

22 Mongolia



22.1 Summary of Coal Industry

22.1.1 ROLE OF COAL IN MONGOLIA

Mongolia's energy needs are met primarily by coal, which accounts for 73 percent of total energy consumption (IEEJ, 2012). Mongolia presently ranks 22nd worldwide in production of coal. Coal production in Mongolia has seen a six-fold increase since 2000. Mongolia has been a net exporter of coal since 2005, exporting over 22 million tonnes (Mmt) in 2012 (EIA, 2014). Table 22-1 provides proven coal reserves and recent coal production data for Mongolia.

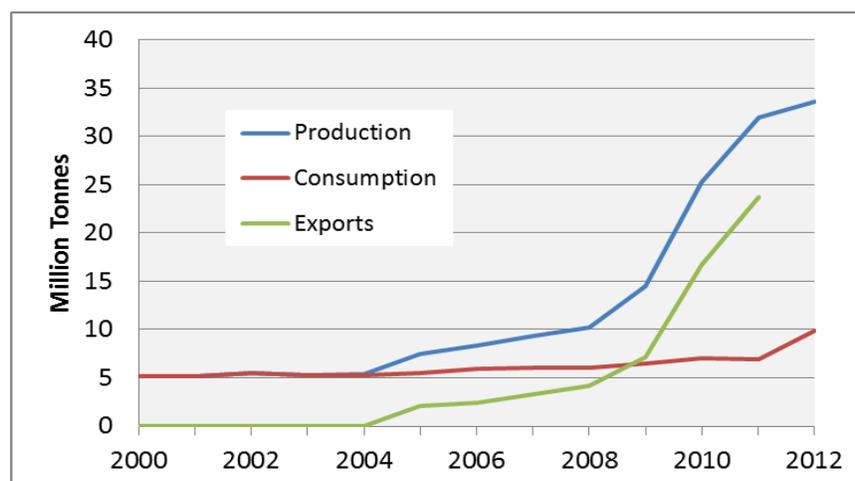
Table 22-1. Mongolia's Coal Reserves and Production

Indicator	Anthracite & Bituminous (million tonnes)	Sub-bituminous & Lignite (million tonnes)	Total (million tonnes)	Global Rank (# and %)
Estimated Proved Coal Reserves (2011)			2,520 (12,200*)	19 (0.28%)
Annual Coal Production (2012)	23.6	9.98	33.6	21 (0.4%)

Sources: EIA (2014), *2008 estimate by Ganbaatar (2008)

Mongolia's coal consumption increased in recent years, from less than 6 Mmt in 2008 to almost 10 Mmt in 2012; however, as a result of decreased export demand and coal price declines, Mongolia experienced a slump in coal production in 2013. Figure 22-1 below shows Mongolia's production, consumption, and exports from 2000 to 2012.

Figure 22-1. Mongolia's Coal Production, Consumption, and Exports (million tonnes)



Source: Modified from EIA (2014)

Mongolia has estimated coal resources of 173.3 billion tonnes (MRAM, 2013) with proved coal reserves of 12.2 billion tonnes, including 2 billion tonnes of coking coal and 10.1 billion tonnes of thermal coal (IEEJ, 2012) in over 370 deposits and occurrences in 15 different basins (shown in Figure 22-2).

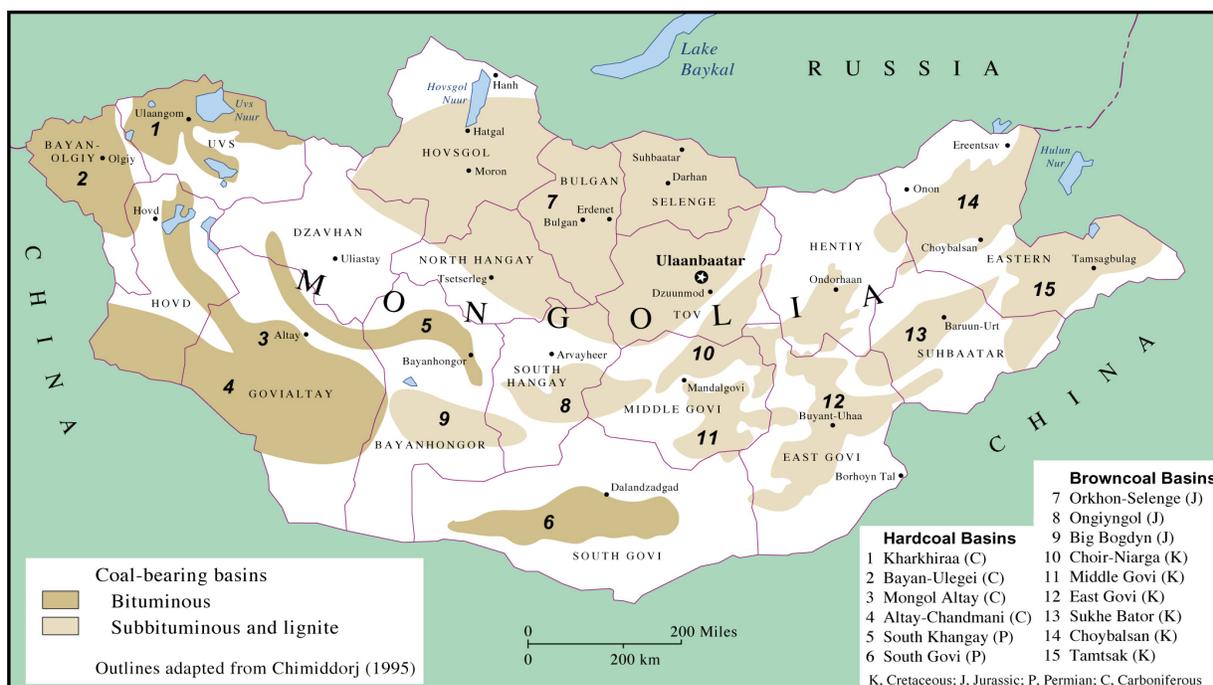
Table 22-2 summarizes the reserves found in major coal deposits of Mongolia.

Table 22-2. Coal Resources Found in Major Coal Deposits

Region	Coal Deposit	Estimated Resources (million tonnes)	Coal Rank	Coal Basin
Central Mongolia	Shivee Ovoo	563	Lignite	Choir-Nyalga
	Tevshiin Govi	588	Lignite	Choir-Nyalga
	Tugrugnuur and Tsaidannuur	2,000*	Brown	Choir-Nyalga
	Baganuur	511	Lignite	Choir-Nyalga
	Chandgan Tal	123	Lignite	Choir-Nyalga
	Khuut	87.5	Sub-bituminous	Middle Gobi
	Uvdug Khudag	159.2	Lignite	Middle Gobi
	Bayan Teeg	29.7	Bituminous	Ongyin Gol
	Sharyn Gol	61.3	Sub-bituminous	Orkhon-Selenge
	Ulaan-Ovoo	54	Sub-bituminous	Orkhon-Selenge
	Nalaikh	59	Sub-bituminous	Orkhon-Selenge
Mogoin Gol	4.1	Bituminous	Orkhon-Selenge	
Saikhan-Ovoo	190**	Anthracite and Bituminous	Orkhon-Selenge	
East Mongolia	Adduun Chuluun	241.3	Lignite	Choibalsan
	Tugalgatai	3,000*	Sub-bituminous	Choir-Nyalga
	Chandgana Tal		Lignite	Choir-Nyalga
	Talbulag	81.5	Lignite	Sukhbaatar
West Mongolia	Khushuut	300*	Bituminous and metallurgical	Mongol-Altai
	Zeegt	4.9	Bituminous	Mongol-Altai
	Nuurst Khotgor	143.3	Bituminous	Kharkhiraa
	Khar Tarvagatai	19.7	Bituminous	Kharkhiraa
	Uvurchuluut	3.8	Lignite and Sub-bituminous	South Khangai
South Gobi	Tavan Tolgoi	6400	Bituminous	South Gobi
	Baruun Naran	155*	Thermal and metallurgical	South Gobi
	Naryn Sukhait	220†	Bituminous	South Gobi
	Aman Gol	1,500	Sub-bituminous	South Gobi
	Ovoot Tolgoi	150*		South Gobi

Sources: MNEC (2014); *Ganbaatar (2008); Asia Coal Limited (2014); †MAK (2010)

Figure 22-2. Mongolia's Coal Basins



Source: Schwochow (1997), modified from Chimiddorj (1995)

22.1.2 STAKEHOLDERS

Table 22-3 identifies potential key stakeholders in coal mine methane (CMM) development in Mongolia.

Table 22-3. Key Stakeholders in Mongolia's CMM Industry

Stakeholder Category	Stakeholder	Role
Mining companies	<ul style="list-style-type: none"> ▪ Aduunchuluun LLC ▪ Asian Coal Ltd. ▪ Aspire Mining Limited ▪ Baganuur JSC ▪ Bayanteeg LLC ▪ Chandganacoal LLC ▪ Chingisiin har alt LLC ▪ Energy Resources LLC ▪ Erdenes MGL ▪ Gobi Coal and Energy LLC ▪ Gobi Khurakh LLC ▪ Hunnu Coal ▪ Korea Resources Corporation ▪ Leighton LLC ▪ Macmahon Mongolia LLC ▪ Maral Michid Od LLC ▪ MoEnCo LLC ▪ Mongolyn Alt (MAK) Group ▪ Peabody Winsway Resources LLC 	Project hosts

Table 22-3. Key Stakeholders in Mongolia's CMM Industry

Stakeholder Category	Stakeholder	Role
Mining companies (con't)	<ul style="list-style-type: none"> ▪ Prophecy Coal Corporation ▪ QGX Ltd. ▪ Red Hill Mongolia LLC ▪ Big Mogul Coal & Energy LLC ▪ Shivee Ovoo JSC ▪ South Gobi Resources ▪ South Gobi Sands LLC ▪ Tevshiin Gobi LLC ▪ Tsegeen Uuden LLC ▪ Tugrug Nuuriin Energy LLC ▪ Xanadu Mines Ltd. 	Project hosts
Developers	<ul style="list-style-type: none"> ▪ KOGAS 	Project opportunity identification and planning
Engineering, consultancy, and related services	<ul style="list-style-type: none"> ▪ Geomaster Engineering LLC ▪ MegaWatt Company Ltd. ▪ Center of Mongolian Mining Professional Engineers ▪ Sproule 	Technical assistance
Universities, Research Establishments	<ul style="list-style-type: none"> ▪ National University of Mongolia ▪ Mongolian University of Science and Technology ▪ Mongolian Technical University 	Technical assistance
Regulatory Agencies and Government Groups	<ul style="list-style-type: none"> ▪ Ministry of Mining ▪ Ministry of Nature, Environment, and Green Development ▪ Ministry of Energy ▪ Mineral Resources Authority ▪ Petroleum Authority ▪ Ministry of Economic Development ▪ Millennium Challenge Account – Mongolia 	Project identification and assessment support
Non-governmental Organizations	<ul style="list-style-type: none"> ▪ Mongolian Nature and Environment Consortium ▪ Mongolian National Mining Association ▪ Mongolian Coal Association ▪ Federation Of Energy, Geology And Mining Workers' Trade Unions Of Mongolia – MEGM 	

Sources: Mongolian Mining Directory (2013) ; InfoMongolia (2014) ; UNFCCC (2014)

22.1.3 STATUS OF COAL AND THE COAL MINING INDUSTRY

Mongolia produced more than 33 Mmt of coal in 2012 (Table 22-1), consuming only 10 Mmt and exporting the remainder. There are more than 30 surface (or open cast) mines in Mongolia, providing almost 99 percent of Mongolia's coal production. Domestic demand for coal is on the rise with increased power demand, which is expected to reach 1,375 megawatts (MW) in 2015 due to Mongolia's rapidly developing mining-based economy and urbanization acceleration. Mining companies account for 40 percent of Mongolia's total electricity consumption (Kohn, 2013). In 2009, it was reported that almost all of Mongolia's exported coal went to China (Liu, 2012). China has historically produced its own coking coal; however, growing demand for coking coal due to a rapid increase in steel production has led to demand for imports from Australia and Mongolia. In 2008, Mongolia supplied more than half of China's coking coal imports and maintained its position as top exporter until the first half of 2013, when Mongolia's exports of coking coal to China fell by 36 percent while Australia's doubled. As of late 2013, Mongolia's coal made up only 17 percent of

China's imports while Australia supplied 39 percent (Els, 2013). Despite the shorter distance to China's steel mills, Mongolian coal must be trucked to the Chinese border, increasing the cost compared to Australia's seaborne coal. As a result of decreased demand from China, as well as coal price declines, Mongolia experienced a slump in coal production in 2013.

It is expected that installation of a railway will increase the competitiveness of Mongolia's coal in China (Ng, 2013). In Mongolia, many of the more substantial deposits of proven coal reserves remain undeveloped due to the lack of infrastructure. Several infrastructure improvements are planned to accommodate an increase in coal mining as well as mining of other vast and valuable mineral reserves such as copper and gold. In October 2013, a consortium of Mongolian coal mining companies including Mongolia Mining Corporation, Erdenes Tavan Tolgoi, Energy Resources LLC and Tavan Tolgoi JSC as well as Chinese state-owned mining and energy company Shenhua Group Corporation Limited, signed a Memorandum of Understanding with the Mongolian Railway State-Owned JSC (MTZ) to construct a freight railway, primarily for transport of coking coal to China. The rail will connect the Gashuun Sukhait border point south of Tavan Tolgoi with the Ganqimoadu port in China (MMC, 2013a).

In November 2013, a 220-kV overhead transmission line connecting the South Gobi region mines Oyu Tolgoi (copper), Tavan Tolgoi (coal), and Tsagaan Suvarga (copper and molybdenum) and South Gobi region customers with Mongolia's Central Electricity System was completed (MCS, 2013). Additionally, World Bank's International Development Association is providing support to create infrastructure necessary for the development of natural resources (World Bank, 2014).

Mongolia's Ministry of Energy (MOE) has outlined a number of policy goals including increased government support in coal export, reductions in customs taxes for coal export, reduction of rail transport tariffs and appropriate changes in relevant laws, all of which will encourage increased coal production (Ganbataar, 2005).

Several new surface coal mine developments are planned. Tethys Mining LLC discovered a large coal deposit, Tugalgatai, in the eastern Mongolian province of Khentii (spelled Hentiy on the map in Figure 22-2) (Daly, 2008). In 2013, Canadian coal company Prophecy Coal Corp. reported that it was in discussions with Tethys to purchase the Tugalgatai coal licenses. Tugalgatai is contiguous to the company's Chandgana licenses, which host a measured resource of 650 Mmt and an indicated resource of 540 Mmt of thermal coal. The Chandgana Coal Project is expected to begin delivery of coal in 2016 to Prophecy's 600-MW Chandgana Power Plant. The plant was approved by the Mongolian government in early 2014 (Prophecy, 2013a; Prophecy, 2014a; Prophecy, 2014b).

Production at the Zeegt coal mine in Gobi-Altai Province is expected to begin in 2015. Gobi Coal and Energy began exploration work in 2006 around a small, formerly-state owned mine (Gobi Coal and Energy, 2014).

Aspire Mining Limited's Ovoot Coking Coal Project is being developed in Khusvgul Province in northwestern Mongolia. Aspire has signed an agreement with the Mongolian government to provide coal to the planned Sainshand Industrial Complex, which is intended to accommodate coke and steel plants. In order to supply the Sainshand Park with Ovoot Project coking coal, the Erdenet – Ovoot Project Railway connecting to the Trans-Mongolian Railway will need to be completed. Northern Railways, Aspire's Mongolian rail infrastructure subsidiary, has applied to the Mongolian Government for a rail concession over the Northern Rail Line (Proactive, 2014).

South Gobi Resources has outlined plans to develop properties near its existing Ovoot Tolgoi coal mine in Ömnögovi Province, namely the Soumber Deposit 20 km east and the Zag Suuj Deposit, located approximately 150km east. South Gobi is developing an additional deposit, the Tsagaan Tolgoi deposit, 415 km northeast of Ovoot Tolgoi (South Gobi, 2014).

Mongolia is also pursuing development of coal-to-liquids capacity. In August of 2013 a South Korean steelmaker, POSCO, announced a joint partnership with Mongolia's MCS Group to develop a coal-to-liquids plant in Ulaanbaatar's Baganuur district. The joint venture (named the Baganuur Energy Corporation) would build and operate a plant to annually produce 450,000 tonnes of diesel and 100,000 tonnes of dimethyl ether (Oxford, 2013). The Ovdog Hudag mine in Dundgovi Province has also been considered for this purpose (Ariuntuya, 2012).

Mongolia's largest underground coal mine, Nalaikh, near Ulaanbaatar, was closed in 1993 due to a major mine fire. Small shallow depth mining at coal outcrops at Nalaikh began in 1922, for the purpose of supplying coal to customers of the capital city of Ulaanbaatar. In 1954 – 1958, the larger underground mining operations were established with the production capacity of 600 thousand tonnes annually. By 1987, the mine reached full capacity, producing 800 thousand tonnes per year. Official underground mining in this area ceased in 1993; however, after the formal closure of the underground mine, the masses of freshly unemployed and skilled miners turned to illegal mining of the Nalaikh deposit. With nearly 200 shafts and five to ten workers per shaft, there are roughly 2,500 miners working the area during the peak season between September and May. The shafts are dug haphazardly, with little to no coordination between shafts. Mining dangers, such as cave-ins, are becoming more frequent (World Bank, 2004; MNEC, 2014). There is interest in CMM recovery and utilization at the Nalaikh mine, and the mine was subject of a United States Environmental Protection Agency Cooperative Agreement entitled, *Pre-feasibility Study on Methane Recovery & Utilization in Nalaikh Coal Mine*, available at <https://www.globalmethane.org/activities/actDetails.aspx?ID=346>.

Profiles of Mongolia's major coal mines are located in Section 1.4, Profiles of Individual Mines.

22.2 Overview of CMM Emissions and Development Potential

Other than the minor production from the Nalaikh mine (still formally closed), all of Mongolia's coal production is from surface mines. Thus, CMM development potential in Mongolia lies predominantly in pre-mine drainage in advance of surface mining operations. Underground CMM recovery and utilization at the Nalaikh mine may occur if coal mining resumes and a project proves to be economically feasible.

22.2.1 CMM EMISSIONS FROM OPERATING MINES

In Mongolia's first National Communication under the United Nations Framework Convention on Climate Change (UNFCCC), the analysis of GHG emissions by fuel type estimates that methane emissions released during coal mining activities, coal mining, and post-mining activities comprise 1.6 – 3.5 percent of all methane emissions (UNFCCC, 2001). As new mining areas have developed, CMM emissions have increased. Table 22-4 summarizes Mongolia's estimated CMM emissions from 2000 – 2010, with projection for 2015.

Table 22-4. Mongolia's CMM Emissions (million cubic meters)

Emissions	2000	2005	2010	2015 (projected)
Total CH ₄ Emitted	6.7	10.5	13.7	15.1

Source: USEPA (2012)

A detailed calculation of methane emissions from Mongolia's coal mines was carried out, under the United States Environmental Protection Agency (U.S. EPA) Cooperative Agreement *Coal Mine Methane (CMM) Resource Assessment and Emissions Inventory Development in Mongolia*. The Mongolian Nature and Environment Consortium (MNEC) has developed basin-specific emission factors which were used to calculate emissions on a basin-by-basin basis. For more information, see <https://www.globalmethane.org/activities/actDetails.aspx?ID=1200>.

A pre-feasibility study has been completed for the Nalaikh mine, assessing the potential for power generation using CMM. Based on a 3.6-MW design capacity using two internal combustion engines, greenhouse gas (GHG) emissions reductions for this project are estimated to be about 96,000 tons CO₂ equivalent annually for such a power generation project, over a 17-year project life. The *Pre-feasibility Study on Methane Recovery & Utilization in Nalaikh Coal Mine* is available at <https://www.globalmethane.org/activities/actDetails.aspx?ID=346>.

Pre-feasibility studies were also completed by U.S. EPA at the Naryn Sukhait and Baganuur mines. The Naryn Sukhait study, completed in March of 2013, forecasted water and gas production and estimated that a pilot project could produce enough gas to fuel an 8.55-MW power generation facility, reducing GHG emissions by 187,900 tonnes over the project's 15-year life. The *Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Naryn Sukhait Mine* is available at http://epa.gov/cmop/docs/Mongolia_%20Naryn%20Sukhait%20Prefeasibility%20Study_FINAL.pdf.

The Baganuur Mine study was completed in December 2013. The pre-feasibility study evaluated utilization of pre-drained CMM for on-site use to fuel an internal combustion power generation facility located in close proximity to the mine's surface facilities. Production modeling performed for this study, estimated CMM production is 54.3 million m³ of methane over 10 years, equating to an installed capacity of approximately 5.0 MW of combined electrical and thermal generating capacity. The proposed power generation project is estimated to reduce CMM emissions by 104,500 tonnes of CO₂e over the project's 10-year life. The study, entitled *Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Baganuur Mine*, is available at <http://epa.gov/cmop/docs/2013%20Coal%20Mongolia%20Baganuur%20PFS.pdf>.

22.2.2 CMM EMISSIONS FROM ABANDONED COAL MINES

Emissions estimates from the closed Nalaikh coal mine indicate that the mine workings are now completely flooded and there are negligible emissions from the abandoned mine (MNEC, 2010). When the mine was operating, the excess mine gas was vented. Emissions rates from the mine prior to its closure (for the period from 1988 to 1993) have been estimated to be as high as 355 liters methane per second (MNEC, 2010).

22.2.3 CBM FROM VIRGIN COAL SEAMS

As no natural gas infrastructure exists in Mongolia, CBM activity is in its infancy. Currently, neither conventional natural gas nor CBM is produced or consumed in Mongolia. Based on coal characteristics, the South Gobi, Kharkhiraa, and Altay-Chamandi basins in southern and western Mongolia appear to be the most likely areas for future CBM development, should it become a viable resource (Schwochow, 1997). The Choir-Nyalga basin within the northwest portion of the Eastern Mongolian coal-bearing province also presents characteristics favorable to future CBM development (MNEC, 2014).

A Canadian company, Storm Cat Energy Corp., acquired a CBM exploration license in the Noyon Uul region of the South Gobi basin in 2004 through a Production Sharing Contract (PSC) with the Petroleum Authority of Mongolia. Results of coring and desorption revealed a total coal thickness of 76.6 meters and gas contents which ranged from 2.34 m³/tonne to 11.8 m³/tonne. Storm Cat estimated the potential CBM resource of the area to range from 17 billion m³ to 34 billion m³, with a best estimate of 25.5 billion m³ (Storm Cat, 2005). This resource estimate was based on the volume of coal estimated at depths shallower than the 1,500-meter drill depth, combined with average gas contents obtained from desorption analyses. While the potential resource is relatively large, no gas production has occurred. Storm Cat has determined that further geological review is necessary. Sproule, a Canadian consulting company, also reports to have evaluated CBM resources in Mongolia (Sproule, 2010). Following talks beginning in 2009, Korean Gas concluded the “Korea-Mongolia Gas Partnership,” an agreement for joint research and exploration to develop CBM in Mongolia, with the MOE in 2010. The agreement seeks to supply methane to Ulaanbaatar through CBM exploration and production activities undertaken by the Korean Gas Research and Development Division and the Korea Institute of Geoscience and Mineral Resources. Drilling thus far has yielded no tangible results (KOGAS, 2010).

22.3 Opportunities and Challenges to CMM Recovery and Use

Mongolia is a signatory to the UNFCCC (Table 22-5). As a Non-Annex I Party to the Kyoto Protocol, Mongolia has no national emissions targets. Mongolia was eligible to host GHG mitigation projects under the Clean Development Mechanism (CDM), and registered four projects in the wind, hydropower, and supply side energy efficiency improvements sectors. No CMM projects were hosted by Mongolia.

Table 22-5. Mongolia’s Climate Change Mitigation Commitment

Agreement	Signature	Ratification
UNFCCC	June 12, 1992	September 30, 1993
Kyoto Protocol		December 15, 1999

Source: UNFCCC (2014)

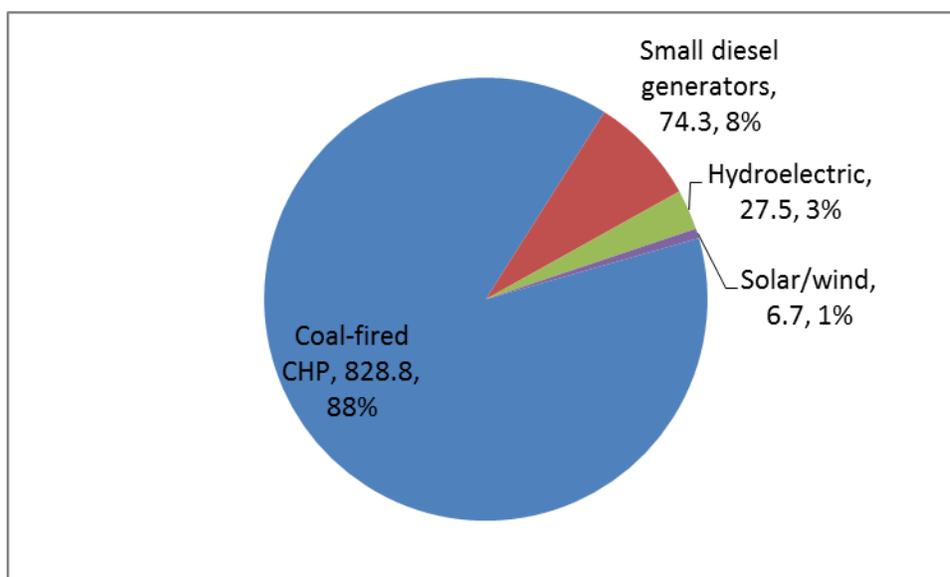
22.3.1 MARKET AND INFRASTRUCTURE FACTORS

The greatest challenge to CMM recovery and utilization in Mongolia is the lack of current markets or infrastructure to support it. With no natural gas production or imports, other fuel sources,

primarily coal, are the principle sources for heat and power. Possible markets for onsite heat and/or power generation include industrial sites and coal mines, based on both their intense electricity demands and extremely harsh winter weather conditions. For example, the Tavan Tolgoi coal mine development will require an estimated 100 MW (Tserenpurev, 2008). In addition, high and steadily increasing costs of petroleum imports to Mongolia may create potential new market demand for liquefied natural gas (LNG) as a vehicle fuel.

Mongolia's installed power capacity is 1,062 MW, most of which is provided by coal (see Figure 22-3); however, only 836 MW (80 percent) is available due to aging power plants operating below design capacity. Mongolia's electricity transmission network connects approximately 70 percent of the country's population, but is considered unreliable, fraught with frequent blackouts occurring in major cities due to aging infrastructure (IEEJ, 2012). Mining accounts for 40 percent of Mongolia's energy consumption, and electricity prices for mining companies that tap into Mongolia's Central Electricity System (CES) will rise by as much as 30 percent according to Mongolia's Energy Regulatory Commission (Kohn, 2013). Electricity demand has increased at an average annual rate of 2.9 percent since 2005, a trend that is expected to continue through 2020.

Figure 22-3. Mongolia's Electricity Supply



Source: IEEJ (2012)

Mongolia's main electricity grid is the CES, which covers 80 percent of Mongolia's electricity supply and includes five coal-fired power plants and an interconnection with Russia for import of electricity. It has a basic transmission grid of 220 kV and 110 kV overhead transmission lines (OHTL). A 220 kV ring system connects the principal generation and load centers of Ulaanbaatar, Darkhan and Erdenet and additional 220 kV connections with load centers of Baganuur and Choir. The Baganuur substation is linked with Power Plant #4 in Ulaanbaatar by a 220 kV two circuit OHTL approximately 130 km long. During peak load periods, electricity is imported from the Russian Federation in order to meet and regulate electricity demand of the system (Prophecy, 2013b). Maximum current import capacity from Russia of 255 MW is expected to be reached (IEEJ, 2012); however, increased imports from Russia are not considered an option for meeting demand as the Mongolian government is concerned about supply security risks attached to reliance on Russian imports as well as the increased expense of Russian electricity.

Mongolia has several laws and resolutions that favor foreign investment in CMM projects. For instance, under the 1993 Law on Foreign Investment, an investor may request a stability agreement providing the investor a legal guarantee for a stable fiscal environment and protection from changes in taxation policy for 10 to 15 years. This protects the contractor from any changes of taxation policy (Chimiddorj, 2006).

The Parliament also passed Resolution #140 on 27 June 2001, which approves a list of favored industries in which foreign investment and involvement will be encouraged. Of these, oil and gas production as well as transmission pipeline construction are included. The MOE's Fuel Division has outlined various development goals which include extraction of petroleum products from coal (Ganbaatar, 2005).

Mongolia's tax policy also appears to be favorable towards CMM project development. Materials and equipment necessary to conduct petroleum operations that are imported by contractors are exempt from customs taxes, value added taxes, and excise taxes. Contractors' earnings from petroleum shares are exempt from income taxes.

22.3.2 REGULATORY INFORMATION

The Constitution of Mongolia indicates that mineral resources in Mongolia are owned by the state. Coal exploration and production are regulated by the Law of Mineral Resources while natural gas and CBM are regulated by the Petroleum Law (Tumurbaatar and Altanchimeg, 2009).

In 1991, the Petroleum Law of Mongolia was ratified by the Parliament. The Law established a legal foundation for new development of petroleum exploration in Mongolia. In 2004, the Mineral Resources and Petroleum Authority of Mongolia (MRPAM) was formed and authorized by the Government of Mongolia to enter into contracts on the matters of oil and gas exploration, development, production, processing, marketing and supply of petroleum products in Mongolia, and to exercise supervision and assistance towards the implementation of such contracts (MIF, 2006). According to Parliament Resolution #43 and Government Resolution #64, MRPAM was reorganized and divided into the separate entities of the Mineral Resources Authority of Mongolia (MRAM) and the Petroleum Authority under the former Ministry of Minerals and Energy, subsequently the Ministry of Mining (MRAM, 2009).

The primary form of petroleum exploration contract in Mongolia is Production Sharing Contract (PSC). Applications are submitted to the Petroleum Authority which signs a PSC with the contractor on the recommendation of the National Security Council and with permission of the Mongolian Government. All materials and equipment necessary to conduct petroleum operations, imported by contractors, are exempt from all customs taxes, value added taxes and excise taxes. The earnings of contractors from their share of petroleum are also exempt from income taxes (Chimiddorj, 2006).

Mongolia's mineral resources are federally owned and administered through the Ministry of Mining (MOM). MRAM and the Petroleum Authority are implementing agencies under the MOM, and are charged with responsible development of mineral and petroleum resources through licensure, and the enforcement of regulations governing development. MRAM is responsible for development of minerals such as coal under the Minerals Law (2006), and the Petroleum Authority, under authority of the Petroleum Law (1991), which governs the production of liquid and gaseous hydrocarbons. The MOM also houses a Fuel Policy Division.

To date there has been no commercial CBM or CMM activity; however, there have been CBM exploration and PSC such as that entered into by Storm Cat Energy with the Petroleum Authority in 2004. Storm Cat Energy explored for CBM both near Ulaanbaatar (Tsaidam block area) and in the South Gobi region near the present Naryn Sukhait surface coal mine (SEC, 2005). No exploration or PSC have been negotiated for resources distinguished as CMM; however, members of the MRAM have indicated that there are regulations which require coal lease holders to not only assess the value of coal within their leasehold, but also estimate the methane resources associated with coal and surrounding strata.

Both the Minerals Law and the Petroleum Law are being revised. A revised draft of the Minerals Law was published in December 2012. The MOM submitted the renewed draft bill of the Petroleum Law to parliament in June 2013, which was passed and made effective on 1 July 2014. This law defines a new category of petroleum resource, unconventional petroleum, which includes bitumen, oil shale, tar sand, gas rich shale, gas sand, and coalbed methane. Conflicts regarding overlap of rights to explore and develop conventional and unconventional petroleum deposits are addressed by encouraging companies interested in developing multiple mineral deposit types and/or oil and gas deposits to apply for the rights to all. If there is overlap of rights among entities, they encourage the leaseholders to find a workable and mutually beneficial approach; if this not possible, the Cabinet will determine the best way forward based on social and economic factors.

Though previous CBM activity has been managed by the Petroleum Authority of the MOM, the MOE claims rights relating to granting permission for research and exploration of methane resources. The primary focus of the MOE has been to supply and distribution of energy. It included a Fuel Division concerned with CBM development and research and asserts that CBM exploration must be permitted through the MOE, but these conflicts may now be resolved internally if the new ministry is created by the merger of MOM and MOE.

22.4 Profiles of Individual Mines

22.4.1 TAVAN TOLGOI

The Tavan Tolgoi coal deposit is located in the territory of Tsogt Tsetsii Soum, within the Ömnögovi Province, approximately 540 km south of Ulaanbaatar. Tavan Tolgoi is one of the world's largest untapped coking and thermal coal deposits. It is divided into six coalfields: Tsankhi, Ukhaa Khudag, Bor Tolgoi, Bor Teeg, Southwest and Eastern coalfields. A small coal mine within the Tavan Tolgoi coal deposit has been in operation since 1967, which until 2011, has supplied coal directly into the Mongolian domestic market. After 2011, all coal produced is exported to China. This coal mine is owned by the local government (51 percent) and other private shareholders. The coal production plan for 2013 was 2 Mmt. Ninety-six percent of the Tavan Tolgoi deposit area is owned by Erdenes MGL (a government owned company), with the exception of the Ukhaa Khudag field which is mined by the Mongolian Mining Corporation (Energy Resources LLC). Erdenes Tavan Tolgoi LLC (Erdenes TT), a subsidiary of Erdenes MGL, is managing the development of the deposit. The Tsankhi field is the largest portion of the entire coal deposit, and is divided into the East and West Tsankhi areas. Recent work has been focused in these two areas. Erdenes TT has chosen the joint venture company of Macmahon Holdings and BBM Operta to operate the mine under a five year contract which extends from 2012 – 2017. Production in 2013 from East Tsankhi mine is expected to be 6 Mmt and 1.5 Mmt from West Tsankhi. The Ukhaa Khudag field, located within the Tavan Tolgoi coal formation is mined by Mongolian Mining Corporation (MMC). The mine is strategically located approximately 240 km from the Mongolian-Chinese border and about 600 km north of Baotou,

China, an important railway transportation hub. The hub provides access to the largest steel producing provinces within China.

MMC began mining operations at Ukhaa Hudag in April of 2009 and became profitable in the first year of operations. MMC's coking coal production has steadily increased from 1.8 Mt in 2009 to 3.9 Mt in 2010, 7.1 Mt in 2011 and 8.6 Mt in 2012, with plans to produce 15 Mt in 2014.

The mine serves as an operational hub for processing coal from Ukhaa Khudag and Baruun Naran mines, complete with all necessary utility infrastructure facilities, including an 18-MW on-site power plant and water supply system (MNEC, 2014).

22.4.2 BAGANUUR

The Baganuur mine is a surface coal mine owned and operated by Baganuur Joint Stock Company (Baganuur JSC), located outside of Ulaanbaatar. The mine is 75 percent state owned and 25 percent privately owned. Baganuur mines 3.5 Mmt of coal per year, with plans to increase production to over 6 Mmt per year by 2020. It is estimated that there are 248.97 Mmt of coal within the Baganuur mining area. The expected service life of Baganuur is 60 years (USEPA, 2013a). Baganuur hosted a United States Environmental Protection Agency study entitled *Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Baganuur Mine*, available at <http://epa.gov/cmop/docs/2013%20Coal%20Mongolia%20Baganuur%20PFS.pdf>.

22.4.3 NARYN SUKHAIT

The Naryn Sukhait coal deposit is located in remote southwestern Mongolia in Ömnögovi Province, approximately 850 km southwest of Ulaanbaatar, and just 57 kilometers north of the Mongolian – Chinese border. Presently there are three large scaled surface coal mines operating at the Naryn Sukhait deposit: Naryn Sukhait Mine-1 operated by Mongolyn Alt (MAK) Corporation, Naryn Sukhait Mine-2 operated by the Mongolian-Chinese joint venture company, Qinhuia-MAK, and the Ovoot Tolgoi mine operated by the Australian company, South Gobi Sands. Projected production of the Naryn Sukhait Mine-1 for 2013 was 10 Mmt. The projected production of the Naryn Sukhait Mine-2 was 1.5 Mmt, while the Ovoot Tolgoi Mine was projected to produce 4 Mmt in 2013 (MNEC, 2014; USEPA, 2013b). MAK hosted a United States Environmental Protection Agency study entitled *Pre-feasibility Study for Coal Mine Methane Recovery and Utilization at Naryn Sukhait Mine*, available at http://epa.gov/cmop/docs/Mongolia_%20Naryn%20Sukhait%20Prefeasibility%20Study_FINAL.pdf.

22.4.4 KHOTGOR

The Nuurst Khotgor coal deposit is located in Uvs Province, approximately 110 km west, southwest of the province center Ulaan Gom. The Nuurst Khotgor Coal Mine began operating as an open cut mine in the Khotgor field in 1963. The mine has produced a total of 4.2 Mmt of coal until it ceased operations in 2013. The coal was utilized by local consumers of the Bayan-Olgii and Uvs Provinces. Presently, mine operations are undertaken in three coal fields (Khotgor, Khotgor Shanaga and Erchim) by different companies. Korea Coal Corporation (KOCOAL), a state-run coal mine developer, purchased a 51 percent stake in the Khotgor Shanaga coal mine for \$10 million US and will invest an additional \$18.1 million US in mine operations. The mine has a soft coal reserve of 79 Mmt and plans to produce up to 1 Mmt of coal annually. The mine, operated by Mongolian-Korean

Joint Venture Company, was scheduled to produce 410 thousand tonnes of coal in 2013. A portion of that production was planned for export to Russia. KOCOAL was established in 1950 as a government-owned coal company to manage coal mines. Its mission has been further increased with coal export and import businesses, including foreign coal mine development. The company currently operates three domestic coal mines, producing approximately 1.2 Mmt annually. The oldest Khotgor mine will have produced 120 thousand tonnes of coal in 2013 while the Erchim Mine forecasted production of 25 thousand tonnes (MNEC, 2014).

22.4.5 SHARYN GOL

The Sharyn Gol coal deposit is located in the territory of Darkhan Soum in Darkhan - Uul Province. The deposit sits approximately 70 km east of Darkhan city, one of the main stations along the Trans-Mongolian Railway. The Sharyn Gol mine is the oldest coal mine in Mongolia, with over 45 years of continuous production history. The mine began its open pit operation in 1965. Produced coal has been utilized mainly by power plants in Ulaanbaatar, Darkhan and Erdenet. Although the original production capacity was 2.5 Mmt per year, the recent annual production has been on the decline, with 465 thousand tonnes produced in 2012, and a production plan for 2013 of 900 thousand tonnes. The Sharyn Gol mine was privatized on the Mongolian Stock Exchange in 2003. Firebird acquired a controlling position in 2010 and led a complete overhaul of the company, including a 17,000 meter drilling program, resulting in the identification of 374 Mmt of coal resources in a JORC-compliant resource statement. Recently, Sharyn Gol JSC received the government approval required for the launch of operations at its planned new open pit. Sharyn Gol is strategically situated on a rail spur connecting to the Trans-Mongolian Railway. As the only significant supplier of high quality thermal coal, Sharyn Gol can take advantage of growing domestic demand in the Darkhan province and throughout the region. The rail connection also offers the company the option to consider exports to Russia and into the international market through Russian ports. Laboratory tests demonstrated that Sharyn Gol coal can be washed efficiently into a premium export quality coal (MNEC, 2014).

Although the Sharyn Gol mine is principally an opencast mine, the mining company began some underground exploration and development in 2005. Since that time, between 60 and 70,000 tonnes of coal have been mined underground. Maximum annual underground production has been 20,000 tonnes. At times, gas build up in the underground workings has been serious enough to cause work to stop until methane concentrations were reduced. Previously the mine carried out initial research on CBM resources to identify the best extraction technology and how to best transition from surface to underground mining.

22.4.6 OTHERS

The Aduunchuluun mine is located in Dornod Province in eastern Mongolia. The mine is owned by Mongolyn Alt (MAK) Corporation. Small-scale extraction began in 1955 and the mine has produced 600 thousand tonnes of brown coal per year since 1979. It is economically unprofitable to transport thermal coal from Aduunchuluun to local and foreign markets because the coal is high in moisture and low in calorific value, thus MAK has investigated construction of a coal briquette plant. Aduunchuluun has also been considered as a site for coal gasification (Ariuntuya, 2012; MAK, 2014a).

The Baruun Naran mine is located in Ömnögovi Province. Commissioning of the mine took place in January 2012 and commercial coal mining operations started in February 2012. The mine produced 800 thousand tonnes of coal in 2012 and 500 thousand tonnes in 2013 (MMC, 2013b).

The Ulaan Ovoo mine is located in Selenge aimag, 17 km from the Russian border, 430 km from Ulaanbaatar, and 120 km from both Mongolian and Russian rail links. Prophecy Coal Company is the sole owner of the mine and commenced operations in 2010. The mine has an estimated 174 Mmt of measured and 34 Mmt of indicated coal resources (Prophecy, 2014c). The mine's annual capacity is estimated to be 6 Mmt (Ariuntuya, 2012).

The Bayanteeg mine is located in Övörkhanga Province in southern Mongolia. Bayanteeg Shareholding Company established the mine in 1962 with an annual output capacity of 25,000 tonnes of coal and has been supplying nearby towns with coal since then. Bayanteeg mine has estimated reserves of 29.6 Mmt, of which 4.6 Mmt have so far been extracted. Bayanteeg has been considered as the site of a medium-size coal-to-gas plant (Ariuntuya, 2012).

The Tevshiiin Govi mine is located in Dundgovi Province and was established in 1990 by the Mongolian government. The mine has since been privatized and produces 50 thousand tonnes of coal annually. The mine has large reserves but is limited by its isolated location (Ariuntuya, 2012).

The Chandgana deposit consists of two properties, Chandgana Tal and Khavtgai Uul. The Chandgana Tal mine opened in 1967 and consists of 124.4 Mmt of measured resource and produces 20 thousand tonnes of coal annually. Khavtgai Uul consists of 509 Mmt measured and 539 Mmt indicated resource and will meet the needs of the planned 600-MW Chandgana Power Plant (Prophecy, 2014b; Ariuntuya, 2012).

The Ovoot Tolgoi mine is located in Ömnögovi Province and is owned by South Gobi Resources. The mine has operated since 2008, shutting down for nine months in 2012-2013 due to lowered coal prices and demand. The mine had planned production of 3.2 Mmt in 2013 (Mining Journal, 2013).

The Eldev mine, owned by MAK, is located in Dornogovi Province. The mine produces 500,000 tonnes per year and sells to both domestic customers including Erdenet Mining Corporation, Khutul Cement & Lime Plant, Darkhan Power Plant, Ulaanbaatar Railway, and Darkhan Metallurgical Plant as well as export markets (MAK, 2014b).

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