

Potential Estimation of Coal Mine Methane Extraction and Utilization in Heilongjiang Province

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1. Foreword

As an important clean energy, coalbed methane is drawn more and more attention of people. Helongjiang province is rich in coal resource. This province is one of the large resource provinces in China. Within the provincial scope of 454,000 km², there are 60 coal basins of every period. Up to the end of 2000, the proven coal reserves were 22.656 billion tons. However, coal resources are distributed quite uneven in the province. Major 4 coal mining areas, i.e. Jixi, Hegang, Shuangyeshan and Qitaihe coal mining areas are distributed in the Sanjiang district in the province's eastern part. The major 4 mining areas have 42 coal mines, of which 70% are high gassy coal mines. To reduce gas accidents, currently some of the coal mines are equipped with gas extraction systems, however, only Hegang's Nanshan coal mine put the drained gas into use. Coal mine methane drained from other coal mines are vented into atmosphere resulting in air pollution and green house effect. With coal mine resource gradually being exhausted, economics loss and other reasons, Among 4 large mining areas 8 coal mines were abandoned. Before the year of 2005, there will be 5 coal mines to be abandoned one by one. After coal mine is abandoned, large amount of methane gas stored in coal seams and workings will constantly escaped, hurting local environment and causing air pollution. Heilongjiang province has many high gassy coal mines. Gas explosion accidents happened quite often. At present there are no enough gas extraction facilities. Some of the gas extraction systems are not in good operation. Strengthening and expanding the gas extraction capacity of operating coal mines can not only reduce gas accidents to happen and protect miners life safety, but also reasonably utilize resources.

2. Current status of CMM extraction and abandoned coal mines

(1) Hegang mining area

Hegang mining area is located in Hegang city in North Eastern part of Heilongjiang province, which is an old mining area that was developed and constructed early. The mining area was discovered in 1914 and developed in 1917. Up to now, there have been 85 years of coal developing history. The mining area is one of the old industrial bases in China. Originally there were 8 operating coal mines in Hegang mining area. After Xinyi coal mine was closed in 1999, currently there are 7 operating coal mines. They are Junde, Xing'an, Fuli, Dalu, Nanshan, Xingshan coal mines and Lingbei open pit coal mine, annual output on the average is over 12 million tons. Up to the end of 2000, there are 2 billion tons of coal reserves remained, one billion tons of workable

reserves. DaLu, Xingshan coal mines will be abandoned by the year of 2003. According to the coal extraction capacity, Lingbei coal mine is expected to keep on mining operation for about 8 years. Mining operation in Xing'an and Junde coal mines will at most last for 60 ~ 70 years. In Hegang mining area only two coal mines Nanshan and Xinyi mines are gassy coal mines.

After Xinyi coal mine is closed, 490 million tons of coal reserves are remained. The coal seam is thick. Coalbed methane content is 8 ~ 10 m³/t. There are abundant coalbed methane resources. Initiative locally is high in coalbed methane development. It is estimated that there are 300,000 households users of CBM domestic market in Hegang and Jiamusi two cities. Nanshan coal mine of Hegang mining area has in-mine gas drainage system. The gas drainage system was built in 1975 and started putting for resident use in 1992. Up to the end of 2000 in-mine gas drainage capacity had reached 22 ~ 25 m³/min. Annual utilized methane reached 8.10 million m³/a, which is able to meet the demand of 30,000 household use. During the period of "the Tenth Five Year Plan", It is planned to increase 2 in-mine gas extraction stations. The capacity will reach 26 million m³/a, which can supply for the use of 100,000 households. Nanshan coal mine will be the model coal mine for in-mine gas extraction and utilization in this province.

(2) Jixi mining area is located in the south east part of Heilongjiang province covering an area of 3375 km². Currently, there are 10 operating coal mines with actual production capacity of 7.4 million tons/a. Among the operating coal mines Didao, Chengzihe, Zhengyang, Xinhua, Donghai, Erdaohezi and Zhangxin coal mines are high gassy coal mines. Especially, 4 coal mines Didao, Chengzihe, Donghai and Erdaohezi coal mines are gas-accident-easy-to-happen coal mines.

Gas outburst happens quite often in Jixi mining area. To guarantee coal production safety, Didao Shaft started in-mine gas drainage in 1983. At present, the integrated gas extraction system has been set up in Didao, Chengzihe, Datonggou, Xiaohengshan, Xinhua and Donghai coal mines, respectively. However, all drained gas is vented to the atmosphere without being utilized, which not only wasted resources but also resulted in air pollution. The gas extraction systems in Didao, Chengzihe, Xinhua and Donghai coal mines are not in good operation, which needs to return normal operation eagerly. Besides, the gas extraction method with coal being mined at the same time were carried out in the 2nd district of Muling No.2 Shaft. During the period of "Tenth Five Year Plan" it is planned to first develop and utilize methane gas in-mine drained in Didao and Chengzihe coal mines.

Up to the end of 2000, there had been 6 abandoned coal mines in Jixi mining area. They are No. 2 Shaft, No. 3 Shaft and No. 6 Shaft of Muling coal mine, Belt incline of Hengshan coal mine, Shaft of XiaoHengshan coal mine, skip shaft of Dayonggou coal mine (see Table 1). All these coal mines are high gassy mines. Except for the

mine mouth of the shaft of Xiaohengshan mine which was not back filled, other 5 mine mouth of coal mines were back filled according to regulations. The remaining coal reserves in abandoned coal mines are 360 million tons. Coalbed methane resources are 5.1 billion m³. By the year of 2003, following 5 shafts the Shaft, No. 3 Shaft, No.9 Shaft, No. 11 Shaft of Didao mine, the Shaft of Erdaohezi mine will be scrapped one by one.

Table 1 Status on Abandoned Coal Mines in Jixi Mining Area

Coal mine	Time of put into operation	Closure time	Remaining coal (10 ⁸ t)	Methane resources (10 ⁸ m ³)	Methane content (m ³ /t)	Relative Methane abundance (m ³ /t)	Absolute Methane abundance (m ³ /min)	
Xiaohengshan mine		1999	2.4		8	10~18	15~30	
Datonghou mine		1998	0.2	0.8	15	47	27	
Hengshan mine	1911	1995	0.20	1.8	5	16	3.7	
Muling coal mine	No. 2 Shaft	1925	1998	0.48	0.55	12	68	27
	No. 3 Shaft	1940	1998	0.28	2.1	10	51	21
	No. 6 Shaft	1956	1998	0.23	1.7	8	19	8

(3) Shuangyeshan Coal Mine

Shuangyashan mining area is located in Shuangyashan city of the eastern part of Heilongjiang province. It is an arc basin with a long axle nearly west to east direction. The basin is 50 km long from west to east, 6 ~ 15 km wide from south to north covering an area of 600 km². Currently, there are 8 operating coal mines and 9 shafts. They are Sifangtai, Dongbaowei, Qixing, Shuangyang No.1 and 2 Shaft, Changxing, Xin'an, Dongrong No. 2 mine, Jixian coal mine. Except for Jixian and Dongrong No.2 mine which use the shaft mining method, other coal mines use incline mining method. Among 8 operating coal mines only Sifangtai mine is high gassy coal mine. Therefore, there is no in-mine gas drainage system in Shuangyashan mining area.

Shuangyashan mining area has 3 abandoned coal mines. They are Lingxi mine, Lingdong mine and Baoshan coal mine. Sifangtai coal mine will be scrapped in 2003. (see Table 2) All these 4 coal mines are high gassy coal mines, and are coal mines where gas explosion accident is easy to happen.

(4) Qitaihe Mining Area

Qitaihe mining area is located in the Qitaihe city in the east part of Heilongjiang province. The mining area has 8 operating coal mines with designed production

capacity 6.39 million t/a. In 2000 the production capacity was 6.75 million tons. Major coal mines are Xinjian, Xinxing, Taoshan, Dongfeng, Xinli, Tiedong, Fuqiang and Longhu coal mines. Most of the coal mines are in their middle age period. There is no abandoned coal mine. Dominant coal products are high quality coking coal and coal used for making up coking coal. 4 of above coal mines Xinjian, Xinxing, Xinli and Taoshan coal mines are high gassy coal mines. Coal reserves are 2.1 billion tons. Coalbed methane resources are 7.2 billion m³. Qitaihe mining area has not yet built in-mine gas extraction system. The feasibility study on the system has been done.

Table 2 Status on Abandoned Coal Mines in Shuangyashan Mining Area

Coal mine	Area (km ²)	Remaining Coal (10 ⁸ t)	Methane resources (10 ⁸ m ³)	Methane content (m ³ /t)	Coal rank
Lingxi coal mine	24	0.11	2.0	18	Fat gas coal
Lingdong coal mine	40	0.38	6.8	18	Fat gas coal
Baoshan coal mine	36	0.71	3.8	8	No.2 Gas coal
Sifangtai coal mine	40	0.4	3.1	8.7	No.2 Gas coal

3. Method of Assessment and Utilization Potential

The gas extraction in abandoned and operating coal mines can be carried out in three stages: the stage for resource assessment and monitoring and test, the engineering project demonstration stage and the utilization and assessment stage. In the earlier stage we need to collect data and investigate coal mines for methane gas resource/reserves, make calculation and assessment. In later stage, test the demonstration engineering project, and finally evaluate whether the method used for methane resource utilization is reasonable. Comparing to surface coalbed methane development, in-mine methane extraction has much less risk. Each parameter of gas drainage has shown relatively better.

To sum up, it has certain potential to conduct AMM and CMM extraction in Heilongjiang province. CMM extraction and utilization can not only reduce the gas accidents to happen, therefore guarantee production safety, but also mitigate air pollution and green house effect and protect global environment. And it is possible to change local energy structure and industry structure and provide opportunities for employment so as to promote local economic development.

The Sanjiang zone in the east part of Heilongjiang province is the old coal industrial zone in China. It has abundant coalbed methane resource. The Planning Commission of Helongjiang province paid a special attention and support to the CMM extraction and utilization. During the period of the “Tenth Five Year Plan”, Helongjiang

province government has planned to combine the surface well extraction with operating coal mine methane extraction and AMM extraction to develop coalbed methane, follow in order and advance step by step, and make a rolling development. Each coal mining administration is vigorous in the gas extraction task. Each coal mine is near the residential area and not far from the city. The gas market is good in prospect. Therefore it is expected to have a potential extensive market in Heilongjiang province in conducting CMM extraction and utilization.

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