20 KAZAKHSTAN

20.1 Summary of Coal Industry

20.1.1 ROLE OF COAL IN KAZAKHSTAN

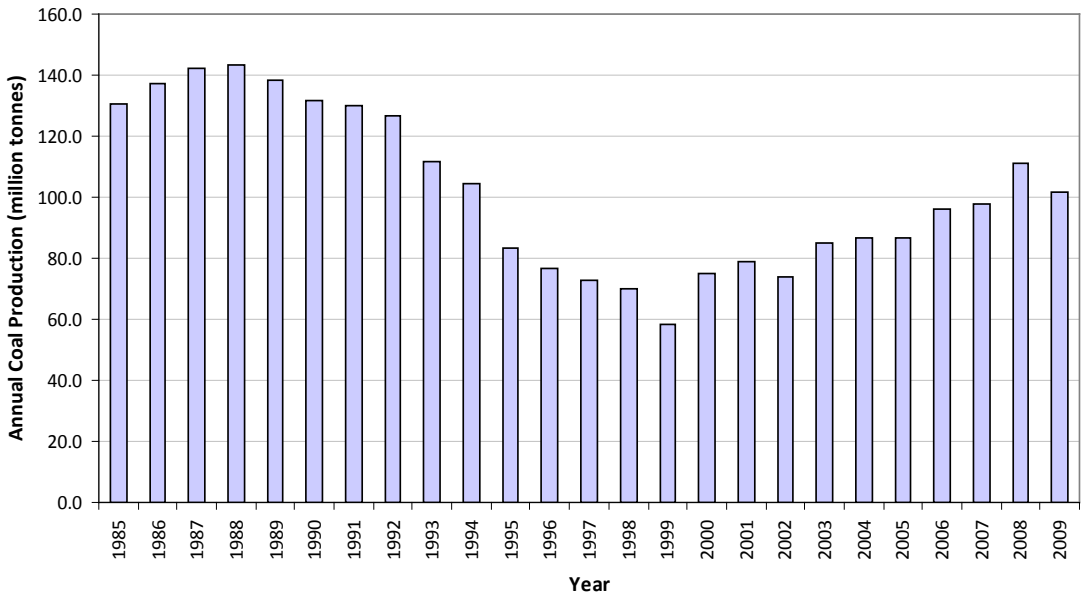
Kazakhstan ranks tenth in the world in coal production, supplying 46.5 percent of its total energy consumption in 2007 (IEA, 2009). It exported 26.4 percent of the coal produced, primarily to Russia and Ukraine. Most power generation (80 percent) is coal-fired, including the largest generator, Ekibastuz No.1 at 4,000 megawatts (MW) (EIA, 2008). Table 20-1 summarizes Kazakhstan's coal resources and recent production, while Figure 20-1 shows historical annual coal production,

Table 20-1. Kazakhstan'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)	28,170	3,130	31,300	7 (3.8%)
Annual Coal Production (2009)			101.5	9 (1.5%)

Source: BP (2010)

Figure 20-1. Kazakhstan Annual Coal Production (million tonnes)



Kazakhstan has registered 49 coal deposits in its state reserve balance (USGS, 2010). The main producing regions are located in the central and northern regions of Kazakhstan in the Ekibastuz, Karaganda, Maykuben, Shubarkol and Turgay basins (Table 20-2).

Table 20-2. Kazakhstan's Major Coal Basins

Basin	Ekibastuz	Karaganda	Maykuben	Shubarkul	Turgay
Annual Estimated Production Capacity (million tonnes)	95	50	10	6.5	1

Source: USGS (2010)

20.1.2 STAKEHOLDERS

Thirty-four companies operate coal mines in Kazakhstan, including 28 of domestic origin, five foreign companies and one joint venture (EOK, 2010). The major companies are listed in Table 20-3. The table also lists other potential stakeholders in Kazakhstan's coal mine methane (CMM) industry.

Table 20-3. Key Stakeholders in Kazakhstan's CMM Industry

Stakeholder Category	Stakeholder	Role
Coal Producing Enterprise	▪ JSC "ArcelorMittal Termirtau" ▪ OJSC "Ispat-Karmet" ▪ Bogatyr-Access-Komir, Ltd. ▪ OJSC "Eurasian Natural Resources Corporation" ▪ OJSC "Borly" ▪ "Maykuben-West" joint venture ▪ KomirInvest, Ltd. ▪ Transenergo, Ltd ▪ "Gefest" Association ▪ Shubarkol Komir ▪ TOTAL Kazakhstan, LLP	Project Hosts
Developer	▪ See http://www.epa.gov/coalbed/networkcontacts.html	Project opportunity identification and planning
Engineering or Consultancy Services	▪ Azimut Energy Services, Ltd. ▪ See http://www.epa.gov/coalbed/networkcontacts.html	Technical assistance
Universities and Research Centers	▪ National Coalbed Methane Center ▪ Climate Change Coordination Center http://www.climate.kz/engl/	Technical assistance
Other	▪ Kazakhstan National Innovation Fund http://www.nif.kz/eng	
Government Groups	▪ Ministry of Energy and Mineral Resources	Licensing and permitting

Source: KazNIIMOSK (2002); EOK (2010); Alekseev (2010)

20.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

Kazakhstan's coal mining industry was restructured and largely privatized between 1995 and 1997 (State, 2005). The Karaganda and Ekibastuz mining associations were dissolved and the mines put up for sale or lease. Many of the coal mining enterprises were closed or reorganized (USGS, 2010; KazNIIMOSK, 2002).

Coal production in Kazakhstan declined by more than 50 percent in the years following independence from the Soviet Union in 1991 (BP, 2010). During the Soviet era, coal production was subsidized and mines were not structured to maximize profits. When subsidies were removed and mines had to operate competitively, it became extremely difficult to obtain foreign investment to maintain their economic viability. This fundamental lack of profitability was compounded by other problems, such as restructuring, mine problems, and accidents. Government efforts to significantly improve production by 2015, by encouraging foreign interest in the coal mining industry, appear to have been successful. Since the low point in 1999, annual production has steadily increased to rates above 100 million tonnes (Mmt), although the world-wide economic downturn in 2009 also affected Kazakhstan coal production with a resultant 8.6 percent decline in production from 2008. Consumption has also declined, largely offsetting the impact of the production decline, thus helping to sustain the level of exports.

Underground mining only occurs in the Karaganda basin, which produces the coking coals essential to the steel and iron sectors and coke plants in Kazakhstan, Russia, Ukraine, and Georgia, and also to the phosphoric and ferroalloy industries. The share of production from underground mines decreased from about 27 percent in 1990 to just 11 percent in 2000 (KazNIIMOSK, 2002), and back up to 30 percent in 2010 (Alekseev, 2010), following new investment from companies such as the ArcelorMittal Group (USGS, 2010). The ArcelorMittal Coal Division operates eight underground mines in the Karaganda Basin producing 12 Mmt annually (Baimukhametov, 2009). Twenty-six underground mines were reportedly in operation in 1990 (KazNIIMOSK, 2002), with 15 now currently producing (EOK, 2010). Four mines operated by KomirInvest and Transenergo have nearly stopped production. ArcelorMittal's eight underground mines (originally operated by Ispat-Karmet) were expanded in 1986 to stabilize production levels.

Table 20-4 provides mine statistics for Kazakhstan.

Table 20-4. Kazakhstan Mine and Production Statistics

Type of mine	Production (million metric tonnes)	Number of major mines
Underground (active)	31.5 (2009)	15 (2010)
Surface (active)	69.9 (2009)	6 (2010)
		3 mines in the Ekibastuz Basin - Bogatyr, Severny, Vostokny (80% of surface production)
		3 others - Borlinskoe deposit, Maykuben Basin, Karaganda Basin (15–20% of surface production)

Source: Alekseev (2010); EOK (2010)

20.2 Overview of CMM Emissions and Development Potential

The Global Methane Initiative (formerly Methane to Markets Partnership) International CMM Projects Database currently identifies one CMM project, in place at the Kazakhstanskaya underground mine in the Karaganda basin. The methane currently drained from the mine is being used for boiler fuel in five neighboring mines (M2M Projects, 2010). The mine is planning an expansion of its degasification systems by 8.5 kilometers (km) along with the installation of three KVTS-10 boilers utilizing 13 million cubic meters (m^3) methane per year. Current coal production is 1 Mmt per year (Mmt/year) with plans to increase production to 1.8 Mmt/year by 2012.

20.2.1 CMM EMISSIONS FROM OPERATING MINES

The Kazakh coal mines are particularly gassy and prone to violent gas outbursts, and must be degasified and ventilated to prevent explosions and promote worker safety. The underground mines in the Karaganda basin use a variety of pre-mining and post-mining methane drainage techniques. Most of the mines are operated at a depth of more than 500 meters (m) and gas contents in these mines average between 18 and 24 m^3/tonne (Baimukhametov et al, 2009) with specific emissions averaging 33 m^3/tonne (KazNIIMOSK, 2002). Pre-drainage has historically been carried out using in-seam boreholes. Advance degassing from the surface has been trialed with limited success because of the low permeability of the coal seams. The Arcelor Temirtau Coal Division has had recent success in increasing degasification rates, and hence coal production rates, by drilling cross-measure boreholes from a roadway driven 8–12 m below the coal seam. Gob gas is drained with vertical wells from the surface or via galleries driven 20–30 m above the seam (Baimukhametov et al., 2009).

Current drained methane emissions are estimated to be approximately 130 million m^3 resulting from increased underground coal production rates (Alekseev, 2010), However, the level of methane utilization is very low, only about 25 million m^3 annually, which is recovered and combusted in the boiler houses of five mines for mine heating. Surface mines are heavily ventilated and ventilation air with methane concentrations of about 1 percent is vented to the atmosphere (KazNIIMOSK, 2002).

Table 20-5 details Kazakhstan's measured and estimated CMM emissions. 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 20-5. Kazakhstan's CMM Emissions (million cubic meters)

Emission Category	1990	1991	1992	1993	1994	1995
Underground coal mines – ventilation emissions	983.66	914.75	915.52	957.82	678.12	671.37
Underground coal mines – drained emissions	189.84	200.83	179.87	162.96	148.31	115.8
Post-underground emissions	34.8	36.4	33.9	30.6	28.7	23
Surface mine emission	560.1	554.1	529.3	488.8	452.0	411.9
Total liberated (= sum of all above)	1768.4	1706.08	1658.69	1640.18	1307.13	1222.07
Recovered & Used	8.8	10.9	11.0	13.0	5.6	5.9
Total emitted (= Total liberated – recovered & used)	1759.6	1695.18	1647.69	1627.18	1301.53	1216.17

Emission Category	1996	1997	1998	1999	2000	2005 (estimated)	2009** (estimated)
Underground coal mines – ventilation emissions	408.0	347.45	303.45	227.32	286.23		400
Underground coal mines – drained emissions	55.4	48.2	42.6	27.2	41		130
Post-underground emissions	14.9	12.7	9.0	7.1	8.0		
Surface mine emission	381.7	350.2	304.3	277.3	381		450
Total liberated (= sum of all above)	860	758.55	659.35	538.92	716.23		980
Recovered & Used	3.5	4.0	10.5	11.3	12.2		25
Total emitted (= Total liberated – recovered & used)	856.5	754.55	648.85	527.62	704.03	467*	955

Source: KazNIIMOSK (2002); *USEPA (2006); **Shultz & Alekseev (2010)

20.2.2 CMM EMISSIONS FROM ABANDONED COAL MINES

At least 14 underground coal mines in Kazakhstan have been abandoned since 1996. All are considered gassy. No specific information about methane recovery projects at abandoned mines is available.

20.2.3 CBM FROM VIRGIN COAL SEAMS

According to the Ministry of Energy and Mineral Resources, Kazakhstan's coalbed methane (CBM) resources are some of the highest among the coal basins of the world, as illustrated in Table 20-6.

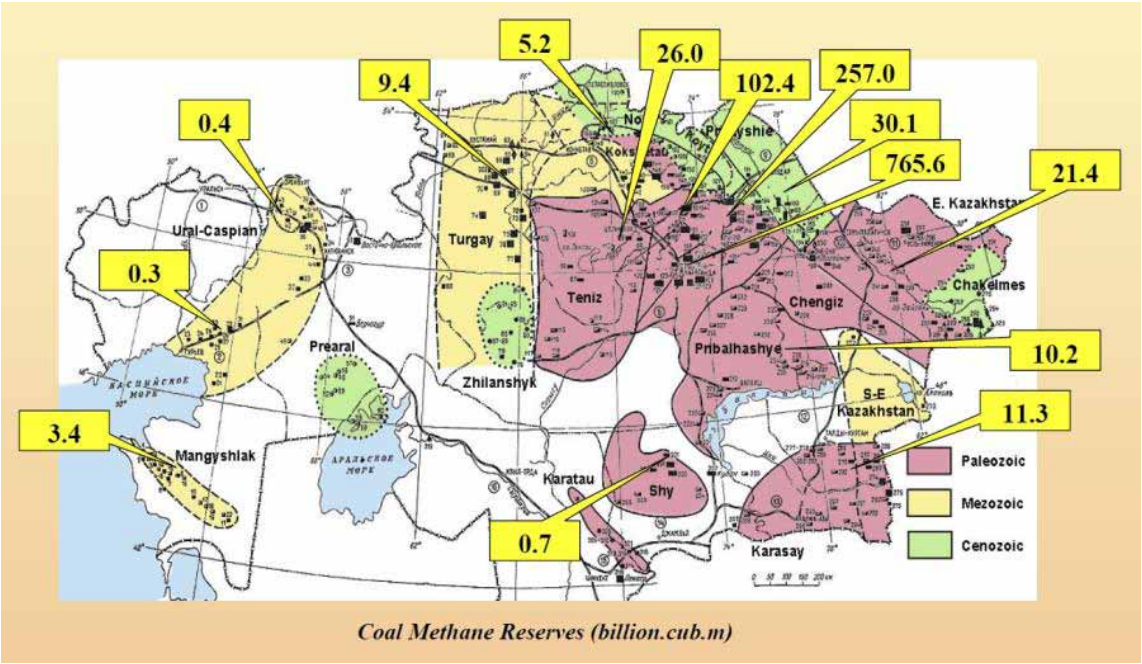
Table 20-6. Summary of Kazakhstan's Selected CBM Resources

Basin or Field	CBM Resources (est.) (billion cubic meters)
Karaganda Basin	550–750
Ekibastuz Basin	75–100
Zavialov Field	14.6–16.8
Samarskiy Field	11.0–14.2

Source: Stoupak and Zhukovskiy (2001)

Kazakhstan is one of the few countries with commercial CBM production. In 2000, 12.5 million m^3 of CBM were produced from 134 wells (Alekseev, et al., 2003). Figure 20-2 shows Kazakhstan's coal regions with estimated methane reserves for each region.

Figure 20-2. Kazakhstan Coal Regions and Coal Methane Reserves



Source: Alekseev, et al. (2003)

TOTAL Kazakhstan, LLP was awarded the State tender for exploring and mining CBM in the Taldykuduk area of the Karaganda coal field in late 2004. The exploration stage, now ongoing, includes drilling six test wells. The Kazakhstan National Innovation Fund and TOTAL hope to attract foreign

investment of $180–$220 million in the second (commercialization) phase of the effort to hasten development of a new CBM industry for the country (USEPA, 2005).

In April 2003, the Ministry of Energy and Mineral Resources recommended that BogatyrAccess Komyr, Ltd. and Azimut Energy Services, Ltd. pursue a CBM development effort in the Ekibastuz basin. These efforts would include attracting domestic and international investors to assess the resources (including seismic studies) and conduct a pilot project including five to six test wells, to identify and select development technologies, and to book recoverable CBM resources as proved reserves (ROK, 2003).

Kazakh firm, Zhumys Stroyservice, announced (May2010) an agreement with the Australian company Arrow Energy Ltd., to perform a feasibility study on the commercial production of CBM in the Karaganda coal basin. Funding would be provided by Arrow Energy with plans for a pilot project to be launched in 2014. (SteelGuru, 2010)

20.3 Opportunities and Challenges to Greater CMM Recovery and Use

Kazakhstan is a signatory to both the UNFCCC and the Kyoto Protocol (see Table 20-7). Kazakhstan applied for Annex I status in June 1999, withdrew its application in June 2000, but finally ratified the Protocol in June 2009. With Annex I status obtained, new CMM projects in Kazakhstan are eligible to earn and sell emission reduction credits through the Clean Development Mechanism. Kazakhstan is currently awaiting status as an Annex B country, to qualify for Joint Implementation. Investment for CMM projects could also come from the National Innovation Fund, mine operators, and foreign investors.

Table 20-7. Kazakhstan's Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 8, 1992	May 17, 1995
Kyoto Protocol	March 12, 1999	June 19, 2009–

Source: UNFCCC (2010)

20.3.1 Market and Infrastructure Factors

Opportunities to develop the country's CBM and CMM resources are a potentially significant source of investment, and Kazakhstan is working to establish an attractive investment climate. The Kazakhstan government prioritizes CMM projects as a means of achieving measurable and verifiable greenhouse gas (GHG) emission reductions. Recently, the government approved proposals for establishing criteria and procedures for screening, review, and approval of GHG emission reduction projects. It also approved similar proposals relating to baseline assessment and validation; emission reduction calculation; monitoring, verification, and registering emission reduction projects; and allocating 5 million tonnes of carbon dioxide equivalent ($MmtCO_2e$) for transfer to investors in GHG reduction projects. As a next step, the government will promulgate regulations (USEPA, 2005).

Kazakhstan will require significant infrastructure investments to commercialize CBM/CMM development. Gas gathering systems will be required as well as interconnects with distribution pipelines. Some synergies may be available with rapidly developing gas production associated with expanding oil production. Kazakhstan produced 1.18 trillion cubic feet (Tcf) of natural gas in 2008 while domestic consumption was at 1.19 Tcf (EIA, 2009). Production has been growing at 22 percent annually over the last decade, compared to consumption growth of 9 percent annually and so Kazakhstan is expected to become a net exporter of gas within the next few years. Current and proposed major gas distribution

pipelines are routed mainly in the west and south of the country and so opportunities for local CMM/CBM projects in the central and northern coal-fields may arise as a result of proximity to underserved markets in these areas. Regional gas demands are increasing, especially from neighboring China, suggesting adequate markets for all methane that can be produced. Possible end uses for recovered methane include industrial boilers, power generation, heating, and transportation fuel (for fleets and private vehicle conversions).

In 2005, 14,609 million KZT was invested in the mining industry. A large portion of those investments, 5,997.7 million KZT, went into coal production and improvement (CMAR, 2006). In 2007, the Arcelor-Mittal Group pledged to invest 500 million USD to increase coal production in the Karaganda region by around 5 Mmt (EIA, 2008). These large investments in the nation's coal production could lead to increased CMM development projects.

20.3.2 REGULATORY INFORMATION

The Government owns all subsurface gas and minerals but has allocated coal reserves to private mine operators as part of their contracts and CMM to contracted coal operators. CMM and CBM project developers must enter into agreements with the coal operators for development and sale of the gas resources (KMIC, nd). Upcoming petroleum legislation and provisional rules for exploration and development will provide a comprehensive and consistent legal framework for CBM exploration and exploitation. At this time, no legislation is in place which distinguishes CMM production from that of natural gas. A recent law, "In Support of the Use of Renewable Energy Resources" introduced in July 2009, does not include references to CMM (Alekseev, 2010).

Mining companies understand the safety issues and are increasingly understanding of the environmental issues associated with CMM. Coal mine safety is a key concern in surface and underground mines—numerous deaths due to mine explosions and methane outbursts underscore the importance of this problem. Environmental and safety standards are improving, but are also driving up development costs.

20.4 Profile of Individual Mines

Kazakhstanskay Mine

Mine Status	Active	**Operator/Owner**	ArcelorMittal Temirtau Coal Division
Mine Area	47 square kilometers (km^2)	**Coal Basin**	Karaganda
Mining Method	Conventional Longwall	**Location**	Shakhtinsk District, 30 km west of the city of Karaganda
Reserves (coking coal)	103.4 Mmt	**2009 VAM volume**	36.5 million m^3/year
No. of seams mined	2 (D6 & D10)	**2009 Drained volume**	7.8 million m^3/year
Depth of seams	650–700 m	**2009 Utilized volume**	7.8 million m^3/year
		Utilization method	Boilers

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