30 RUSSIA

30.1 Summary of Coal Industry

30.1.1 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, however—along with the development of nuclear power—led to decreasing dependence on coal. As of 2007, 15.2 percent of Russia's total primary energy supply came from coal/peat (IEA, 2007a). 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.

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 30-1). Russia exported 104.5 million tonnes (Mmt) of coal in 2008 (EIA, 2008a). Russia's 2009 energy strategy estimates an increase in coal exports by 160 percent from 2008 to 2020 (IEA, 2009).

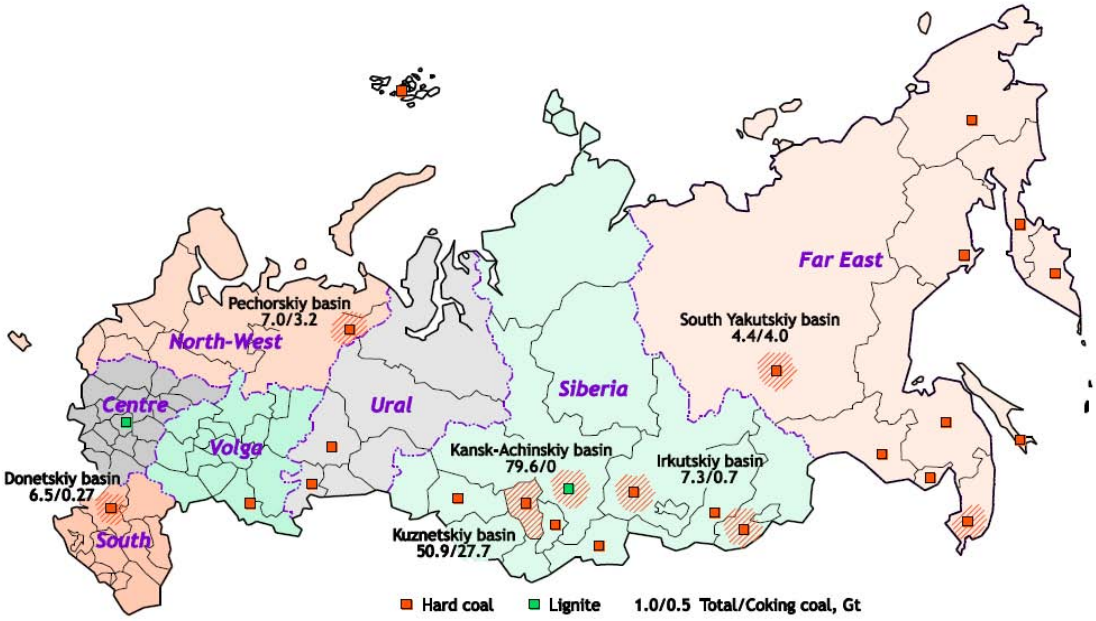
Table 30-1. Russia's Coal Reserves and Production

Indicator	Anthracite & Bituminous (million tonnes)	Sub-bituminous & Lignite (million tonnes)	Total (million tonnes)	Global Rank # (%)
Estimated Proved Coal Reserves (2006)*	49,088.0	107,922.0	157,010.0	2 (19.3)
Annual Coal Production (2007)**	217.9	71.1	289.0	5 (4.8)

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

Russia's coal resources are primarily concentrated in Siberia (80 percent), followed distantly by the Far East region (10 percent), as seen in Figure 30-1. The main coal-producing basins in Siberia are the Kuznetskiy and Kansko-Achinskiy, along with the South Yakutsly basin in the Far East region (IEA, 2009).

Figure 30-1. Russia's Coal Fields



Note: The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: IEA (2009)

30.1.2 STAKEHOLDERS

Table 30-2 lists potential stakeholders in coal mine methane (CMM) development in Russia.

Table 30-2. 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

Stakeholder Category	Stakeholder	Role
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

30.1.3 Status of Coal and the Coal Mining Industry

Between 1996 and 2001, Russia worked with the World Bank to restructure the country's coal industry, which is now privatized. As a result, the state monopoly, formally known as RosUgol, has been dissolved and roughly 80 percent of domestic coal production now comes from independent producers (EIA, 2008b). Table 30-3 presents production statistics for Russian coal mining.

Table 30-3. Russia's Recent Coal Mining Statistics (2007)

Type of Mine	**Production**(million tonnes)	Number of Mines
Underground (active) mines – total	109.2	97
Surface (active) mines – total	205.3	143
Total mines	314.5	240

Source: USGS (2007)

Russia's coal mines are extremely gassy with an average of 11.6 cubic meters (m^3) of methane per tonne of coal (IEA, 2009). As of 2005, 78 out of 92 underground mines were considered gassy (Tailakov, 2005a). Another report from the Moscow State Mining University estimates that there are 82 coal mines of "potential methane hazard" operating, of which 50 can be considered "abundant" in methane—22 out of these 50 mines are using degasification technology (M2M Symposium, 2006).

30.2 Overview of CMM Emissions and Development Potential

The Global Methane Initiative (formerly Methane to Markets Partnership) International CMM Projects Database currently identifies seven CMM projects in Russia, all of which are 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).

30.2.1 CMM EMISSIONS FROM OPERATING MINES

CMM in Russia is primarily located in three coal basins: Kuzbass, Pechora, and Donetsk (also known as Donbass, the majority of which is situated in Ukraine). According to UNFCCC's National Inventory Submissions of Greenhouse Gases, CMM from underground coal mines in Russia totaled 1.8 billion m^3 in 2005 (UNFCCC, 2009). The Kuzbass accounts for 78 percent of CMM reserves located in former Union of Soviet Socialist Republics (USSR), and the Pechora Basin accounts for 12 percent (Uglemetan, 2004a). Data from 2008 collected by IPKON RAN[2] estimates 1.5 billion m^3 of CMM from these two coal basins alone (IEA, 2009).

Methane emissions from all Russian coal mines are summarized in Table 30-4. The Kuzbass had 47 active mines in 2003 (Tailakov, 2003) and their methane emissions are quantified in Table 30-5. The data in these tables may vary from the U.S. EPA data presented in the Executive Summary due to differences in inventory methodology and rounding of digits.

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

Emission Category	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
Underground coal mines	3325.80	2090.97	1688.20	1780.28	1639.55	1743.92	1845.21	1886.34	2047.22	2028.11
Post-underground mine	0.51	0.32	0.26	0.28	0.26	0.28	0.29	0.31	0.32	0.32
Surface mines	1381.08	958.56	1059.45	1103.61	1059.45	1154.05	1147.75	1229.73	1267.56	1299.10
Post-surface mine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4707.40	3049.86	2747.92	2884.17	2699.26	2898.26	2993.25	3116.37	3315.10	3327.53

Source: UNFCCC (2009)

Table 30-5. 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)

Methane drainage was first initiated in the Kuzbass in 1951 and in the Pechora basin in 1956 (at the Severnaya, Komsomolsksya, Vorkutinskaya, and Zapolyarnaya mines). Degasification, however, reached its peak in 1990 when many of these mines had to shut down due to financial losses. The mines in the Pechora basin vented 289.8 million m^3 of methane in 1998 (RRR, 2001). In 2000, vented methane in the

[2] Research Institute of Comprehensive Exploitation of Mineral Resources at the Russian Academy of Sciences

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 recent years, the rate of methane recovery from CMM drainage has been roughly 27–30 percent on average, with only 25 percent of active mines utilizing degasification system as of 2009. As of 2008, total methane drained from mines in the Kuzbaas and Pechora basins was estimated to be 320 million m^3. Being drained primarily for the purpose of safety, the recovered methane has typically been of poor concentration (less than 25 percent). Currently, only methane drained from the Vorkuta mines in the Pechora basin is being used for boiler fuel (40 million m^3 in 2006) (IEA, 2009).

The following CMM-related activities are underway in Russia:

- CMM project potential is being studied by the not-for-profit organization 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 started in 2003 and is scheduled to end in December 2010. The expected project financing will amount to about US$11 million. The project aims to mitigate greenhouse gas (GHG) emissions by removing barriers to implementing and financing CMM recovery and utilization projects in Russia. Its initial focus is on the Kuzbass region, with replication potential expected in other coal-producing areas in Russia and elsewhere (Uglemetan, 2010).
- Plans for a CMM project at active underground mines in Prokopyevsk, Kuzbass are in development. The recovered methane is intended for use in boilers for heat generation. The potential methane reduction is estimated to be 2.0 million m^3 or 29,346 million tons carbon dioxide equivalent ($MmtCO_2e$) (M2M, 2010).

30.2.2 CMM Emissions from Abandoned Coal Mines

There are 43 abandoned mines in the Kuzbass, 39 of which are monitored for methane concentrations. Methane is registered at 32 mines, 14 of which have dangerous levels of methane gas and five with methane concentrations that could be explosive (Uglemetan, 2005).

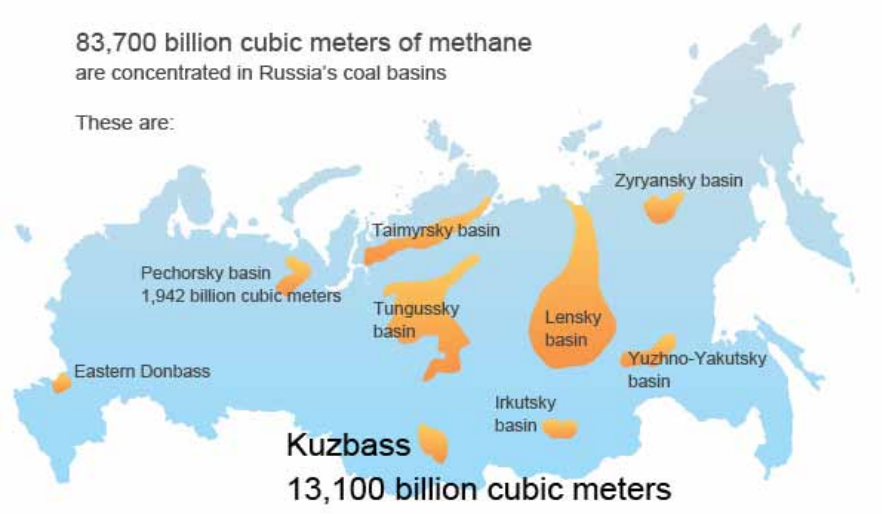
30.2.3 CBM from Virgin Coal Seams

Russia is estimated to have significant coalbed methane (CBM) resources – 75–80 trillion m^3 in coal seams, with the Kuzbass basin providing possibly one of the largest CBM resource development opportunities in the world. Gazprom estimates 13.1 trillion m^3 of CBM in Kuzbass (see Figure 30-2), accessible at 1,800–2,000 meter (m) depth (Gazprom, 2010). Another source estimates Kuzbass CBM resources to be 94 billion m^3 in active degasification areas and 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. Overall CBM resource is estimated at 48 trillion m^3. The breakdown for individual basins is provided in Table 30-6 (M2M Symposium, 2006). It is estimated that if appropriate technology is deployed and if an economic environment favorable for CBM is created, Russian CBM production could increase to up to 2 billion m^3 per year (M2M Workshop – Russia, 2005).

Table 30-6. Estimate of CBM Resources

Basin	CBM Resources (trillion cubic meters)
Kuzbass	13.085
Pechora	1.942
Eastern Donbass	0.097
South Yakutia	0.92
Ziryank	0.099
Tunguska	20.0
Lensk	6.0
Taymir	5.5
Total resources	47.643

Figure 30-2. CBM Distribution in the Kuzbass Basin in Russia



Source: Gazprom (2010)

The following activities are promoting CBM development in Russia:

- Gazprom is running a pilot operation at eight exploratory wells in Taldinskoye field in the Kuzbaas basin. The recovered CBM is being supplied to gas filling stations. Gazprom aims to reach 4.0 billion m^3 of CBM production from expanded operations by 2021. The project was initiated in 2003, when 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 (Gazprom, 2010).
- In early 2005, the Rosnauka (a.k.a. Federal Agency for Science and Innovation [FASI]), 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 GHG 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 (M2M Partnership – Beijing, 2006). FASI was disbanded as an independent agency in March 2010 but its operations were rolled back into the Ministry (ERAWATCH, 2010). One of FASI's projects, which started in 2007, is a joint operation with private industry (Siberian Coal Energy Company) and implemented by the IPKON RAN research institute. The project will develop operating procedures for CMM recovery for use in gassy mines. The procedures will conform to the Kyoto Protocol, increase productivity of coal seams with high gas content, and use CMM to generate electricity, heat, and emission reductions for carbon trading (IEA, 2009). The project is on-going and will be used as a model for future projects.

- The Uglemetan International Coal & Methane Research Center works actively to promote the development of CBM recovery in Russia by providing information and assistance to interested companies and government agencies. The non-profit organization was formed in 2002 expressly for this purpose.

30.3 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 30-7). Russia has accepted a GHG emission reduction target of 15–25 percent by 2020, with 1990 as its baseline emissions (UNFCCC, 2010a). 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 is coordinating the JI program. Under the directive, companies planning to implement JI projects must apply for approval from the Ministry; applications will be accepted through December 31, 2012. In January 2007, the Trade Ministry also drafted general regulations on the JI program and emission credits trading (USEPA, 2007). Currently, Russia is actively working to fulfill requirements to be eligible for JI Track 1 projects[3] and International Emissions Trading, which would hugely incentivize CMM and CBM development in the country.

Table 30-7. 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 (2010b); UNFCCC (2010c)

30.3.1 Market and Infrastructure Factors

Table 30-8 lists total consumption by potential CMM markets in Kuzbass. According to a 2009 report, CMM recovery and utilization is a huge economic opportunity in Russia and estimates US$130 million in revenue if all of its 1.9 billion m^3 CMM were to be recovered and used (based on 2008 regulated wholesale natural gas prices in Russia) (IEA, 2009). However, safety concerns would remain the principal driver for CMM projects.

[3] Track 1 procedure for JI projects voids the need for external verification in reporting of emission reduction units by the project host country.

Table 30-8. 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 sale price, making it difficult for a CMM project to achieve financial viability. In 2009, the wholesale natural gas price was US$70 per 1,000 m^3 (IEA, 2009), which is relatively cheap compared to other energy sources. Further, power generation projects are not financially viable; 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 to 600 RUR without a value-added tax (VAT). Third, the region lacks the technological capability to extract CBM economically from saturated, low-permeability coal seams (M2M Workshop-Russia, 2005).

However, there are many positive aspects that favor CMM development in Russia. 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 20–100 km of high-priority CBM/CMM production areas (M2M Workshop-Russia, 2005). Also, Russia is working toward establishing a favorable legislative climate for CMM development (see below).

30.3.2 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. As for CMM, licensing for ownership and use currently lacks clarity, which hinders investments from third parties looking to utilize the recovered gas. Licensing processes for CMM activities are also unclear. While an additional license is not required for CMM recovered from and used within the mine, new mineral extraction licenses are needed if the recovered CMM is sold to another party or used for heat and power generation that is sold to another party (IEA, 2009).

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 (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 the mine's onsite needs. Uglemetan, as an organization devoted to the promotion of CMM and CBM development projects, provides investors with the latest information on the current investment climate in Russia.

Russian mines are subject to safety regulations, but lack the resources to ensure their enforcement. 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 (e.g., using flame arresters), but Kuzbass mines do not flare gas emissions at this time (Tailakov, 2005c).

Russia's recent regulatory and energy market developments are poised to stimulate CMM utilization on a larger scale. Initiatives such as a government decision on gradual price increases for natural gas for industrial and residential users, liberalization of the electricity market, and renewable energy targets inclusive of CMM will facilitate the creation of a market where CMM could become competitive with other energy sources. The Decree on Main State Policy Areas to Increase the Energy Supply from Renewable Power Generation by 2020, passed in January 2009, has specifically incentivized CMM recovery and use by setting targets for increased share of renewable energy—inclusive of CMM—in the electric power supply. More supporting regulations and clarity are needed though to further leverage this legislation for CMM development (IEA, 2009).

30.4 Profiles of Individual Mines

Baidaevskaya Mine, Kuzbass

Total no. of coal seams: 24		
Thickness of mined seams: Average – 3.31 m; Range 2.6–3.7 m		
Overburden: Thickness – 50 m ; No. of seams – 8–17		
Coal reserves: 92.5 million tonnes		
Coal quality and rank:	Ash (%): 24.7	Sulfur (%): 0.44
	Heating Value (kcal/kg): 8,343	Volatile Matter (%): 39.5
	Moisture (%): 5.4	Rank: high volatile bituminous

Chertinskaya Mine, Kuzbass

Total no. of coal seams: 4		
Thickness of mined seams: Average – 2.14 m; Range 1.5–3.0 m		
Overburden: Thickness – 50–365 m ; No. of seams – N/A		
Coal reserves: 70.5 million tonnes		
Coal quality and rank:	Ash (%): 29.5	Sulfur (%): 0.30
	Heating Value (kcal/kg): 8,370	Volatile Matter (%): 38.8
	Moisture (%): 6.6	Rank: high volatile bituminous

Source: USEPA (1996)

Although mining and methane emissions and recovery data is outdated, geologic profiles on more coal mines are available in "Reducing Methane Emissions from Coal Mines in Russia: A Handbook for Expanding Coalbed Methane Recovery and Use in the Kuznetsk Coal Basin" at http://www.epa.gov/cmop/docs/int005.pdf (USEPA, 1996).

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