

# 30 UKRAINE



## 30.1 Summary of Coal Industry

### 30.1.1 ROLE OF COAL IN UKRAINE

Ukraine produced approximately 1 percent of total world coal production in 2005 (see Table 30-1), making it the thirteenth largest producer of coal in the world (IEA, 2005). BP ranked Ukraine as eleventh in production in their 2007 survey report (BP, 2007).

**Table 30-1. 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 (2005)*	16,274	17,879	34,153	7 (3.9%)
Annual Coal Production (2005)**	60.0	0.4	60.4	13 (1.10%)

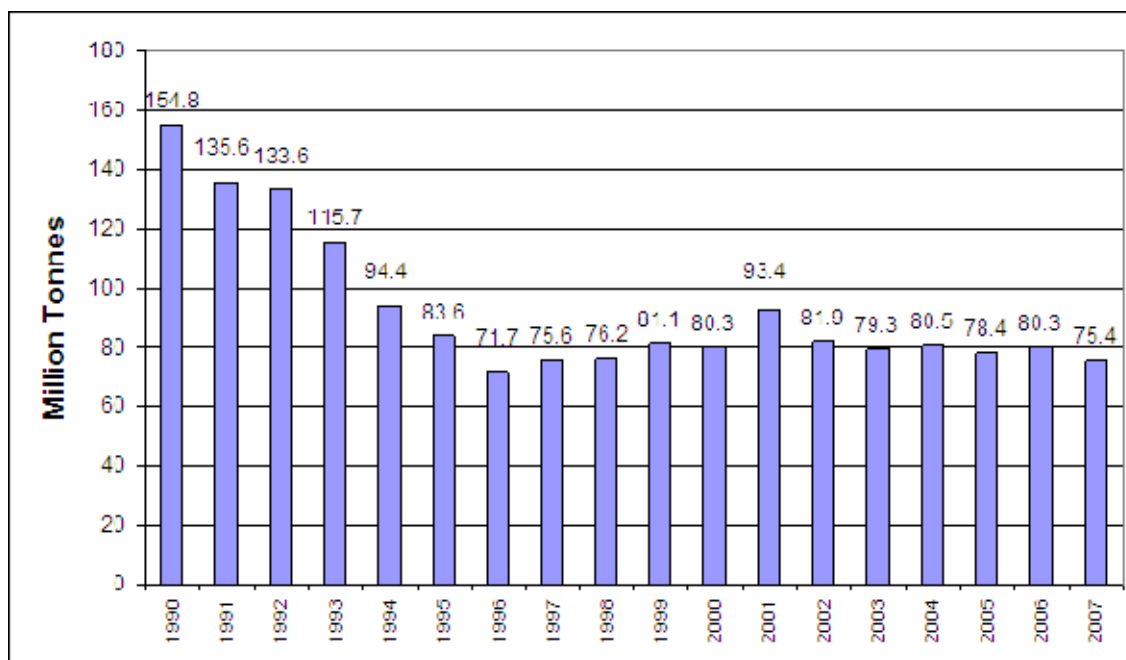
Source: \*EIA (2007a); \*\*IEA (2007)

In 2005, almost all of Ukraine's production was hard coal—0.4 Mmt of lignite was produced comprising only 0.7 percent of total coal production (IEA, 2005). As reflected in Table 30-1, Ukraine's total coal reserves as of 2005 were 34.2 billion tonnes, of which about 16.3 billion tonnes were hard coals and 17.9 billion tonnes were soft coals (sub-bituminous and lignite) (EIA, 2007a). In 2000, World Energy Council estimated proven reserves at a similar 33.9 billion tonnes (WEC, 2000). However, contrary to the data reported in Table 30-1, 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, with only 130 seams exceeding 0.45 meters in thickness, and only 10 suitable for development (M2M Workshop – Ukraine, 2005). The remaining seams are too deep or too thin.

It should be noted that Table 30-1 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 (Rapsun, 2008).

Coal production in Ukraine has been declining significantly, falling by almost 50 percent from 154.8 million tonnes (Mmt) in 1990 to 80.5 Mmt in 2004 (PEER, 2005), as seen in Figure 30-1. Another source estimates the reduction in coal production from 116.5 Mmt in 1992 to 60 Mmt in 2004 (EIA, 2007b).

Figure 30-1. History of Ukraine's Coal Production

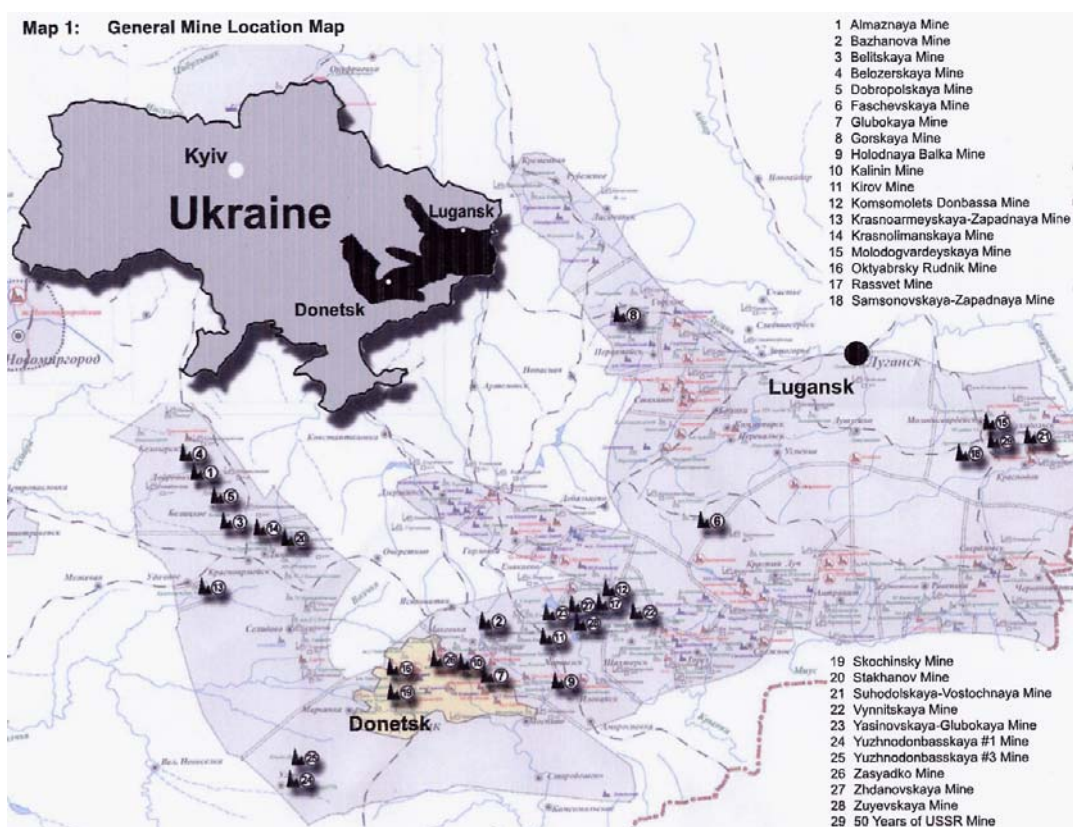


Source: PEER (2005); Raptsun (2008)

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. In 2003, coal supplied 23 percent of Ukraine's total energy consumption (PEER, 2005). Due to the same reasons and high coal production costs, Ukraine is not among the world's major coal exporters. In 2004, 69.1 percent of the country's rated generating capacity was in thermal sources (coal, oil, and gas-fired), compared to nuclear at 22.6 percent and hydroelectric at 8.3 percent (EIA, 2004). However, thermal production's role has been declining as nuclear generation capacity is increasing. In 1998, thermal generation provided 47 percent of the demand compared to hydroelectric at 12.2 percent and nuclear at 36.3 percent (WEC, 2000). By 2004, thermal was down to 45.3 percent and nuclear had increased to 47.9 percent (EIA, 2004).

Coal is produced in two major basins in Ukraine, the Donetsk Basin (60,000 km<sup>2</sup>) in southeastern Ukraine (and western Russia), and the Lviv-Volyn basin (7,500 km<sup>2</sup>) in western Ukraine, which continues into Poland (Sachsenhofer, 2002; M2M-Ukraine, 2005). The Donetsk Basin is commonly referred to as "the Donbass" (Figure 30-2).

Figure 30-2. Ukraine’s Coal Fields



Source: PEER (2000)

### 30.1.2 STAKEHOLDERS

Potential stakeholders in coal mine methane (CMM) development in Ukraine are listed in Table 30-2.

Table 30-2. Key Stakeholders in Ukraine’s CMM Industry

Stakeholder Category	Stakeholder	Roles
Coal Associations	▪ Makayevugol Coal Association	Potential project hosts
	▪ Dobropolyengol	
	▪ Dobropolye	
	▪ Luganskugol	
	▪ Pervomayskugol	
	▪ Donugol	
	▪ Krasnodonugol	
	▪ Oktyabrugol	
	▪ Donetsk Region Administration	
	Equipment Manufacturers	
▪ Zeppelin Ukraine (Ukrainian division of Caterpillar)		
▪ GE Jenbacher (Austria)		

Stakeholder Category	Stakeholder	Roles
Developers	<ul style="list-style-type: none"> <li>▪ EcoMetan</li> <li>▪ EnergoImpex</li> <li>▪ EuroGas (Lviv-Volyn Basin)</li> <li>▪ See <a href="http://www.epa.gov/coalbed/netwrokcontacts.html">www.epa.gov/coalbed/netwrokcontacts.html</a></li> </ul>	Project opportunity identification and planning
Engineering, Consultancy, and Related Services	<ul style="list-style-type: none"> <li>▪ REI Drilling (USA)</li> <li>▪ Advanced Resources International Inc. (USA)</li> <li>▪ See <a href="http://www.epa.gov/coalbed/netwrokcontacts.html">www.epa.gov/coalbed/netwrokcontacts.html</a></li> </ul>	Technical assistance
Government Groups	<ul style="list-style-type: none"> <li>▪ Ministry of Fuel and Energy of Ukraine</li> <li>▪ Coal Industry Ministry</li> </ul>	Project approval
Universities, Research Establishments	<ul style="list-style-type: none"> <li>▪ Partnership for Energy and Environmental Reform</li> </ul>	Technical assistance

### 30.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

Ukraine has experienced a steep decline in coal production since 1990. However, the country's annual coal production has stabilized at approximately 80 Mmt in recent years (PEER, 2005) or 60 Mmt according to EIA (2007c). About one-half of the production is steam coal and the remainder is coking coal. Stabilization and a slight increase in coal production have resulted from the closure of uneconomical mines, increased cash receipts for coal sales, and a reduction in barter transactions. With current reserves sufficient to last for over 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, 2000), 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 3 were surface mines (UA, 2005; PEER, 2002).

Most of the mines in Ukraine are underground (Table 30-3) producing bituminous coal. 151 of the 165 active mines in 2002 were in the Donetsk basin (all but three underground), while the remaining 14 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 30-3. Ukraine's Coal Mines and Production**

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

Source: PEER (2005)

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

## 30.2 Overview of CMM Emissions and Development Potential

The Methane to Markets International CMM Projects Database currently identifies nine CMM recovery projects in Ukraine, eight of which are in place in active, underground mines in the Donbass and one in the Lugansk basin. The methane is used for boiler fuel in four of these

projects, for combined heat and power in two, for industrial use in one, and for power generation in the remaining two (M2M Projects, 2008). Four projects are currently proposed to expand activities, and improve capture and utilization (M2M Partnership, 2007).

### 30.2.1 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 30-4). The data in this table may vary from the USEPA data presented in the Executive Summary due to differences in inventory methodology and rounding of digits.

**Table 30-4. Ukraine's CMM Emissions (million cubic meters)**

Emission Category	1990	1991	1992	1993	1994	1995	1996	1997
Underground mining - active	3557.51	3276.00	3161.00	2615.28	2414.07	1945.49	1881.85	1839.08
Underground - post-mining	306.41	253.07	251.81	219.87	180.82	160.20	138.05	146.72
Surface mining - active	12.79	9.91	7.97	5.72	3.68	3.16	2.19	1.97
Surface - post-mining	1.83	1.41	1.14	0.82	0.52	0.45	0.31	0.28
Total Emissions	3878.53	3540.40	3421.92	2841.69	2599.10	2109.30	2022.41	1988.05
Additional Recovered and Flared	144.77	137.97	88.22	69.38	94.89	89.03	48.06	56.74

Emission Category	1998	1999	2000	2001	2002	2003	2004	2005	2006
Underground mining - active	1852.92	1819.07	2039.44	1684.68	1911.38	1864.53	1890.53	1837.13	1871.18
Underground - post-mining	146.72	157.36	156.06	163.33	160.77	156.83	159.02	154.53	157.39
Surface mining - active	1.93	1.63	1.47	1.43	1.23	0.88	0.77	0.43	0.43
Surface - post-mining	0.27	0.23	0.21	0.20	0.18	0.13	0.11	0.06	0.06
Total Emissions	2001.84	1978.29	2197.18	1849.65	2073.55	2022.37	2050.42	1992.14	2029.06
Additional Recovered and Flared	83.26	78.93	72.91	134.28	152.35	148.62	150.69	146.43	149.18

Source: UNFCCC (2007); Raptsun (2008)

Another source estimates that in 2004, 1,221 million m<sup>3</sup> of CMM was emitted by underground coal mines, 357 million m<sup>3</sup> of which was drained by degasification systems and 179 million m<sup>3</sup> 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, none of those 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 coal bed methane (CBM) projects.

In August 2005, the U.S. Trade and Development Agency (USTDA) awarded a \$585,570 grant to the Donetsk Regional Administration for conducting a feasibility study on commercial development of CBM and 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 and CBM (USTDA, 2005).

### 30.2.2 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. 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.

### 30.2.3 CBM FROM VIRGIN COAL SEAMS

Ukraine's CBM resource is approximately 1.7 trillion m<sup>3</sup> (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).

In 1999, Ukraine's Cabinet of Ministers adopted an Energy Program which sets a CBM use goal of 8 billion m<sup>3</sup> by 2010 (M2M Workshop-Ukraine, 2005). Ukraine has very limited 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.

## 30.3 Opportunities and Challenges to Greater CMM Recovery and Use

Ukraine has signed and ratified both the UNFCCC and the Kyoto Protocol (see Table 30-5). As an Annex I country, Ukraine is eligible to host Joint Implementation (JI) projects.

**Table 30-5. 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 (2004); UNFCCC (2005)

Per the Kyoto Protocol, Ukraine must stabilize greenhouse gas emissions at the 1990 level of 854.1 Mmt CO<sub>2</sub>e. Emission reductions since 1990 due largely to coal mine closures have resulted in current estimated emissions of 565 Mmt CO<sub>2</sub>e (M2M-Ukraine, 2005).

### 30.3.1 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 currently is 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. Ukraine currently imports 78.1 percent of its natural gas requirements (EIA, 2007c). The potential markets for natural gas and CMM in Ukraine and the surrounding region 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.

### 30.3.2 REGULATORY INFORMATION

The state typically owns the 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. Pending legislation may further privatize the industry.

State programs to advance CMM production do not appear to include direct government funding but rely instead on private investment. In 1998, a law was passed establishing Free Economic Zone status to the Donetsk Region, which provides for various tax incentives to attract investment (PEER, 2000). Legislation passed by the Rada (Ukrainian Parliament) exempts foreign-manufactured materials and equipment used in CMM development from Ukraine's value added tax through 2008. Additional tax exemptions, credits, and deferrals may still be needed to stimulate private investment in CMM development.

On February 22, 2006, the Ukrainian Cabinet officially approved a set of JI 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.

## 30.4 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, 2000).

Table 30-6 summarizes mine data of the major Donetsk Basin Mines considered to have the best CMM potential.

**Table 30-6. Major Donetsk Basin Mines with Significant CMM Development Potential**

Name of Mine	Methane Liberated by Mining (million m <sup>3</sup> /year)			Methane Utilized (million m <sup>3</sup> /year)	Methane Content in Captured Gas (percent)	Specific Methane Emissions (m <sup>3</sup> /tonne)	Coal Production (thousand tonnes/year)
	Ventilation	Degasification	Total Emissions				
Almaznaya	10.93	0.21	11.14	0.00	11 – 12	20.50	543.20
Bazhanova	22.92	13.25	36.17	9.88	50.0	31.08	1,136.80
Belitskaya	3.08	2.05	5.13	0.00	7.8	22.53	227.70
Belozerskaya	7.99	1.79	9.78	0.00	22.0	24.76	395.50
Dobropolskaya	9.20	0.79	9.99	0.00	3.2	8.23	1,213.00
Faschevskaya	11.97	1.55	13.52	0.00	12.0	47.55	284.90
Glubokaya	33.40	7.90	41.30	5.41	42.0	59.66	692.60
Gorskaya	8.24	0.00	8.24	0.00	NA	32.58	252.90
Holodnaya Balka	29.40	15.70	45.10	12.62	66.0	74.08	608.80
Kalinin	44.57	2.94	47.51	0.00	22.0	143.66	330.70
Kirov	8.41	7.31	15.72	0.00	33.0	16.40	958.10
Komsomolets Donbassa	116.81	11.56	128.37	4.20	30.0	93.43	1,373.90
Krasnoarmeyskaya - Zapadnaya	78.73	12.40	91.13	0.00	30 – 38	25.0	3,137.50
Krasnolymanskaya	40.21	21.56	61.77	0.00	19.5	18.93	3,263.75
Molodogvardeyskaya	10.38	4.23	14.61	0.00	19.6	27.28	535.60
Oktyabrsky Rudnik	12.30	1.26	13.56	0.00	6.0	40.20	337.22
Rassvet	36.11	5.26	41.37	0.00	20.0	116.44	355.30
Samsonovskaya – Zapadnaya	NA	NA	NA	NA		NA	
Skochinsky	34.6	3.99	38.59	0.00	38.0	49.15	784.70
Stachanova	35.45	16.78	52.23	0.00	42.0	33.51	1,558.50
Suhodolskaya – Vostochnaya	52.50	7.10	59.60	0.00	15.0	286.50	208.00
Vinnitskaya	8.80	3.20	12.00	0.00	22.0	37.24	322.20
Yasinovskaya – Glubokaya	19.88	1.84	21.72	0.00	18.0	65.46	331.80
Yuzhno – Donbasskaya #1	15.38	1.89	17.27	0.00	13.5	15.24	1,133.40
Yuzhno – Donbasskaya #3	15.27	2.89	18.16	0.00	25.0	14.83	1,224.90
Zasyadko	79.10	30.60	109.70	12.36	30.0	36.20	3,027.00
Zhdanovskaya	12.98	2.26	15.24	0.00	17.2	30.35	502.10
Zuyevskaya	33.00	3.10	36.10	0.00	30.5	99.60	362.50
50 Years of the USSR	21.76	0.00	21.76	0.00	NA	34.36	633.20

Source: PEER (2000)

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