

34 UKRAINE



34.1 Summary of Coal Industry

34.1.1 ROLE OF COAL IN UKRAINE

Ukraine produced approximately 1 percent of total world coal production in 2007 (see Table 34-1), making it the eleventh largest producer of coal in the world (IEA, 2010; BP, 2010). BP ranked Ukraine as twelfth in production in their 2010 survey report with total production of 73.7 thousand tonnes in 2009 (BP, 2010).

Table 34-1. Ukraine's Coal Reserves and Production

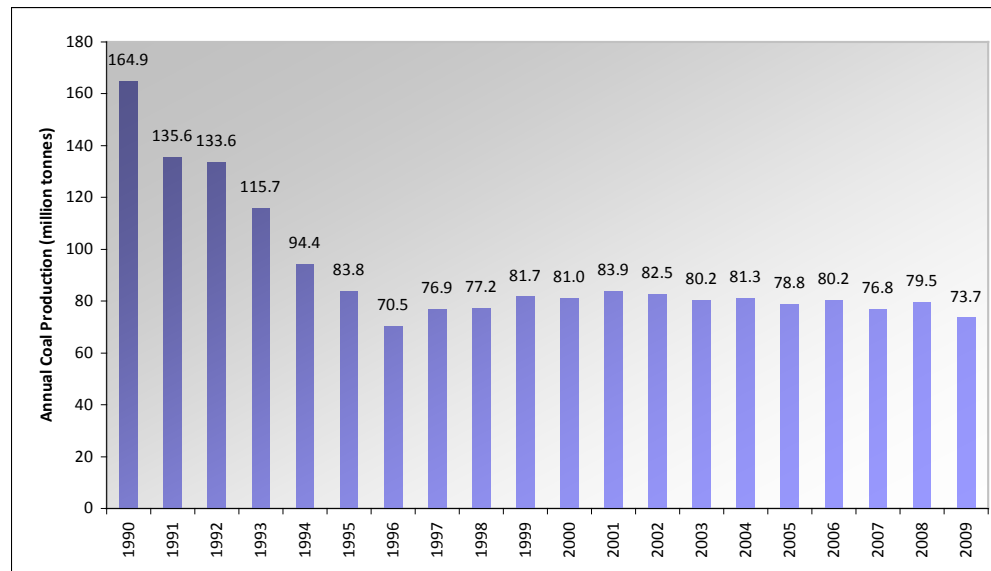
Indicator	Anthracite & Bituminous (million tonnes)	Sub-bituminous & Lignite (million tonnes)	Total (million tonnes)	Global Rank (# and %)
Estimated Proved Coal Reserves (2009)*	15,351	18,522	33,873	6 (4.1%)
Annual Coal Production (2010)**	58.7	0.2	58.9	11 (1.2%)

Source: *BP (2010); **IEA (2010)

In 2007, almost all of Ukraine's production was hard coal—0.2 million tonnes (Mmt) of lignite was produced comprising only 0.3 percent of total coal production (IEA, 2010). As reflected in Table 34-1, Ukraine's total coal reserves as of 2009 were 33.9 billion tonnes, of which about 15.3 billion tonnes were hard coals and 18.5 billion tonnes were soft coals (sub-bituminous and lignite) (BP, 2010). However, contrary to the data reported in Table 34-1, another estimate puts Ukraine's coal reserves total at a much higher 213 billion tonnes (M2M Workshop – Ukraine, 2005). Coal in 330 seams have been explored to a depth of 1,800 meters (m), with 130 seams exceeding 0.45 m in thickness. Only 10 seams are suitable for development with the remainder being too deep or too thin to mine (M2M Workshop – Ukraine, 2005).

It should be noted that Table 34-1 contains data on raw coal production. To understand actual coal production in Ukraine, it is more useful to consider washed coal statistics. In 2004, Ukraine produced 80.5 Mmt of raw coal but only 60 million tons of washed coal. Ukrainian coal undergoes substantial washing because of typically high levels of contaminants, which can result in as much as a 25 percent product loss (Raptsun, 2008).

Coal production in Ukraine declined significantly from 1990 to 1996, falling by more than 50 percent from 164.9 million tonnes (Mmt) in 1990 to 70.5 Mmt in 1996, as seen in Figure 34-1. Coal production has since stabilized at an approximate average of 80 Mmt per year (BP, 2010).

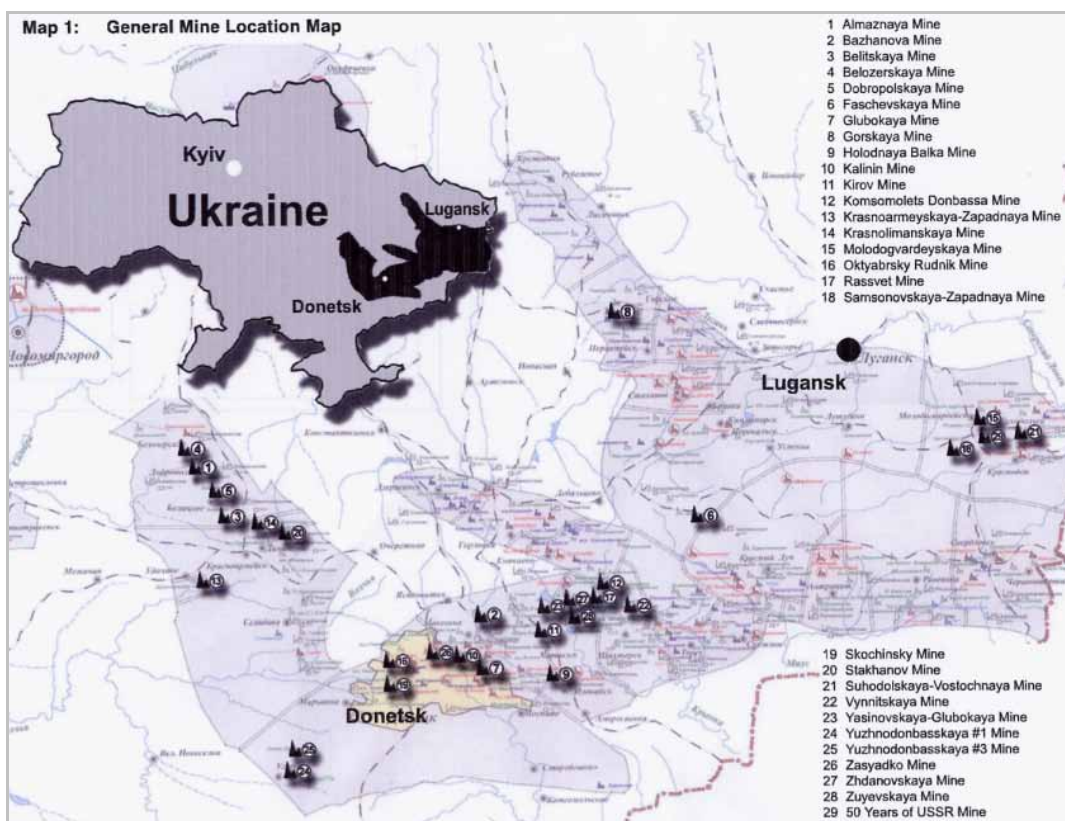
Figure 34-1. History of Ukraine's Coal Production

Source: BP (2010)

Ukraine remains critically reliant on coal as its primary resource for electric power generation since its domestic energy sector is plagued by limited alternative energy sources, increasing foreign debt, and outdated, inefficient equipment (PEER, 2005). In 2007, coal supplied 29.4 percent of Ukraine's total energy supply (IEA, 2009). Ukraine is not among the world's major coal exporters because of a lack of progress on deregulation, along with underinvestment in coal production leading to high coal production costs. Despite its sizeable resources, Ukraine is a net importer of coal and in 2008 imported a net 8.5 Mmt (EIA, 2010). In 2005, 45.4 percent of the country's rated generating capacity was in thermal sources (coal, oil, and gas-fired), compared to nuclear at 47.5 percent and hydroelectric at 7.0 percent (EIA, 2005). Thermal production's role has been steadily declining as nuclear generation capacity has increased. In 1998, thermal generation provided 47 percent of demand compared to hydroelectric at 12.2 percent and nuclear at 36.3 percent (WEC, 2000).

Coal is produced in two major basins in Ukraine: the Donetsk Basin (60,000 square kilometers [km²]) in southeastern Ukraine (and western Russia) and the Lviv-Volyn basin (7,500 km²) in western Ukraine, which continues into Poland (Sachsenhofer, 2002; M2M-Ukraine, 2005). The Donetsk Basin is commonly referred to as "the Donbass" (Figure 34-2).

Figure 34-2. Ukraine’s Coal Fields



Source: PEER (2000)

34.1.2 STAKEHOLDERS

Potential stakeholders in coal mine methane (CMM) development in Ukraine are listed in Table 34-2.

Table 34-2. Key Stakeholders in Ukraine’s CMM Industry

Stakeholder Category	Stakeholder	Roles
Coal associations	<ul style="list-style-type: none"> ▪ Makeyevugol Coal Association ▪ Donugol ▪ Donetsk Regional Administration 	Project host
	<ul style="list-style-type: none"> ▪ Dobropolyengol ▪ Dobropolye ▪ Luganskugol ▪ Pervomayskugol ▪ Krasnodonugol ▪ Oktyabrugol 	Potential project host
Equipment manufacturers	<ul style="list-style-type: none"> ▪ Caterpillar, USA ▪ Zeppelin Ukraine (Ukrainian division of Caterpillar) ▪ GE Jenbacher (Austria) 	Power generation equipment supplier

Stakeholder Category	Stakeholder	Roles
Developers	<ul style="list-style-type: none"> ▪ EcoMetan ▪ EnergoImpex ▪ EuroGas (Lviv-Volyn Basin) ▪ Green Gas International ▪ See http://www.epa.gov/coalbed/networkcontacts.html 	Project opportunity identification and planning
Engineering, consultancy, and related services	<ul style="list-style-type: none"> ▪ REI Drilling (USA) ▪ Advanced Resources International Inc. (USA) ▪ See http://www.epa.gov/coalbed/networkcontacts.html 	Technical assistance
Government Groups	<ul style="list-style-type: none"> ▪ Ministry of Fuel and Energy of Ukraine ▪ Coal Industry Ministry 	Project approval
Universities, Research Establishments	<ul style="list-style-type: none"> ▪ Donetsk Coal Research Institute ▪ Ukrainian Natural Gas Research Institute ▪ Dnipropetrovsk Mining University of Ukraine ▪ National Academy of Sciences 	Technical assistance

34.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

Ukraine experienced a steep decline in coal production from 1990 to 1996 (see Table 34-1), but production has since stabilized at approximately 80 Mmt annually (BP, 2010). About one-half of the production is steam coal and the remainder is coking coal. Stabilization and a slight increase in coal production resulted from the closure of uneconomical mines, increased cash receipts for coal sales, and a reduction in barter transactions. 2009 production figures were down as a result of the worldwide economic slowdown in 2008, which severely impacted Ukraine's steel industry, one of the coal industry's biggest markets. However, with current reserves sufficient to last for more than 400 years, the coal mining industry should remain stable for the foreseeable future, although commercialization and rationalization of Ukraine's coal industry has not yet been accomplished.

In 1997, a Ukraine mine closure plan was adopted that called for the closure of the most inefficient of the country's 284 active mines (PEER, 2002). By 1999, there were 244 active mines (PEER, 2001). In 2000, the number had dropped to only 232 (USEPA, 2008) and by 2005, 167 operating coal mines remained in Ukraine, of which 164 were underground and three were surface mines (UA, 2005; UNFCCC, 2007).

Most of the mines in Ukraine are underground (Table 34-3) producing bituminous coal. Ninety-two percent of the active mines in 2002 were in the Donetsk basin (all but three underground), while the remaining 8 percent were found in the Lviv-Volyn basin (PEER, 2002). The three surface mines all produce low-methane content, sub-bituminous coal or lignite (PEER, 2002).

Table 34-3. Ukraine – Number of Coal Mines by Type

Type of mine	Production (tonnes)	Number of mines
Underground (active) mines – total (2004)	79.8	164
Surface (active) mines – total (2004)	0.8	3

Source: PEER (2005); UNFCCC (2007)

In 2001, 77 percent of operating mines were considered gassy. At some mines, the natural gas content can exceed 35 cubic meters (m³) per tonne of dry ash-free coal (PEER, 2002).

34.2 Overview of CMM Emissions and Development Potential

The Global Methane Initiative (formerly Methane to Markets Partnership) International CMM Projects Database identifies 15 CMM projects in Ukraine, involving eight active, underground mines and two surface mines in the Donbass, and one underground mine in the Lugansk basin. The methane is used for boiler fuel in five of these projects, for combined heat and power in six, and for industrial use, power generation, vehicle fuel and flaring in the remaining four projects (M2M CMM Projects, 2010). GMI's 2010 General Projects Database lists a further seven projects proposed to expand activities, and improve CMM capture and utilization (M2M Partnership, 2010).

A new CMM degasification and utilization project at the Sukhodolska-Vostochnaya Coal Mine in Krasnodon was announced by Green Gas International in February 2010. The mine currently operates at depths up to 1,000 meters and the project plans to enhance the gas drainage system to provide a steady source of methane for heat and power production for use at the mine. The project is expected to be operational by the end of 2010 and to yield an estimated 20 million m³ per year of methane, resulting in annual greenhouse gas (GHG) reductions of 200,000–250,000 tonnes of carbon dioxide equivalent (mtCO₂e) (GreenGas, 2010).

34.2.1 CMM EMISSIONS FROM OPERATING MINES

Ukraine is considered to be the world's third largest emitter of methane emissions from coal mining activities (USEPA, 2006), even though emissions have been significantly reduced by mine closures and reduced coal production (see Table 34-4). The data in this table may vary from the U.S. EPA data presented in the Executive Summary due to differences in inventory methodology and rounding.

Table 34-4. Ukraine's CMM Emissions (million cubic meters)

Emission Category	1990	1991	1992	1993	1994	1995	1996	1997	1998
Underground mining - active	3557.51	3276.00	3161.00	2615.28	2414.07	1945.49	1881.85	1839.08	1852.92
Underground - post-mining	306.41	253.07	251.81	219.87	180.82	160.20	138.05	146.72	146.72
Surface mining - active	12.79	9.91	7.97	5.72	3.68	3.16	2.19	1.97	1.93
Surface - post-mining	1.83	1.41	1.14	0.82	0.52	0.45	0.31	0.28	0.27
Total Emissions	3878.53	3540.40	3421.92	2841.69	2599.10	2109.30	2022.41	1988.05	2001.84
Additional Recovered and Flared	144.77	137.97	88.22	69.38	94.89	89.03	48.06	56.74	83.26
Emission Category	1999	2000	2001	2002	2003	2004	2005	2010*	2015*
Underground mining - active	1819.07	2039.44	1684.68	1911.38	1864.53	1890.53	1837.13		
Underground - post-mining	157.36	156.06	163.33	160.77	156.83	159.02	154.53		
Surface mining - active	1.63	1.47	1.43	1.23	0.88	0.77	0.43		
Surface - post-mining	0.23	0.21	0.20	0.18	0.13	0.11	0.06		
Total Emissions	1978.29	2197.18	1849.65	2073.55	2022.37	2050.42	1992.14	1713.60	1663.9
Additional Recovered and Flared	78.93	72.91	134.28	152.35	148.62	150.69	146.43		

Source: UNFCCC (2007); *USEPA (2006) – estimated and projected

Another source estimates that in 2004, 1,221 million m³ of CMM was emitted by underground coal mines, 357 million m³ of which was drained by degasification systems and 179 million m³ of which was utilized (M2M Workshop – Ukraine, 2005). At that time, 42 mines employed degasification. The low percentage of capture can be attributed to numerous factors, including poor degasification system maintenance and lack of investment in new degasification infrastructure.

Most of the attention to potential CMM development has focused on the Donbass due to its vast coal and methane reserves, large number of coal mines, high ranked coal deposits, and the depth of the mines, which are often in excess of 2,000 feet. Numerous projects have been conceptualized for development in Ukraine, including several for which detailed business plans were drafted. To date, however, very few have come to fruition and only a small number are being actively considered. However, the continuing evolution of new mining laws, tax benefits, privatization efforts and private domestic and multi-national collaborative efforts offer promise for increased implementation of CMM and coalbed methane (CBM) projects.

In August 2005, the U.S. Trade and Development Agency (USTDA) awarded a US\$585,570 grant to the Donetsk Regional Administration to conduct a feasibility study on commercial development of CBM/CMM in the Donbass region. The project aimed to increase the domestic supply of natural gas, increase mine safety, and improve local environmental quality. The analysis focused on developing the best technical and economic approach for methane drainage at mines, evaluating the technical and economic merits of producing CMM, and assessing the most likely markets and infrastructure required to utilize CMM/CBM (USTDA, 2005). The study focused on two mines, Bazhanov and South Donbass No. 3, which were found to have average CMM emissions of 9.9 and 8.8 million m³ per year respectively. Economic analysis suggests these emissions are sufficient to power on-site electricity generators with capacities of 1.7 megawatts (MW) and 3.3 MW. The Bazhanov mine already utilizes 5.5 million m³ per year of drained methane in onsite boilers for heating purposes. (USTDA, 2008) The two mines are currently searching for further financial and technical assistance to move their CMM projects to the development stage (M2M Partnership, 2010).

34.2.2 CMM EMISSIONS FROM ABANDONED COAL MINES

Hundreds of mines have been closed and abandoned in Ukraine since the inception of its coal industry. Between 1990 and 2004, 119 underground mines were abandoned or were in the process of closure in a major effort by the state to increase mine efficiency, improve mine safety, and achieve mine profitability (UNFCCC, 2007). The mine closure rate has declined in recent years, as the government attempts to bolster national coal production with technical upgrades at coal mines rather than closure, and has investigated opening some previously closed mines (Euracoal, 2008). By some estimates, the amount of methane released by abandoned mines could be as high as 23,000 tonnes per year per km of excavated mine.

In Ukraine, 77 percent of abandoned mines are considered gassy (i.e., assuming the same percentage as active operating mines) (PEER, 2002). The number of projects at abandoned coal mines is unknown but thought to be zero at present, although several mines are being evaluated for abandoned mine methane potential.

34.2.3 CBM FROM VIRGIN COAL SEAMS

Ukraine's CBM resource is approximately 1.7 trillion m³ (ARI, 1992; Thomas, 2002). The USTDA grant awarded to the Donetsk Regional Administration in 2005 aimed to assess the most likely markets and infrastructure required to utilize virgin CBM (USTDA, 2005). The study looked at the feasibility of drilling CBM wells in the areas surrounding the Bazahnov and South Donbass No. 3 mines. Multiple

seams of coal are present in a section 500–900 meters (m) deep and with gas contents ranging from 15 to 20 m³ per tonne. Markets for potential produced gas include direct pipeline sales and compressed natural gas (CNG) projects (USTDA, 2008).

EuroGas Inc. was the first foreign company to drill for CBM in 1998, but has had no commercial success. In 2008, they formed a joint venture with one of Ukraine’s largest industrial holding groups to explore and develop CBM leases in east and west Ukraine, although this project is still in the planning stages (EuroGas, 2010).

Ukraine has very limited research and development (R&D) resources available for pursuing CMM or CBM research, namely lack of technology for and experience in applying hydro-fracturing to stimulate CBM production. A more favorable investment climate along with clarity on CBM ownership issues are needed before more foreign companies are likely to commit to CBM projects in Ukraine.

34.3 Opportunities and Challenges to Greater CMM Recovery and Use

Ukraine has signed and ratified both the UNFCCC and the Kyoto Protocol (see Table 34-5). As an Annex I country, Ukraine is eligible to host Joint Implementation (JI) projects.

Table 34-5. Ukraine’s Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 11, 1992	May 13, 1997
Kyoto Protocol	March 15, 1999	April 12, 2004

Source: UNFCCC (2005); UNFCCC (2007a)

Per the Kyoto Protocol, Ukraine must stabilize greenhouse gas (GHG) emissions at the 1990 level of 55.4 million tonnes of carbon dioxide equivalent (MmtCO₂e). Emission reductions since 1990 due largely to coal mine closures have resulted in current estimated emissions of 28.5 MmtCO₂e (UNFCCC, 2007).

34.3.1 MARKET AND INFRASTRUCTURE FACTORS

In Ukraine, mineral resources and mines are owned by the state. Existing mines are operated under licenses. While methane in coal is owned by the state, it is assigned to companies, mines, and individuals. CBM/CMM development is subject to the approval of the Coal Industry Ministry (M2M Workshop - Ukraine, 2005).

Most CMM that is not flared is currently used for basic applications such as boiler firing and mine air heating. There is significant potential, however, for CMM to fuel power generation in gas or dual-fuel power plants, to supplement supplies for other residential, commercial, and industrial uses, or to be converted into transportation fuel. In 2008, Ukraine imported 79.4 percent of its natural gas requirements (EIA, 2010) and so the potential markets for CMM in Ukraine are significant, especially as prices for natural gas increase. The principal barrier to expanding the use of CMM is poor market access, including the lack of modern infrastructure to gather and transport methane produced by CMM processes to internal end use markets and to existing international pipelines that serve foreign markets, mainly Western Europe.

34.3.2 REGULATORY INFORMATION

The state typically owns coal mines and coal resources, including methane, but many successful mines are leased or are privatized. Approximately 25 coal mines have been privatized, which represent roughly 40 percent of Ukraine's annual coal production (IEA, 2006). The remaining mines are state owned and are referred to as Joint Stock Holding Companies (Triplett, 2006). Independent mines include the Komsomokts Donbassa Mine, the Yuzhnodonbasskaya #1 and #3 Mines, and the Zasyadko Mine.

State programs to advance CMM production, have previously relied mainly on private investment. Government support has taken the form of various tax incentives to attract investment in coal regions and exempting foreign-manufactured materials and equipment used in CMM development from Ukraine's value-added tax.

On February 22, 2006, the Ukrainian Cabinet officially approved a set of Joint Implementation procedures formally outlining the federal government's procedures for consideration, approval, and implementation for domestic companies such as coal mines to carry out JI projects under Article 6 of the Kyoto Protocol; several projects have already been submitted under these guidelines.

More recently, Ukraine has undertaken several important policy steps to promote the capture and use of CMM. On September 25, 2008, the Ukrainian Parliament passed a law on green electricity tariffs. The law provides incentives for electricity produced from alternative sources like CMM. It guarantees access to the grid for such power facilities, and it provides a special tariff for alternative power that is about twice the normal wholesale power price. When implemented, this law should help attract investment to several proposed CMM power projects in Ukraine. The National Electricity Regulatory Commission must set the specific tariff for each approved type of alternative energy for the law to become effective (USEPA, 2009a).

In early 2009, Ukraine's Parliament passed the first reading of the Law on Gas (Methane) from Coal Beds. The draft law would not allow new mines to begin operating unless they brought concentrations of methane down to acceptable levels. Existing mines would also face restrictions on releasing methane to the atmosphere. In addition, the draft law clarifies ownership issues, making it easier for third parties to obtain licenses to use vented CMM. Finally, it clarifies that CMM owners can sell their gas into the natural gas transmission system when the gas meets system requirements (USEPA, 2009a).

In June 2009, Ukrainian President Viktor Yuschenko signed important coal mine legislation that includes a tax exemption for Ukrainian CMM projects. Starting in 2010 and continuing through January 2020, profits from the production and use of CMM earned by Ukrainian enterprises will no longer be subject to taxation. Additionally, the Ukrainian National Electricity Regulatory Commission is authorized to set price limits for methane if its production is funded from the state budget. The government plans to grant state support and guarantees to the producers and suppliers of energy from CMM to help increase the production and use of methane from coal deposits (USEPA, 2009b).

34.4 Profiles of Individual Mines

Twenty-nine mines have been identified as primary opportunities for CBM/CMM development in Ukraine. These mines have been profiled in great detail by the Partnership for Energy and Environmental Reform in its *Handbook on Opportunities for Production and Investment in the Donetsk Basin* (PEER, 2001).

The Yuzhno-Donbasskaya #3 Mine is profiled below. Other updated profiles are available on the M2M website under “Projects” (M2M Partnership, 2010).

Yuzhno-Donbasskaya #3 Mine

Mine Status	Active	Mine Owner	Donetskya Vulgina Energetichna Kompanya			
Mining Method	Longwall	Parent Company	State			
Depth of Seams	585–940 m	Location	Vugledar, Donetsk			
No. of Seams	2 – C ₁₁ & C ₁₀	2008 VAM Volume	30.32. Million m ³			
Seam Thickness	1.5–1.7 m	2008 Drained Methane (CH₄) Volume	2.9 Million m ³			
2008 Coal Production	1.2 million tonnes	2008 Utilized CH₄ Volume	0			
	1997	1998	1999	2000	2001	2002
Coal Production (thousand tonnes/year)	1019	1053	1224	1273	1569	1510
Methane (million m ³ /year)						
Emitted from ventilation systems	15.56	23.70	15.27	12.31	31.23	49.66
Liberated from drainage systems	2.58	1.00	2.89	2.9*	2.9*	2.9*
Total Methane Emissions	18.14	24.70	18.16	15.21	34.13	52.56
	2003	2004	2005	2006	2007	2008
Coal Production (thousand tonnes/year)	1289	1190	1266	1200*	1200*	1200*
Methane (million m ³ /year)						
Emitted from ventilation systems	46.97	53.75	47.97	35.00	32.90	30.32
Liberated from drainage systems	2.9*	2.9*	2.9*	2.9*	2.9*	2.9*
Total Methane Emissions	49.87	56.65	50.87	37.90	35.80	33.12

Source: M2M Partnership (2010)

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