26 Russia

26.1 Summary of Coal Industry

26.1.1 Role of Coal in Russia

Russia's coal industry became a principal sector of the country's economy at the end of the 1930s. By 1950, coal accounted for 59 percent of Russia's fuel balance. The discovery of huge oil and natural gas reserves in the 1960s coupled with the development of nuclear power, however, led to decreasing dependence on coal. Today, more than 40 percent of coal consumed in Russia is used for heat and power generation. Natural gas is the principal competitor with coal in these end uses. Coal accounts for approximately 16 percent of domestic energy production (EIA, 2007a).

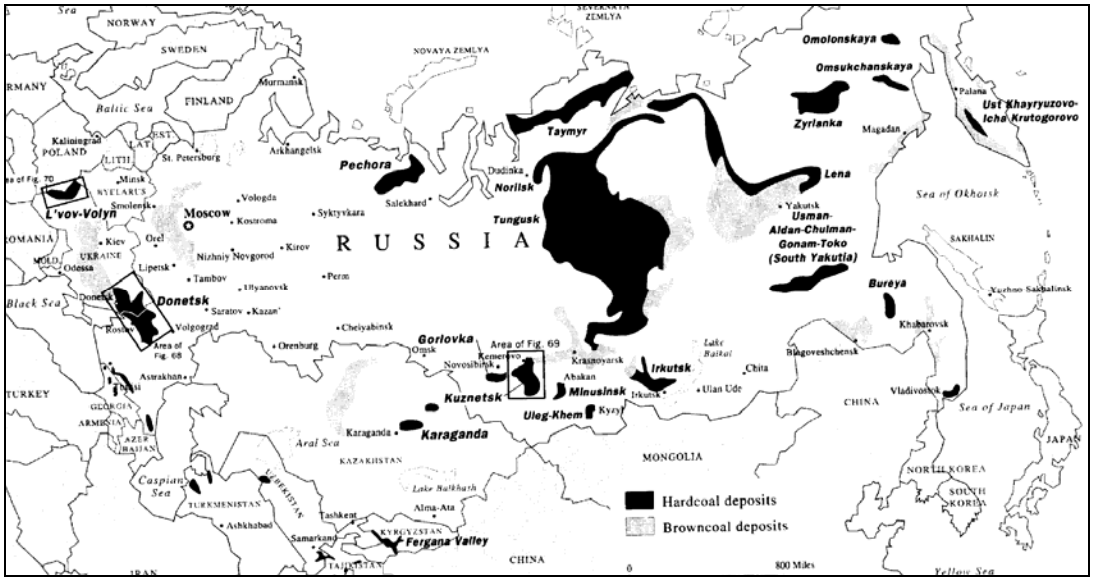
Russia is ranked fifth in global coal production and has coal reserves of approximately 157 billion tonnes, which is second worldwide only to the United States (see Table 26-1). Russia exported 90.72 million tonnes of coal in 2004 (EIA, 2007b).

Table 26-1. Russia's Coal Reserves and Production

Indicator	Anthracite & Bituminous (million tonnes)	Sub-bituminous & Lignite (million tonnes)	Total (million tonnes)	Global Rank # (%)
Estimated Proved Coal Reserves (2005)*	49,088	107,923	157,011	2 (18.1%)
Annual Coal Production (2005)**	202.9	73.7	276.6	5 (5.03%)

Source: *EIA (2007c); **IEA (2007)

Figure 26-1. Russia's Coal Fields



Source: Schwochow (1997)

Figure 26-1 highlights Russia's hardcoal and browncoal deposits. As seen, coal is found in the Kuzbass, Kansko-Achinsky, Pechora, Irkutsk, and South-Yakutia basins (Malyshev, 1998; Tailakov, 2005a).

26.1.2 STAKEHOLDERS

Table 26-2 lists potential stakeholders in coal mine methane (CMM) development in Russia.

Table 26-2. Key Stakeholders in Russia's CMM Industry

Stakeholder Category	Stakeholder	Role
Mining Companies	▪ Severstal-Resource ▪ Evraz Holding ▪ MDM ▪ Ural Mining and Metallurgical Company ▪ Sibirsky Delovoy Soyuz ▪ Sibuglemet ▪ Belon ▪ Mechel ▪ Siberian Coal Energy Company	Project hosts
Equipment Manufacturers	▪ Kyshtym Machine Works ▪ Druzhkov Machine Works ▪ Artemovsk Machine Works ▪ VENTPROM ▪ Yurga Machine Works	Power generation equipment supplier
Developers	▪ Uglemetan ▪ See http://www.epa.gov/coalbed/networkcontacts.html	Project opportunity identification and planning
Engineering/Consultancy	▪ Uglemetan ▪ See http://www.epa.gov/coalbed/networkcontacts.html	Technical assistance
Universities/Research Establishments	▪ Institute of Coal and Coal Chemistry ▪ Russian Academy of Sciences Skochinsky Mining Institute ▪ Russian Academy of Sciences URO Mining Institute ▪ Moscow State Mining University ▪ Promgas ▪ VostNII ▪ Skochinsky Mining Institute	Technical assistance
Natural Gas Transmission & Distribution Companies	▪ Gazprom	Distribution and pipeline sales
Government Groups	▪ Federal Ministry of Natural Resources ▪ Russian Federation Ministry of Energy ▪ Russian Federal Mining and Industrial Inspectorate (RosTechNadzor) ▪ Regional administrations	▪ Licensing ▪ Project approval ▪ Safety standards for mines ▪ Regional environmental and safety rules and requirements

26.1.3 Status of Coal and the Coal mining Industry

The coal mining industry in Russia is privatized. Between 1996 and 2001, Russia worked with the World Bank to restructure the country's coal industry. As a result, the state monopoly, formally known as RosUgol, has been dissolved, and roughly 77 percent of domestic coal production comes from independent producers (EIA, 2007a). Table 26-3 presents production statistics for Russian coal mining.

Table 26-3. Russia's Recent Coal Mining Statistics (2003)

Type of Mine	Production (million tonnes)	Number of Mines
Underground (active) mines – total	93.1	92, 209*
Surface (active) mines – total	182.9	119, 64*
Total mines	276.0	201, 273*, 224**

Source: Tailakov (2005a), *Lawson (2002), **Coal (2008)

In Russia, 78 out of 92 underground mines are considered gassy (Tailakov, 2005a). Another report on gassy coal mines states that there are 82 coal mines of "potential methane hazard functioning now." Fifty of those mines are abundant in methane, and 22 of those are using degassing technology (M2M Symposium, 2006).

26.2 Overview of CMM Emissions and Development Potential

The Methane to Markets International CMM Projects Database currently identifies seven CMM recovery projects in Russia. All are in place in active underground mines. Four projects in the Pechora basin and one in the Kuznetsk basin (also known as the Kuzbass) provide boiler fuel, and two remaining projects (one in the Kuzbass) provide power generation (M2M Projects, 2008). A project is proposed for recovery and use of gob gas for two mines (M2M Partnership, 2007).

26.2.1 CMM Emissions from Operating Mines

CMM in Russia is primarily located in three coal basins: Kuznetsk, Pechora, and Donetsk ("Donbass", the majority of which is situated in Ukraine). The Kuzbass accounts for 78 percent of CMM reserves located in former USSR, and the Pechora Basin accounts for 12 percent (Uglemetan, 2004a). Methane emissions from all Russian coal mines are summarized in Table 26-4. 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 26-4. Russia's CMM Emissions (million cubic meters)

Emission Category	1990	1991	1992	1993	1994	1995	1996	1997	1998
Underground coal mines	1913.51	1654.72	1657.10	1632.57	1469.25	1508.81	1446.00	1447.10	1390.43
Surface mines	932.76	932.76	860.59	749.05	706.44	658.37	674.07	675.61	686.36
Total	2846.27	2515.30	2406.15	2339.01	2127.62	2182.88	2121.61	2133.46	2131.86

Emission Category	1997	1998	1999	2000	2001	2002	2003	2004	2005

Underground coal mines	1286.18	1625.28	1654.85	1449.32	1756.40	2050.90	1781.12	1286.18	1625.28
Surface mines	814.29	853.01	941.84	944.87	1071.76	1135.13	1197.61	814.29	853.01
Total	2100.47	2478.29	2596.70	2394.19	2828.16	3186.03	2978.73	2100.47	2478.29

Source: UNFCC (2007a)

The Kuzbass had 47 active mines in 2003 (Tailakov, 2003). Methane emissions from mines in the Kuzbass are quantified in Table 26-5.

Table 26-5. Kuzbass CMM Emissions (million cubic meters)

Emission Category	1990	1991	1992	1993	1994	1995	1996
Underground coal mines – ventilation emissions	860.5	797.1	774.7	761.3	704.5	627.7	704.5
Post-underground emissions	31.3	24.1	25.9	23	21.3	20.9	19
Surface mine emission (total)	376.3	407	269.2	248.1	239.4	249.5	251.8

Emission Category	1997	1998	1999	2000	2001	2002
Underground coal mines – ventilation emissions	627.7	1399	1483	1458	1446	1443
Post-underground emissions	18.8	16.4	–	–	–	–
Surface mine emission (total)	266	294	–	–	–	–

Source: Tailakov (2005a)

In the Pechora Basin, methane drainage began in 1956 at the Severnaya, Komsomolsksya, Vorkutinskaha, and Zapolyarnaya mines. The mines in the basin vented 289.8 million m^3 of methane in 1998 (RRR, 2001). In 2000, vented methane in the Pechora Basin decreased to 42.05 million m^3 (Uglemetan, 2005). The wide disparity between the ventilation emissions was the result of mine closures between 1998 and 2000. In 1998, the seven Pechora Basin mines had an average degasification efficiency of about 0.5. By 2000, three of the mines in the basin were closed and only Severnaya, Komsomolsksya, Vorkutinskaya, and Zapolyarnaya mines have continued mining operations. The average degasification efficiency of those mines is significantly higher, accounting for degasification efficiency of 0.7 on average, resulting in more drainage and less ventilation emissions in 2000.

In 2000, 32 million m^3 were utilized in Vorkutaugol, which is equivalent to less than 20 percent of drained methane. Active coal mines in the Vorkuta region contain an estimated 40 billion m^3 of recoverable methane (RRR, 2001).

26.2.2 CMM Emissions from Abandoned Coal Mines

There are 43 abandoned mines in Kuzbass, 39 of which are monitored. Methane is registered at 32 mines, 14 of which have dangerous methane concentrations. Explosive methane concentrations are reported at five mines (Uglemetan, 2005). Beneficially using methane at or near the explosive range presents technical and safety challenges.

26.2.3 CBM from Virgin Coal Seams

Russia is estimated to have significant coalbed methane (CBM) resources – 75-80 trillion m^3 in coal seams. Methane resources in Kuzbass are 2.49 trillion m^3 above 600 meters and 7.45 trillion m^3 between 600 and 1,200 meters. There are no industrial boreholes in Kuzbass, but there are approximately five experimental ones (Malyshev, 2000). Another source estimates Kuzbass CBM

resources to be 94 billion m^3 in active degasification areas and another 120 billion m^3 in areas where degasification is expected to be conducted in the future, for a total of 214 billion m^3 (M2M Workshop – Russia, 2005). The Pechora basin's CBM resource is estimated at 2.26 to 3.40 trillion m^3, but the area's harsh climate may limit exploitation of this resource. There are no reliable estimates of CBM resources in the remote Tungusk basin (U.S. Congress, 1994). It is estimated that if appropriate technology is deployed and if an economic environment favorable for CMM is created, Russian CMM production of up to 2 billion m^3 per year could result (M2M Workshop – Russia, 2005).

On April 17, 2008, the company Arcticheskie razrabotki (Arctic Developments) won a license for the Apsatskoe coking coal and methane deposit in an auction. The company paid 1.325 billion rubles for the lot. The starting price was 530 million rubles. The Apsatskoe deposit is located in the north of the Chita region and covers an area of 100 km^2. The maximum depth of occurrence of a carboniferous horizon is 2.5 km. The upper horizon carboniferous horizon is 100 percent coking coal and the lower is 85 percent. The confirmed reserves of the deposit are 3.2 million tonnes of C1 category and 0.09 million tonnes of C2 category. The deposits contain about 180 billion m^3 of methane. The winner, after paying a one-off fee, will obtain subsurface usage rights at the site for a period of 20 years (Yuzhannikova, 2008).

The following projects designed to reduce impediments to CBM/CMM development have been initiated:

- In 2003, a Global Environment Fund/United Nations Development Programme project began to remove barriers to financing and implementing CMM recovery. This project will include establishing a CMM Recovery and Utilization Company that is expected to remain as a self-sustaining entity following project completion.
- Also in 2003, GAZPROM implemented a pilot well drilling program to assess the feasibility of establishing a new CBM-based fuel and energy complex in southern West Siberia and to identify priority areas in the Kuzbass for CBM/CMM development. As of late 2005, four experimental CBM wells (from 640 to 980 meters deep) were in place communicating with five to seven coal seams. Gas production ranged from 1,000 to 3,000 m^3 per day, following a month of dewatering.
- In early 2005, the Rosnauka, a federal agency in the Ministry of Science and Higher Education, began an effort to accelerate CBM/CMM development projects to improve mine safety and reduce greenhouse gas emissions. This activity involved improving stimulation techniques to enhance methane desorption and drainage, improving methane production and utilization technologies, organizing a scientific and educational center for CBM/CMM development and coordinating same with foreign experts, and developing a CBM/CMM business plan.

26.3 Opportunities and Challenges to Greater CMM Recovery and Use

It was Russia's ratification of the Kyoto Protocol that brought it into force worldwide in 2004 (see Table 26-6). In doing so, Russia accepted a greenhouse gas emission reduction target of 17.4 percent of its baseline emissions. As an Annex I country, Russia is eligible to host Joint Implementation (JI) projects. On May 28, 2007 Directive No. 332 enabled full participation in JI projects. Russia's Economic Development and Trade Ministry will coordinate the JI program. Under the directive, companies planning to implement JI projects must apply for approval from the Ministry; applications will be accepted between January 1, 2008 and December 31, 2012. In

January of 2007, the Trade Ministry also drafted general regulations on the JI program and emission credits trading (USEPA, 2007).

Table 26-6. Russia's Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 13, 1992	December 28, 1994
Kyoto Protocol	March 11, 1999	November 18, 2004

Source: UNFCCC (2007b); UNFCCC (2007c)

26.3.1 Market and Infrastructure Factors

Mines in Russia use traditional ventilation systems as well as bleeder shafts. Traditional drainage is conducted to a very limited extent mainly using gob wells. Collected CMM most likely would be used by the coal mines themselves as well as by manufacturing companies that use large amounts of natural gas. Table 26-7 lists total consumption by potential CMM markets in Kuzbass.

Table 26-7. Total Consumption by Potential CMM Markets

Market	Electrical Power (million kilowatt hours)	Thermal Power (thousand Gcal)	Natural Gas (million cubic meters)
All sectors*	21,343	31,113	3,010
Industry	18,387	23,940	2,971
Fuel industry	4,385	5,570	N/A

Source: *Tailakov (2005b)

Russia has many barriers to expanded CMM/CBM development. First, CMM and CBM must compete with large, in-country proven gas resources with low-cost production capacity. Second, state regulations keep the large gas supply at a low sales price, making it difficult for a CMM project to achieve financial viability. The current natural gas price is 760 RUR value-added-tax (VAT)-free per 1,000 m^3. Power generation projects are not easily made financially viable either; the price per kWhr of electrical power for industrial entities ranges from 0.43 to 0.98 RUR. Coal prices (for ROM D-grade coal) vary from 450-600 RUR without VAT. Third, the region lacks the technological capability to extract CBM economically from saturated, low-permeability coal seams. Finally, there is a general lack of state support for unconventional fuel production (M2M Workshop-Russia, 2005).

Despite these barriers, many positive aspects related to Russia's CMM development potential exist. Mining and geological conditions are similar to those in Australia, Canada, and the United States. Further, expected CBM production rates are promising and natural gas infrastructure and markets exist within 20 to 100 km of high-priority CBM/CMM production areas (M2M Workshop-Russia, 2005).

CMM project potential has been studied by the not-for-profit organization "International Coal & Methane Research Center - Uglemetan" and by ICF Consulting Ltd. Their joint involvement resulted in a United Nations Development Program/Global Environment Facility project titled "Russian Federation - Removing Barriers for CMM Recovery & Utilization," which has been approved by the Russian Federation Ministry of Energy. The expected project financing will amount to about 10 million USD. The project will mitigate greenhouse gas emissions by removing barriers to implementing and financing CMM recovery and utilization projects in Russia. Its initial focus will be on the Kuzbass region, with further replication potential expected

in other coal producing areas in Russia and elsewhere (Tailakov, 2005c). For more information on the project, see Uglemetan (2004b).

26.3.2 Regulatory Information

CBM, like any other mineral resource in Russia, is owned by the state. A license is required for methane extraction. There are three types of licenses: exploration license, production license, and combined license. The license is applied for at the Territorial Authority representing the Federal Ministry of Natural Resources, which publishes a tender announcement. The tender is held with a minimum starting price determined by the Federal Agency and it typically takes about a year to obtain a license. At this time, CMM use licensing lacks clarity. Currently, according to some officials, extracted methane can be used to meet the mine's own needs, but a license is required to sell methane utilization products (Tailakov, 2005c).

Russia offers significant opportunity for foreign investment in CMM projects because of its large CMM resources and a significant market for clean energy. Although rules and regulations on foreign investment in Russia are complex, the investment climate is improving (Tailakov, 2005c). CMM projects are expected to be pursued through Production Sharing Agreements (PSAs), which provide exemptions from all federal taxes with the exception of certain payments for subsoil use, a modified profits tax, VAT and excise on domestic purchases, and unified social tax during the period of PSA validity. For more information on PSAs and the current investment climate in Russia, see Uglemetan (2004b). Methane extraction from virgin seams and sale is taxed at 7 percent and is subject to a single license fee. There are no royalties if methane is used for mine's own needs.

Russian mines are subject to safety regulations. A "Guide for Safe Operation of CMM Energy Units" has been prepared by the local mine safety institute in Kuzbass to provide guidelines to coal mines for the safe installation of CMM recovery and utilization systems. According to the regulations, drained gas must have a minimum methane concentration of 30 percent to ensure that it is not within the explosive range. In addition, the regulations cover various aspects of flame safety (using flame arresters, etc.), but Kuzbass mines do not flare gas emissions at this time (Tailakov, 2005c).

There have recently been some positive regulatory and energy market developments that could prove stimulating for CMM utilization on a larger scale. These developments include government decisions on gradual price increases for natural gas for industrial and residential users, liberalization of electricity market, and inclusion of CMM in the list of renewable energy sources in the 2007 Amendment to the Law on United Energy System. These developments will facilitate creation of a market where CMM could become competitive with other energy sources.

26.4 Profiles of Individual Mines

Limited information profiling individual mines in Russia was found (Tailakov, 2003; USEPA, 1996).

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