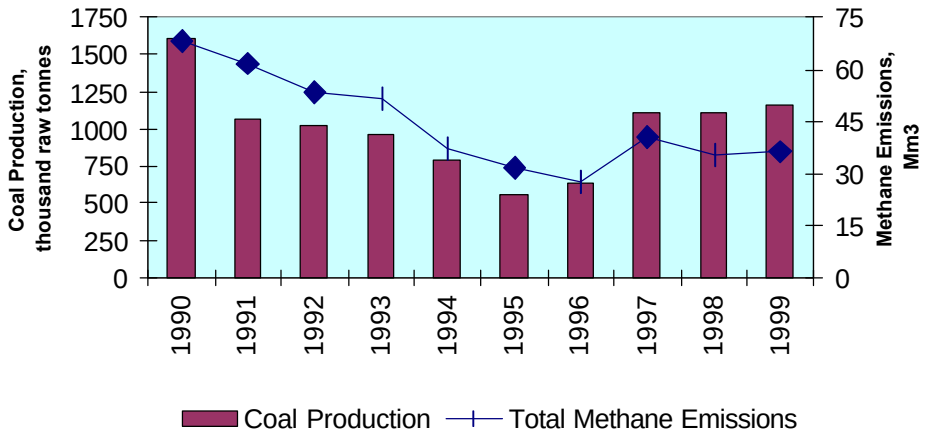


Chart 2: Methane Emissions, Bazhanova Mine

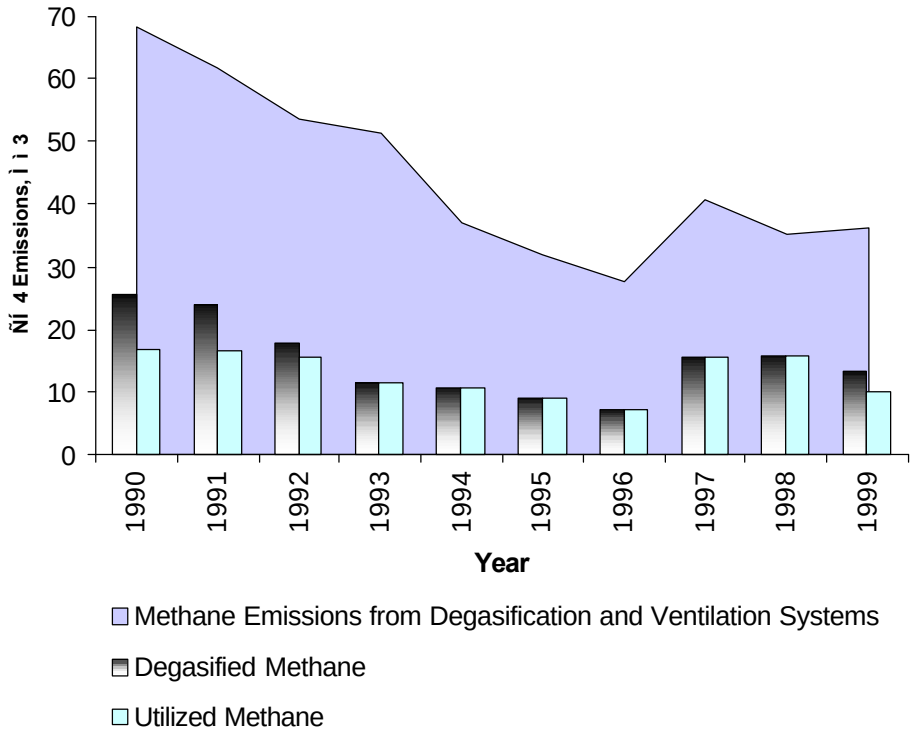
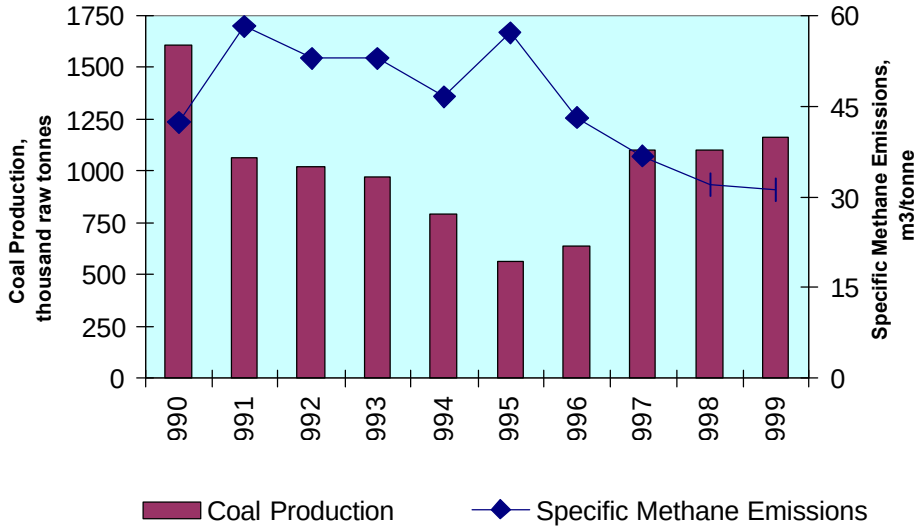


Chart 3: Coal Production and Specific Methane Emission Trends, Bazhanova Mine



5.3 Belitskaya Mine

General Overview

The mine became operational in 1959. The mine was designed by Dneprgiproshakht — a mine development institute in Dnipropetrovsk, Ukraine. The actual production capacity declined over the years following a general aggravation in the status of reserves and mining facilities. For the year 2000, the mine is expected to produce 350,000 tonnes of coal. The mine is a part of the Dobropolyeugol Coal Association.

The mining property is located in the northwestern section of the Krasnoarmeysk geologic/industrial district. There are two more active mines, Dobropolskaya and Rodinskaya, in close proximity. In administrative terms, the area belongs to the Dobropolye Rayon of the Donetsk Oblast in southeastern Ukraine. The boundaries of the property can be outlined as follows: in the northwest — by the Dobropolye thrust; in the southeast — by the central thrust, where it is crossing m_5, m_4 and m_3 seams, extending into the Rodinskaya Mine property; in the southwest — by Mertsalovsky thrust; in the northeast — by a contour line at 500 meters from the surface for m_5, m_4 and m_3 seams, and a contour line at 750 meters for other seams.

With a surface area of approximately 80 km^2, the property extends eight to ten kilometers along the strike, and six to eight kilometers down the pitch of the coal seams. The mine's surface facilities are located 15 km from Dobropolye, and 25 km from Krasnoarmeysk. The mine receives its power supply from Kurakhovskaya Thermal Power Plant through a substation that is located near the town of Belitskoye. After washing, the coal is processed into coke. While the mine has no coal cleaning systems of its own, a full-cycle preparation plant (Oktyabrskaya) is utilized that is located close to the mine.

As of this time, no license has been issued to the mine for production of coal mine methane. As of 1999, the mine had an average of 1,722 employees listed on its payroll.

The mine's mailing address is Belitskaya Mine, Belitskoye, Donetsk Oblast 85043.

Telephone/fax number: 38 0627 76-2562.

Table 1: General Information, Belitskaya Mine

1.	Total Mineable Reserves, thousand tonnes	68,200
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	68,200
3.	Total Mining Area, km^2	80
4.	Depth of Shaft(s), m	276.4 / 258.6 / 524.0
5.	Mining Capacity, tonnes / day	1,200
6.	Annual Electricity Consumption, MWh	43,760
7.	Coal Consumers	Joint-stock company «ARS», Donetsk
8.	Annual Heat Consumption, Gcal	79,000
9.	Type(s) of Boilers	DKVR 10/13: 2 units DKVR 6.5/13: 1 unit KE 10/14: 1 unit
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	15,500 /640
12.	Fuel Demand Self-covered by the Mine, percent	94.5

Table 2: General Geologic Information, Belitskaya Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	5.0 to 17.5
2. Geothermal and Pressure Gradients:	
Geothermal, ◦Ñ/100 m	2.8
Pressure, MPa / 1,000 m	4–9
3. Overburden Composition:	
Sandstone, percent	20
Shale, percent	77
Limestone, percent	2
4. Number of Coal Seams Above Currently Mined	13
5. Aggregate Thickness of Seams Above Currently Mined, m	9.1
6. Geologic Phenomena	Faults: Central (amplitude 200–425 m), Mercalovski (to 84 m), Dobropolsky (76–360 m), Novo-Belitsky (14–16 m), Belitsky (15–35 m).
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 8
8. Porosity and Permeability, Sandstone:	
Porosity, percent	6 to 12
Permeability, mD	0.02–1.90
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	2.2
Satellite Seams, billion m^3	2.1
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Belitskaya Mine

	Coal Seam:	
	m_2	l_8
1. Rank of Coal	High-vol bituminous B	High-vol bituminous B
2. Seam Thickness, m	1.12	0.65
3. Pitch, degrees	5–14	6–8
4. Depth of Mining, m	233	435
5. Ash Content:		
Coal in Place, percent	15.3	4.6
Run of Mine Coal, percent	45.3	50.6
6. Moisture, percent	4.6	4.3
7. Sulfur Content, percent	4.6	1.2
8. Gas Content, m^3 per tonne of daf coal	>5	12.5
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	150–200	
12. Mining Equipment	1KM-87L, 1KM-103M, KD-80	

Table 4: Coal Production, Methane Emissions and Degasification, Belitskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	N/A	N/A	11.52	0.00	N/A	17.13	672.50
1991	13.05	3.54	16.59	0.00	N/A	30.26	548.10
1992	10.82	3.92	14.74	0.00	N/A	25.72	573.10
1993	9.63	3.78	13.41	0.00	N/A	22.19	604.20
1994	9.09	4.80	13.89	0.00	N/A	24.36	570.30
1995	7.80	3.25	11.05	0.00	N/A	25.12	439.90
1996	5.67	1.31	6.98	0.00	N/A	18.37	379.90
1997	6.18	0.93	7.11	0.00	N/A	11.90	597.60
1998	4.43	1.17	5.60	0.00	7.00	18.91	296.20
1999	3.08	2.05	5.13	0.00	7.80	22.53	227.70

Table 5: Degasification Parameters, Belitskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	4
4. Number of Longwalls Degassed	1
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	50.0
• Methane Content, percent	7.8
• Methane Capture Rate, m^3/min	3.9
• Methane Utilization Rate by Season, m^3/min	0
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	3,140

Chart 1: Coal Production and Total Methane Emission Trends, Belitskaya Mine

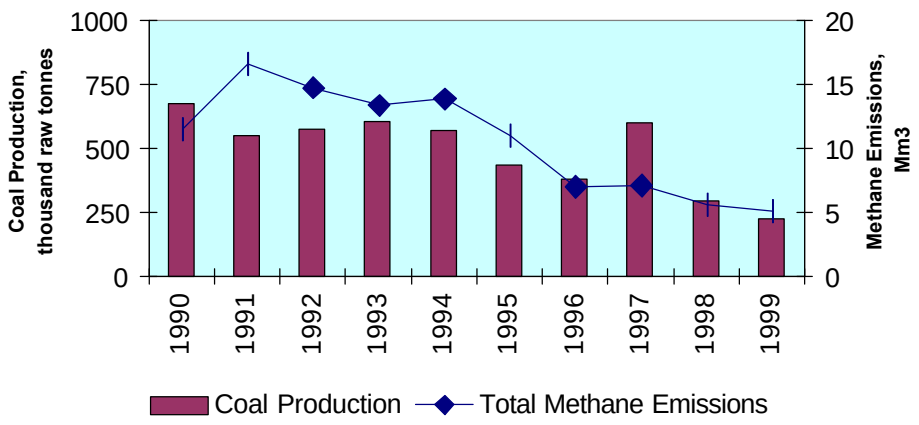


Chart 2: Methane Emissions, Belitskaya Mine

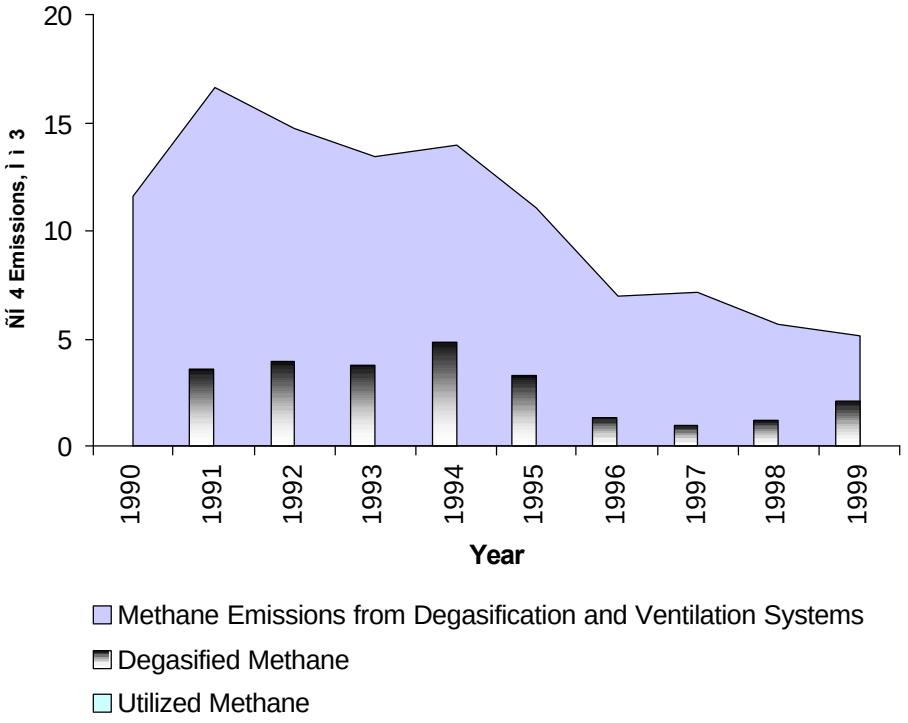
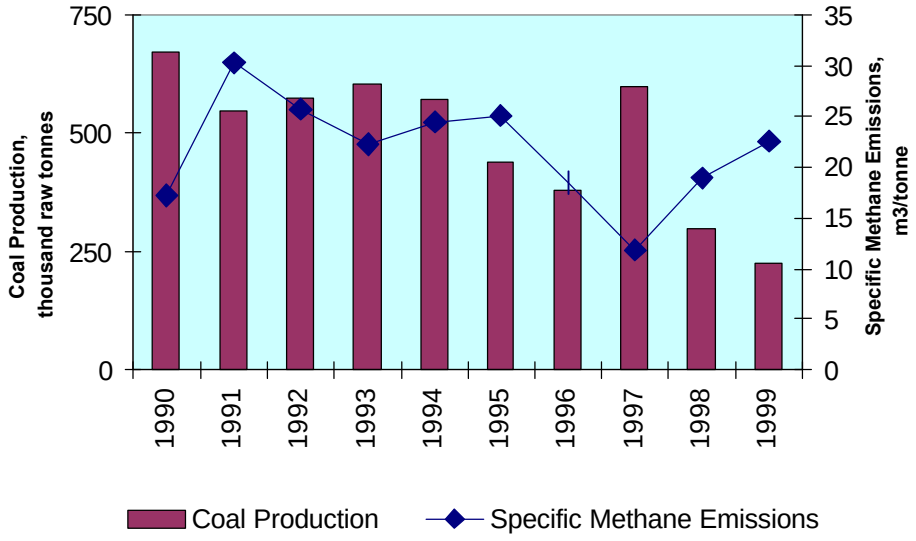


Chart 3: Coal Production and Specific Methane Emission Trends, Belitskaya Mine



5.4 Belozerskaya Mine

General Overview

The mining property is located in the northwestern section of the Krasnoarmeysk geologic/industrial district, which is a part of the Donetsk Coal Basin. In administrative terms, the mine belongs to the Dobropolye Rayon of the Donetsk Oblast in southeastern Ukraine and is a part of the Dobropolyeugol Coal Association.

The mine became operational in 1954. After incorporating two other mines in 1965 by joining the workings, and focusing the renewed operation on upper-level seam reserves, the mine achieved a sustained increase in overall tonnage.

Development is based on a panel-by-panel approach. Coal is mined with retreating longwalls along the strike, with panel length ranging from 1,800 to 2,000 meters.

The mine's mailing address is Belozerskaya Mine, Belozerskoe, Donetsk Oblast 343125.

Table 1: General Information, Belozerskaya Mine

1.	Total Mineable Reserves, thousand tonnes	80,414
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	6,592
3.	Total Mining Area, km^2	13.7
4.	Depth of Shaft(s), m	200
5.	Mining Capacity, tonnes / day	2,740
6.	Annual Electricity Consumption, MWh	N/A
7.	Coal Consumers	Coke and chemical plant; Uglegorsky and Kurahovsky thermal power plants
8.	Annual Heat Consumption, Gcal	84,000
9.	Type(s) of Boilers	KE 10/14: 4 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	17,000 / 3,000
12.	Fuel Demand Self-covered by the Mine, percent	25.5

Table 2: General Geologic Information, Belozerskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	5 to 20
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.8
Pressure, MPa / 1,000 m	4–10
3. Overburden Composition:	
Sandstone, percent	20
Shale, percent	75
Limestone, percent	2
4. Number of Coal Seams Above Currently Mined	14
5. Aggregate Thickness of Seams Above Currently Mined, m	14.7
6. Geologic Phenomena	Faults: Dobropolsky (amplitude 10–57 m), Gnilushinsky (4–22 m), South zone of Gnilushinsky (4.5 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 9
8. Porosity and Permeability, Sandstone:	
Porosity, percent	8 to 12
Permeability, mD	0.01–2.50
9. Total Methane Resource, billion m^3, including:	35.7
Coal Seams, billion m^3	1.6
Satellite Seams, billion m^3	0.9
Sandstone, billion m^3	33.2

Table 3: Geologic and Mining Conditions, Belozerskaya Mine

	Coal Seam:		
	m_5^{1B}	l_3	l_8
1. Rank of Coal	High-vol bituminous C	High-vol bituminous B, C	High-vol bituminous A, B
2. Seam Thickness, m	0.90	2.29	2.19
3. Pitch, degrees	10	10	10
4. Depth of Mining, m	260	890	615
5. Ash Content:			
Coal in Place, percent	14.8	6.8	10.0
Run of Mine Coal, percent	39.6	27.4	50.8
6. Moisture, percent	9.0	5.1	6.4
7. Sulfur Content, percent	3.26	1.87	1.71
8. Gas Content, m^3 per tonne of daf coal	5	>15	15
9. Mining Method	Longwall		
10. Roof Control Method	Complete caving		
11. Panel Width, m	150–220		
12. Mining Equipment	KMK-500, 3KD-90, 2GSH-68B, CP-301M		

Table 4: Coal Production, Methane Emissions and Degasification, Belozerskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	15.50	24.10	39.60	0.00	N/A	35.00	1,131.50
1991	17.90	14.70	32.60	0.00	N/A	33.10	985.50
1992	17.82	15.08	32.90	0.00	N/A	36.05	912.50
1993	25.90	6.73	32.11	0.00	N/A	49.98	642.40
1994	34.11	4.78	38.89	0.00	N/A	38.60	1,007.40
1995	13.46	14.19	27.65	0.00	N/A	74.27	372.30
1996	7.36	3.57	10.93	0.00	N/A	49.91	219.00
1997	5.68	3.57	9.25	0.00	N/A	16.56	558.45
1998	7.31	2.73	10.04	0.00	N/A	15.48	671.90
1999	7.99	1.79	9.78	0.00	22	24.76	395.50

Table 5: Degasification Parameters, Belozerskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	2
2. Number of Pumps, 150 m^3/min Capacity	6
3. Number of Pumps, 50 m^3/min Capacity	1
4. Number of Longwalls Degassed	2
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	16
• Methane Content, percent	22
• Methane Capture Rate, m^3/min	3.5
• Methane Utilization Rate by Season, m^3/min	0
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	13,500

Chart 1: Coal Production and Total Methane Emission Trends, Belozerskaya Mine

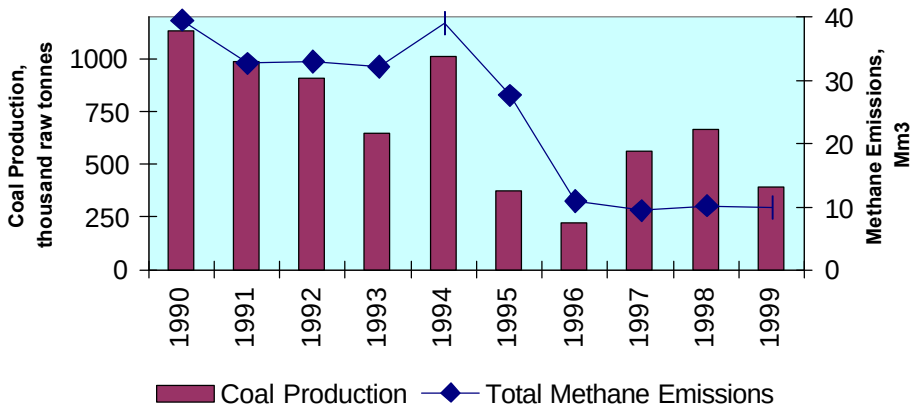


Chart 2: Methane Emissions, Belozerskaya Mine

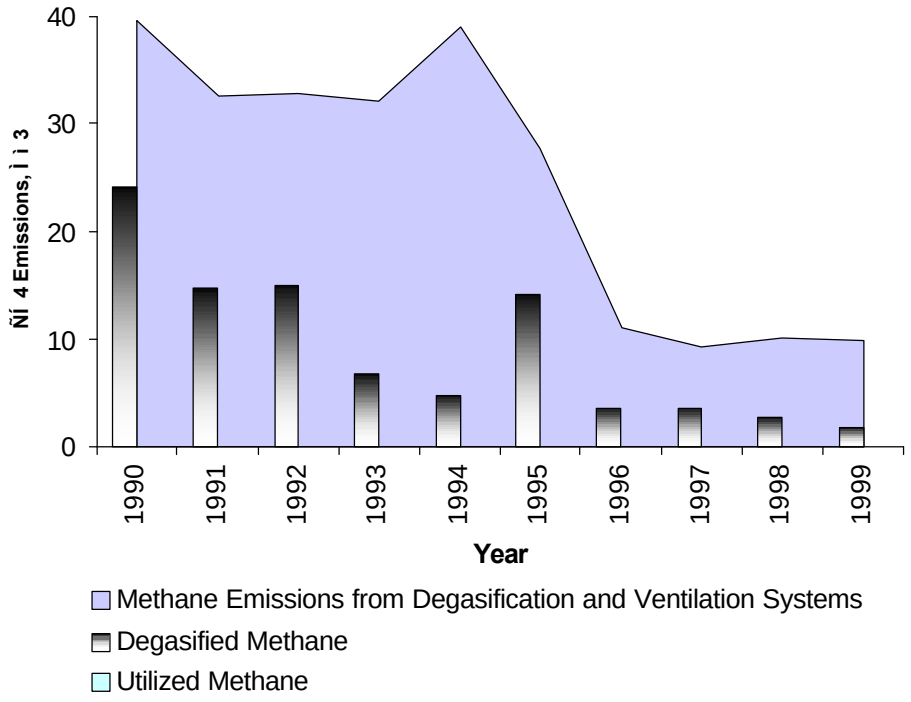
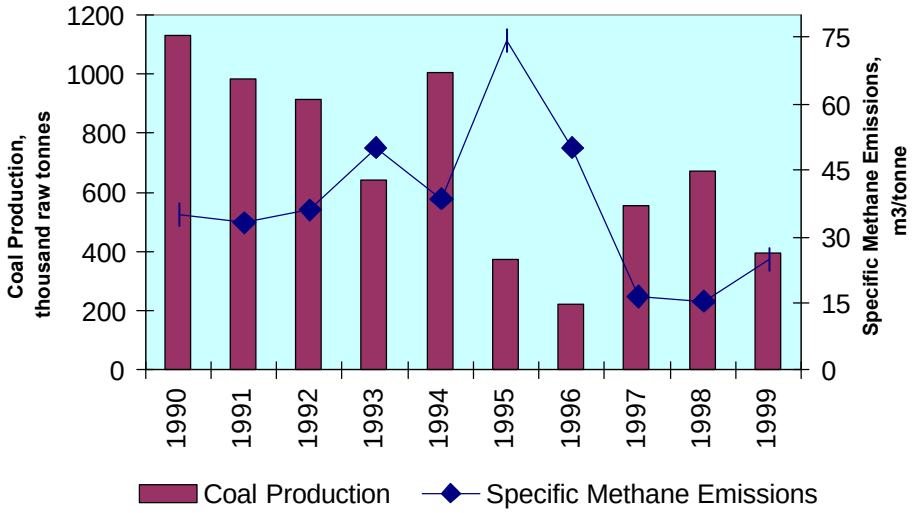


Chart 3: Coal Production and Specific Methane Emission Trends, Belozerskaya Mine



5.5 Dobropolskaya Mine

General Overview

The mine became operational in 1941 and produced 1,213,000 raw tonnes during 1999.

The mining property is located in the northwestern section of the Krasnoarmeysk geologic/industrial district of the Donetsk Coal Basin. In administrative terms, the property is located in Dobropolye Rayon of Donetsk Oblast. The mine is a subsidiary of the Dobropolye Coal Association that is owned by the State of Ukraine and controlled by the Ministry of Fuel and Energy.

The property was established with the following boundaries: the northwest limited by the property of the Belozerskaya Mine; the southeast limited by the Dobropolye thrust at the intersection with the k_8 coal seam; the southwest limited by the k_8 seam outcropping into superficial deposits; and, the northeast limited by the m_6 seam at 65 meters below the surface.

As of January 1, 2000, the mine employed a total of 3,080 personnel.

The mailing address is Dobropolskaya Mine, 1 Ulitsa Kievskaya, Dobropolye, Donetsk Oblast 85033.

Telephone: 38 0627 72-2400; fax: 38 0627 72-3818.

Table 1: General Information, Dobropolskaya Mine

1.	Total Mineable Reserves, thousand tonnes	58,591
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	58,591
3.	Total Mining Area, km^2	50.7
4.	Depth of Shaft(s), m	321
5.	Mining Capacity, tonnes / day	3,400
6.	Annual Electricity Consumption, MWh	37,539
7.	Coal Consumers	Dobropolye Coal Supply Company
8.	Annual Heat Consumption, Gcal	33,340
9.	Type(s) of Boilers	DKVR 10/13: 4 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	5,476 / 792
12.	Fuel Demand Self-covered by the Mine, percent	22.5

Table 2: General Geologic Information, Dobropolskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	14.0 to 16.5
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa /1,000 m	3–8
3. Overburden Composition:	
Sandstone, percent	20
Shale, percent	77
Limestone, percent	1.5
4. Number of Coal Seams Above Currently Mined	12
5. Aggregate Thickness of Seams Above Currently Mined, m	9.5
6. Geologic Phenomena	Faults: Karpovsky (amplitude 19–60 m), "A" (3–5 m), #1 and #2(3–20 m), Dobropolsky (50–310 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 7
8. Porosity and Permeability, Sandstone:	
Porosity, percent	5 to 16
Permeability, mD	0.03–1.80
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	1.7
Satellite Seams, billion m^3	4.4
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Dobropolskaya Mine

	Coal Seam:	
	m_4	m_5
1. Rank of Coal	High-vol bituminous B	High-vol bituminous B
2. Seam Thickness, m	1.00	0.93
3. Pitch, degrees	10	10
4. Depth of Mining, m	550	530
5. Ash Content:		
Coal in Place, percent	12.0	12.4
Run of Mine Coal, percent	37	18
6. Moisture, percent	2.9	2.6
7. Sulfur Content, percent	3.4	2.6
8. Gas Content, m^3 per tonne of daf coal	14	16
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	150–250	
12. Mining Equipment	KD-80, KM-88, 1K101	

Table 4: Coal Production, Methane Emissions and Degasification, Dobropolskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	11.10	5.90	17.00	0.00	N/A	17.91	949.00
1991	12.20	2.10	14.30	0.00	N/A	17.81	803.00
1992	11.82	2.22	14.04	0.00	N/A	17.48	803.00
1993	12.61	1.47	14.08	0.00	N/A	19.19	733.65
1994	11.51	0.00	11.51	0.00	N/A	14.74	781.10
1995	12.25	0.00	12.25	0.00	N/A	16.14	759.20
1996	14.87	1.16	16.03	0.00	N/A	20.43	784.75
1997	16.82	0.68	17.50	0.00	N/A	16.20	1,080.40
1998	9.72	0.53	10.25	0.00	N/A	9.87	1,038.70
1999	9.20	0.79	9.99	0.00	3.2	8.23	1,213.00

Table 5: Degasification Parameters, Dobropolskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	4
3. Number of Pumps, 50 m^3/min Capacity	None
4. Number of Longwalls Degassed	2
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	46.0
• Methane Content, percent	3.2
• Methane Capture Rate, m^3/min	1.5
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	4,000

Chart 1: Coal Production and Total Methane Emission Trends, Dobropolskaya Mine

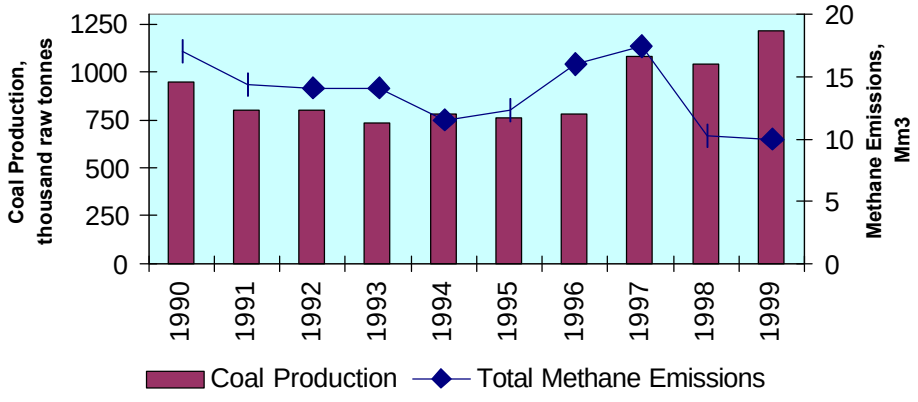


Chart 2: Methane Emissions, Dobropolskaya Mine

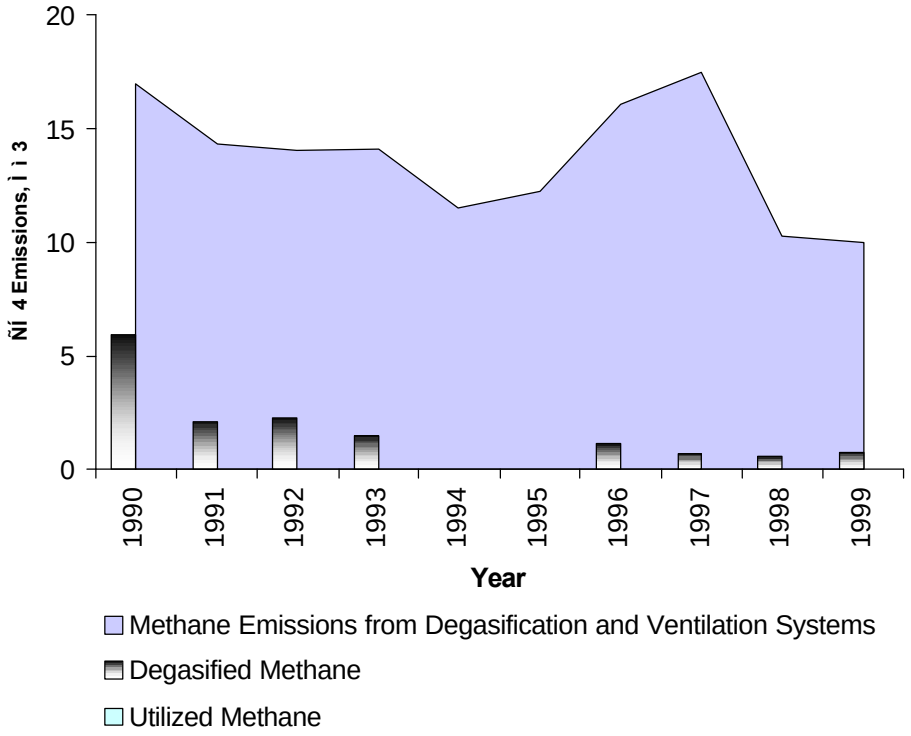
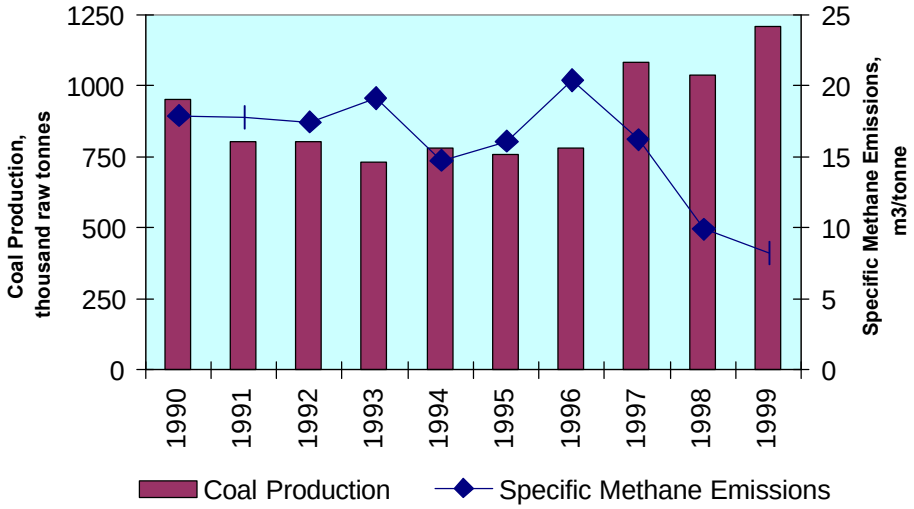


Chart 3: Coal Production and Specific Methane Emission Trends, Dobropolskaya Mine



5.6 Faschevskaya Mine

General Overview

The mine became operational in 1949 and is a part of the Luganskugol Coal Association. It is located in the Perevalsk Rayon of the Lugansk Oblast, and is 23 km southwest of the rayon (a small administrative district) capital Perevalsk. The nearest towns are Faschevka (1 km south) and Gorodische (1.5 km north).

The surface area is a prairie-type flatland that lies within the main Donetsk watershed. The property is crossed by two rivers: the Belaya in the north, and the Mius in the south.

The mine has no coal preparation or thermal drying facilities. Two 76 mm in-mine degasification boreholes were drilled from the intermediate entries: one 80 meters long, drilled into the seam roof at 35 degrees of entry and 45 degrees rotation; and the second 70 meters long, drilled into the seam floor at 30 degrees of entry.

The mine does not have a license for production of coal mine methane.

The mailing address is Faschevskaya Mine, Faschevka, Perevalsk Rayon, Lugansk Oblast 94334.

Table 1: General Information, Faschevskaya Mine

1.	Total Mineable Reserves, thousand tonnes	12,959
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	5,142
3.	Total Mining Area, km^2	26.71
4.	Depth of Shaft(s), m	520
5.	Mining Capacity, tonnes / day	800
6.	Annual Electricity Consumption, MWh	34,030
7.	Coal Consumers	Electric Generation
8.	Annual Heat Consumption, Gcal	11,071
9.	Type(s) of Boilers	DKVR 2.5/13: 1 unit KE 10/14: 1unit KE 6.5/14C: 1 unit KE 4/14: 1 unit Lankashirsky: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	2,097 / 700
12.	Fuel Demand Self-covered by the Mine, percent	63

Table 2: General Geologic Information, Faschevskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	10 to 35
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.54
Pressure, MPa / 1,000 m	N/A
3. Overburden Composition:	
Sandstone, percent	34
Shale, percent	59
Limestone, percent	5
4. Number of Coal Seams Above Currently Mined	12
5. Aggregate Thickness of Seams Above Currently Mined, m	4.0
6. Geologic Phenomena	Faults: Faschevsky, Kramatorsky, Zaporozhsky (amplitude 10–25 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	3.8 to 8.9
8. Porosity and Permeability, Sandstone:	
Porosity, percent	8.2 to 9.5
Permeability, mD	0.01–0.02
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	0.7
Satellite Seams, billion m^3	2.5
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Faschevskaya Mine

	Coal Seam:		
	l_8	l_6	m_3
1. Rank of Coal	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous
2. Seam Thickness, m	0.75	0.80–0.90	0.76
3. Pitch, degrees	15	15	14
4. Depth of Mining, m	450	170–500	500
5. Ash Content:			
Coal in Place, percent	19.1	30.2	15.0
Run of Mine Coal, percent	35.7	54.6	N/A
6. Moisture, percent	2.0	2.0	2.0
7. Sulfur Content, percent	2.0	2.5	2.0
8. Gas Content, m^3 per tonne of daf coal	30	15–30	30
9. Mining Method	Longwall		
10. Roof Control Method	Complete caving		
11. Panel Width, m	150–180		
12. Mining Equipment	K-101, MK-67,1R-101		

Table 4: Coal Production, Methane Emissions and Degasification, Faschevskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	9.30	2.70	12.00	0.00	N/A	23.48	511.00
1991	6.60	2.70	9.30	0.00	N/A	18.20	511.00
1992	24.28	5.52	29.80	0.00	N/A	74.22	401.50
1993	15.77	5.31	21.08	0.00	N/A	59.54	354.05
1994	14.24	3.36	17.60	0.00	N/A	48.70	361.35
1995	22.29	3.73	26.02	0.00	N/A	74.26	350.40
1996	30.12	1.84	31.96	0.00	N/A	116.90	273.50
1997	8.83	2.94	11.77	0.00	N/A	54.70	215.35
1998	11.25	3.42	14.67	0.00	N/A	50.45	290.80
1999	11.97	1.55	13.52	0.00	12	47.55	284.90

Table 5: Degasification Parameters, Faschevskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	4
4. Number of Longwalls Degassed	2
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	25
• Methane Content, percent	12
• Methane Capture Rate, m^3/min	2.95
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	3,100

Chart 1: Coal Production and Total Methane Emission Trends, Faschevskaya Mine

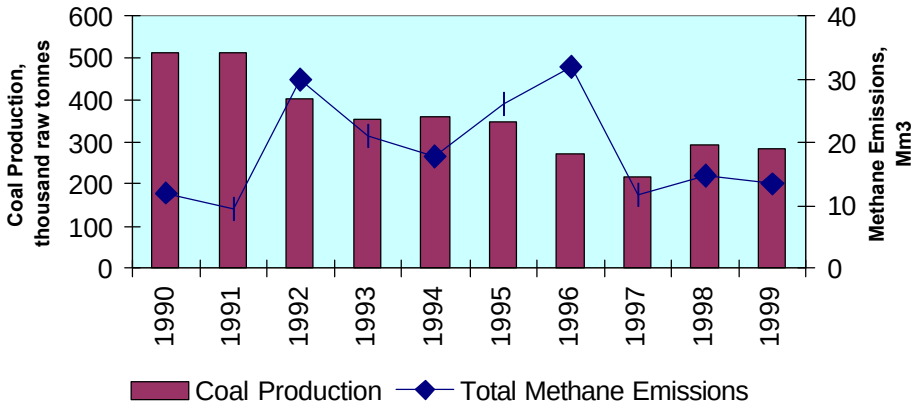


Chart 2: Methane Emissions, Faschevskaya Mine

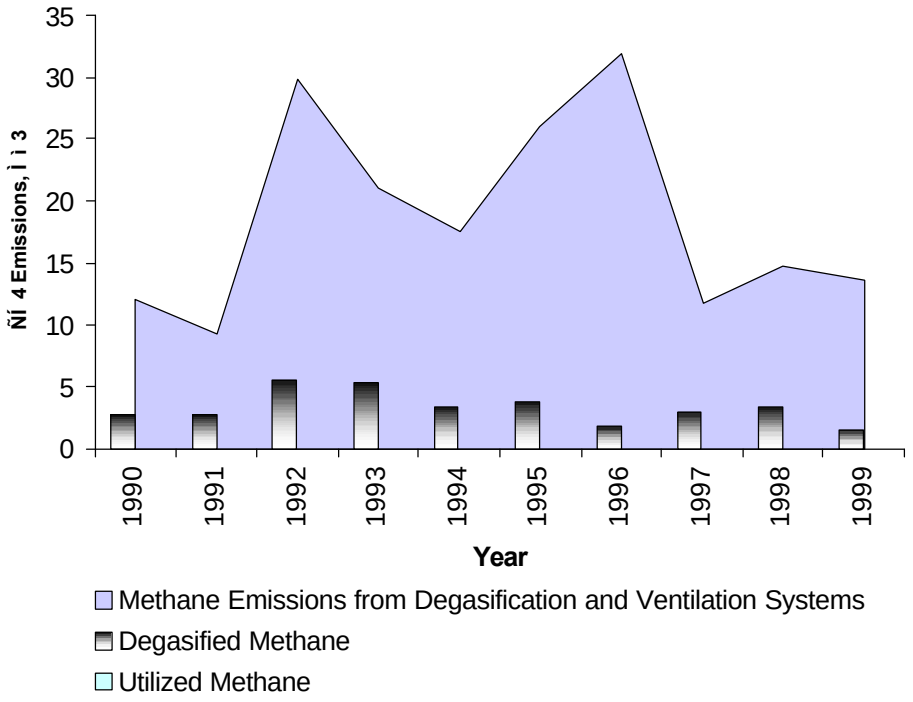
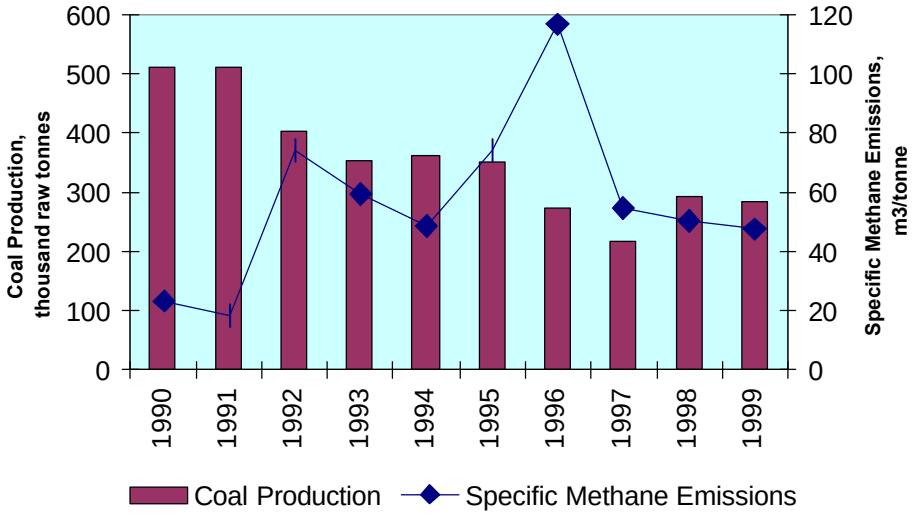


Chart 3: Coal Production and Specific Methane Emission Trends, Faschevskaya Mine



5.7 Glubokaya Mine

General Overview

The mine became operational in 1957. Since 1984, the mine is a part of the Donugol Coal Association.

The mining property is located in the Donetsk and Makeyevka geologic/industrial district, in the southeastern part of the Calmius-Thorez depression. The surface terrain is undulating plain that is crisscrossed by multiple gullies and ravines of the Gruzskaya River system. In administrative terms, the area is located in the Budennovsk Rayon, which is a part of the city of Donetsk. Agricultural properties of the Gruzsky Farm are located within two kilometers of the mine's surface facilities. The nearest railroad station is at Obyedinyonnaya, where the mine has an assigned cargo handling point. The nearest highway is the road from Donetsk to Makeyevka.

The mine employs a total of 3,083 personnel.

The mailing address is Glubokaya Mine Donetsk-44.

Telephone number for the main office: 38 0622 9951.

Table 1: General Information, Glubokaya Mine

1.	Total Mineable Reserves, thousand tonnes	23,378
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	23,378
3.	Total Mining Area, km^2	55
4.	Depth of Shaft(s), m	514.6 / 579.0 / 862.0 / 1031.0
5.	Mining Capacity, tonnes / day	1,818
6.	Annual Electricity Consumption, MWh	73,761
7.	Coal Consumers	N/A
8.	Annual Heat Consumption, Gcal	36,150
9.	Type(s) of Boilers	KE 10/14: 2 units DE 6.5/13: 1unit E 1/9: 2 units
10.	Boilers Fueled with	Methane
11.	Fuel Consumption, winter/summer, Mm^3	11.74 / 1.13 (concentration 42%)
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Glubokaya Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	26 to 32
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa / 1,000 m	6–10
3. Overburden Composition:	
Sandstone, percent	21
Shale, percent	77
Limestone, percent	0.2
4. Number of Coal Seams Above Currently Mined	9
5. Aggregate Thickness of Seams Above Currently Mined, m	7.0
6. Geologic Phenomena	Faults: Italyansky (amplitude 5–50 m), Sofievsky (0–50 m), Pervomaysky (125–466 m) and 3 fault zones (2–113 m), #2 (3–50 m), #1(6.5–50 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 10
8. Porosity and Permeability, Sandstone:	
Porosity, percent	2 to 6
Permeability, mD	0.01–0.03
9. Total Methane Resource, billion m^3, including:	10.9
Coal Seams, billion m^3	1.4
Satellite Seams, billion m^3	0.41
Sandstone, billion m^3	9.1

Table 3: Geologic and Mining Conditions, Glubokaya Mine

	Coal Seam:			
	h_{10}	h_8	h_6	h_4
1. Rank of Coal	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous
2. Seam Thickness, m	1.43	0.70	0.92	0.80
3. Pitch, degrees	18–33	8–10	3–9	2–10
4. Depth of Mining, m	988	665	570	875
5. Ash Content:				
Coal in Place, percent	12.7	11.6	13.4	11.0
Run of Mine Coal, percent	31.3	37.9	43.6	25.2
6. Moisture, percent	1.3	1.3	1.3	1.3
7. Sulfur Content, percent	3.6	0.7	2.8	0.9
8. Gas Content, m^3 per tonne of daf coal	32	30	30	30
9. Mining Method	Longwall			
10. Roof Control Method	Complete caving			
11. Panel Width, m	170–260			
12. Mining Equipment	RKU10, UST2M, UST4, KM-98, KM-87UMN			

Table 4: Coal Production, Methane Emissions and Degasification, Glubokaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	49.00	8.80	57.80	8.80	40	81.67	707.70
1991	45.00	10.50	55.50	8.60	40	80.70	687.70
1992	33.27	10.04	43.31	8.20	40	61.55	703.70
1993	36.00	8.04	44.04	7.99	42	70.00	629.50
1994	28.75	5.26	34.01	5.26	41	59.15	575.00
1995	26.86	6.31	33.17	5.41	41	57.89	573.00
1996	24.39	4.31	28.70	4.31	40	45.10	636.50
1997	29.54	7.10	36.64	7.10	40	51.23	715.20
1998	27.65	6.52	34.17	6.50	42	43.23	790.50
1999	33.40	7.90	41.30	5.41	42	59.66	692.60

Table 5: Degasification Parameters, Glubokaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	4
3. Number of Pumps, 50 m^3/min Capacity	None
4. Number of Longwalls Degassed	8
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	35.80
• Methane Content, percent	42
• Methane Capture Rate, m^3/min	15
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	2.4
♦ Summer	15.0
6. Length of Pipeline, m	22,957

Chart 1: Coal Production and Total Methane Emission Trends, Glubokaya Mine

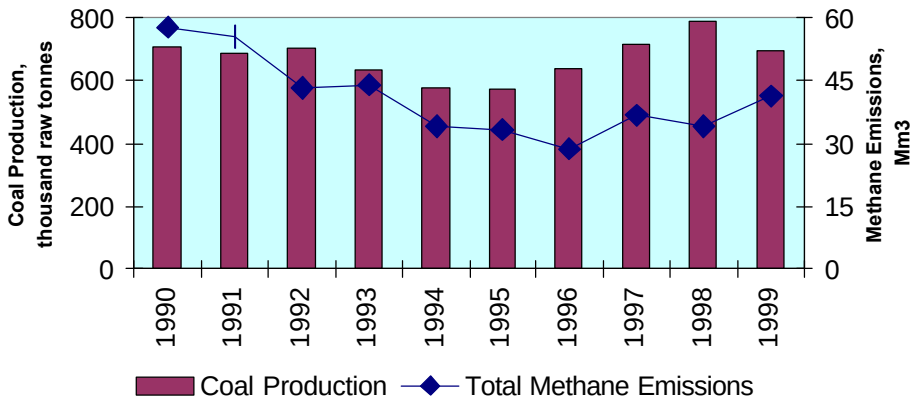


Chart 2: Methane Emissions, Glubokaya Mine

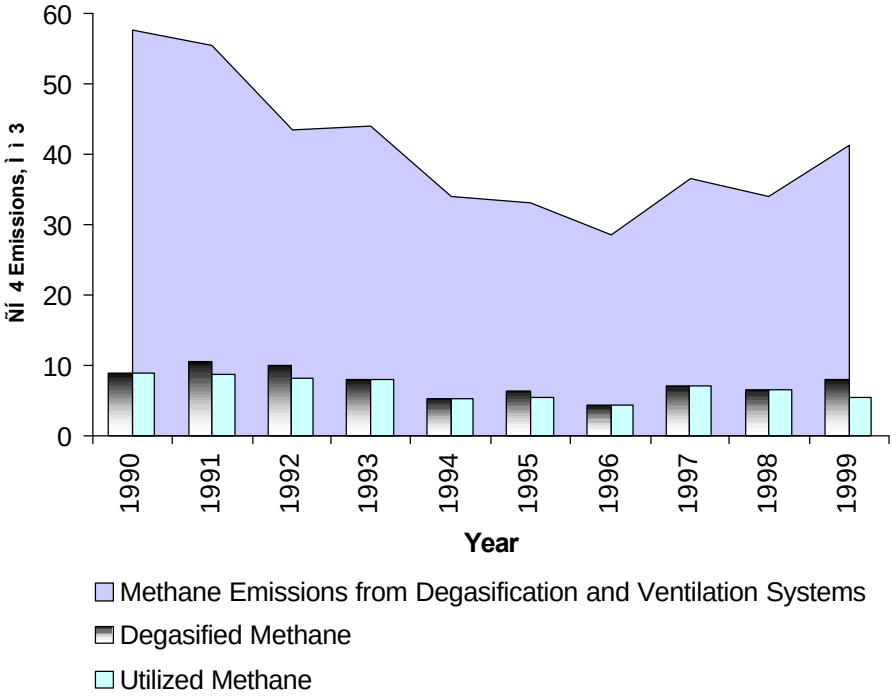
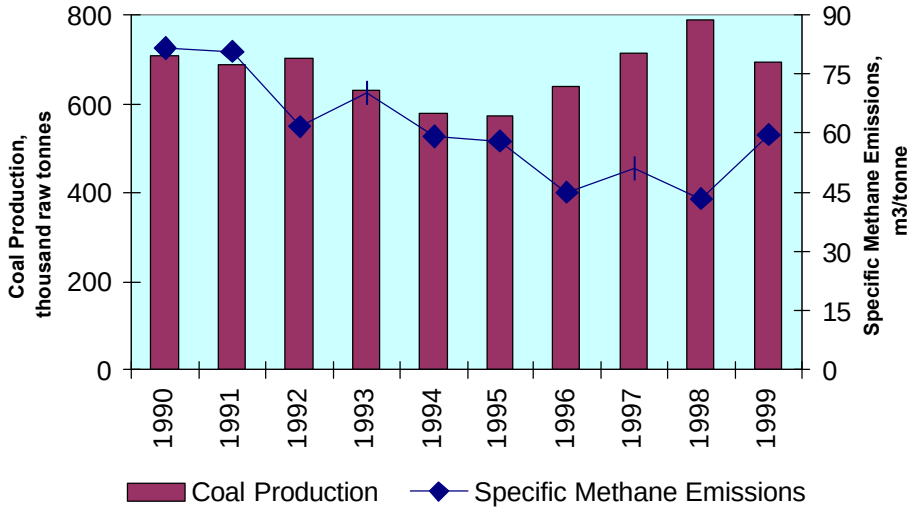


Chart 3: Coal Production and Specific Methane Emission Trends, Glubokaya Mine



5.8 Gorskaya Mine

General Overview

The mine's coal reserves are located in the Almazno-Marievsky geologic/industrial district that lies in the northern section of the Donetsk Coal Basin. In geologic terms, the mine is in an element of the northeastern slope of the Bakhmut Depression that is complicated by second-order folding represented by the Gorsky Syncline and the Karbonit Anticline. Also, those structures are complicated by flexural bends and continuity disturbances that include several thrusts (Mirnodolinsky, Yuzhny and Vrubovsky), and a diagonal upthrow fault. The mine is a part of the Pervomayskugol Coal Association.

The mining property is bounded by the unassigned Mirnodolinsky tract in the northwest and by Karbonit Mine property in the south. The explored coal seams of the Gorsky Gluboky section within the interval of 800 to 1,500 meters are estimated to contain 256.3 million tonnes of mineable reserves. Considering their low lithification, the coal seams and surrounding rock strata in this area tend to store significant amounts of gas. In the working seams, the gas content ranges from 13 to 16 m^3 per tonne daf, with a gradual increase to as much as 25 m^3 per tonne daf at the Gorsky Gluboky section.

The surface area is mostly used for farming with some planted forest areas. Within a 30 km range from the mine, the nearest industrial towns are Lisichansk, Rubezhnoye and Severodonetsk to the east, and Pervomaysk and Popasnaya to the west. The mining property itself includes the town of Gorsk and other smaller towns. The property is crossed by several asphalt roads and railroad tracks.

The mine has two stationary degasification stations (in the northern and southern sections of the property) with three NV50 vacuum pumps installed at each location. Due to the extreme length of the 4 inches underground pipelines between coal faces and surface degasification wells, the pumps have proven ineffective and are not presently operational. In the northern section, the mine drilled three 198 mm surface degasification wells to 900 meters and another well to 800 meters. In the southern section, one 198 mm surface well was drilled to 700 meters. The mine has access to a total of 13 workable seams within the C_2^7, C_2^6 and C_2^5 coal suites. At present, it is producing from the k_8 seam with a second seam (m_3) under development.

The mailing address is Gorskaya Mine, 21 Kuybisheva Street, Gorsk, Lugansk Oblast 349975.

Table 1: General Information, Gorskaya Mine

1.	Total Mineable Reserves, thousand tonnes	46,548
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	4,219
3.	Total Mining Area, km^2	48.5
4.	Depth of Shaft(s), m	700 / 900
5.	Mining Capacity, tonnes / day	900
6.	Annual Electricity Consumption, MWh	62,370
7.	Coal Consumers	Uglegorsk Power Plant
8.	Annual Heat Consumption, Gcal	42,491
9.	Type(s) of Boilers	DKVR 10/13: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	8,235
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Gorskaya Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	13 to 25
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.8
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	20
Shale, percent	60
Limestone, percent	17
4. Number of Coal Seams Above Currently Mined	13
5. Aggregate Thickness of Seams Above Currently Mined, m	4.8
6. Geologic Phenomena	Faults: Maryevsky, Karbonitsky, Brubovsky, Southern, multiple small-amplitude faults (0.5 to 5 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	0.23 to 1.17
8. Porosity and Permeability, Sandstone:	
Porosity, percent	N/A
Permeability, mD	0.01–0.03
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	2.0
Satellite Seams, billion m^3	N/A
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Gorskaya Mine

	Coal Seam:	
	k_8	m_3
1. Rank of Coal	High-vol bituminous C, B	High-vol bituminous C
2. Seam Thickness, m	1.8	1.4
3. Pitch, degrees	5	7
4. Depth of Mining, m	900–1000	900
5. Ash Content:		
Coal in Place, percent	16.0	25.0
Run of Mine Coal, percent	25.0	N/A
6. Moisture, percent	4.5	8.0
7. Sulfur Content, percent	3.3–5.0	4.5
8. Gas Content, m^3 per tonne of daf coal	16	15
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	150–250	
12. Mining Equipment	2KMT	

Table 4: Coal Production, Methane Emissions and Degasification, Gorskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	13.50	1.30	14.80	0.00	N/A	18.43	803.00
1991	15.60	1.70	17.30	0.00	N/A	22.57	766.50
1992	15.51	2.00	17.51	0.00	N/A	34.27	511.00
1993	17.03	0.00	17.03	0.00	N/A	44.44	383.25
1994	12.35	1.52	13.87	0.00	N/A	64.40	215.35
1995	13.40	0.68	14.08	0.00	N/A	33.54	419.75
1996	12.93	0.68	13.61	0.00	N/A	64.29	211.70
1997	8.14	0.00	8.14	0.00	N/A	31.41	259.15
1998	9.15	0.00	9.51	0.00	N/A	53.85	176.60
1999	8.24	0.00	8.24	0.00	N/A	32.58	252.90

Table 5: Degasification Parameters, Gorskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	2
2. Number of Pumps, 150 m^3/min Capacity	0
3. Number of Pumps, 50 m^3/min Capacity	6
4. Number of Longwalls Degassed	0
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	0
• Methane Content, percent	0
• Methane Capture Rate, m^3/min	0
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	N/A

Chart 1: Coal Production and Total Methane Emission Trends, Gorskaya Mine

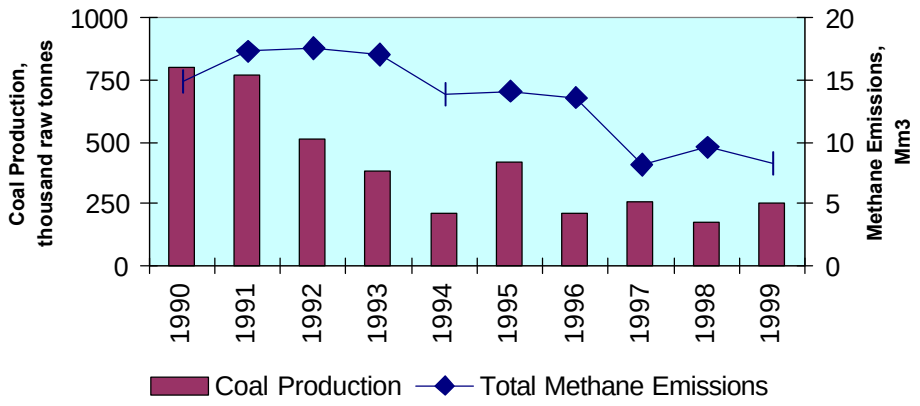


Chart 2: Methane Emissions, Gorskaya Mine

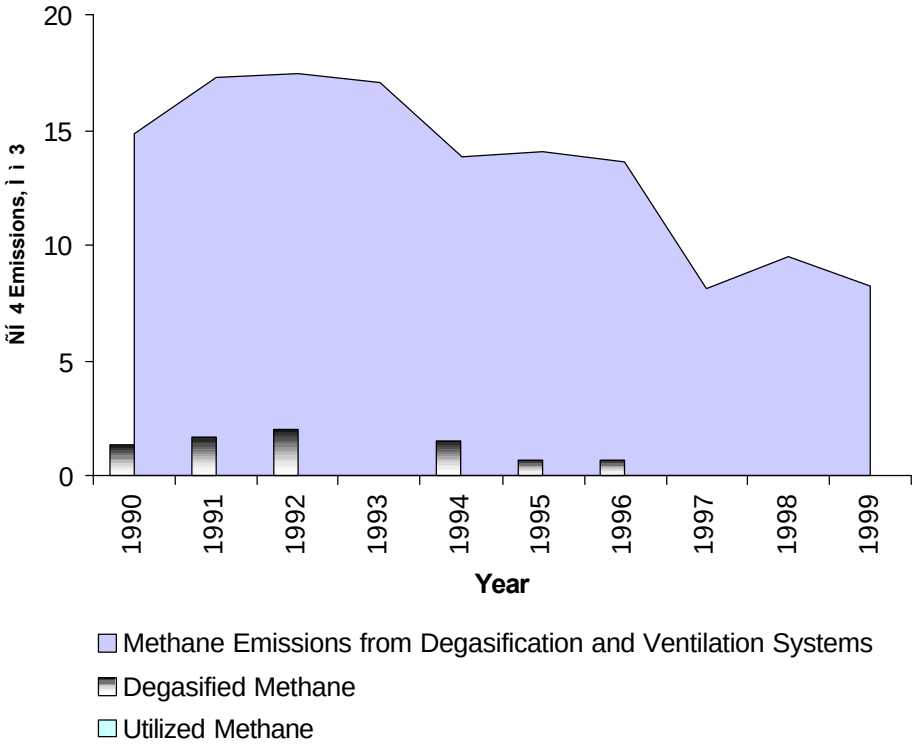
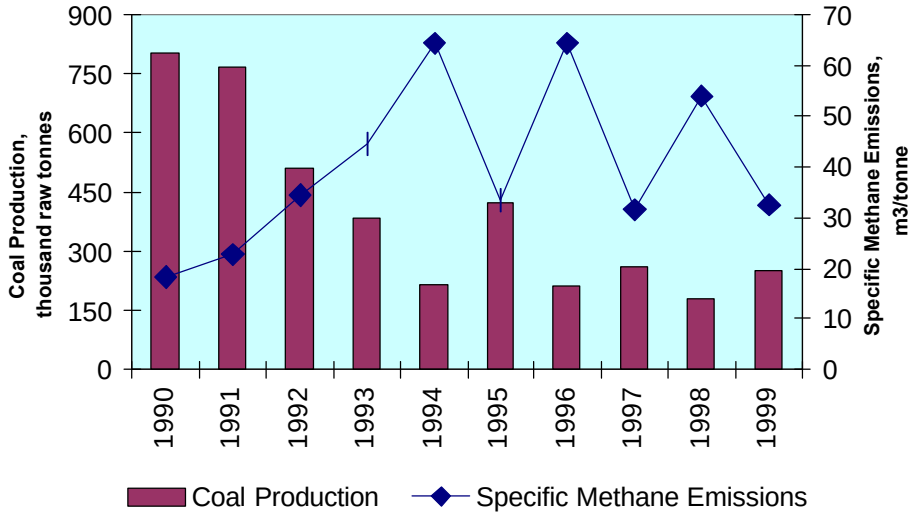


Chart 3: Coal Production and Specific Methane Emission Trends, Gorskaya Mine



5.9 Holodnaya Balka Mine

General Overview

The mine became operational in 1957 and is a part of the Makeyevugol Coal Association. The mining property is located in the central section of the Donetsk and Makeyevka geologic/industrial district, within the city limits of Makeyevka (population 436,000), which is a major industrial center. The city industries include a total of 19 underground mines, two iron and steel works, several coking plants, construction, textile manufacturing, and food processing facilities. The city of Makeyevka is surrounded by large farms.

The mine property is situated on the southern slope of the main Donetsk watershed, on the right, and partly on the left slope of the Gruzskaya River, which is a tributary of the Calmius River. The surface area is a prairie-type flatland that is crisscrossed by multiple ravines, or *balkas* in Ukrainian, hence the name of the mine. The largest of these are Kholodnaya, Kolesnikova, Verbovaya, Kutsaya and Dresnukha. Elevation ranges from 234 meters above sea level in the northern section of the property to 124 meters in the valleys of the ravines.

The mine property includes several small mining towns, namely, Novaya Zarya, Shevchenko, Novogrigoryevka and Kholodnaya Balka. Most of this area is used for farming. While the mine has no full-size coal preparation plant or thermal drying systems, there is a facility where large coal pieces are cleaned using heavy media. The processed coal is shipped to the Starobeshevskaya Thermal Power Plant.

The mine does not have a license for production of coal mine methane.

The mailing address is Holodnaya Balka Mine, Makeyevka 86154.

Table 1: General Information, Holodnaya Balka Mine

1.	Total Mineable Reserves, thousand tonnes	51,346
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	19,093
3.	Total Mining Area, km^2	55.56
4.	Depth of Shaft(s), m	208.2 / 845.0
5.	Mining Capacity, tonnes / day	1,470
6.	Annual Electricity Consumption, MWh	44,108
7.	Coal Consumers	Starobeshevo Power Plant
8.	Annual Heat Consumption, Gcal	81,700
9.	Type(s) of Boilers	DKVR 10/13: 1 unit DKVR 6.5/13: 3 units DKVR 4/13: 2 units E 1/9: 1 unit
10.	Boilers Fueled with	Methane
11.	Fuel Consumption, winter/summer, Mm^3 of CH_4	12.62
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Holodnaya Balka Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	18 to 30
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.4
Pressure, MPa / 1,000 m	4–7
3. Overburden Composition:	
Sandstone, percent	14
Shale, percent	83
Limestone, percent	3
4. Number of Coal Seams Above Currently Mined	12
5. Aggregate Thickness of Seams Above Currently Mined, m	7.6
6. Geologic Phenomena	Faults: «I» (amplitude 14 m), Dulinsky (150–180 m), Markovsky (30–50 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 5
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3 to 6
Permeability, mD	0.01–0.02
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	1.8
Satellite Seams, billion m^3	5.8
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Holodnaya Balka Mine

	Coal Seam: h_{10}^{8}
1. Rank of Coal	Low-vol bituminous
2. Seam Thickness, m	0.8–1.3
3. Pitch, degrees	3–20
4. Depth of Mining, m	750
5. Ash Content:	
Coal in Place, percent	14.3
Run of Mine Coal, percent	34.8
6. Moisture, percent	4.1
7. Sulfur Content, percent	4.2
8. Gas Content, m^3 per tonne of daf coal	18
9. Mining Method	Longwall Mining
10. Roof Control Method	Complete caving
11. Panel Width, m	240–248
12. Mining Equipment	MKD-90B, KD-80

Table 4: Coal Production, Methane Emissions and Degasification, Holodnaya Balka Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	19.70	6.20	25.90	N/A	N/A	30.85	839.50
1991	29.90	2.20	32.10	N/A	N/A	38.24	839.50
1992	30.48	6.95	37.44	N/A	N/A	60.34	620.50
1993	30.64	2.31	32.95	N/A	N/A	57.14	576.70
1994	18.24	4.63	22.87	N/A	32.00	46.07	496.40
1995	19.29	5.94	25.23	5.94	38.00	56.20	448.95
1996	18.13	5.15	23.28	5.15	60.00	70.77	328.50
1997	14.62	8.30	22.92	8.30	62.00	52.33	438.00
1998	15.35	15.61	30.96	14.10	63.00	59.67	518.90
1999	29.40	15.70	45.10	12.62	66.00	74.08	608.80

Table 5: Degasification Parameters, Holodnaya Balka Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	3
4. Number of Longwalls Degassed	3
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	45.3
• Methane Content, percent	66
• Methane Capture Rate, m^3/min	29.9
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	29.9
♦ Summer	12
6. Length of Pipeline, m	7,778

Chart 1: Coal Production and Total Methane Emission Trends, Holodnaya Balka Mine

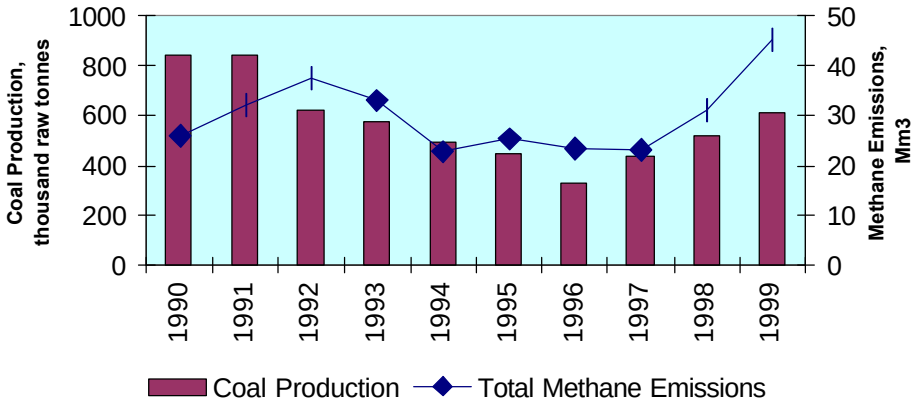


Chart 2: Methane Emissions, Holodnaya Balka Mine

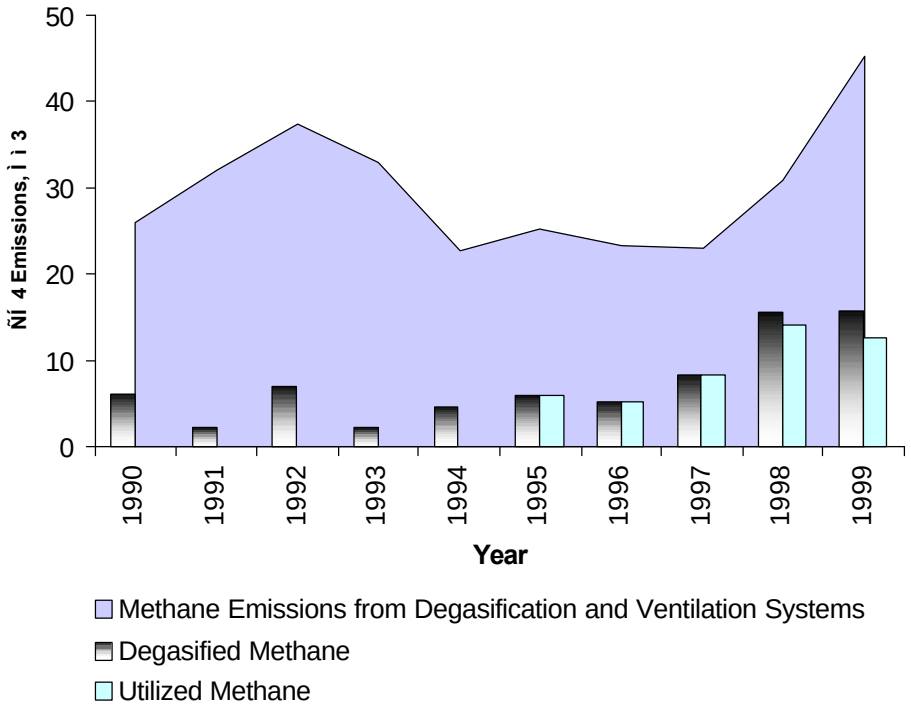
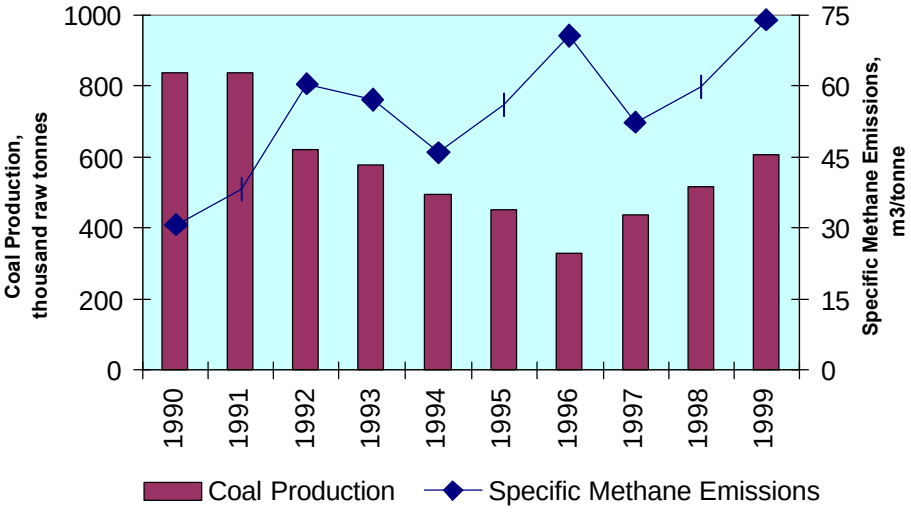


Chart 3: Coal Production and Specific Methane Emission Trends, Holodnaya Balka Mine



5.10 Kalinin Mine

General Overview

The mine became operational in 1963 and is a part of the Donugol Coal Association.

The mine is located within the city limits of Donetsk and in the Krasnogvardeysky Rayon, which is a part of the city of Makeyevka. The surface is a mildly undulating plain, on which numerous structures were built by the city of Donetsk.

At present, the mine employs a total of 1,813 persons.

The mine has been issued a license (#1314 of April 9, 1998) with twenty years duration for extraction of coal, germanium, methane and drainage water.

The mailing address is Kalinin Mine, 4 Prospekt Mira, Donetsk 83017.

Telephone: 38 0622 52-3390.

Table 1: General Information, Kalinin Mine

1.	Total Mineable Reserves, thousand tonnes	14,914
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	14,914
3.	Total Mining Area, km^2	28.0
4.	Depth of Shaft(s), m	N/A
5.	Mining Capacity, tonnes / day	1200
6.	Annual Electricity Consumption, MWh	58,969
7.	Coal Consumers	Alchevsky and Kommunarsky Coke and Chemical Plants, Uglegorsky Thermal Power Plant
8.	Annual Heat Consumption, Gcal	11,613
9.	Type(s) of Boilers	DKV 10/13: 3 units KE 10/14: 1unit
10.	Boilers Fueled with	Natural Gas
11.	Fuel Consumption, winter/summer, Mm^3	1.517/ 0.11
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Kalinin Mine

1. Coal Seam Gas Content, Range, m^3/tonne	14 to 27
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	3
Pressure, MPa / 1,000 m	4–12
3. Overburden Composition:	
Sandstone, percent	20
Shale, percent	77
Limestone, percent	0.5
4. Number of Coal Seams Above Currently Mined	10
5. Aggregate Thickness of Seams Above Currently Mined, m	6.5
6. Geologic Phenomena	Faults: Kalininsky (amplitude 250–270 m), Francuzsky (500–580 m), Centralny (5–15 m), Mushketovsky (150 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	3 to 10
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3 to 5
Permeability, mD	0.01–0.02
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	0.7
Satellite Seams, billion m^3	1.1
Sandstone, billion m^3	1.8

Table 3: Geologic and Mining Conditions, Kalinin Mine

	Coal Seam: h_{10}
1. Rank of Coal	High vol, bituminous A, B; Mid.-vol bituminous
2. Seam Thickness, m	1.3
3. Pitch, degrees	20
4. Depth of Mining, m	1,240
5. Ash Content:	
Coal in Place, percent	10.3
Run of Mine Coal, percent	30.5
6. Moisture, percent	2.0
7. Sulfur Content, percent	3.2
8. Gas Content, m^3 per tonne of daf coal	23.6
9. Mining Method	Longwall
10. Roof Control Method	Complete caving
11. Panel Width, m	170–260
12. Mining Equipment	

Table 4: Coal Production, Methane Emissions and Degasification, Kalinin Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	104.40	9.30	113.70	9.30	N/A	94.40	1,204.50
1991	53.80	8.10	61.90	4.80	N/A	67.84	912.50
1992	45.78	7.57	53.35	0.00	N/A	76.93	693.50
1993	65.75	9.57	75.32	0.00	N/A	106.92	704.45
1994	65.59	3.05	68.64	0.00	N/A	142.47	481.80
1995	48.30	8.51	56.81	0.00	N/A	167.36	339.45
1996	54.14	2.42	56.56	2.42	N/A	336.87	167.90
1997	31.43	2.79	34.22	0.00	N/A	153.70	222.65
1998	32.96	3.68	36.64	0.00	N/A	126.35	290.00
1999	44.57	2.94	47.51	0.00	22	143.66	330.70

Table 5: Degasification Parameters, Kalinin Mine

Parameter	Indicator
1. Number of Pumping Stations	N/A
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	3
4. Number of Longwalls Degassed	2
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	25
• Methane Content, percent	22
• Methane Capture Rate, m^3/min	5.6
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	8,300

Chart 1: Coal Production and Total Methane Emission Trends, Kalinin Mine

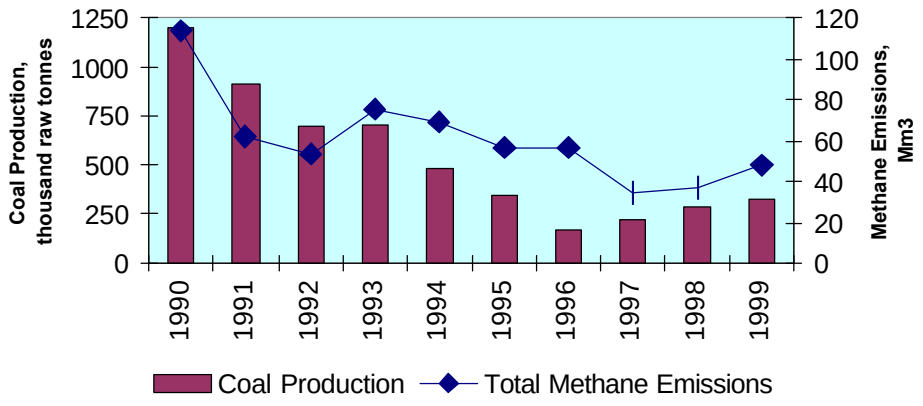


Chart 2: Methane Emissions, Kalinin Mine

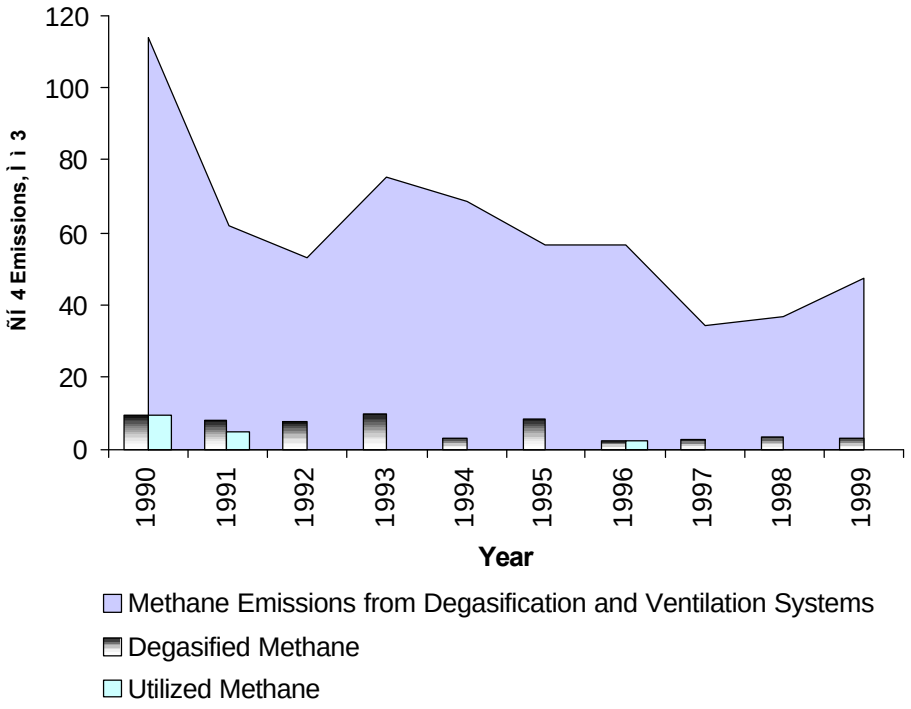
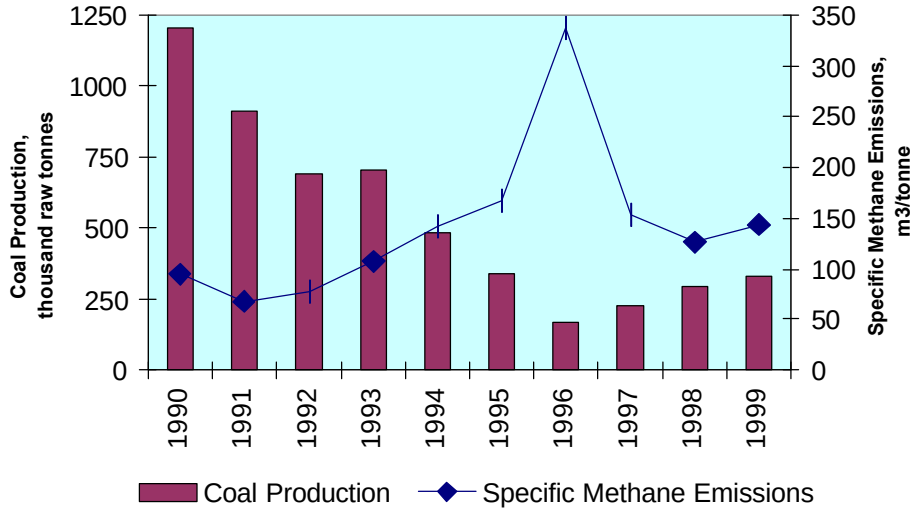


Chart 3: Coal Production and Specific Methane Emission Trends, Kalinin Mine



5.11 Kirov Mine

General Overview

Formerly a mining complex of the same name, the mine began operations in 1996. The original mines of the complex included Kirov #1 that started mining in 1947, and Kirovskaya Zapadnaya that became operational in 1948. The mine is a part of the Makeyevugol Coal Association.

The mine is located in the eastern section of the Donetsk and Makeyevka geologic/industrial district of the Donetsk Coal Basin. In administrative terms, it is situated in Gornyatsky Rayon within the city limits of Makeyevka (population 436,000), which is a major industrial center. The city industries include a total of 19 underground mines, two iron and steel works, several coking plants and metal manufacturing construction facilities. The city of Makeyevka is surrounded by large farms.

The surface above the mine is in the watershed of the Gruzskaya and the Nizhnaya Krynka Rivers. The terrain is prairie-type flatland that is crisscrossed by multiple ravines. Elevation ranges from 270 meters above sea level in the eastern section of the property to 222 meters in the lowest valleys of the ravines.

The mailing address is Kirov Mine, Makeevka, Donetsk Oblast 339900.

Table 1: General Information, Kirov Mine

1.	Total Mineable Reserves, thousand tonnes	23,662
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	22,674
3.	Total Mining Area, km^2	36
4.	Depth of Shaft(s), m	475
5.	Mining Capacity, tonnes / day	2,125
6.	Annual Electricity Consumption, MWh	55,880
7.	Coal Consumers	N/A
8.	Annual Heat Consumption, Gcal	14,400
9.	Type(s) of Boilers	DKVR 6.5/13: 3 units KVKS-3: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	3,000 / 0
12.	Fuel Demand Self-covered by the Mine, percent	9.7

Table 2: General Geologic Information, Kirov Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	12.0 to 30
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.8
Pressure, MPa / 1,000 m	4–7
3. Overburden Composition:	
Sandstone, percent	43
Shale, percent	51
Limestone, percent	1.4
4. Number of Coal Seams Above Currently Mined	16
5. Aggregate Thickness of Seams Above Currently Mined, m	8.5
6. Geologic Phenomena	Faults: Prodolny (amplitude 30–150 m), Severny (20 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	3 to 7
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3 to 7
Permeability, mD	0.01–0.02
9. Total Methane Resource, billion m^3, including:	12.2
Coal Seams, billion m^3	0.9
Satellite Seams, billion m^3	0.2
Sandstone, billion m^3	11.1

Table 3: Geologic and Mining Conditions, Kirov Mine

	Coal Seam:		
	l_4	l_1	h^b_{10}
1. Rank of Coal	Mid-vol bituminous	Mid-vol bituminous	Low-vol bituminous
2. Seam Thickness, m	0.70	1.00–1.20	0.95
3. Pitch, degrees	6	6–8	6-9
4. Depth of Mining, m	440	490	260
5. Ash Content:			
Coal in Place, percent	11.2	20.0	13.1
Run of Mine Coal, percent	16.3	38.7	26.4
6. Moisture, percent	0.8	1.2	1.2
7. Sulfur Content, percent	0.3–3.0	1.5–3.7	2.5–4.5
8. Gas Content, m^3 per tonne of daf coal	21.0	21.0	30.0
9. Mining Method	Longwall		
10. Roof Control Method	Complete caving		
11. Panel Width, m	185–210		
12. Mining Equipment	MKD-80, MKD-90, UST-2M		

Table 4: Coal Production, Methane Emissions and Degasification, Kirov Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	9.20	4.20	13.40	0.00	15.00	45.89	292.00
1991	14.90	3.00	17.90	0.00	12.00	61.30	292.00
1992	9.06	3.21	12.27	0.00	9.00	37.35	328.50
1993	7.25	1.00	8.25	0.00	16.00	23.54	350.40
1994	4.70	4.00	8.70	0.00	16.00	27.09	321.20
1995	7.04	4.20	11.24	0.00	15.00	38.49	292.00
1996	7.73	4.30	12.03	0.00	25.00	33.63	357.70
1997	9.30	7.80	17.10	0.00	22.00	35.76	478.15
1998	9.60	9.40	19.00	0.00	30.00	25.00	760.40
1999	8.41	7.31	15.72	0.00	33.00	16.40	958.10

Table 5: Degasification Parameters, Kirov Mine

Parameter	Indicator
1. Number of Pumping Stations	2
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	6
4. Number of Longwalls Degassed	4
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	42
• Methane Content, percent	33
• Methane Capture Rate, m^3/min	13.9
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	7,360

Chart 1: Coal Production and Total Methane Emission Trends, Kirov Mine

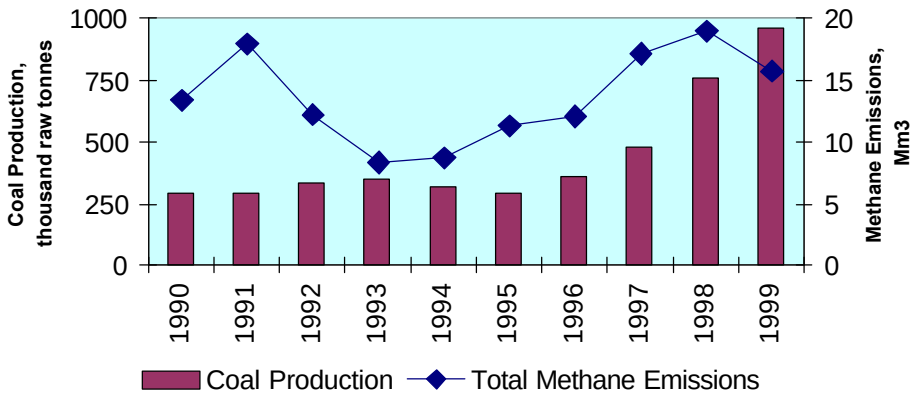


Chart 2: Methane Emissions, Kirov Mine

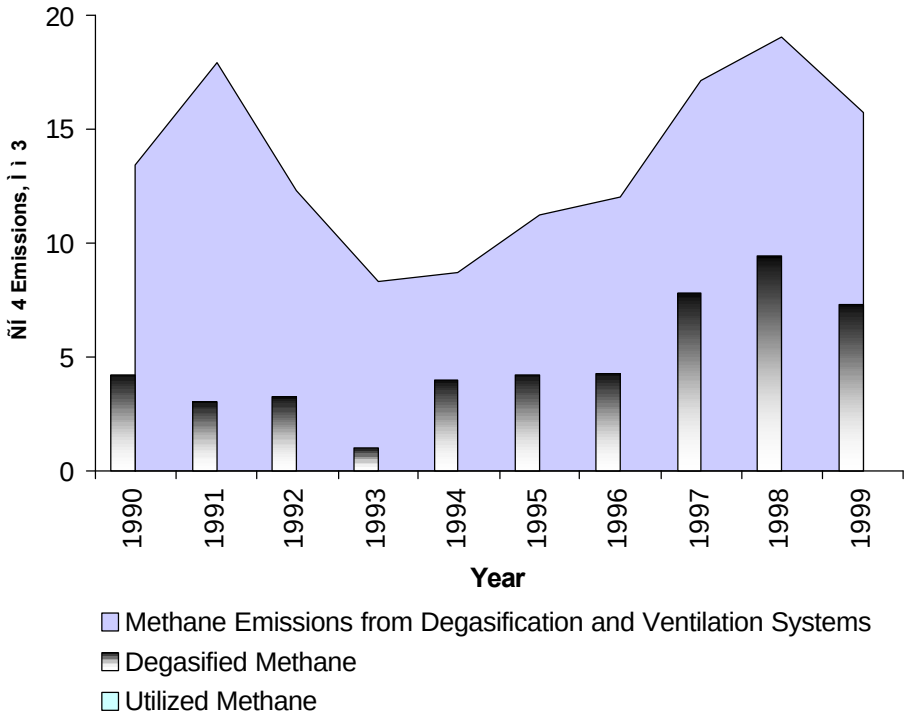
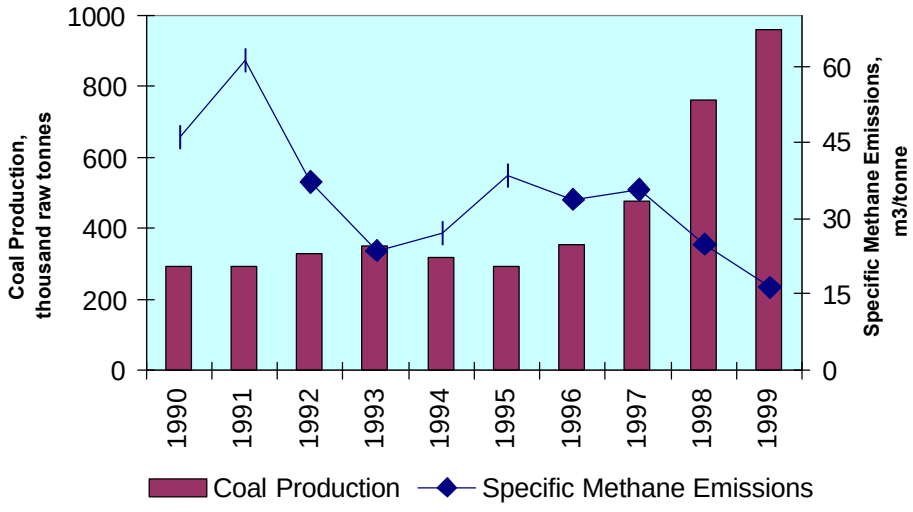


Chart 3: Coal Production and Specific Methane Emission Trends, Kirov Mine



5.12 Komsomolets Donbassa Mine

General Overview

The Komsomolets Donbassa Mine became operational in December 1980.

Extending over an area of 62.5 km^2, the property is located in the western section of the Chistyakovo-Snezhnoye syncline in the central part of the Donetsk Coal Basin. The location is within a short distance of the region's major industrial towns of Shakhtyorsk, Thorez, Khartsyzsk and Yenakievo. The distance from the mine to regional centers of Donetsk and Makeyevka is 25 to 35 kilometers to the southwest.

Komsomolets Donbassa is not part of an Association and is categorized as independent. The mine has been selected to be the first mine in Ukraine to be privatized. All of the shares of the company were sold during 2000.

The surface above the mine is an undulating plain that is crisscrossed by several major ravines with either continuous or seasonal streams. The elevation ranges from 269.7 to 152.5 meters above sea level. Most of the surface is farmed.

The mine employs a total of 5,175 persons.

The mailing address is Komsomolets Donbassa Mine, Kirovskoye, Donetsk Oblast 86300.

Telephone number: 38 062 5065012.

Table 1: General Information, Komsomolets Donbassa Mine

1.	Total Mineable Reserves, thousand tonnes	137,449
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	66,530
3.	Total Mining Area, km^2	62.5
4.	Depth of Shaft(s), m	379 / 633 / 808
5.	Mining Capacity, tonnes / day	5,950
6.	Annual Electricity Consumption, MWh	146,330
7.	Coal Consumers	Electric Generation
8.	Annual Heat Consumption, Gcal	71,008
9.	Type(s) of Boilers	KE 25/14C: 4 units KE 10/14C: 4 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	16,392 /318
12.	Fuel Demand Self-covered by the Mine, percent	82

Table 2: General Geologic Information, Komsomolets Donbassa Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	25 to 35
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.0
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	25
Shale, percent	70
Limestone, percent	3.5
4. Number of Coal Seams Above Currently Mined	15
5. Aggregate Thickness of Seams Above Currently Mined, m	7
6. Geologic Phenomena	Faults: Yunkomovsky
7. Gas Pressure in Surrounding Rock Strata, MPa	4 to 8
8. Porosity and Permeability, Sandstone:	
Porosity, percent	0.7 to 5.7
Permeability, mD	0.001
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	5.5
Satellite Seams, billion m^3	1.5
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Komsomolets Donbassa Mine

	Coal Seam:		
	l_7	l_4	l_3
1. Rank of Coal	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous
2. Average Seam Thickness, m	1.08	1.02	1.38
3. Pitch, degrees	2–24	2–30	2–28
4. Depth of Mining, m	628–790	628–790	418–790
5. Ash Content:			
Coal in Place, percent	9.3	10.1	12.5
Run of Mine Coal, percent	34.4	33.9	33.5
6. Moisture, percent	2.9	3.0	3.0
7. Sulfur Content, percent	1.9	3.2	2.8
8. Gas Content, m^3 per tonne of daf coal	25	25	25
9. Mining Method	Longwall		
10. Roof Control Method	Complete caving		
11. Panel Width, m	150–250		
12. Mining Equipment	Mechanized complexes KD-80, KMT, BMV-14		

Table 4: Coal Production, Methane Emissions and Degasification, Komsomolets Donbassa Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	104.20	8.90	113.10	N/A	N/A	50.73	2,229.4
1991	130.50	9.80	140.30	9.80	N/A	77.28	1,815.5
1992	123.20	9.20	132.40	N/A	N/A	80.77	1,639.2
1993	97.18	3.15	100.33	N/A	N/A	66.45	1,509.9
1994	78.46	10.52	88.98	5.26	30	68.90	1,291.5
1995	83.09	10.52	93.61	5.26	30	69.12	1,354.3
1996	97.46	7.88	105.34	3.94	30	76.33	1,380.1
1997	125.12	6.31	131.43	1.84	30	109.86	1,196.3
1998	108.98	11.04	120.02	3.94	30	90.59	1,324.8
1999	116.81	11.56	128.37	4.20	30	93.43	1,373.9

Table 5: Degasification Parameters, Komsomolets Donbassa Mine

Parameter	Indicator
1. Number of Pumping Stations	2
2. Number of Pumps, 150 m^3/min Capacity	4
3. Number of Pumps, 50 m^3/min Capacity	1
4. Number of Longwalls Degassed	4
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	73.3
• Methane Content, percent	30
• Methane Capture Rate, m^3/min	22
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	12
♦ Summer	0
6. Length of Pipeline, m	23,000

Chart 1: Coal Production and Total Methane Emission Trends, Komsomolets Donbassa Mine

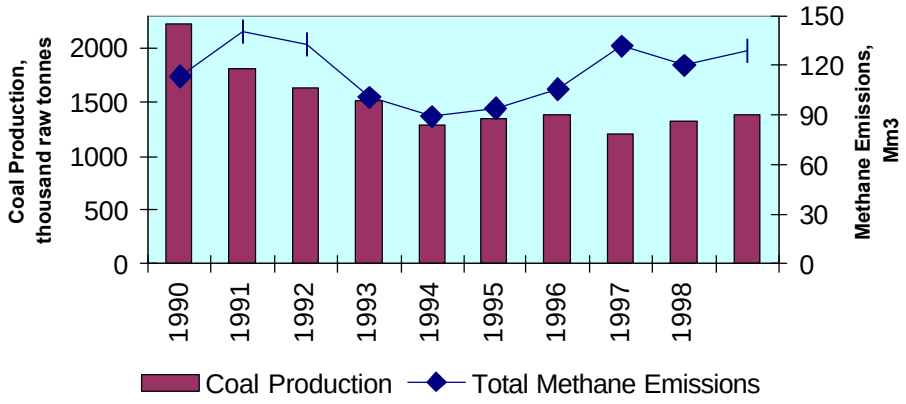


Chart 2: Methane Emissions, Komsomolets Donbassa Mine

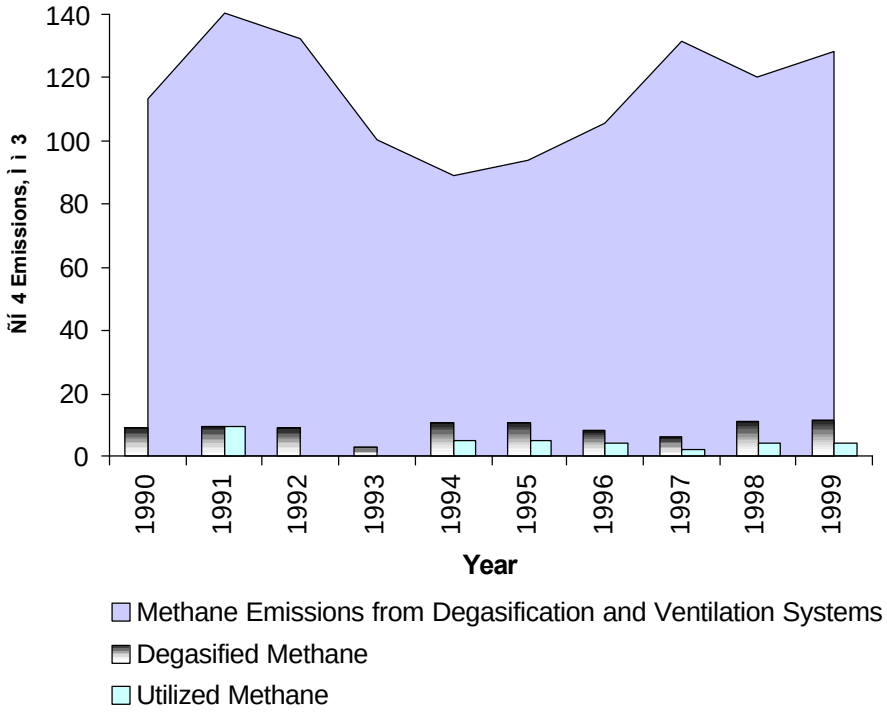
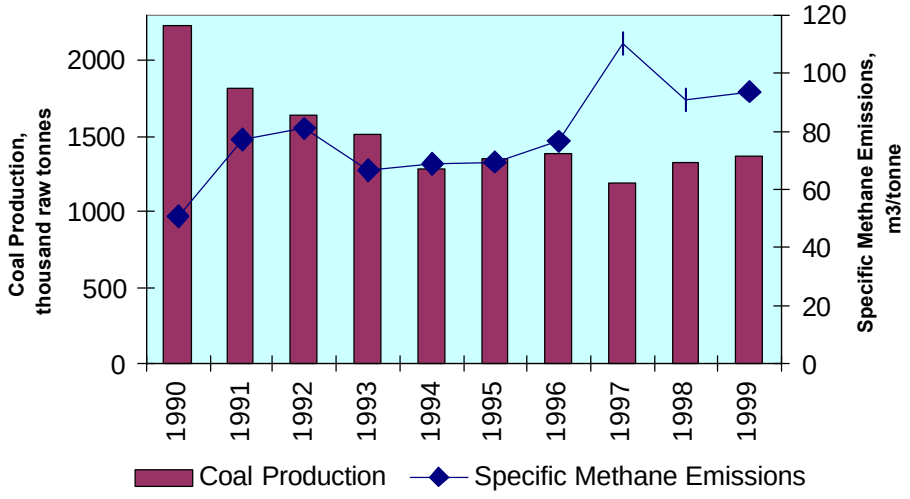


Chart 3: Coal Production and Specific Methane Emission Trends, Komsomolets Donbassa Mine



5.13 Krasnoarmeyskaya-Zapadnaya Mine

General Overview

Designed by Dneprgiproshakht, a mine design institute in Dnipropetrovsk, Ukraine, the mine became operational in 1990. The property is located in the western section of the Donetsk Coal Basin. In administrative terms, it is a part of the Krasnoarmeysk Rayon in the Donetsk Oblast. The rayon capital, Krasnoarmeysk, is located 16 km east of the mine. The mine is a part of the Makeyevugol Coal Association.

During the years of 1991 through 1994, the mine operated at 115 to 154 percent of the original production capacity. As of January 1, 2000, the coal reserves were estimated at 79,449 million tonnes of coking coal with an ash content of 35.8 percent and a sulfur content of 1.0 percent. The mine is operating at the d_4 coal seam that varies from 0.80 to 1.95 meters in thickness and is generally considered prone to outbursts. The in-situ gas content is estimated at 16 to 22 m^3 per tonne. The total length of underground workings is 89.2 km. While the overall thickness of the d_4 seam is 0.90 to 2.15 meters, its mineable thickness is mostly under two meters, and generally ranges from 0.75 to 1.90 meters.

The property is limited by the Krivoy Rog-Pavlovsky fault up the dip and by the Kotlinsky thrust down the pitch of the coal seam. Along strike of the seam, it is outlined by #6 fault and its hypothetical extension to the Kotlinsky thrust. In the south, the property is limited by a conventional boundary that was drawn at exploration borehole #2184, and by the seam pinchout line towards the Kotlinsky thrust. The mine has two adjacent coal blocks that are located to the north and the south of the actively mined area. The mine is operating with a main vertical shaft, an auxiliary shaft, two ventilation shafts (intake shaft #1 in the eastern section and ventilation shaft #1 at the 6th coal block), and a ventilation shaft. All of the shafts were driven to their design depth level.

The mailing address is Udachna Station, Krasnoarmeysk, Donetsk Oblast 83000.

Table 1: General Information, Krasnoarmeyskaya-Zapadnaya Mine

1.	Total Mineable Reserves, thousand tonnes	79,449
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	79,449
3.	Total Mining Area, km^2	96
4.	Depth of Shaft(s), m	705
5.	Mining Capacity, tonnes / day	9,800
6.	Annual Electricity Consumption, MWh	119,862
7.	Coal Consumers	N/A
8.	Annual Heat Consumption, Gcal	42,820
9.	Type(s) of Boilers	KE 25/14: 3 units E 1/9: 10 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	16,300 / 8,300
12.	Fuel Demand Self-covered by the Mine, percent	N/A

Table 2: General Geologic Information, Krasnoarmeyskaya-Zapadnaya Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	15 to 25
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.3–3.3
Pressure, MPa / 1,000 m	4–8
3. Overburden Composition:	
Sandstone, percent	30
Shale, percent	67
Limestone, percent	1
4. Number of Coal Seams Above Currently Mined	40
5. Aggregate Thickness of Seams Above Currently Mined, m	16.0
6. Geologic Phenomena	Faults: Kotlinsky (amplitude 8–243m), Udachinsky #1 (4–86 m), #2 (0–28 m), #3 (0–18 m), Krivorozhsko-Pavlovsky (360–925 m), Alexandrovsky (50–60 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 7
8. Porosity and Permeability, Sandstone:	
Porosity, percent	4.5 to 21.0
Permeability, mD	0.03–1.93
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	1.9
Satellite Seams, billion m^3	5.4
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Krasnoarmeyskaya-Zapadnaya Mine

	Coal Seam: d_4
1. Rank of Coal	High-vol bituminous A
2. Seam Thickness, m	1.7
3. Pitch, degrees	2–12
4. Depth of Mining, m	590–700
5. Ash Content:	
Coal in Place, percent	15.1
Run of Mine Coal, percent	33.7
6. Moisture, percent	1.3
7. Sulfur Content, percent	0.9
8. Gas Content, m^3 per tonne of daf coal	15–25
9. Mining Method	Longwall
10. Roof Control Method	Complete caving
11. Panel Width, m	150–250
12. Mining Equipment	RKU-13, conveyer: SP-301M

Table 4: Coal Production, Methane Emissions and Degasification, Krasnoarmeyskaya-Zapadnaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1991	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1992	43.10	7.88	50.98	0.00	N/A	10.76	730.00
1993	57.82	8.41	66.23	0.00	N/A	42.58	1,551.00
1994	67.75	7.88	75.63	0.00	N/A	49.33	1,533.00
1995	50.88	8.94	59.82	0.00	N/A	36.42	1,642.50
1996	61.60	6.73	68.33	0.00	N/A	40.52	1,686.30
1997	58.55	7.15	65.70	0.00	N/A	34.62	1,898.00
1998	76.53	8.99	85.52	0.00	N/A	34.63	2,469.20
1999	78.73	12.40	91.13	0.00	25	29.05	3,137.50

Table 5: Degasification Parameters, Krasnoarmeyskaya-Zapadnaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	3
3. Number of Pumps, 50 m^3/min Capacity	None
4. Number of Longwalls Degassed	5
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	95.0
• Methane Content, percent	25
• Methane Capture Rate, m^3/min	23.6
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	26,900

Chart 1: Coal Production and Total Methane Emission Trends, Krasnoarmeyskaya-Zapadnaya Mine

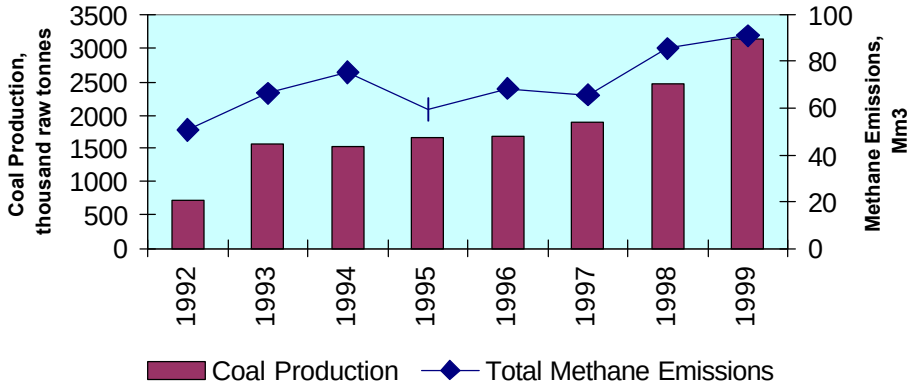


Chart 2: Methane Emissions, Krasnoarmeyskaya-Zapadnaya Mine

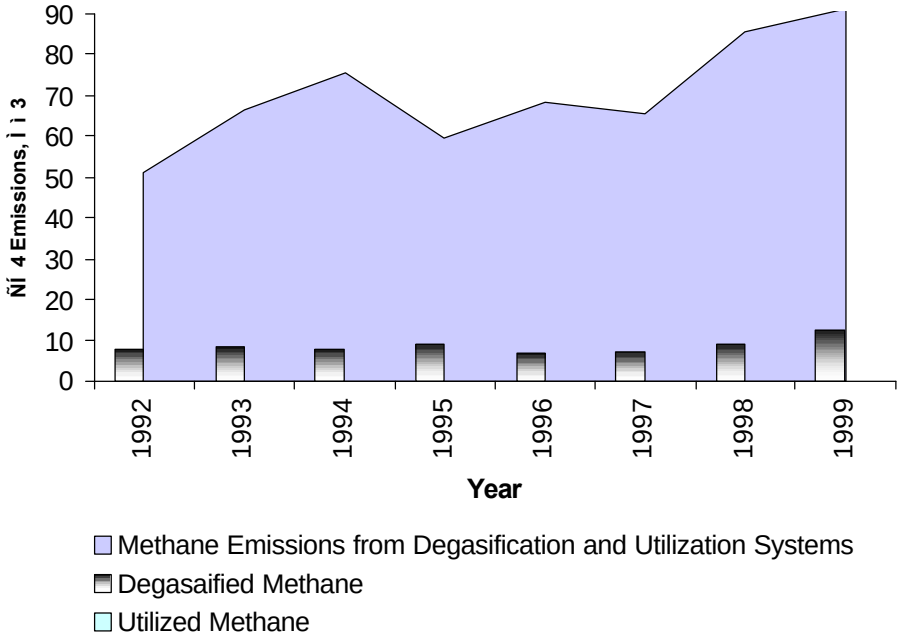
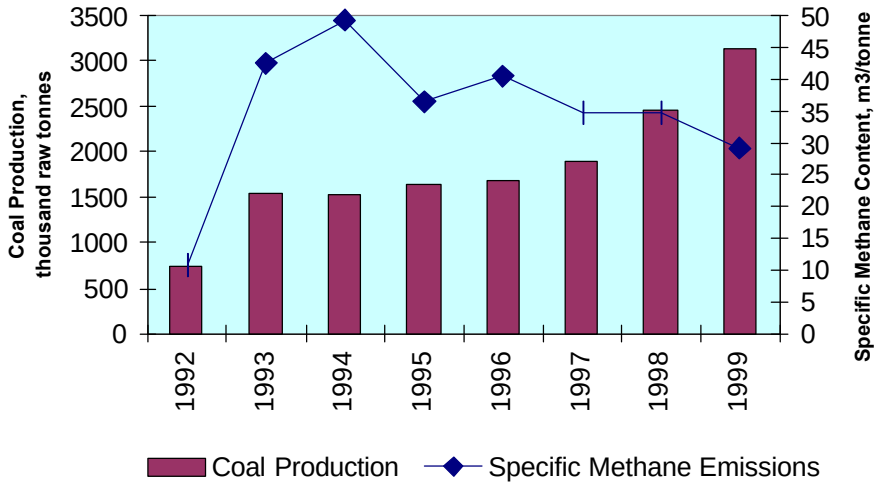


Chart 3: Coal Production and Specific Methane Emission Trends, Krasnoarmeyskaya-Zapadnaya Mine



5.14 Krasnolimanskaya Mine

General Overview

The mine became operational in 1959. Its production in 1999 was 3.3 million raw tonnes. The mine is located in Krasnoarmeysk Rayon of the Donetsk Oblast, and is situated 20 kilometers from the rayon capital Krasnoarmeysk. Krasnolimanskaya does not belong to an Association; however, the mine is subordinate to the Ministry of Fuel and Energy of Ukraine.

The operational boundaries of the property are outlined as follows: in the east by the m_3, l_3, l_7 and k_5 coal seams at 650 meters below the surface; in the west by the m_4 group seams at the point of outcropping through the carboniferous strata, and farther to their intersection with the Glubokoyarsky Fault to the south, ending at the contour line at 650 meters below surface; in the south by the property of the Centralnaya Mine; in the north by the central fault.

Water is supplied to the mine and surrounding towns through the Karlovka-Krasnoarmeysk conduit and from an artesian well that is located in the town of Fedorovka.

The mailing address is Krasnolimanskaya Mine, Rodinskoe, Donetsk Oblast 85300.

Table 1: General Information, Krasnolimanskaya Mine

1.	Total Mineable Reserves, thousand tonnes	85,024
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	13,156
3.	Total Mining Area, km^2	21.4
4.	Depth of Shaft(s), m	535.2; 560.5
5.	Mining Capacity, tonnes / day	10,000
6.	Annual Electricity Consumption, MWh	133,800
7.	Coal Consumers	Coke and Chemical Plants
8.	Annual Heat Consumption, Gcal	94,220
9.	Type(s) of Boilers	DKVR 10/13: 4 units KE 10/14: 3 units
10.	Boilers Fueled with	Heavy Oil
11.	Fuel Consumption, winter/summer, tonnes	10,706
12.	Fuel Demand Self-covered by the Mine, percent	N/A

Table 2: General Geologic Information, Krasnolimanskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	15 to 25
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.9
Pressure, MPa / 1,000 m	4–10
3. Overburden Composition:	
Sandstone, percent	37
Shale, percent	60
Limestone, percent	1
4. Number of Coal Seams Above Currently Mined	13
5. Aggregate Thickness of Seams Above Currently Mined, m	16
6. Geologic Phenomena	Faults: Central (amplitude 202–425 m), Krasnolimansky (5–15 m), Glubokoyarsky (70–80 m), Fedorovsky (10–45 m), Grachevsky (5–95 m), Grushevsky (5–15 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	3 to 9
8. Porosity and Permeability, Sandstone:	
Porosity, percent	4 to 11
Permeability, mD	0.06–0.09
9. Total Methane Resource, billion m^3, including:	17.6
Coal Seams, billion m^3	2.1
Satellite Seams, billion m^3	1.9
Sandstone, billion m^3	13.6

Table 3: Geologic and Mining Conditions, Krasnolimanskaya Mine

	Coal Seam:	
	l_3	k_5
1. Rank of Coal	High-vol bituminous	High-vol bituminous
2. Seam Thickness, m	2.12–2.26	1.05–2.23
3. Pitch, degrees	7–9	7–9
4. Depth of Mining, m	857	1,000
5. Ash Content:		
Coal in Place, percent	12.8	6.5
Run of Mine Coal, percent	23.1	34.4
6. Moisture, percent	4.1	3.8
7. Sulfur Content, percent	3.40	1.93
8. Gas Content, m^3 per tonne of daf coal	15–25	15–25
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	150–250	
12. Mining Equipment		

Table 4: Coal Production, Methane Emissions and Degasification, Krasnolimanskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	34.70	26.70	61.40	0.00	N/A	24.40	2,512.30
1991	36.20	28.20	64.40	0.00	N/A	39.14	1,645.40
1992	27.30	21.20	48.50	0.00	N/A	25.00	1,942.70
1993	27.50	28.60	56.10	0.00	N/A	31.80	1,766.70
1994	23.10	14.80	37.90	0.00	N/A	34.73	1,091.40
1995	27.10	17.30	44.40	0.00	N/A	29.10	1,527.50
1996	31.00	18.50	49.50	0.00	N/A	25.95	1,907.60
1997	34.40	16.60	51.00	0.00	N/A	22.52	2,264.40
1998	37.80	15.60	53.40	0.00	N/A	22.60	2,361.60
1999	40.21	21.56	61.77	0.00	19.50	18.93	3,263.75

Table 5: Degasification Parameters, Krasnolimanskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	2
2. Number of Pumps, 150 m^3/min Capacity	8
3. Number of Pumps, 50 m^3/min Capacity	N/A
4. Number of Longwalls Degassed	4
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	210
• Methane Content, percent	19.5
• Methane Capture Rate, m^3/min	41.0
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	14,525

Chart 1: Coal Production and Total Methane Emission Trends, Krasnolimanskaya Mine

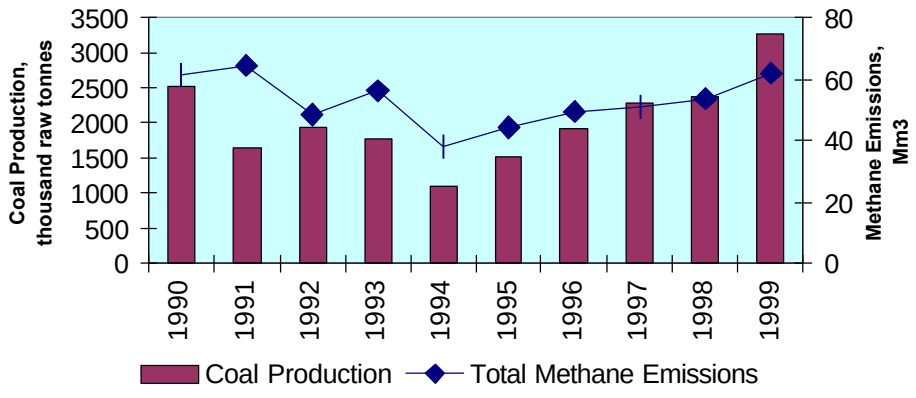


Chart 2: Methane Emissions, Krasnolimanskaya Mine

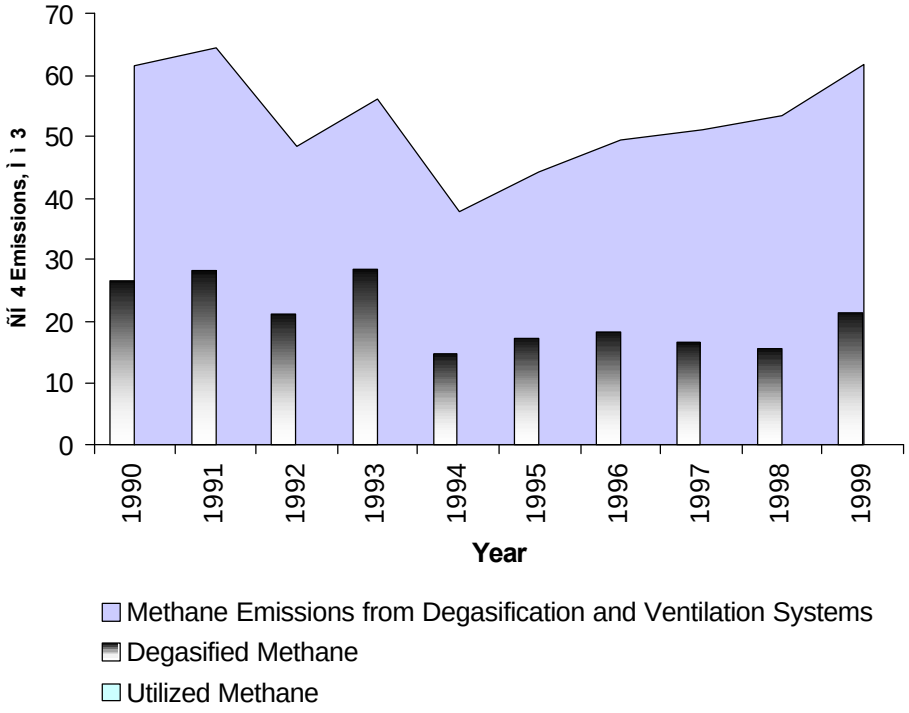
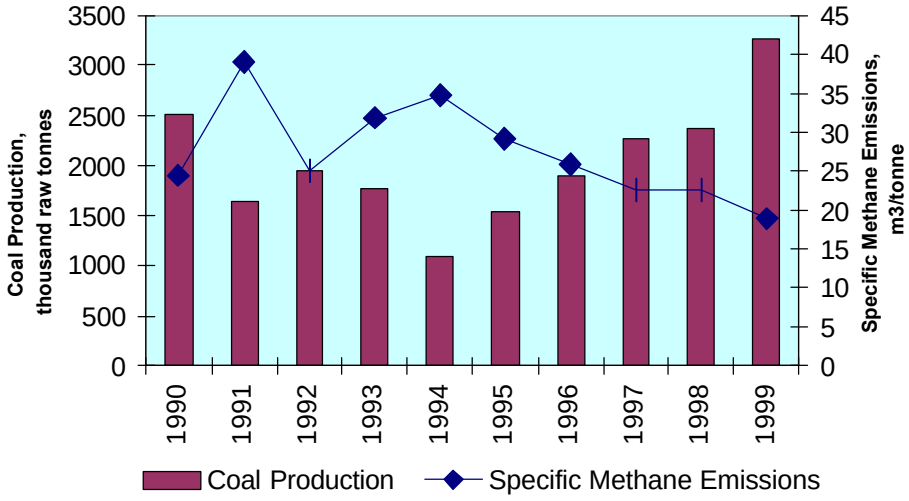


Chart 3: Coal Production and Specific Methane Emission Trends, Krasnolimanskaya Mine



5.15 Molodogvardeyskaya Mine

General Overview

Designed by Yuzhgiproshakht (a Ukrainian mine design institute), the mine became operational in two stages in 1971 and 1973. The mine accessed the coal reserves by drilling two vertical shafts in the central section, and three ventilation shafts in the side sections of the property. The apportioned area has a total of four mineable coal seams. The mine is a part of the Krasnodonugol Coal Association.

The property is located in the Krasnodon Rayon of the Lugansk Oblast; the nearest major towns are Molodogvardeysk (8 km) and the oblast capital Lugansk (43 km). The rayon's industries include ten underground mines, a mine equipment repair plant, an auto parts factory and other operations. Several large farms are located in the vicinity of Krasnodon.

The property is situated at the watershed of two rivers: the Luganchik to the west and the Severskiy Donets to the east of the mine. The terrain mildly undulating plain with several sparsely located gullies and ravines, some of them with natural streams. The elevation ranges from 94 to 212 meters above sea level. Most of the surface is farmed.

The mailing address is Molodogvardeyskaya Mine, Molodogvardeysk, Lugansk Oblast 349380.

Table 1: General Information, Molodogvardeyskaya Mine

1.	Total Mineable Reserves, thousand tonnes	63,600
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	30,100
3.	Total Mining Area, km^2	28
4.	Depth of Shaft(s), m	717 / 624
5.	Mining Capacity, tonnes / day	2,000
6.	Annual Electricity Consumption, MWh	40,060
7.	Coal Consumers	Coke and Chemical Plants
8.	Annual Heat Consumption, Gcal	12,157
9.	Type(s) of Boilers	KVTS-20: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	18,198
12.	Fuel Demand Self-covered by the Mine, percent	N/A

Table 2: General Geologic Information, Molodogvardeyskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	10 to 22
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa / 1,000 m	6–10
3. Overburden Composition:	
Sandstone, percent	71
Shale, percent	15
Limestone, percent	11
4. Number of Coal Seams Above Currently Mined	16
5. Aggregate Thickness of Seams Above Currently Mined, m	5.8
6. Geologic Phenomena	Faults: Samsonovsky
7. Gas Pressure in Surrounding Rock Strata, MPa	N/A
8. Porosity and Permeability, Sandstone:	
Porosity, percent	5.9 to 6.4
Permeability, mD	N/A
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	0.5
Satellite Seams, billion m^3	0.1
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Molodogvardeyskaya Mine

	Coal Seam:	
	k_2	i_3^1
1. Rank of Coal	High vol bituminous	High vol bituminous
2. Seam Thickness, m	1.80–1.95	0.70–2.20
3. Pitch, degrees	8	8
4. Depth of Mining, m	617–765	617–712
5. Ash Content:		
Coal in Place, percent	12.0	13.0
Run of Mine Coal, percent	38.0	52.9
6. Moisture, percent	1.9	0.9
7. Sulfur Content, percent	3.6	3.3
8. Gas Content, m^3 per tonne of daf coal	10–20	10–22
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	150–250	
12. Mining Equipment	KM-87, 2KMT	

Table 4: Coal Production, Methane Emissions and Degasification, Molodogvardeyskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	20.00	2.90	22.90	0.00	N/A	14.26	1,606.00
1991	21.00	2.70	23.70	0.00	N/A	15.10	1,569.50
1992	19.29	2.28	21.57	0.00	N/A	17.91	1,204.50
1993	13.46	3.36	16.82	0.00	N/A	29.92	562.10
1994	8.51	2.94	11.45	0.00	N/A	31.06	368.65
1995	5.78	1.00	6.78	0.00	N/A	24.44	277.40
1996	7.67	1.21	8.88	0.00	N/A	14.22	624.15
1997	9.35	6.94	16.29	0.00	N/A	22.65	719.05
1998	18.40	7.94	26.34	0.00	N/A	58.12	453.20
1999	10.38	4.23	14.61	0.00	19.6	27.28	535.60

Table 5: Degasification Parameters, Molodogvardeyskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	5
4. Number of Longwalls Degassed	3
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	41.0
• Methane Content, percent	19.6
• Methane Capture Rate, m^3/min	8.05
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	9,000

Chart 1: Coal Production and Total Methane Emission Trends, Molodogvardeyskaya Mine

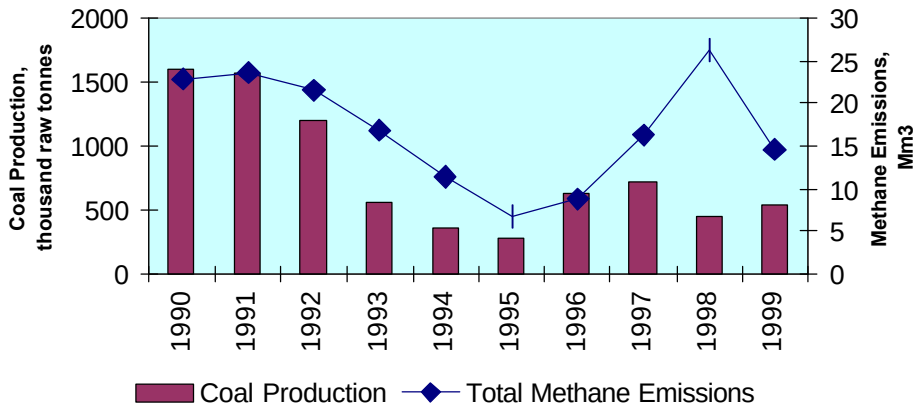


Chart 2: Methane Emissions, Molodogvardeyskaya Mine

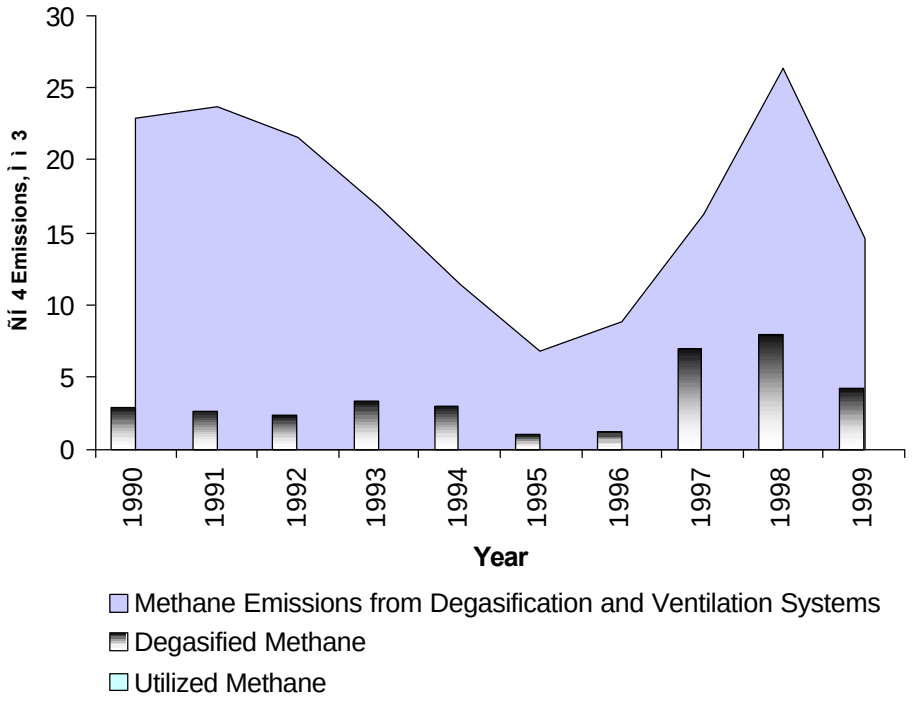
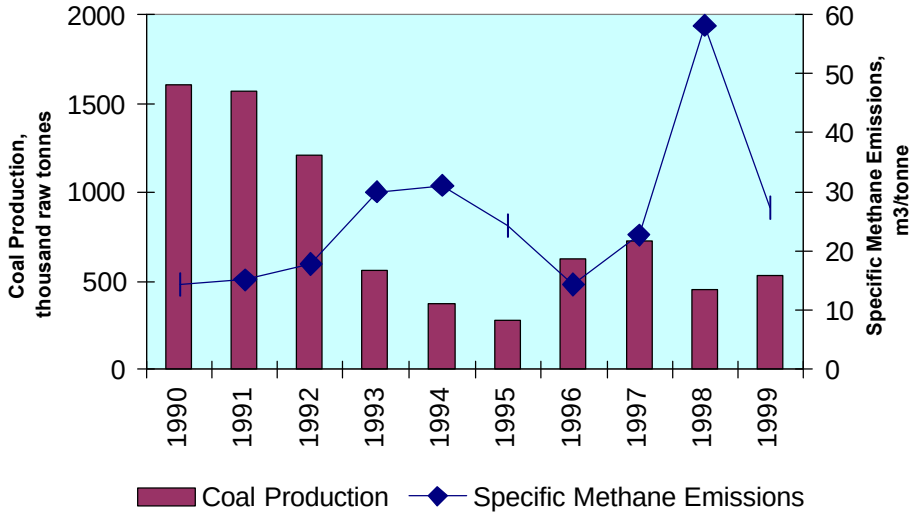


Chart 3: Coal Production and Specific Methane Emission Trends, Molodogvardeyskaya Mine



5.16 Oktyabrsky Rudnik Mine

General Overview

The mine became operational in 1975, and it is a part of the Donugol Coal Association.

The mining property is located in the central section of the Donetsk and Makeyevka geologic/industrial district. In geologic and tectonic terms, it lies in the southern part of the Calmius-Thorez depression. The overall size of the property is 49 km^2. The surface above the mine is an undulating plain that is crisscrossed by ravines. Most of the area is used by two large farms — Spartak and Elita, both of them located in the Yasinovataya Rayon of the Donetsk Oblast.

As of March 1, 2000, the mine employed a total of 2,649 persons.

The mailing address is 1 Prospekt Marshala Zhukova, GOAO Oktyabrsky; Donetsk Oblast 83071.

Telephone: 38 0622 55-2489; fax: 38 0622 55-4843.

Table 1: General Information, Oktyabrsky Rudnik Mine

1.	Total Mineable Reserves, thousand tonnes	97,512
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	97,512
3.	Total Mining Area, km^2	48.58
4.	Depth of Shaft(s), m	1,000
5.	Mining Capacity, tonnes / day	2,260
6.	Annual Electricity Consumption, MWh	75,825
7.	Coal Consumers	Coal and Chemical Plants, Zuevsky Power Plant
8.	Annual Heat Consumption, Gcal	26,900
9.	Type(s) of Boilers	DKVR 10/13: 6 units E 1/9: 4 units
10.	Boilers Fueled with	Natural Gas, Coal
11.	Fuel Consumption, winter/summer	4.4 Mm^3 of gas and 1,222 tonnes of coal
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Oktyabrsky Rudnik Mine

1. Coal Seam Gas Content, Range, m^3/tonne	10.4 to 24.7
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.9
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	31
Shale, percent	66
Limestone, percent	1
4. Number of Coal Seams Above Currently Mined	12
5. Aggregate Thickness of Seams Above Currently Mined, m	9.1
6. Geologic Phenomena	Faults: Vetkovsky #3 (amplitude 20 m), Koksovy (10–80 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	5 to 12
8. Porosity and Permeability, Sandstone:	
Porosity, percent	5 to 10
Permeability, mD	0.01–0.20
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	3.7
Satellite Seams, billion m^3	1.4
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Oktyabrsky Rudnik Mine

	Coal Seam:	
	m_3	l_8^1
1. Rank of Coal	High-vol bituminous B	High-vol bituminous B
2. Seam Thickness, m	1.1	1.5
3. Pitch, degrees	8–12	9–13
4. Depth of Mining, m	1,200	1,060
5. Ash Content:		
Coal in Place, percent	5.5	9.1
Run of Mine Coal, percent	33.5	38.4
6. Moisture, percent	2.8	2.6
7. Sulfur Content, percent	1.0	1.4
8. Gas Content, m^3 per tonne of daf coal	20.0	20.0
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	170–185	
12. Mining Equipment	KD-80, 2KM-87	

Table 4: Coal Production, Methane Emissions and Degasification, Oktyabrsky Rudnik Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	11.00	10.00	21.00	0.00	N/A	14.03	1,496.50
1991	31.00	6.30	37.30	0.00	N/A	34.06	1,095.00
1992	31.48	5.26	36.74	0.00	N/A	67.10	547.50
1993	24.39	1.58	25.97	0.00	N/A	45.32	573.05
1994	20.08	2.15	22.23	0.00	N/A	58.00	383.25
1995	17.08	1.68	18.76	0.00	N/A	57.12	328.50
1996	10.56	1.84	12.40	0.00	N/A	43.00	288.35
1997	6.41	1.52	7.93	0.00	N/A	33.95	233.60
1998	11.98	1.63	13.61	0.00	N/A	45.46	299.40
1999	12.30	1.26	13.56	0.00	6	40.20	337.22

Table 5: Degasification Parameters, Oktyabrsky Rudnik Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	2
3. Number of Pumps, 50 m^3/min Capacity	None
4. Number of Longwalls Degassed	1
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	40
• Methane Content, percent	6
• Methane Capture Rate, m^3/min	2.4
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	6,500

Chart 1: Coal Production and Total Methane Emission Trends, Oktyabrsky Rudnik Mine

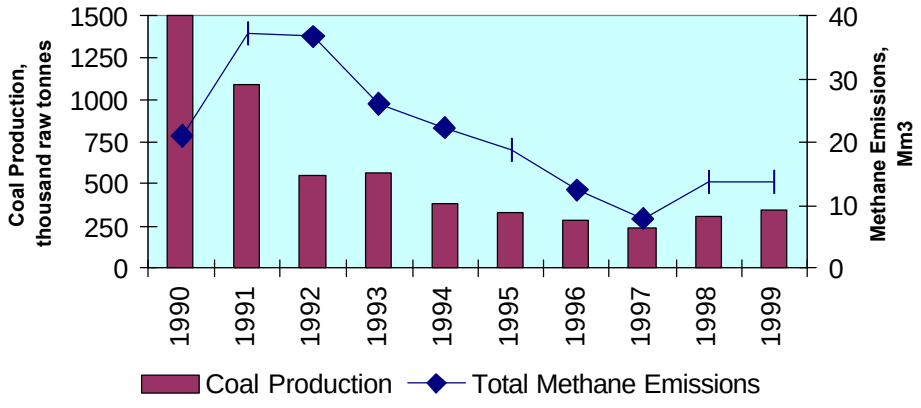


Chart 2: Methane Emissions, Oktyabrsky Rudnik Mine

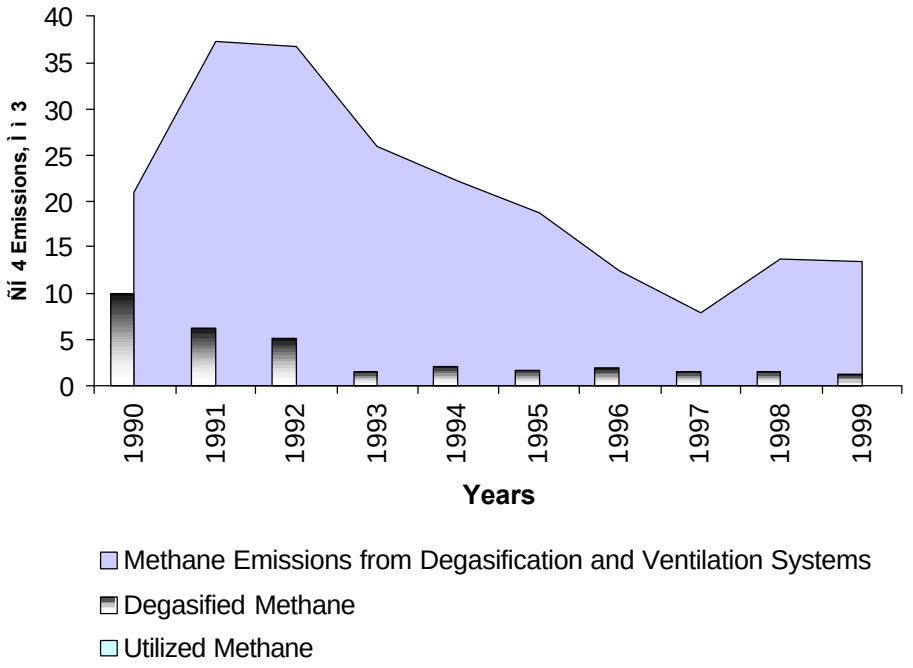
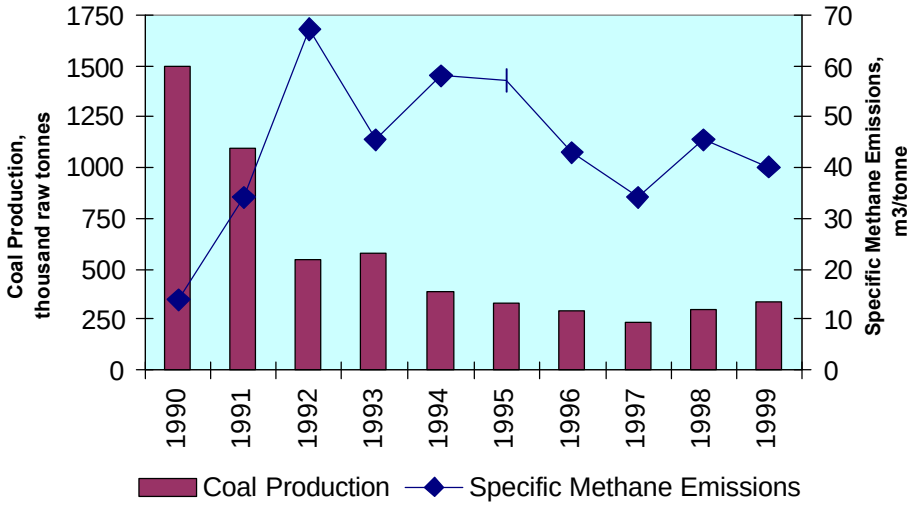


Chart 3: Coal Production and Specific Methane Emission Trends, Oktyabrsky Rudnik Mine



5.17 Rassvet Mine

General Overview

The mine became operational in 1956 and is a part of the Oktyabrugol Coal Association.

The surface above the mine (2,904.3 hectars) is an undulated plain that is crisscrossed by multiple ravines—Olkhovaya, Klepova and Bugayeva. The nearest major cities are Donetsk and Makeyevka.

The mine has a total of 1,800 employees on its payroll.

The Rassvet Mine has filed an application for a coal mine methane production license that is currently being considered by Ukrainian government agencies.

The mailing address is Rassvet Mine, Kirovskoye, Donetsk Oblast 86300.

Telephone: 38 06250 62759.

Table 1: General Information, Rassvet Mine

1.	Total Mineable Reserves, thousand tonnes	14,315
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	2,884
3.	Total Mining Area, km^2	29.04
4.	Depth of Shaft(s), m	200
5.	Mining Capacity, tonnes / day	1,300
6.	Annual Electricity Consumption, MWh	N/A
7.	Coal Consumers	Power plants
8.	Annual Heat Consumption, Gcal	9,264
9.	Type(s) of Boilers	DKVR-6.5/13: 1 unit KE 10,5: 1 unit Lankashirsky: 4 units Revokatova: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	1,700/230
12.	Fuel Demand Self-covered by the Mine, percent	34.3

Table 2: General Geologic Information, Rassvet Mine

1. Coal Seam Gas Content, Range, m^3/tonne	30
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.3
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	29
Shale, percent	65
Limestone, percent	3
4. Number of Coal Seams Above Currently Mined	12
5. Aggregate Thickness of Seams Above Currently Mined, m	3.0
6. Geologic Phenomena	Faults: None
7. Gas Pressure in Surrounding Rock Strata, MPa	4 to 6
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3 to 5
Permeability, mD	0.001
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	1.5
Satellite Seams, billion m^3	0.2
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Rassvet Mine

	Coal Seam:		
	m_3	l_6	l_3
1. Rank of Coal	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous
2. Seam Thickness, m	0.95	0.84	1.27
3. Pitch, degrees	9–12	14–15	14–16
4. Depth of Mining, m	340–600	240–470	470–560
5. Ash Content:			
Coal in Place, percent	9.8	8.2	26.2
Run of Mine Coal, percent	19.5	19.5	32
6. Moisture, percent	10.0	1.3	1.3
7. Sulfur Content, percent	3.6	0.7	2.8
8. Gas Content, m^3 per tonne of daf coal	32	30	30
9. Mining Method	Longwall		
10. Roof Control Method	Complete caving		
11. Panel Width, m	150–250		
12. Mining Equipment	Mechanized complexes		

Table 4: Coal Production, Methane Emissions and Degasification, Rassvet Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	40.50	17.50	58.00	0.00	N/A	69.10	839.50
1991	37.50	15.80	53.30	6.60	N/A	69.54	766.50
1992	32.74	13.72	46.46	0.00	N/A	79.55	584.00
1993	32.11	5.68	37.79	0.00	N/A	69.96	540.20
1994	28.38	2.52	30.91	2.52	N/A	74.29	416.10
1995	28.38	4.99	33.37	0.00	N/A	57.86	576.70
1996	32.06	1.58	33.64	1.58	N/A	80.14	419.75
1997	29.49	0.84	30.33	0.00	N/A	80.68	375.95
1998	27.07	4.20	31.27	0.00	N/A	66.99	466.80
1999	36.11	5.26	41.37	0.00	20	116.44	355.30

Table 5: Degasification Parameters, Rassvet Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	3
4. Number of Longwalls Degassed	2
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	50
• Methane Content, percent	20
• Methane Capture Rate, m^3/min	10
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	N/A

Chart 1: Coal Production and Total Methane Emission Trends, Rassvet Mine

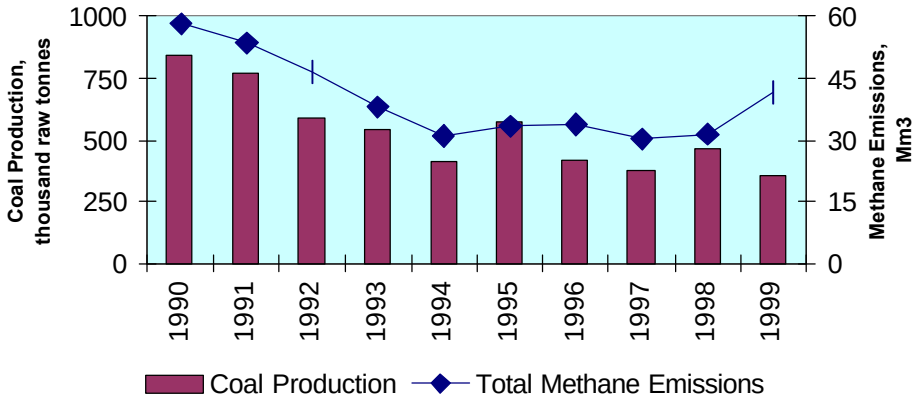


Chart 2: Methane Emissions, Rassvet Mine

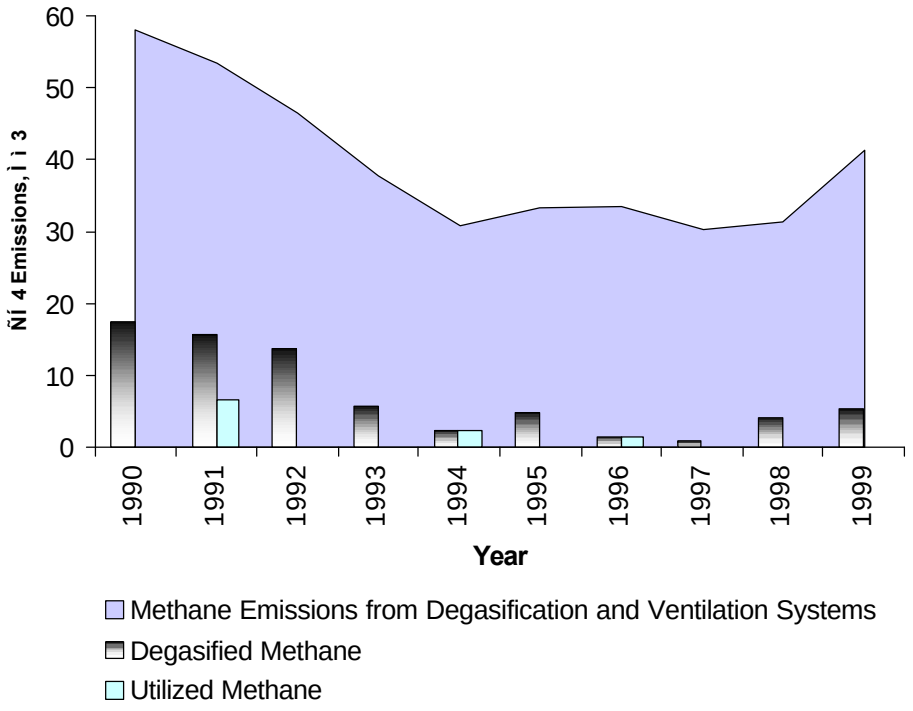
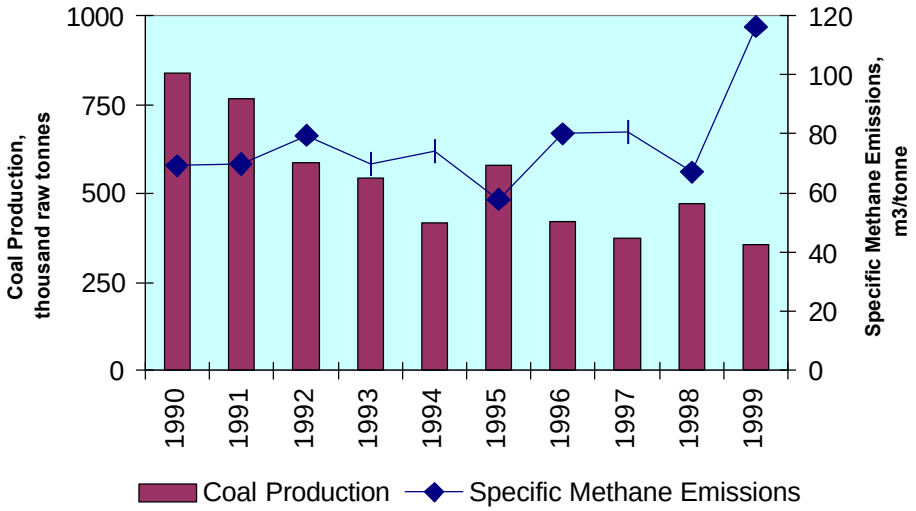


Chart 3: Coal Production and Specific Methane Emission Trends, Rassvet Mine



5.18 Samsonovskaya-Zapadnaya Mine

General Overview

The mine became operational in September 1999. As the mine is new, there is only a limited amount of data available. The mine is a part of the Krasnodonugol Coal Association.

The Samsonovskaya-Zapadnaya mine is situated in the territory of the Krasnodon Rayon in the Lugansk Oblast. There is a slight folding zone in the northern part of the reserve. Several kettleholes (Sukhodolskaya, Duvannaya, Krasnodonskaya) have additional series of flexure folds separated with anticlinal uplifts. In geological terms the mine field belongs to the eastern part of Lutuginskaya kettlehole. The kettlehole is crisscrossed by the Almazny uplift in the north and by the Samsonovsky uplift in the south. It is an asymmetric anticline with steep southern and gentle northern limbs separated by a slightly undulated platform.

Gas content of coal seams varies from 15 to 30 cubic meters of methane per tonne of daf coal.

The mine is developing the K_2^H coal seam that has a high gas content in adjacent areas. The coal deposit has high porosity and permeability and contains large quantities of organic residue. This is caused by a thick chalk deposition that prevents methane from migrating to the surface over time. The upper border of the methane zone is 200–250 meters deep.

The mailing address is Samsonovka, Krasnodon Rayon, Lugansk Oblast 94274.

Table 1: General Geologic Information, Samsonovskaya-Zapadnaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	15 to 30
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.4
Pressure, MPa	N/A
3. Overburden Composition:	
Sandstone, percent	32
Shale, percent	55
Limestone, percent	10
4. Number of Coal Seams Above Currently Mined	10
5. Aggregate Thickness of Seams Above Currently Mined, m	5.0
6. Geologic Phenomena	Faults: Samsonovsky, G, G1, G2, B (amplitude 10–15m)
7. Gas Pressure in Surrounding Rock Strata, MPa	N/A
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3.6 to 16
Permeability, mD	0.02–1.9
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	4.7
Satellite Seams, billion m^3	0.2
Sandstone, billion m^3	N/A

Table 2: Geologic and Mining Conditions, Samsonovskaya-Zapadnaya Mine

	Coal Seam: k_2^H
1. Rank of Coal	High-vol bituminous B
2. Seam Thickness, m	1.25
3. Pitch, degrees	2–12
4. Depth of Mining, m	714–856
5. Ash Content:	
Coal in Place, percent	13.5
Run of Mine Coal, percent	
6. Moisture, percent	2.0
7. Sulfur Content, percent	2.0
8. Gas Content, m^3 per tonne of daf coal	20–30
9. Mining Method	Longwall
10. Roof Control Method	Complete caving
11. Panel Width, m	200 m
12. Mining Equipment	2KD-90

Historical Information Not Available

5.19 Skochinsky Mine

General Overview

The mine became operational in 1975 and is a part of the Donugol Coal Assoiation. The mining property is located in the western part of the Donetsk and Makeyevka geologic/ industrial district. In administrative terms, the mine is situated in the Kirovsky and Petrovsky Rayons that are a part of the city of Donetsk. The surface area of the property is 80 km^2; measuring 22 kilometers along the strike and 3–4 kilometers down the pitch of the coal seams.

From the hydrographic standpoint, the property is located within the system of two rivers: the Volchya and the Calmius. The terrain is a prairie-type flatland, crisscrossed by small rivers, gullies and ravines. The elevation ranges from 148 to 250 meters above sea level.

The mine's boiler facilities are located at the eastern intake shaft and the #1 western intake shaft. The boilers provide heating for the buildings on the mine property and the ventilation air that is supplied to underground workings through each of the shafts. These boilers are fueled by coal that is supplied 100 percent by the mine. The heating needs of the third shaft, which is a cage shaft for the central panel of the mine, are covered by the boilers of the nearby Abakumov Mine.

The mine employs a total of 3,300 persons.

The mailing address is Skochinsky Mine, Donetsk, Donetsk Oblast 83084.

Table 1: General Information, Skochinsky Mine

1.	Total Mineable Reserves, thousand tonnes	144,433
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	70,385
3.	Total Mining Area, km^2	80
4.	Depth of Shaft(s), m	1,294
5.	Mining Capacity, tonnes / day	2,180
6.	Annual Electricity Consumption, MWh	82,994
7.	Coal Consumers	Avdeevsky ñî kå and chemical plant
8.	Annual Heat Consumption, Gcal	15,136
9.	Type(s) of Boilers	DKVR 6.5/13: 2 units KE 10/14: 3 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	5,586 / 439
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Skochinsky Mine

1. Coal Seam Gas Content, Range, m^3/tonne	16 to 22
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa / 1,000 m	4–14
3. Overburden Composition:	
Sandstone, percent	27
Shale, percent	70
Limestone, percent	0.6
4. Number of Coal Seams Above Currently Mined	12
5. Aggregate Thickness of Seams Above Currently Mined, m	7.6
6. Geologic Phenomena	Faults: Mushketovsky (amplitude 5–65 m) «A», «B», (1.0 –1.5 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	3 to 12
8. Porosity and Permeability, Sandstone:	
Porosity, percent	2 to 11
Permeability, mD	0.005–0.020
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	13.27
Satellite Seams, billion m^3	5.63
Sandstone, billion m^3	26.96

Table 3: Geologic and Mining Conditions, Skochinsky Mine

	Coal Seam: h_6^1
1. Rank of Coal	High-vol bituminous B
2. Seam Thickness, m	1.10–1.95
3. Pitch, degrees	8-16
4. Depth of Mining, m	1,298
5. Ash Content:	
Coal in Place, percent	4.6
Run of Mine Coal, percent	23.4
6. Moisture, percent	2.2
7. Sulfur Content, percent	0.9–1.2
8. Gas Content, m^3 per tonne of daf coal	16–22
9. Mining Method	Longwall
10. Roof Control Method	Complete caving
11. Panel Width, m	160–220
12. Mining Equipment	Mechanized complexes

Table 4: Coal Production, Methane Emissions and Degasification, Skochinsky Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	71.25	13.60	84.85	0.00	20.00	72.65	1,168.00
1991	69.02	6.30	75.32	0.00	20.00	66.57	1,131.50
1992	57.89	7.36	65.25	0.00	25.00	68.76	949.00
1993	57.29	6.68	63.97	0.00	22.50	81.74	782.63
1994	51.53	3.21	54.74	0.00	17.50	83.46	655.90
1995	48.32	3.02	51.34	0.00	17.50	115.81	443.30
1996	48.09	3.26	51.35	0.00	17.50	98.69	520.30
1997	42.12	4.08	46.20	0.00	20.00	82.28	561.50
1998	34.48	3.94	38.42	0.00	38.00	72.11	532.80
1999	34.60	3.99	38.59	0.00	38.00	49.18	784.70

Table 5: Degasification Parameters, Skochinsky Mine

Parameter	Indicator
1. Number of Pumping Stations	3
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	14
4. Number of Longwalls Degassed	4
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	20
• Methane Content, percent	38
• Methane Capture Rate, m^3/min	7.6
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	17,400

Chart 1: Coal Production and Total Methane Emission Trends, Skochinsky Mine

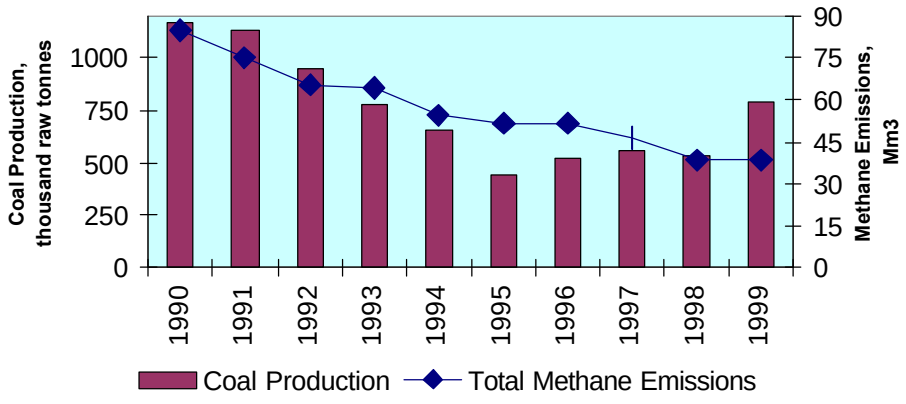


Chart 2: Methane Emissions, Skochinsky Mine

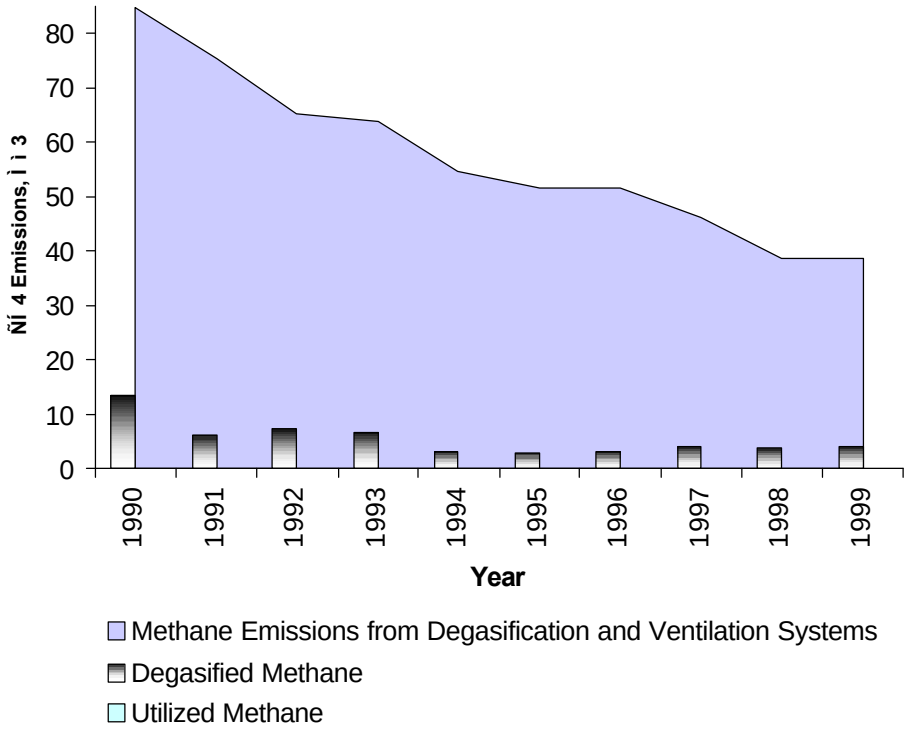
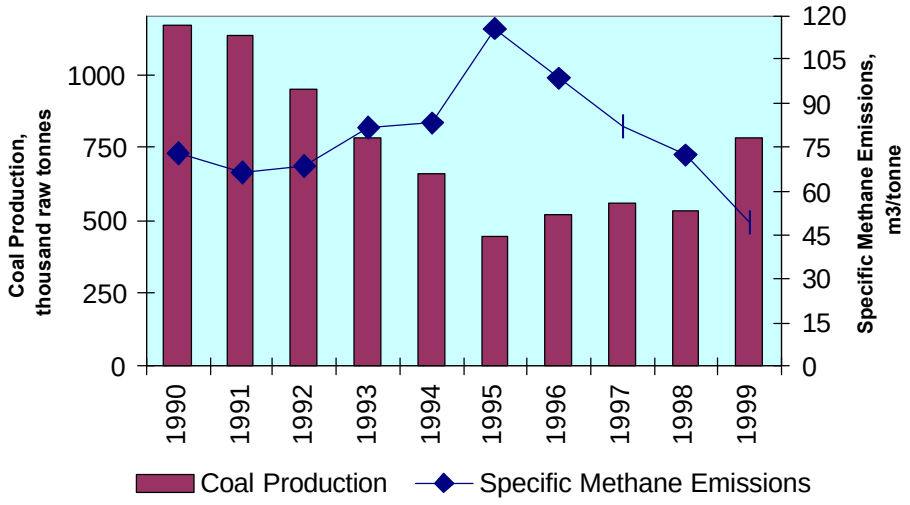


Chart 3: Coal Production and Specific Methane Emission Trends, Skochinsky Mine



5.20 Stakhanov Mine

General Overview

The mine was registered in January 1999 and is a State-owned enterprise. It is located near the town of Krasnoarmeysk in Donetsk region and is a part of the Krasnoarmeyskugol Coal Association.

There are more than 7,100 employees at the mine.

The mine produces steam and coking coal. During 1999, the mine produced approximately 1.5 million raw tonnes of coal. The estimated mineable reserves are 139,717 thousand tonnes of coal.

Estimated methane resources are more than 4.9 billion cubic meters, and the methane content of the coal seams ranges from 12 to 17 cubic meters per tonne of coal.

The mailing address is Stakhanov Mine, 1 Shosseyna Street, Dimitrov, Donetsk Oblast 85322.

Table 1: General Information, Stakhanov Mine

1.	Total Mineable Reserves, thousand tonnes	139,717
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	76,878
3.	Total Mining Area, km^2	N/A
4.	Depth of Shaft(s), m	N/A
5.	Mining Capacity, tonnes / day	5,200
6.	Annual Electricity Consumption, MWh	N/A
7.	Coal Consumers	Power Generation Coke and Chemical Plants
8.	Annual Heat Consumption, Gcal	
9.	Type(s) of Boilers	DKVR20/13: 4 units DKVR10/13: 3 units KE 25/14: 1 unit KE 10/14: 4units E 1/9: 6 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	N/A
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Stakhanov Mine

1. Coal Seam Gas Content, Range, m^3/tonne	12.5 to 17.0
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa / 1,000 m	5–12
3. Overburden Composition:	
Sandstone, percent	25
Shale, percent	70
Limestone, percent	2
4. Number of Coal Seams Above Currently Mined	6
5. Aggregate Thickness of Seams Above Currently Mined, m	5.2
6. Geologic Phenomena	Faults: Central (amplitude 0–55 m), Glubokoyarsky (30–80 m), Krasnolimansky (11–20 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	5 to 12
8. Porosity and Permeability, Sandstone:	
Porosity, percent	6 to 12
Permeability, mD	0.08–0.40
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	4.0
Satellite Seams, billion m^3	0.9
Sandstone, billion m^3	22.3

Table 3: Geologic and Mining Conditions, Stakhanov Mine

	Coal Seam:			
	l_7	l_1	l_3	k_5
1. Rank of Coal	High-vol bituminous B, C	High-vol bituminous B, C	High-vol bituminous C	High-vol bituminous B
2. Seam Thickness, m	1.24–1.36	0.98–1.20	1.50–1.76	0.90–1.28
3. Pitch, degrees	10	9–10	8	11
4. Depth of Mining, m	825–1,110	825–1,000	825–1,140	825–990
5. Ash Content:				
Coal in Place, percent	4.7	7.3	9.4	4.9
Run of Mine Coal, percent	37.0	32.0	33.1	25.8
6. Moisture, percent	3.2	2.4	1.9	1.9
7. Sulfur Content, percent	1.0	2.6	4.4	1.0
8. Gas Content, m^3 per tonne of daf coal	15.0	13.5	15.0	12.8
9. Mining Method	Longwall			
10. Roof Control Method	Complete caving			
11. Panel Width, m	150–250			
12. Mining Equipment	Mechanized complexes			

Table 4: Coal Production, Methane Emissions and Degasification, Stakhanov Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	67.20	19.40	86.60	0.00	49	22.38	3,869.00
1991	72.60	16.80	89.40	0.00	42	26.62	3,358.00
1992	48.62	15.77	64.39	0.00	39	35.28	1,825.00
1993	55.45	13.77	69.22	0.00	34	33.99	2,036.70
1994	56.45	9.20	65.65	0.00	23	49.14	1,335.90
1995	36.48	3.36	39.84	0.00	8	28.28	1,408.90
1996	41.00	3.47	44.47	0.00	9	37.09	1,199.00
1997	36.27	3.36	39.63	0.00	8	28.13	1,408.90
1998	46.10	9.09	55.19	0.00	23	37.95	1,454.20
1999	35.45	16.78	52.23	0.00	42	33.51	1,558.50

Table 5: Degasification Parameters, Stakhanov Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	4
3. Number of Pumps, 50 m^3/min Capacity	None
4. Number of Longwalls Degassed	8
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	76.0
• Methane Content, percent	42
• Methane Capture Rate, m^3/min	31.9
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	22,957

Chart 1: Coal Production and Total Methane Emission Trends, Stakhanov Mine

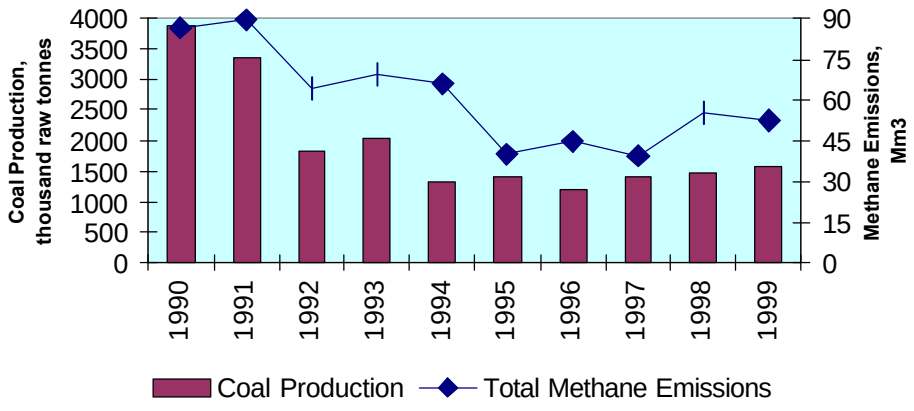


Chart 2: Methane Emissions, Stakhanov Mine

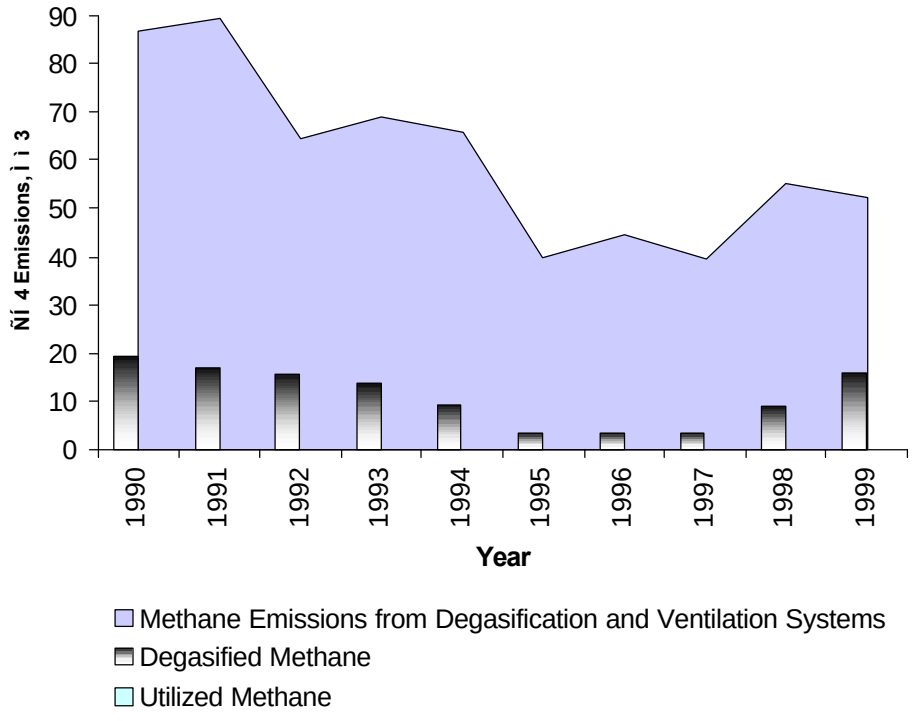
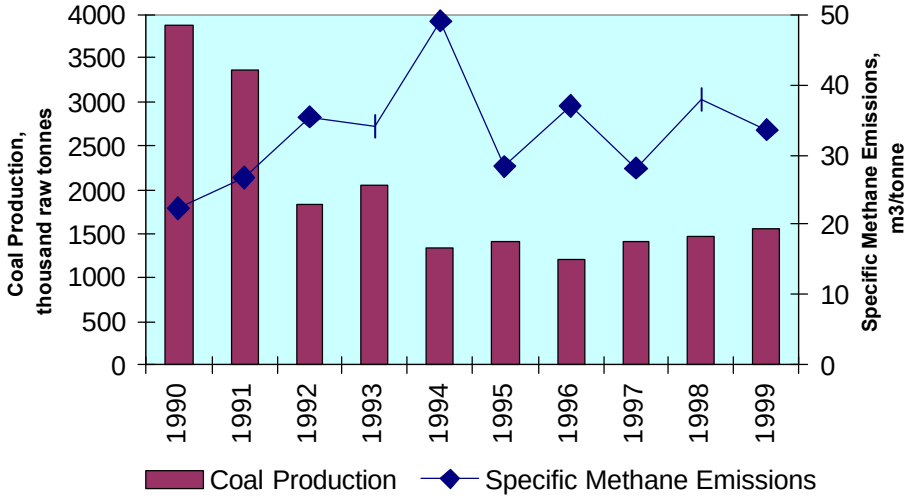


Chart 3: Coal Production and Specific Methane Emission Trends, Stakhanov Mine



5.21 Suhodolskaya-Vostochnaya Mine

General Overview

The mine became operational in two stages in 1980 and December 1989.

The mining property is located in three geologic sections and is a part of the Krasnodonugol Coal Association.

There are many small settlements on the mine reserve area and surrounding territory. The large towns near the mine are Krasnodon, Suhodolsk and Molodogvardeysk. The traffic system, consisting of railway and highways, is well developed in the region.

The surface is a prairie-type flatland that is crisscrossed by multiple gullies and ravines. The coal deposit is located at the watershed of the Severskiy Donets and Bolshaya Kamenka Rivers. The elevation ranges from 196 meters above sea level to 50 meters at the lowest points.

The mailing address is Suhodolsk, Lugansk Oblast 349380.

Table 1: General Information, Suhodolskaya-Vostochnaya Mine

1.	Total Mineable Reserves, thousand tonnes	157,402
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	43,627
3.	Total Mining Area, km^2	58
4.	Depth of Shaft(s), m	577–1,044
5.	Mining Capacity, tonnes / day	2,000
6.	Annual Electricity Consumption, MWh	78,819
7.	Coal Consumers	Coke and Chemical Plants
8.	Annual Heat Consumption, Gcal	65,770
9.	Type(s) of Boilers	DKVR 20/13: 2 units E 1/9: 6 units NIISTU-5: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	15,660
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Suhodolskaya-Vostochnaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	17 to 30
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa / 1,000 m	N/A
3. Overburden Composition:	
Sandstone, percent	37
Shale, percent	58
Limestone, percent	2
4. Number of Coal Seams Above Currently Mined	7
5. Aggregate Thickness of Seams Above Currently Mined, m	6.5
6. Geologic Phenomena	Faults: Duvanny
7. Gas Pressure in Surrounding Rock Strata, MPa	N/A
8. Porosity and Permeability, Sandstone:	
Porosity, percent	N/A
Permeability, mD	4.6–6.6
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	4.0
Satellite Seams, billion m^3	2.8
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, Suhodolskaya-Vostochnaya Mine

	Coal Seam: i_3^1
1. Rank of Coal	High-vol bituminous A
2. Seam Thickness, m	0.7–2.2
3. Pitch, degrees	5–14
4. Depth of Mining, m	785–1,028
5. Ash Content:	
Coal in Place, percent	14.5
Run of Mine Coal, percent	47.7
6. Moisture, percent	4.0
7. Sulfur Content, percent	1.1
8. Gas Content, m^3 per tonne of daf coal	16.9–29.9
9. Mining Method	Longwall
10. Roof Control Method	Complete caving
11. Panel Width, m	180–190
12. Mining Equipment	2KMT, KM-98

Table 4: Coal Production, Methane Emissions and Degasification, Suhodolskaya-Vostochnaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	62.10	2.80	64.90	0.00	N/A	80.82	803.00
1991	87.00	5.20	92.20	0.00	N/A	84.20	1,095.00
1992	4.07	5.15	9.22	0.00	N/A	10.53	876.00
1993	39.68	5.15	44.83	0.00	N/A	94.47	474.50
1994	18.08	6.15	24.23	0.00	N/A	70.62	343.10
1995	14.77	8.62	23.39	0.00	N/A	45.13	518.30
1996	13.93	5.99	19.92	0.00	N/A	70.88	281.05
1997	5.89	7.46	13.35	0.00	N/A	55.42	240.90
1998	44.20	12.30	56.50	0.00	N/A	223.23	253.10
1999	52.50	7.10	59.60	0.00	15	286.50	208.00

Table 5: Degasification Parameters, Suhodolskaya-Vostochnaya Mine

Parameter	Indicator
1. Number of Pumping Stations	3
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	7
4. Number of Longwalls Degassed	2
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	90.0
• Methane Content, percent	15.0
• Methane Capture Rate, m^3/min	13.5
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	6,000

Chart 1: Coal Production and Total Methane Emission Trends, Suhodolskaya-Vostochnaya Mine

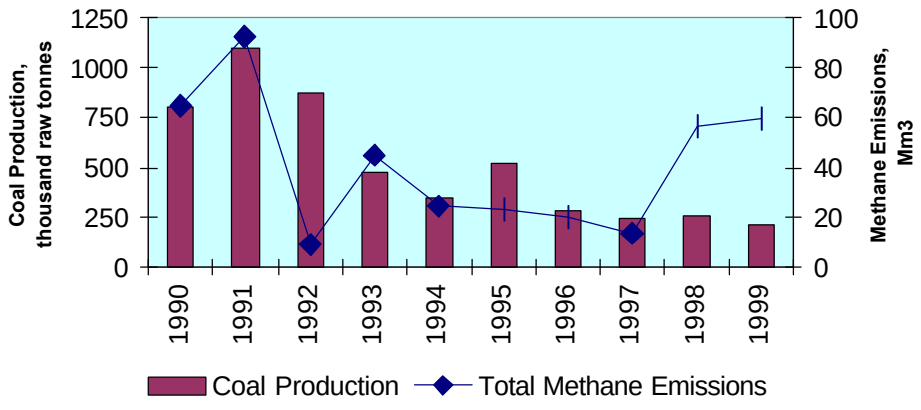


Chart 2: Methane Emissions, Suhodolskaya-Vostochnaya Mine

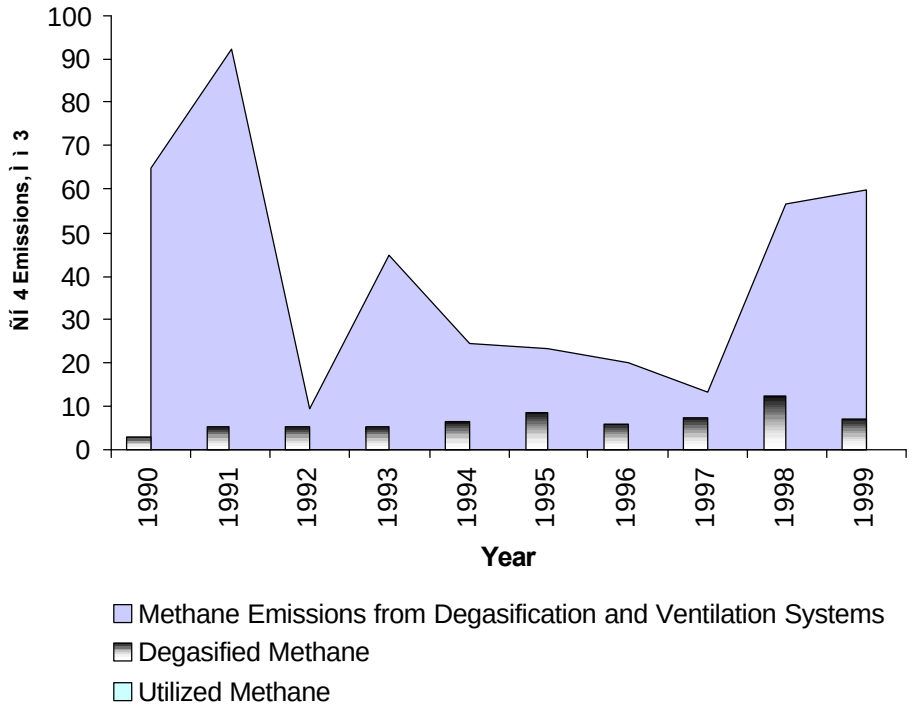
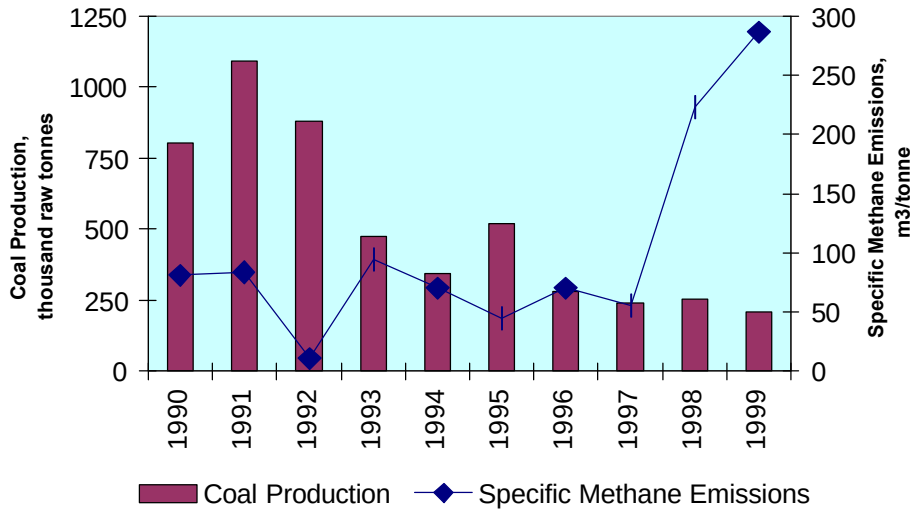


Chart 3: Coal Production and Specific Methane Emission Trends, Suhodolskaya-Vostochnaya Mine



5.22 Vynnitskaya Mine

General Overview

The mine became operational in 1957 and is a part of the Shakhtyorskanthracite Coal Association.

The mining property is located in the eastern geologic/ industrial district of the Donetsk Coal Basin, or, in administrative terms, in the Shakhtyorsk Rayon of the Donetsk Oblast. From the geologic standpoint, the area lies in the central section of the Chistyakovo-Snezhnoye southern synclinal limb. Vinnitskaya is surrounded by other active mines, namely Shakhtyorskaya Glubokaya, and several mines of the Pervoye Maya mining complex. The mine is situated near the towns of Kirovskoye and Stozhkovo.

The surface above the mine is an undulating plain with ridges and moderate slopes located at the southern slope of the main Donetsk watershed. From north to south, the property is crossed by the Klenovaya and the Khartsyzskaya Rivers that are oriented in the western direction. Elevation ranges from 251 meters above sea level in the eastern section of the property to 146 meters at the waterline of the Khartsyzskaya River.

Vinnitskaya has been issued a license for production of coal mine methane (#1204 of December 30, 1997). The mine does not have coal preparation facilities. Methane drainage systems have been in operation since 1974; the gas is drained using vertical surface wells and a 150 mm pipeline with a total length of 300 meters.

As of this time, the mine employs 1,550 persons.

The mailing address is Vynnitskaya Mine, Shakhtyorsk, Stozhkovo, Donetsk Oblast 86233.

Table 1: General Information, Vynnitskaya Mine

1.	Total Mineable Reserves, thousand tonnes	14,683
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	5,035
3.	Total Mining Area, km^2	N/A
4.	Depth of Shaft(s), m	265 / 289 / 260 / 320
5.	Mining Capacity, tonnes / day	850
6.	Annual Electricity Consumption, MWh	23,600
7.	Coal Consumers	Electric Generation
8.	Annual Heat Consumption, Gcal	9,907
9.	Type(s) of Boilers	Lankashirsky: 4 units Revokatova: 3 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	1,488 / 576
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Vynnitskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	20 to 38
2. Geothermal and Pressure Gradients:	N/A
Geothermal, °Ñ/100 m	2.2
Pressure, MPa / 1,000 m	4–8
3. Overburden Composition:	
Sandstone, percent	26
Shale, percent	70
Limestone, percent	3
4. Number of Coal Seams Above Currently Mined	7
5. Aggregate Thickness of Seams Above Currently Mined, m	2.5
6. Geologic Phenomena	No Faults
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 7
8. Porosity and Permeability, Sandstone:	
Porosity, percent	0.73 to 3.62
Permeability, mD	0–0.24
9. Total Methane Resource, billion m^3, including:	2.8
Coal Seams, billion m^3	0.6
Satellite Seams, billion m^3	0.4
Sandstone, billion m^3	1.8

Table 3: Geologic and Mining Conditions, Vynnitskaya Mine

	Coal Seam:	
	l_3	l_4
1. Rank of Coal	Antracite	Antracite
2. Seam Thickness, m	1.00	0.95
3. Pitch, degrees	3 to 13	6 to 14
4. Depth of Mining, m	430	390
5. Ash Content:		
Coal in Place, percent	12.0	11.8
Run of Mine Coal, percent	33.8	36.6
6. Moisture, percent	3.5	2.3
7. Sulfur Content, percent	0.9	3.2
8. Gas Content, m^3 per tonne of daf coal	20 to 38	20 to 38
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	150–200	
12. Mining Equipment	KM-88, KD-80, 1K101	

Table 4: Coal Production, Methane Emissions and Degasification, Vynnitskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	8.70	9.70	18.40	0.00	20.00	84.02	219.00
1991	15.60	6.80	22.40	0.00	20.00	68.19	328.50
1992	14.45	6.31	20.76	0.00	20.00	71.10	292.00
1993	10.99	5.15	16.14	0.00	20.00	58.96	273.75
1994	10.93	3.73	14.66	0.00	20.00	53.55	273.75
1995	11.51	4.94	16.45	0.00	20.00	68.29	240.90
1996	11.04	2.89	13.93	0.00	20.00	54.52	255.50
1997	7.52	3.68	11.20	0.00	20.00	32.99	339.45
1998	11.88	2.21	14.09	0.00	20.00	36.37	387.40
1999	8.80	3.20	12.00	0.00	22.00	37.24	322.20

Table 5: Degasification Parameters, Vynnitskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	2
4. Number of Longwalls Degassed	1
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	28
• Methane Content, percent	22
• Methane Capture Rate, m^3/min	6.1
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	1,300

Chart 1: Coal Production and Total Methane Emission Trends, Vynnitskaya Mine

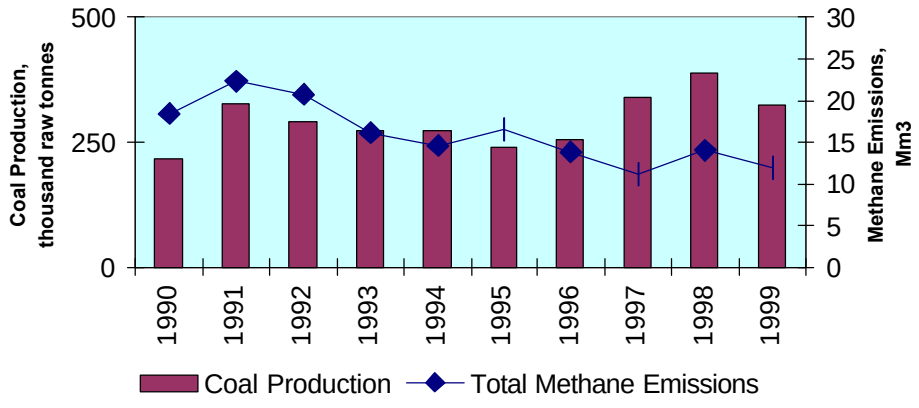


Chart 2: Methane Emissions, Vynnitskaya Mine

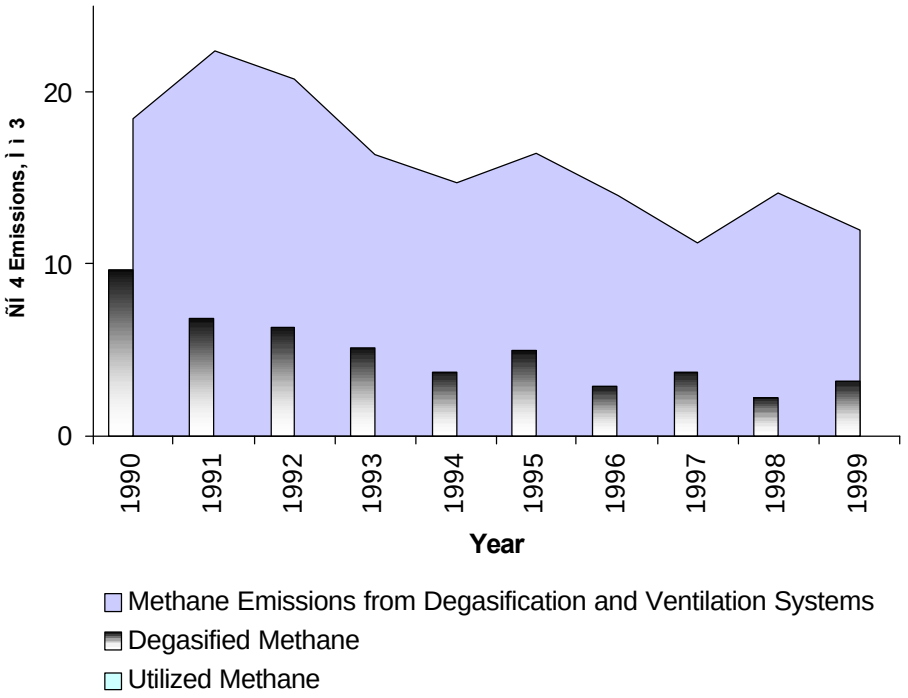
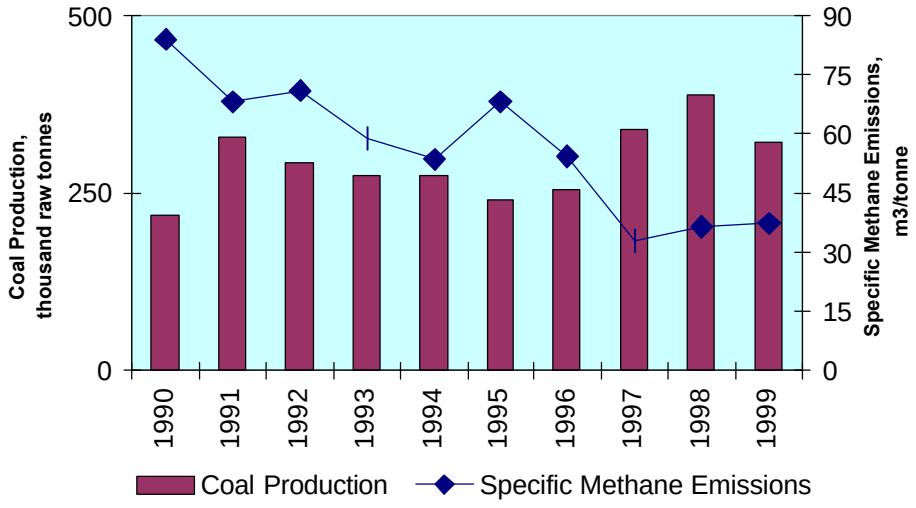


Chart 3: Coal Production and Specific Methane Emission Trends, Vynnitskaya Mine



5.23 Yasinovskaya-Glubokaya Mine

General Overview

The mine started its operations in 1961; initial mining commenced at the 380 meter level. In December 1980, more production sections became operational at a deeper level (475 meters). The mining property is located in Sovetsky Rayon within the city limits of Makeyevka in the Donetsk Oblast. It is a well-industrialized locality with two more mines (13-Bis and Severnaya), and numerous mining towns (Nizhnaya Krynka, Kommunar, Krasniy Oktyabr) in the area. The mine is a part of the Makeyevugol Coal Association.

The property is located on the southern slope of the Calmius-Thorez depression. From the northwest and southeast, it is limited by two large thrusts (Frantsuzsky and Yassinovsky). The central section of the property is crossed by several smaller thrusts (#4 group) with an amplitude of less than 20 meters. The seams extend in a general northeasterly direction with a moderate pitch of 4–10 degrees, increasing to 10–20 degrees at the eastern block panel. In geologic terms, the strata date back to the middle Carboniferous period with overlying Quarternary sediments. The surface is an undulating plain that is crisscrossed by ravines. The elevation ranges from 255 meters above sea level in the southwestern section, to 111.5 meters in the northeastern section of the property.

Most of the surface area is farmed.

A railroad between Ilovaysk and Gorlovka runs along the southwestern border of the property with the nearest railroad station at Khanzhonkovo.

As of January 1, 2000, the mine employed a total of 2,067 persons; including 1,605 underground mine workers.

The mailing address is Nizhnaya Krynka, Makeyevka, Donetsk Oblast 86185.

Telephone: 38 06232 38874.

Table 1: General Information, Yasinovskaya-Glubokaya Mine

1.	Total Mineable Reserves, thousand tonnes	41,453
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	40,101
3.	Total Mining Area, km^2	52.7
4.	Depth of Shaft(s), m	516 / 490
5.	Mining Capacity, tonnes / day	1,220
6.	Annual Electricity Consumption, MWh	58,021
7.	Coal Consumers	Alchevsky Coke and Chemical Plant
8.	Annual Heat Consumption, Gcal	18,019
9.	Type(s) of Boilers	DKVR 10/13: 4 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	5,200/109
12.	Fuel Demand Self-covered by the Mine, percent	55

Table 2: General Geologic Information, Yasinovskaya-Glubokaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	25
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.8
Pressure, MPa / 1,000 m	2.3
3. Overburden Composition:	
Sandstone, percent	54.8
Shale, percent	40.7
Limestone, percent	1.9
4. Number of Coal Seams Above Currently Mined	10
5. Aggregate Thickness of Seams Above Currently Mined, m	5.84
6. Geologic Phenomena	Faults: Yassinovsky (amplitude 50–60 m), Frantsuzsky (110–180 m), Promezhutochny (0–50 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	0.42 to 6.70
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3 to 5
Permeability, mD	0.01–0.08
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	1.5
Satellite Seams, billion m^3	N/A
Sandstone, billion m^3	1.1

Table 3: Geologic and Mining Conditions, Yasinovskaya-Glubokaya Mine

	Coal Seam:		
	l_6	l_4	l_2
1. Rank of Coal	mid.-vol bituminous	mid.-vol bituminous	mid.-vol bituminous
2. Seam Thickness, m	0.82–1.00	0.65–0.71	0.92–1.10
3. Pitch, degrees	7–10	4–6	3–6
4. Depth of Mining, m	606	575	475
5. Ash Content:			
Coal in Place, percent	8.6	8.2	15.9
Run of Mine Coal, percent	26.6	30.8	44.8
6. Moisture, percent	1.4	1.0	1.5
7. Sulfur Content, percent	1.52	1.14	2.62
8. Gas Content, m^3 per tonne of daf coal	25	25	25
9. Mining Method	Longwall		
10. Roof Control Method	Complete caving		
11. Panel Width, m	150–250		
12. Mining Equipment	KM-98, UST-2M, KD-80		

Table 4: Coal Production, Methane Emissions and Degasification, Yasinovskaya-Glubokaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	32.90	8.00	40.90	0.00	25	38.64	1,058.50
1991	25.80	12.20	38.00	0.00	35	38.56	985.50
1992	27.67	11.25	38.92	0.00	35	46.36	839.50
1993	22.08	8.41	30.49	0.00	27	48.28	631.50
1994	18.61	3.21	21.82	0.00	18	39.07	558.45
1995	23.39	2.89	26.28	0.00	18	71.28	368.65
1996	24.91	2.89	27.80	0.00	18	84.63	328.50
1997	23.34	1.84	25.18	0.00	18	58.46	430.70
1998	27.80	1.84	29.64	0.00	18	90.39	327.90
1999	19.88	1.84	21.72	0.00	18	65.46	331.80

Table 5: Degasification Parameters, Yasinovskaya-Glubokaya Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	N/A
3. Number of Pumps, 50 m^3/min Capacity	5
4. Number of Longwalls Degassed	1
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	19.4
• Methane Content, percent	18.0
• Methane Capture Rate, m^3/min	3.5
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	15,000

Chart 1: Coal Production and Total Methane Emission Trends, Yasinovskaya-Glubokaya Mine

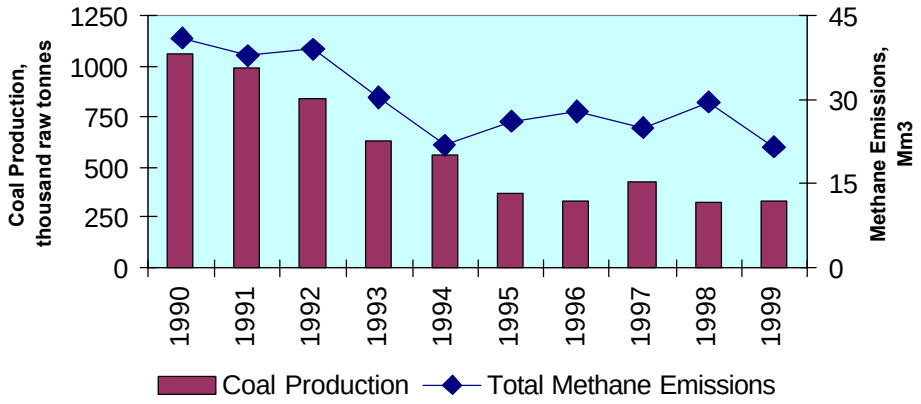


Chart 2: Methane Emissions, Yasinovskaya-Glubokaya Mine

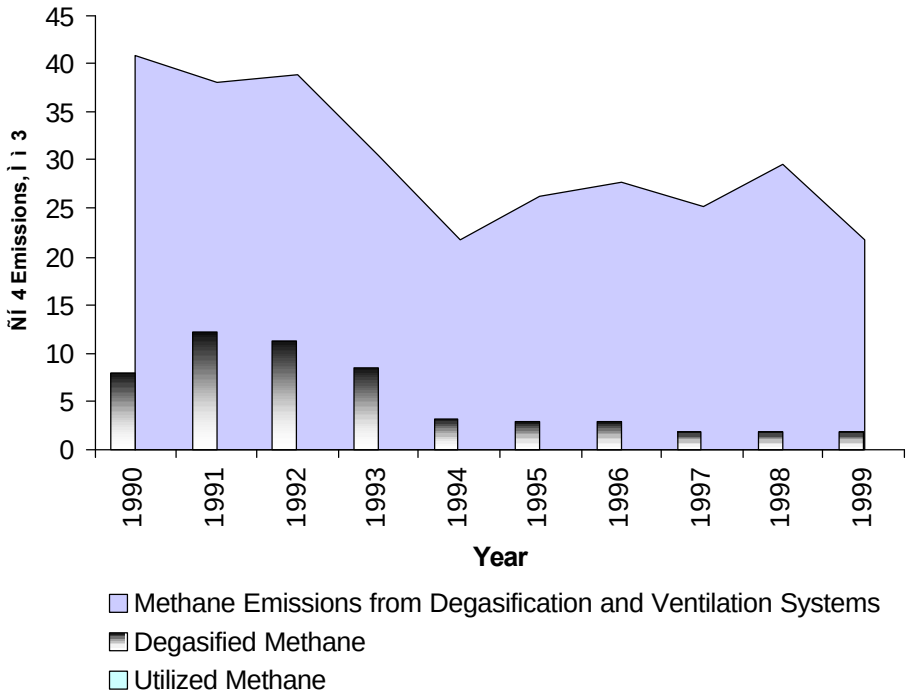
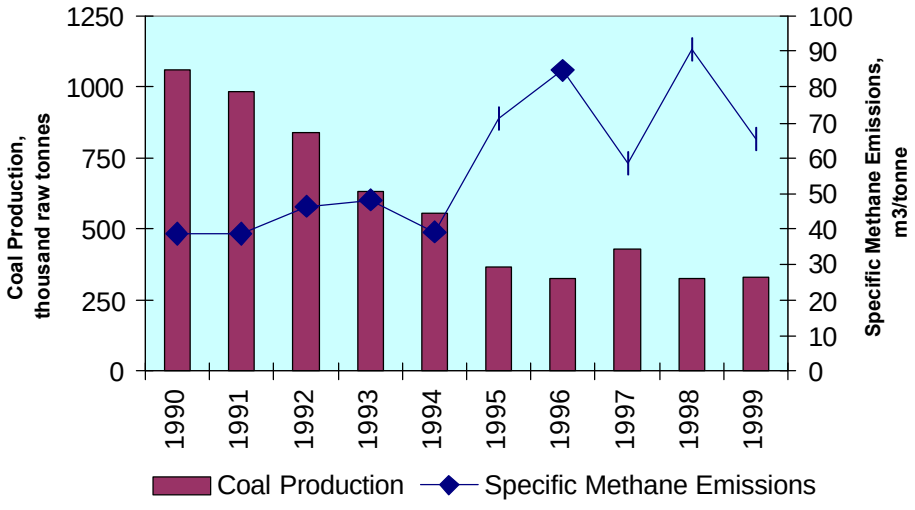


Chart 3: Coal Production and Specific Methane Emission Trends, Yasinovskaya-Glubokaya Mine



5.24 Yuzhnodonbasskaya #1 Mine

General Overview

The mine became operational in 1973 and is not part of a coal association. The mining property (48 km^2) is located in the southwestern part of the Donetsk Coal Basin. In administrative terms, the mine is situated in the Mariynsky and Volnovakha Rayons of the Donetsk Oblast, 50 km from the oblast capital Donetsk.

The surface terrain is a typical prairie-type flatland that is crisscrossed by gullies and ravines of two river systems: the Sukhie Yaly and the Kashlagach. The elevation ranges from 200 meters in the southeastern section, to 140 meters in the valleys at the watershed of the Kashlagach in the northwestern section of the property.

An asphalt road and a railroad that connect Donetsk and Mariupol are 25 and 20 km to the east of the property. Another railroad, from Donetsk to Krasnoarmeysk, is located 20 km from the property.

The area is located in a temperate climatic zone.

Most of the surface is farmed, and the nearest town is Ugledar (3 km).

The mailing address is Ugledar, Donetsk Oblast 85670.

Table 1: General Information, Yuzhnodonbasskaya #1 Mine

1.	Total Mineable Reserves, thousand tonnes	69,317
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	69,317
3.	Total Mining Area, km^2	48
4.	Depth of Shaft(s), m	440
5.	Mining Capacity, tonnes / day	3,390
6.	Annual Electricity Consumption, MWh	72,200
7.	Coal Consumers	Electric Generation
8.	Annual Heat Consumption, Gcal	36,642
9.	Type(s) of Boilers	DKVR10/13: 1 unit KE 10/14: 4units E 1/9: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	3,490 / 510
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Yuzhnodonbasskaya #1 Mine

1. Coal Seam Gas Content, Range, m^3/tonne	10 to 13
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa / 1,000 m	2–6
3. Overburden Composition:	
Sandstone, percent	17
Shale, percent	80
Limestone, percent	1
4. Number of Coal Seams Above Currently Mined	12
5. Aggregate Thickness of Seams Above Currently Mined, m	7.6
6. Geologic Phenomena	Faults: Vladimirsky (amplitude 70–200 m), Shevchenkovsky (77–150 m), Nikolsky (10–80 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	2 to 7
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3.7 to 19.9
Permeability, mD	0.05–5.88
9. Total Methane Resource, billion m^3, including:	4.2
Coal Seams, billion m^3	1.1
Satellite Seams, billion m^3	0.6
Sandstone, billion m^3	2.5

Table 3: Geologic and Mining Conditions, Yuzhnodonbasskaya #1 Mine

	Coal Seam:			
	ñ$_{18}$	*ñ*$_{13}$	*ñ*$_{11}$	*ñ*$_{10}^{2h}$
1. Rank of Coal	High vol bituminous C	High vol bituminous C	High vol bituminous C	High vol bituminous C
2. Seam Thickness, m	0.80	0.75	1.30	0.95–1.20
3. Pitch, degrees	4–6	4–5	2–9	4–8
4. Depth of Mining, m	355	480	480	480
5. Ash Content:				
Coal in Place, percent	5.5	5.0	6.1	4.9
Run of Mine Coal, percent	46.4	43.1	11.5	35.6
6. Moisture, percent	5.0	6.5	6.2	6.0
7. Sulfur Content, percent	0.9–1.0	2.0	1.1	2.2
8. Gas Content, m^3 per tonne of daf coal	5-8	3–10	9–11	5–10
9. Mining Method	Longwall			
10. Roof Control Method	Complete caving			
11. Panel Width, m	150–250			
12. Mining Equipment	KMK-98, MK-67, KD-80, KD-90, K-103, 1K-103, 2GSH-68B			

Table 4: Coal Production, Methane Emissions and Degasification, Yuzhnodonbasskaya #1 Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	30.80	1.60	32.40	0.00	12.2	18.49	1,752.00
1991	30.40	2.40	32.80	0.00	18.3	19.54	1,679.00
1992	23.60	0.37	23.97	0.00	2.8	22.65	1,058.50
1993	14.72	1.16	15.88	0.00	8.8	14.95	1,062.15
1994	16.92	0.95	17.87	0.00	7.2	14.66	1,219.10
1995	18.24	0.58	18.82	0.00	4.4	16.80	1,120.55
1996	16.61	0.58	17.19	0.00	4.4	20.30	846.80
1997	10.41	1.94	12.35	0.00	14.8	9.50	1,299.40
1998	19.71	2.15	21.86	0.00	16.4	17.32	1,261.90
1999	15.38	1.89	17.27	0.00	13.5	15.24	1,133.40

Table 5: Degasification Parameters, Yuzhnodonbasskaya #1 Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	—
3. Number of Pumps, 50 m^3/min Capacity	3
4. Number of Longwalls Degassed	1
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	26.6
• Methane Content, percent	13.5
• Methane Capture Rate, m^3/min	3.6
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	4,690

Chart 1: Coal Production and Total Methane Emission Trends, Yuzhnodonbasskaya #1 Mine

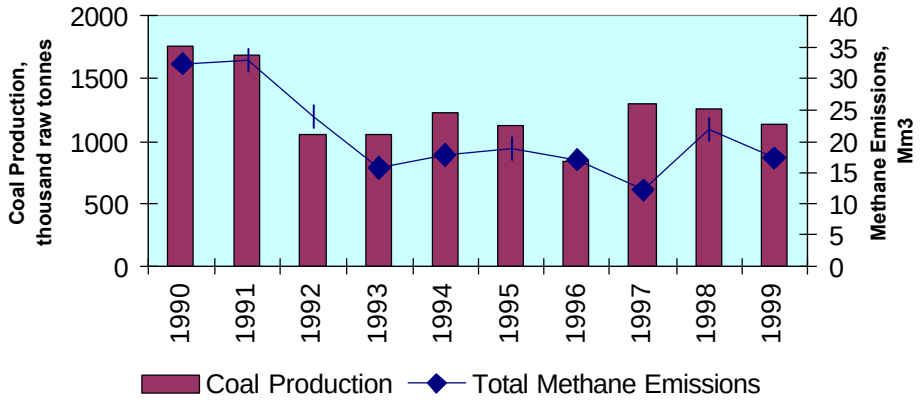


Chart 2: Methane Emissions, Yuzhnodonbasskaya #1 Mine

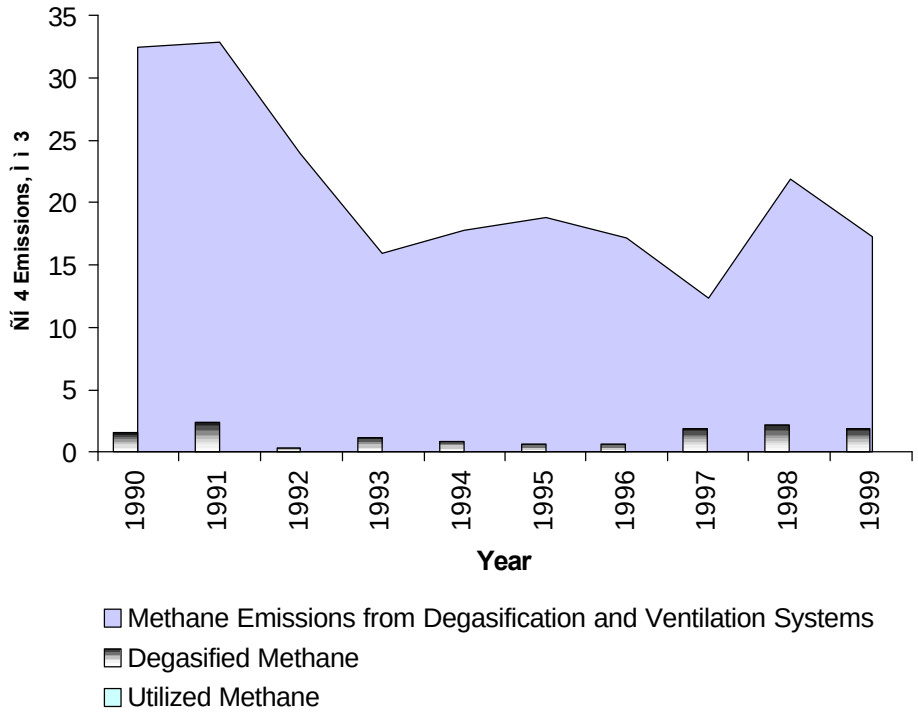
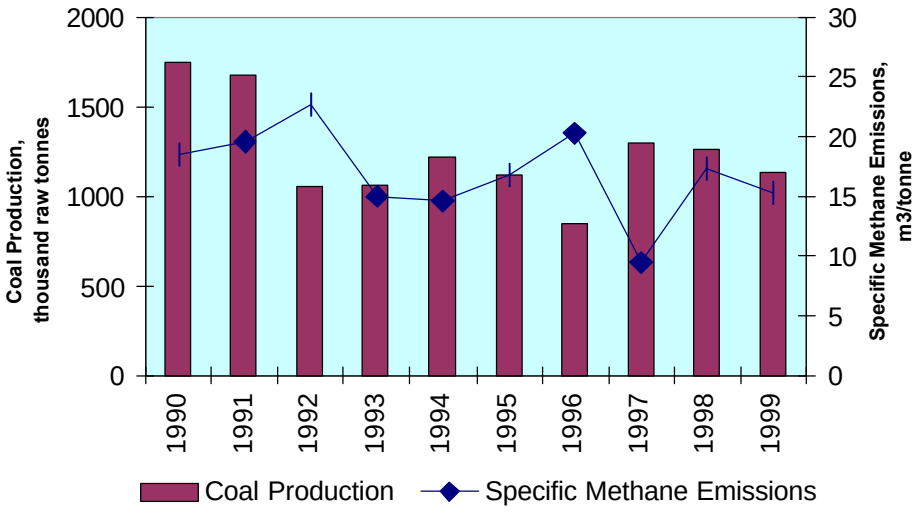


Chart 3: Coal Production and Specific Methane Emission Trends, Yuzhnodonbasskaya #1 Mine



5.25 Yuzhnodonbasskaya #3 Mine

General Overview

Yuzhnodonbasskaya #3 Mine became operational in 1985 and is a not part of a coal association.

The property is located in the Mariynsky and Volnovakha Rayons of the Donetsk Oblast, 50 km to the southwest of oblast capital Donetsk. The nearest towns are Dobropolye and Ugledar (6 km to the south). The latter is a large mining town with a population of 20,000; most of them mine employees of Yuzhnodonbasskaya #1 and #3.

The mine's surface facilities are adjacent to the Uglesborochnaya railroad handling point, connecting to Yuzhno-Donbasskaya station through a nearby junction. The mine receives its electric power supply from Kurakhovskaya Power Plant that is situated 25 km north of the property.

The area is located in a temperate climatic zone, with large seasonal temperature difference, little precipitation, and mostly easterly and southeasterly winds.

The mailing address is Ugledar, Donetsk Oblast 85670.

Table 1: General Information, Yuzhnodonbasskaya #3 Mine

1.	Total Mineable Reserves, thousand tonnes	156,928
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	156,928
3.	Total Mining Area, km^2	47
4.	Depth of Shaft(s), m	824
5.	Mining Capacity, tonnes / day	4,000
6.	Annual Electricity Consumption, MWh	112,836
7.	Coal Consumers	N/A
8.	Annual Heat Consumption, Gcal	65,842
9.	Type(s) of Boilers	KE 25/14: 3 units E 1/9: 1unit E 1/9: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	11,600/ 2,120
12.	Fuel Demand Self-covered by the Mine, percent	11.6

Table 2: General Geologic Information, Yuzhnodonbasskaya #3 Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	10 to 16
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.6–3.2
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	22
Shale, percent	75
Limestone, percent	1.5
4. Number of Coal Seams Above Currently Mined	16
5. Aggregate Thickness of Seams Above Currently Mined, m	17.3
6. Geologic Phenomena	Faults: Slozhny (amplitude 10–50 m), Pridolinny (25–105 m), Dolinny (to 300 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	8 to 10
8. Porosity and Permeability, Sandstone:	
Porosity, percent	8 to 13
Permeability, mD	0.5–2.7
9. Total Methane Resource, billion m^3, including:	10.0
Coal Seams, billion m^3	3.4
Satellite Seams, billion m^3	2.5
Sandstone, billion m^3	4.1

Table 3: Geologic and Mining Conditions, Yuzhnodonbasskaya #3 Mine

	Coal Seam: c_{11}
1. Rank of Coal	High-vol bituminous A
2. Seam Thickness, m	1.6–1.7
3. Pitch, degrees	6–12
4. Depth of Mining, m	624
5. Ash Content:	
Coal in Place, percent	6.6
Run of Mine Coal, percent	33
6. Moisture, percent	6.0
7. Sulfur Content, percent	1.0
8. Gas Content, m^3 per tonne of daf coal	10–16
9. Mining Method	Longwall
10. Roof Control Method	Complete caving
11. Panel Width, m	150–250
12. Mining Equipment	3MKD-90

Table 4: Coal Production, Methane Emissions and Degasification, Yuzhnodonbasskaya #3 Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	12.60	0.50	13.10	0.00	4.30	13.29	985.50
1991	16.30	0.00	16.30	0.00	0.00	16.54	985.50
1992	12.09	0.00	12.09	0.00	0.00	20.70	584.00
1993	15.77	0.00	15.77	0.00	0.00	17.78	886.95
1994	11.72	0.00	11.72	0.00	0.00	22.00	532.90
1995	15.24	1.05	16.29	0.00	9.10	26.25	620.50
1996	11.14	0.58	11.72	0.00	5.00	17.08	686.20
1997	15.56	2.58	18.14	0.00	22.30	16.96	1,069.45
1998	23.70	1.00	24.70	0.00	8.60	23.84	1,036.00
1999	15.27	2.89	18.16	0.00	25.00	14.83	1,224.90

Table 5: Degasification Parameters, Yuzhnodonbasskaya #3 Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	N/A
3. Number of Pumps, 50 m^3/min Capacity	3
4. Number of Longwalls Degassed	4
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	22
• Methane Content, percent	25
• Methane Capture Rate, m^3/min	5.49
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	6,249

Chart 1: Coal Production and Total Methane Emission Trends, Yuzhnodonbasskaya #3 Mine

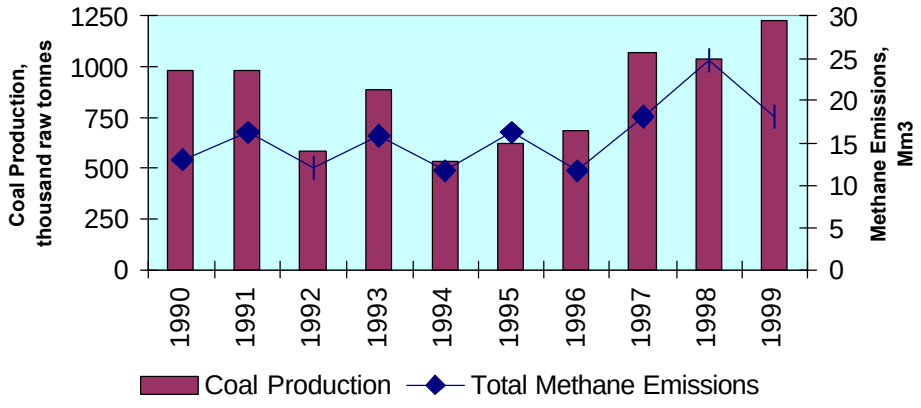


Chart 2: Methane Emissions, Yuzhnodonbasskaya #3 Mine

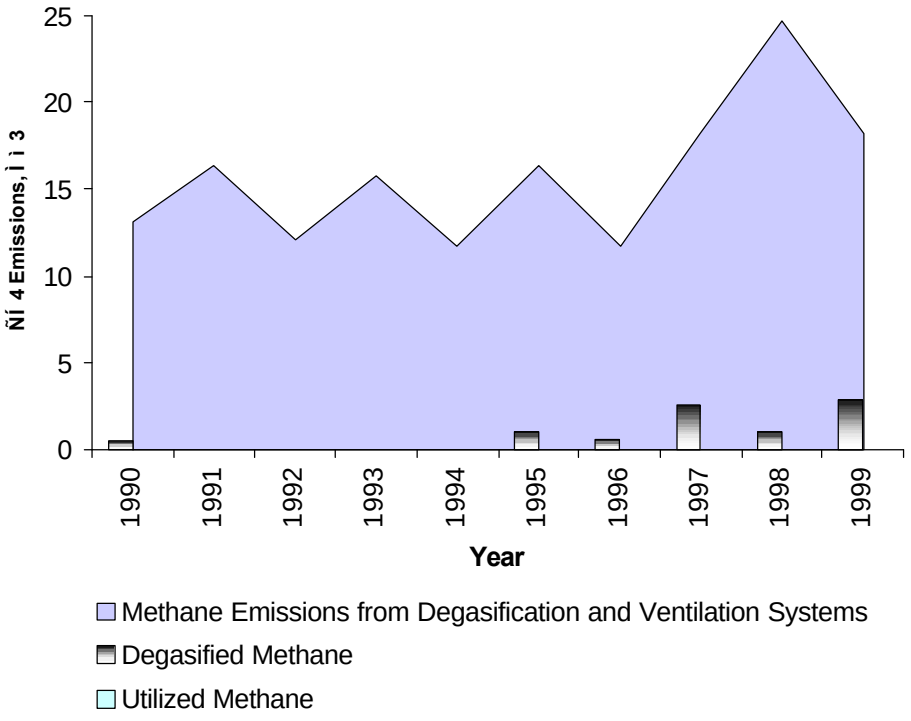
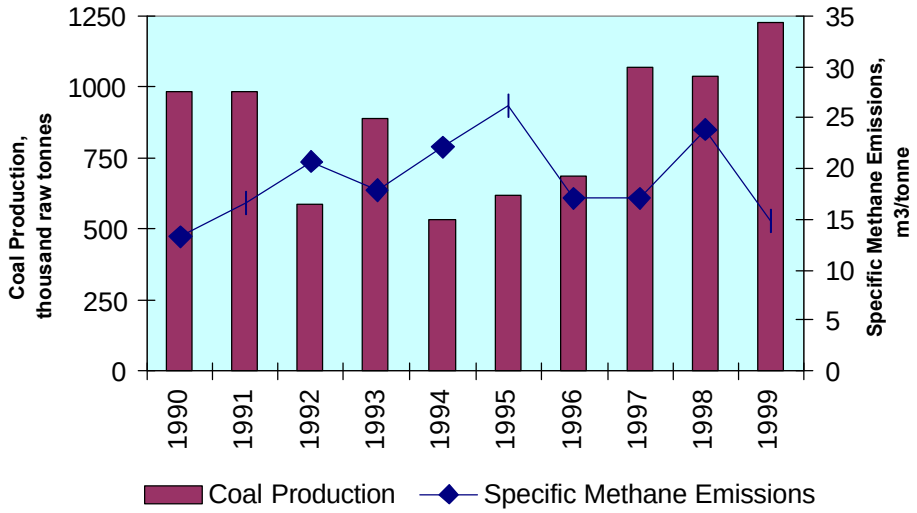


Chart 3: Coal Production and Specific Methane Emission Trends, Yuzhnodonbasskaya #3 Mine



5.26 Zasyadko Mine

General Overview

Zasyadko Mine became operational in 1958. The mine is classified as an independent mine and is not part of a coal association. The mined is owned by the State but is leased to a private company that operates the mine on a rental basis.

The mine is located in Kievsky Rayon, which is a part of the city of Donetsk. The mining property includes territories that are adjacent to the cities of Donetsk and Makeyevka, as well as part of the Yasinovataya Rayon of the Donetsk Oblast.

In geologic terms, the area is located at the slopes of the Calmius River, more specifically from the watershed between Vakhnutka ravine and the Calmius, partly extending to the western slope of the river basin. Multiple gullies and ravines comprise the terrain with the maximum elevation difference of 75 to 80 meters.

The mailing address is Prospekt Zasyadko, Donetsk 83054.

Telephone: 38 0622 51-7070.

Table 1: General Information, Zasyadko Mine

1.	Total Mineable Reserves, thousand tonnes	96,308
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	58,253
3.	Total Mining Area, km^2	N/A
4.	Depth of Shaft(s), m	N/A
5.	Mining Capacity, tonnes / day	8,300
6.	Annual Electricity Consumption, MWh	215,000
7.	Coal Consumers	Coke and Chemical Plants
8.	Annual Heat Consumption, Gcal	163,972
9.	Type(s) of Boilers	DKVR 10/13: 2 units KE 10/14: 4 units
10.	Boilers Fueled with	Coal, methane
11.	Fuel Consumption, winter/summer, tonnes	22,900
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Zasyadko Mine

1. Coal Seam Gas Content, Range, m^3/tonne	19 to 23
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.8
Pressure, MPa /1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	24
Shale, percent	72
Limestone, percent	2
4. Number of Coal Seams Above Currently Mined	25
5. Aggregate Thickness of Seams Above Currently Mined, m	14.6
6. Geologic Phenomena	Faults: Grigoryevsky (amplitude 7–73 m), Vetkovskie #1,2 (20–55 m), Sofievsky (13–14 m)
7. Gas Pressure in Surrounding Rock Strata, MPa	4 to 10
8. Porosity and Permeability, Sandstone:	
Porosity, percent	5 to 11
Permeability, mD	0.02–0.03
9. Total Methane Resource, billion m^3, including:	17.6
Coal Seams, billion m^3	3.9
Satellite Seams, billion m^3	0.8
Sandstone, billion m^3	12.9

Table 3: Geologic and Mining Conditions, Zasyadko Mine

	Coal Seam:			
	m_3	l_4	l_1	k_8
1. Rank of Coal	High-vol bituminous B	High-vol bituminous B	High-vol bituminous B	High-vol bituminous B
2. Seam Thickness, m	1.4–2.2	0.8–1.2	1.6–2.1	0.8–1.0
3. Pitch, degrees	2–15	9–13	9–19	9–19
4. Depth of Mining, m	950–1400	650–802	860–1120	820–1080
5. Ash Content:				
Coal in Place, percent	4.8	4.3	9.3	9.2
Run of Mine Coal, percent	20.0	26.4	31.0	9.6
6. Moisture, percent	1.0	1.0	0.8	1.0
7. Sulfur Content, percent	2.3	0.8	3.2	1.5
8. Gas Content, m^3 per tonne of daf coal	23.0	19–20	21.0	20.0
9. Mining Method	Longwall			
10. Roof Control Method	Complete caving			
11. Panel Width, m	210–250			
12. Mining Equipment				

Table 4: Coal Production, Methane Emissions and Degasification, Zasyadko Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	41.20	33.70	74.90	33.70	N/A	33.10	2,263.00
1991	41.90	33.00	74.90	33.00	N/A	31.57	2,372.50
1992	65.81	18.82	84.63	N/A	N/A	39.30	2,153.50
1993	59.13	20.03	79.16	N/A	N/A	56.19	1,408.90
1994	59.13	20.03	79.16	20.03	N/A	45.09	1,755.65
1995	62.28	25.28	87.56	8.40	N/A	48.46	1,806.75
1996	53.45	24.49	77.94	10.51	N/A	39.91	1,952.75
1997	88.41	24.65	113.06	12.09	N/A	41.03	2,755.75
1998	85.41	27.80	113.21	12.00	N/A	35.66	3,175.00
1999	79.10	30.60	109.70	12.36	30.00	36.20	3,027.00

Table 5: Degasification Parameters, Zasyadko Mine

Parameter	Indicator
1. Number of Pumping Stations	3
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	16
4. Number of Longwalls Degassed	3
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	194
• Methane Content, percent	30
• Methane Capture Rate, m^3/min	58.2
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	30.00
♦ Summer	—
6. Length of Pipeline, m	31,600

Chart 1: Coal Production and Total Methane Emission Trends, Zasyadko Mine

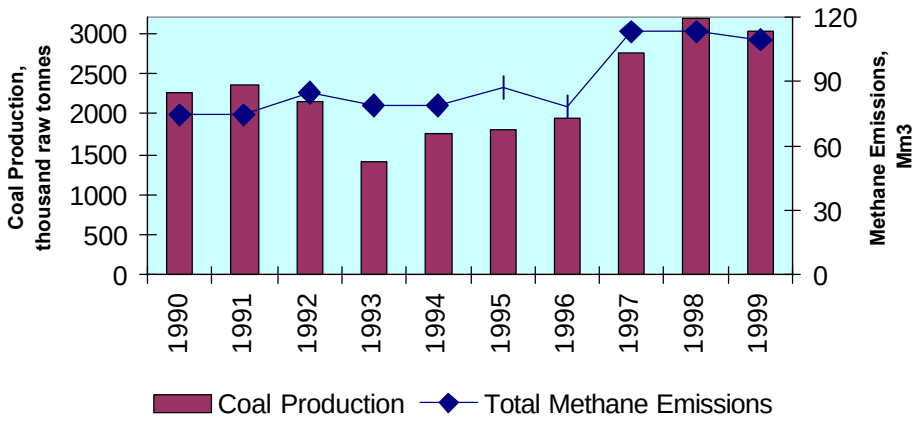


Chart 2: Methane Emissions, Zasyadko Mine

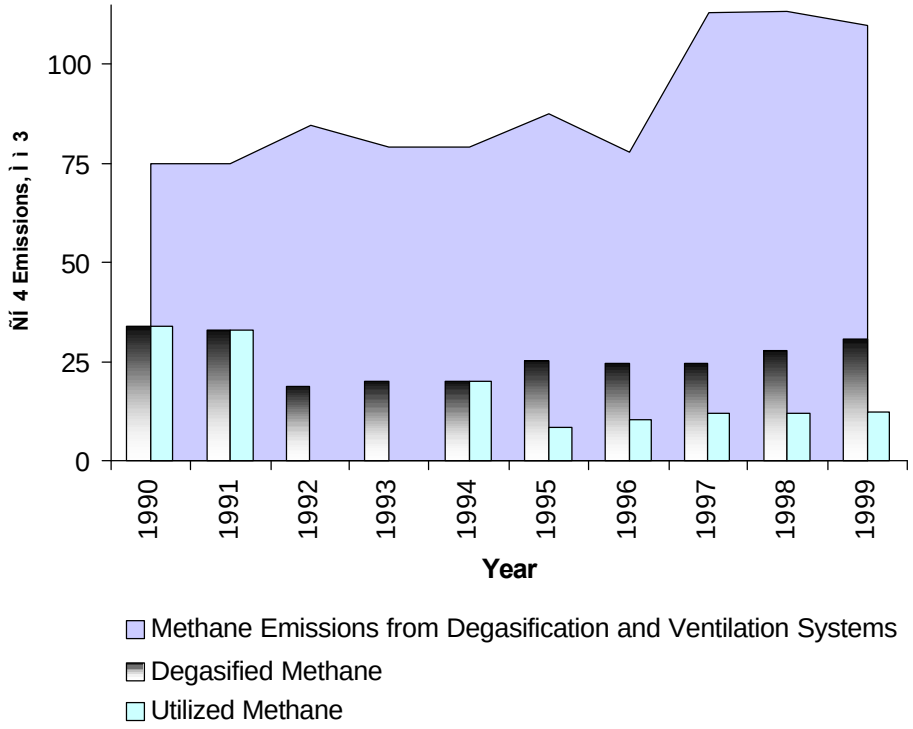
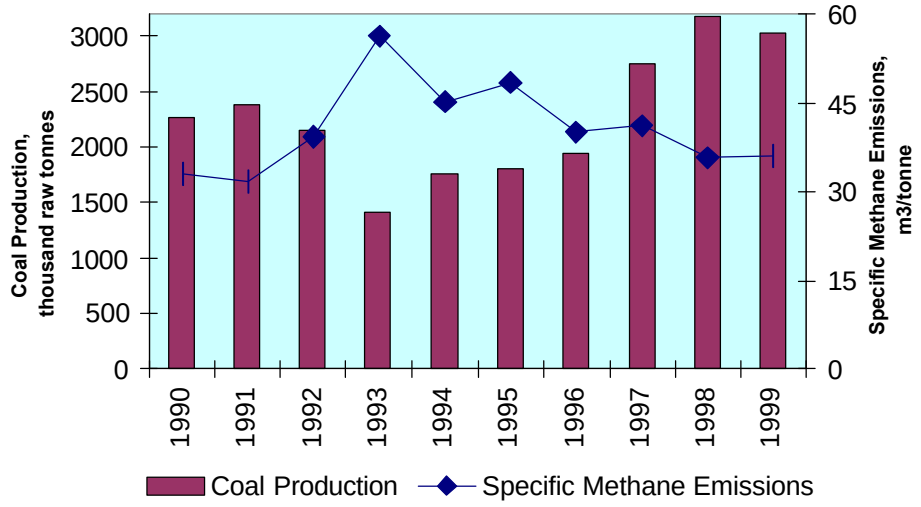


Chart 3: Coal Production and Specific Methane Emission Trends, Zasyadko Mine



5.27 Zhdanovskaya Mine

General Overview

The mine became operational in 1957 and is part of the Oktyabrugol Coal Association. The mining property is located in the Donetsk and Makeyevka geologic/ industrial district in the central section of the Donetsk Coal Basin. The location is within a short distance of the region's major industrial centers of Makeyevka, Khartsyzsk and Yenakievo with their large iron and steel works and other industries, including pipe and steel rope manufacturing.

The surface terrain is undulating plain that is crisscrossed by ravines. Elevation ranges from 260 meters above sea level in the southern part, to 200 meters in the northern section of the property. Most of the surface is farmed.

The mine has been issued a license for production of coal mine methane (#1499 of July 24, 1998).

The mine employs a total of 2,150 persons.

The mailing address is Zhdanovka, Donetsk Oblast 86391.

Telephone: 38 6252 50541.

Table 1: General Information, Zhdanovskaya Mine

1.	Total Mineable Reserves, thousand tonnes	43,276
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	4,529
3.	Total Mining Area, km^2	27.2
4.	Depth of Shaft(s), m	600
5.	Mining Capacity, tonnes / day	2,000
6.	Annual Electricity Consumption, MWh	35,600
7.	Coal Consumers	Electric Generation
8.	Annual Heat Consumption, Gcal	41,000
9.	Type(s) of Boilers	DKV 10/13: 2 units KE 10/14: 2 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	6,000 / 2,000
12.	Fuel Demand Self-covered by the Mine, percent	28.6

Table 2: General Geologic Information, Zhdanovskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	15 to 35
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.4
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	24
Shale, percent	70
Limestone, percent	3
4. Number of Coal Seams Above Currently Mined	7
5. Aggregate Thickness of Seams Above Currently Mined, m	2
6. Geologic Phenomena	Faults: Yunkomovsky
7. Gas Pressure in Surrounding Rock Strata, MPa	4 to 10
8. Porosity and Permeability, Sandstone:	
Porosity, percent	3 to 8
Permeability, mD	0.08–0.40
9. Total Methane Resource, billion m^3, including:	6.5
Coal Seams, billion m^3	2.0
Satellite Seams, billion m^3	0.4
Sandstone, billion m^3	4.1

Table 3: Geologic and Mining Conditions, Zhdanovskaya Mine

	Coal Seam:			
	l_7	l_4	l_6	l_3
1. Rank of Coal	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous
2. Seam Thickness, m	1.20–1.90	1.10	0.96–1.28	1.30
3. Pitch, degrees	17–18	18	17	18
4. Depth of Mining, m	660	548	567	470
5. Ash Content:				
Coal in Place, percent	7.1	13.4	9.6	8.1
Run of Mine Coal, percent	33.1	26.7	26.8	31.2
6. Moisture, percent	4.1	3.0	3.5	1.4
7. Sulfur Content, percent	2.3	3.1	1.3	2.0
8. Gas Content, m^3 per tonne of daf coal	15–35	30	30–35	25–30
9. Mining Method	Longwall			
10. Roof Control Method	Complete caving			
11. Panel Width, m	150–200			
12. Mining Equipment				

Table 4: Coal Production, Methane Emissions and Degasification, Zhdanovskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	18.60	6.30	24.90	0.00	N/A	20.06	1,241.00
1991	28.20	3.60	31.80	0.00	N/A	20.26	1,569.50
1992	23.49	2.63	26.12	0.00	N/A	23.08	1,131.50
1993	22.39	6.52	28.91	0.00	N/A	28.58	1,011.50
1994	20.92	12.72	33.64	0.00	N/A	34.91	963.60
1995	18.82	5.57	24.39	0.00	N/A	41.50	587.65
1996	19.29	3.00	22.29	0.00	N/A	30.84	722.70
1997	13.40	3.21	16.61	0.00	N/A	36.41	456.25
1998	11.41	2.21	13.62	0.00	N/A	55.84	243.90
1999	12.98	2.26	15.24	0.00	17.2	30.35	502.10

Table 5: Degasification Parameters, Zhdanovskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	3
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	3
4. Number of Longwalls Degassed	N/A
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	25
• Methane Content, percent	17.2
• Methane Capture Rate, m^3/min	4.3
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	N/A

Chart 1: Coal Production and Total Methane Emission Trends, Zhdanovskaya Mine

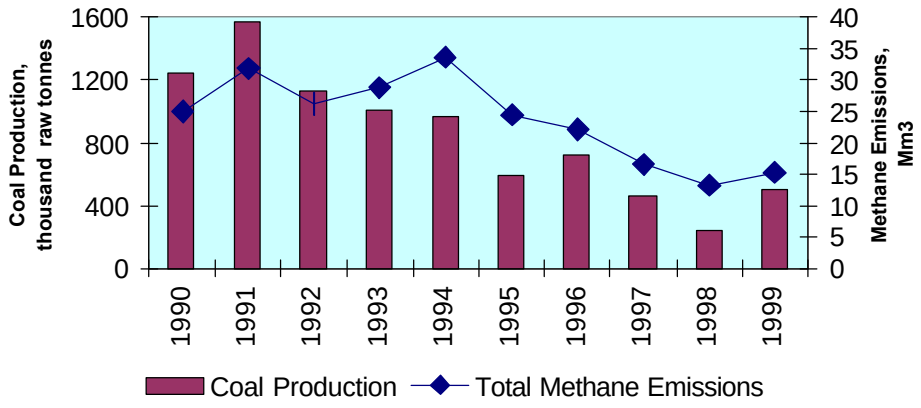


Chart 2: Methane Emissions, Zhdanovskaya Mine

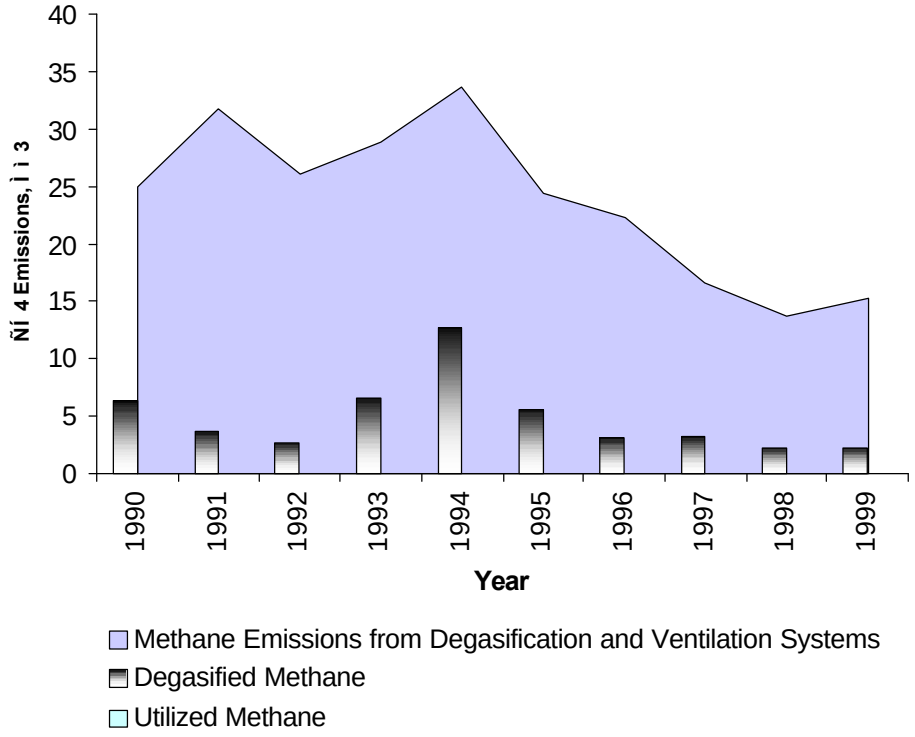
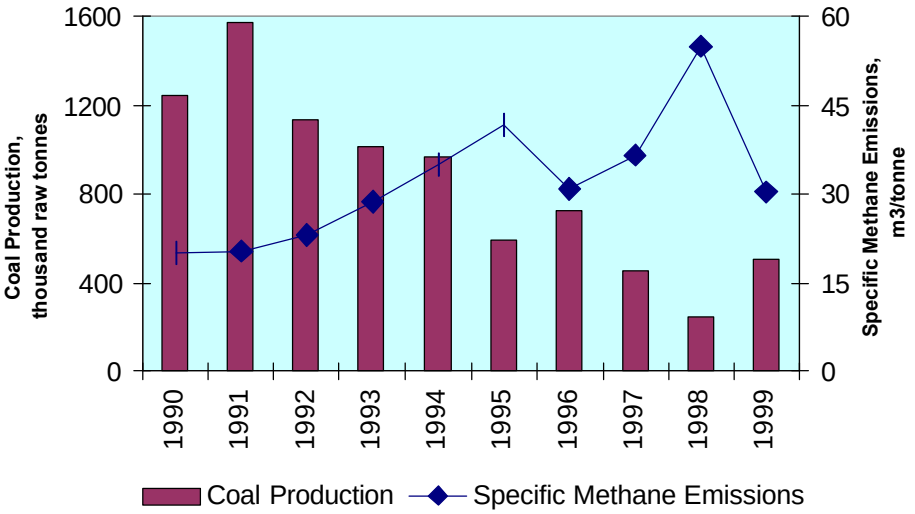


Chart 3: Coal Production and Specific Methane Emission Trends, Zhdanovskaya Mine



5.28 Zuyevskaya Mine

General Overview

The mine is located in the town of Zhdanovka and in Sovetsky Rayon that is a part of the city of Makeyevka. The Kommunarskaya Mine was operating on the same property since 1939. Zuyevskaya was formed by combining that mine and several other smaller mines. Zuyevskaya Mine became operational in 1956 and is a part of the Oktyabrugol Coal Association.

The mine property, extending over an area of 20 km^2, is located in the western section, southern slope of the Chistyakovo-Snezhnoye syncline. It is limited by the Kirovskaya Mine on the east, Kirovskaya Kapitalnaya section in the north, and Yunkomovsky thrust in the west.

A railroad is located northwest of the mine.

The mailing address is Zuyevskaya Mine, Osino-Olhovka, Donetsk Oblast 86397.

Table 1: General Information, Zuyevskaya Mine

1.	Total Mineable Reserves, thousand tonnes	17,394
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	6,251
3.	Total Mining Area, km^2	20
4.	Depth of Shaft(s), m	1,300
5.	Mining Capacity, tonnes / day	1,600
6.	Annual Electricity Consumption, MWh	34,308
7.	Coal Consumers	Electric Generation
8.	Annual Heat Consumption, Gcal	32,380
9.	Type(s) of Boilers	Lankashirski: 4 units DKVR 2,5/13: 4 units
10.	Boilers Fueled with	Coal
11.	Fuel Consumption, winter/summer, tonnes	11,500 / 4,500
12.	Fuel Demand Self-covered by the Mine, percent	100

Table 2: General Geologic Information, Zuyevskaya Mine

1. Coal Seam Gas Content, Range, m^3/tonne	30 to 35
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.5
Pressure, MPa / 1,000 m	6–12
3. Overburden Composition:	
Sandstone, percent	25
Shale, percent	71
Limestone, percent	2
4. Number of Coal Seams Above Currently Mined	17
5. Aggregate Thickness of Seams Above Currently Mined, m	4
6. Geologic Phenomena	Faults: Miscellaneous faults, thrusts, erosion of coal seams, flexures
7. Gas Pressure in Surrounding Rock Strata, MPa	4 to 10
8. Porosity and Permeability, Sandstone:	
Porosity, percent	2 to 7
Permeability, mD	0.002–0.030
9. Total Methane Resource, billion m^3, including:	1.2
Coal Seams, billion m^3	0.9
Satellite Seams, billion m^3	0.3
Sandstone, billion m^3	0

Table 3: Geologic and Mining Conditions, Zuyevskaya Mine

	Coal Seam:		
	k_5	k_3	k_2
1. Rank of Coal	Low-vol bituminous	Low-vol bituminous	Low-vol bituminous
2. Seam Thickness, m	0.96–1.10	1.30–1.60	0.95–1.15
3. Pitch, degrees	17–21	21–22	21–23
4. Depth of Mining, m	577	560	470-580
5. Ash Content:			
Coal in Place, percent	9.7	11.4	13.7
Run of Mine Coal, percent	22.1	N/A	37.0
6. Moisture, percent	7.1	8.9	9.4
7. Sulfur Content, percent	1.2	2.2	2.1
8. Gas Content, m^3 per tonne of daf coal	30–35	30–35	20–35
9. Mining Method	Longwall		
10. Roof Control Method	Complete caving		
11. Panel Width, m	130–170		
12. Mining Equipment	1K-101, SP-202		

Table 4: Coal Production, Methane Emissions and Degasification, Zuyevskaya Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	29.40	6.90	36.30	0.00	27.60	66.20	548.30
1991	20.70	3.20	23.90	0.00	28.60	47.36	504.60
1992	22.40	3.70	26.10	0.00	38.50	52.78	494.50
1993	21.10	3.30	24.40	0.00	26.50	68.02	358.70
1994	8.80	3.00	11.80	0.00	28.50	32.52	362.90
1995	27.30	3.70	31.00	0.00	30.50	62.50	496.00
1996	23.60	2.50	26.10	0.00	26.00	64.90	402.10
1997	20.00	3.30	23.30	0.00	27.50	58.71	396.80
1998	22.70	0.64	23.34	0.00	25.50	49.07	475.60
1999	33.00	3.10	36.10	0.00	30.50	99.60	362.50

Table 5: Degasification Parameters, Zuyevskaya Mine

Parameter	Indicator
1. Number of Pumping Stations	2
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	2
4. Number of Longwalls Degassed	2
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	19.6
• Methane Content, percent	30.5
• Methane Capture Rate, m^3/min	5.9
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	6,300

Chart 1: Coal Production and Total Methane Emission Trends, Zuyevskaya Mine

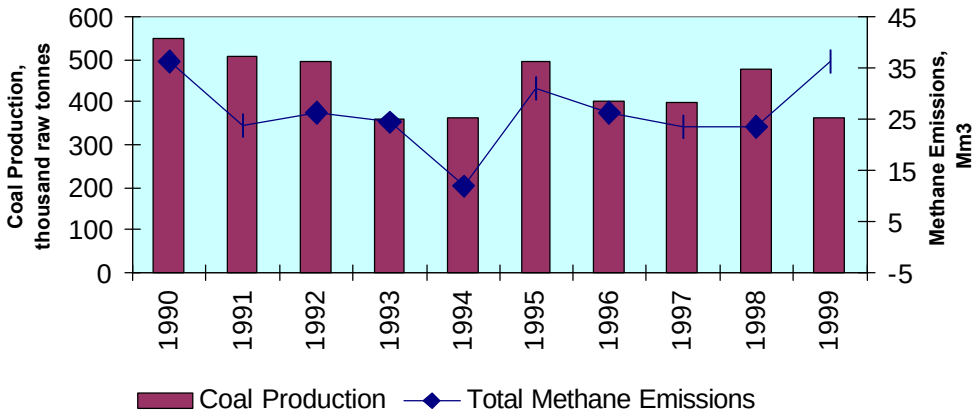


Chart 2: Methane Emissions, Zuyevskaya Mine

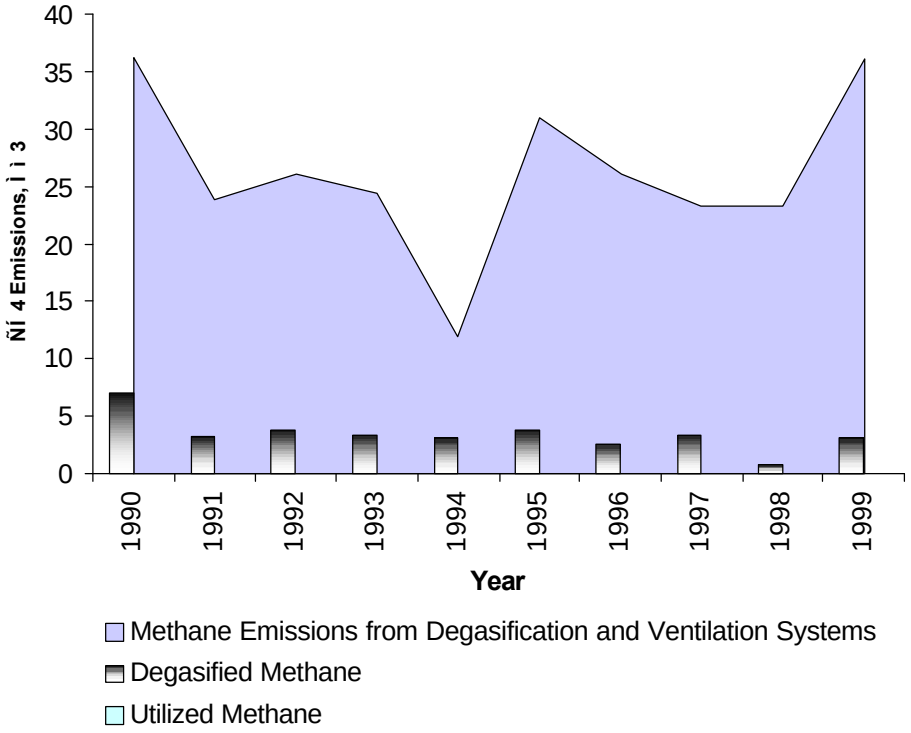
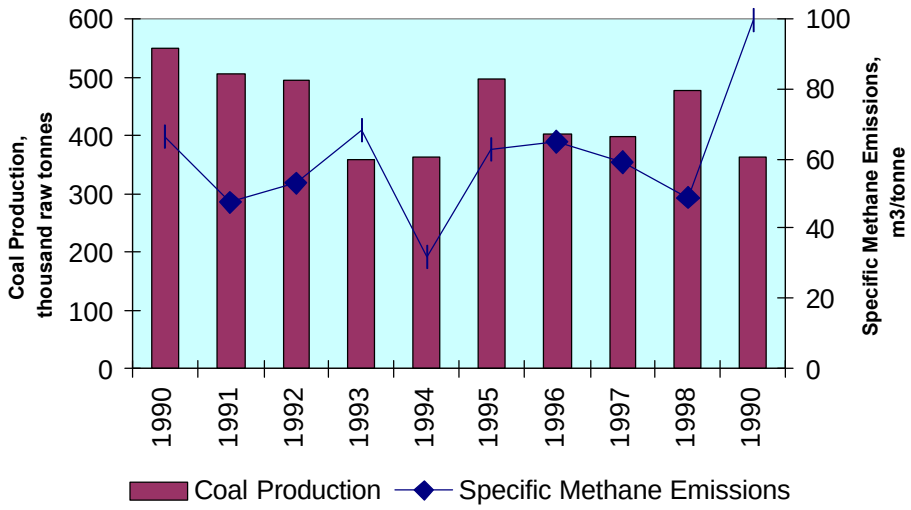


Chart 3: Coal Production and Specific Methane Emission Trends, Zuyevskaya Mine



5.29 50 Years of the USSR Mine

General Overview

The mine is located in the Krasnodon Rayon of the Lugansk Oblast in southeastern Ukraine and became operational in May 1970. The mine is a part of the Krasnodonugol Coal Association.

The mining property is situated near the town of Molodogvardeysk. The rayon capital Krasnodon is located 10 km to the southeast of the mine and the oblast capital Lugansk is located 40 km to the northwest of the center of the property. An asphalt paved road connecting Krasnodon and Lugansk is located near the southern edge of the mining property.

The surface area above the mine is located at the watershed of two rivers, the Luganchik and the Seversky Donets. The terrain is generally flat with some minor slopes; additional terrain features include multiple gullies and ravines. The elevation ranges from 202 meters above sea level in the southern section of the property to 112 meters at the lowest points of the ravines. Most of the area has no forestation and is primarily used for farming.

The coal reserve is accessed through six vertical shafts and is developed in blocks on a level-by-level basis. The mine uses the retreat system, where mining progresses from the edges of the property toward the shafts. The coal is mined utilizing regular longwalls progressing along the strike. The mine employs exhaust-type ventilation with several combined systems. The coal produced is used for making coke at the iron and steel works in Alchevsk.

At present, the mine is operating at two coal seams and produced 633,000 raw tonnes during 1999.

Table 1: General Information, 50 Years of the USSR Mine

1.	Total Mineable Reserves, thousand tonnes	11,410
2.	Mineable Reserves, Active Mine Levels, thousand tonnes	9,509
3.	Total Mining Area, km^2	14
4.	Depth of Shaft(s), m	822.5
5.	Mining Capacity, tonnes / day	2,550
6.	Annual Electricity Consumption, MWh	89,800
7.	Coal Consumers	Alchevsky mining and smelting plant
8.	Annual Heat Consumption, Gcal	19,393
9.	Type(s) of Boilers	No boilers
10.	Boilers Fueled with	Steam*
11.	Fuel Consumption, winter/summer, Gcal	19,393
12.	Fuel Demand Self-covered by the Mine, percent	100

* Steam purchased from adjacent mine.

Table 2: General Geologic Information, 50 Years of the USSR Mine

1. Coal Seam Gas Content, Range, m^3 /tonne	28 to 36
2. Geothermal and Pressure Gradients:	
Geothermal, °Ñ/100 m	2.2
Pressure, MPa / 1,000 m	N/A
3. Overburden Composition:	
Sandstone, percent	40
Shale, percent	56
Limestone, percent	2.5
4. Number of Coal Seams Above Currently Mined	28
5. Aggregate Thickness of Seams Above Currently Mined, m	7.2
6. Geologic Phenomena	There are no major faults on the mine field. The closest faults are: Samsonovsky, Duvanny, Northern Duvanny that surround the mine field.
7. Gas Pressure in Surrounding Rock Strata, MPa	0.1 to 10.3
8. Porosity and Permeability, Sandstone:	
Porosity, percent	2.4 to 9.0
Permeability, mD	N/A
9. Total Methane Resource, billion m^3, including:	
Coal Seams, billion m^3	0.14
Satellite Seams, billion m^3	0.03
Sandstone, billion m^3	N/A

Table 3: Geologic and Mining Conditions, 50 Years of the USSR Mine

	Coal Seam:	
	$k_2^{Â}$	i_3^1
1. Rank of Coal	High-vol bituminous B	High-vol bituminous B, A
2. Seam Thickness, m	1.15–2.39	0.78–1.58
3. Pitch, degrees	0–60	0–46
4. Depth of Mining, m	425–570	650–710
5. Ash Content:		
Coal in Place, percent	12.30	13.60
Run of Mine Coal, percent	29.50	29.60
6. Moisture, percent	3.90	2.90
7. Sulfur Content, percent	4.40	2.80
8. Gas Content, m^3 per tonne of daf coal	28–36	N/A
9. Mining Method	Longwall	
10. Roof Control Method	Complete caving	
11. Panel Width, m	160–185	
12. Mining Equipment	2ÊÌ Ò-1.5; ÊÌ Ñ-97; 3ÊD-90Ò	

Table 4: Coal Production, Methane Emissions and Degasification, 50 Years of the USSR Mine

Year	Methane Liberated by Mining, million m^3/year			Methane Utilized, million m^3/year	Methane Content in Captured Gas, percent	Specific Methane Emissions, m^3/tonne	Coal Production, thousand tonnes/year
	Ventilation	Degasification	Total Emissions				
1990	22.90	1.90	24.80	0.00	N/A	23.49	1,055.90
1991	21.00	4.20	25.20	0.00	N/A	25.38	993.00
1992	24.70	6.10	30.80	0.00	N/A	27.08	1,137.50
1993	23.44	6.73	30.17	0.00	N/A	36.33	830.50
1994	18.71	0.00	18.71	0.00	N/A	34.62	540.50
1995	18.66	0.00	18.66	0.00	N/A	37.44	498.40
1996	29.28	0.00	29.28	0.00	N/A	63.67	459.90
1997	23.86	0.00	23.86	0.00	N/A	32.89	725.50
1998	18.71	0.00	18.71	0.00	N/A	39.13	478.10
1999	21.76	0.00	21.76	0.00	N/A	34.36	633.20

Table 5: Degasification Parameters, 50 Years of the USSR Mine

Parameter	Indicator
1. Number of Pumping Stations	1
2. Number of Pumps, 150 m^3/min Capacity	None
3. Number of Pumps, 50 m^3/min Capacity	2
4. Number of Longwalls Degassed	1
5. Average Degasification Statistics, Jan to June 1999:	
• Methane–air Mixture Consumed, m^3/min	N/A
• Methane Content, percent	N/A
• Methane Capture Rate, m^3/min	N/A
• Methane Utilization Rate by Season, m^3/min	
♦ Winter	0
♦ Summer	0
6. Length of Pipeline, m	1,950

Chart 1: Coal Production and Total Methane Emission Trends, 50 Years of the USSR Mine

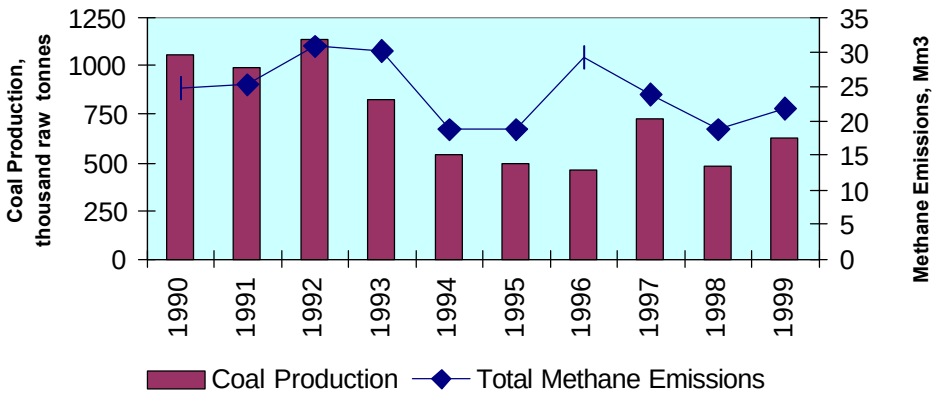


Chart 2: Methane Emissions, 50 Years of the USSR Mine

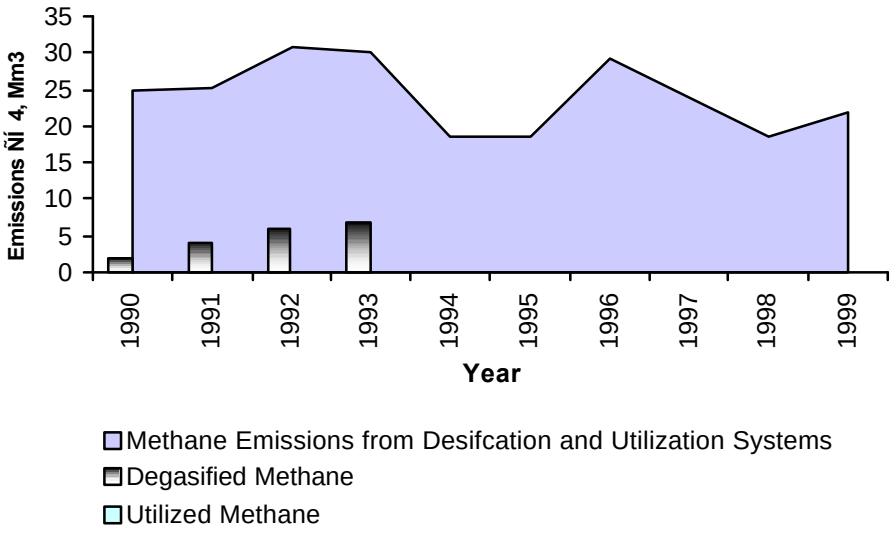


Chart 3: Coal Production and Specific Methane Emission Trends, 50 Years of the USSR Mine

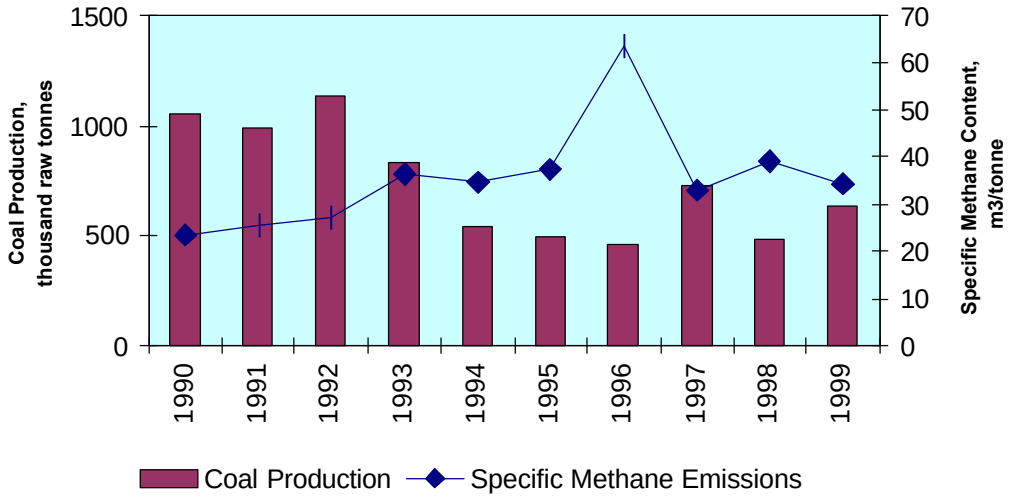


Figure 2: Typical Stratigraphic Column of The Donetsk Basin

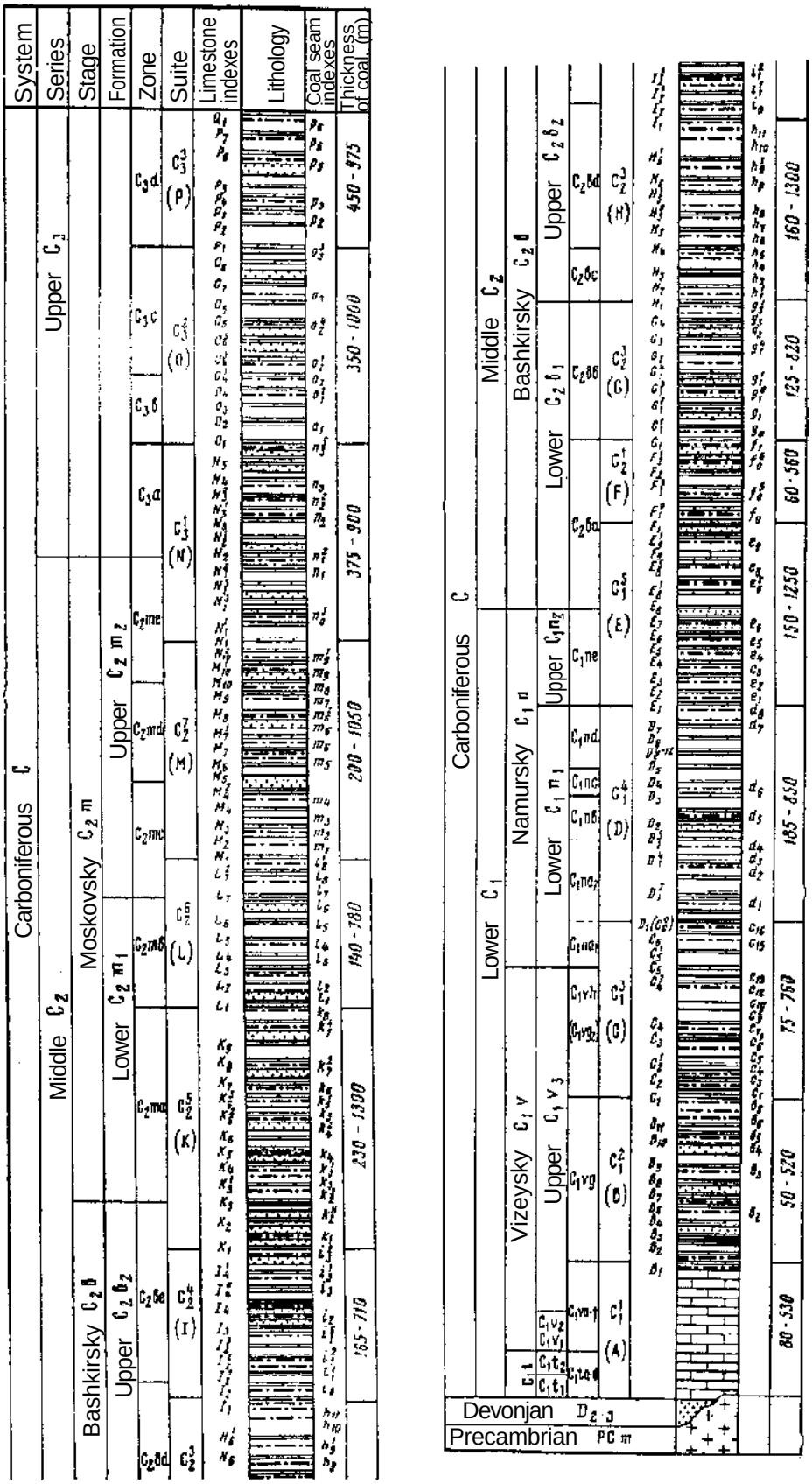


Figure 3: Comparison of Coal Seam Classifications

Ukrainian rank	*Volatile matter, percent*	*Heating value, kcal/kg*	*Carbon content, percent*	*Approximate U. S. equivalent*
Long-flame	≥ 35	7300–8100	77–83	High volatile bituminous C
Gas	≥ 35	7000–8600	81–87	High volatile bituminous B
Gas-fat	27–35	8300–8750	81–87	
Fat	27–35	8300–8750	85–88	
Coking	18–27	8500–8800	88–91	High volatile bituminous A
Lean-coking	14–22	8500–8800	90–93	Medium volatile bituminous
Lean	8–17	> 8400	91–94	Low volatile bituminous
Anthracite	> 8	< 8400	94–97	Anthracite

Figure 4: Ukrainian Boiler Descriptions

Type of Boiler	*Capacity, tonnes of steam/ hour*	*Steam pressure, ATM*	*Standard consumption of fuel*	
			Coal, tonnes/ hour	*Natural Gas, m^3/ hour*
DKVR-2,5/13	2.5	13	0.32	252
DKVR-4/13; DKV-4/13; KE-4/14	4.0	13	0.54	420
DKVR-4.5/13	4.5	13	0.54	420
DKVR-10/13;KE-10/14; DKV-10/13	10.0	13	1.30	1,020
DKVR-20/13	20.0	13	2.00	1,560
KE-25/14	25.0	14	3.20	2,520
KE-6.5/14	6.5	14	1.00	780
KE-1/9; E-1/9	1.0	9	0.14	108

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