

Status and Potential of AMM Project Development in China



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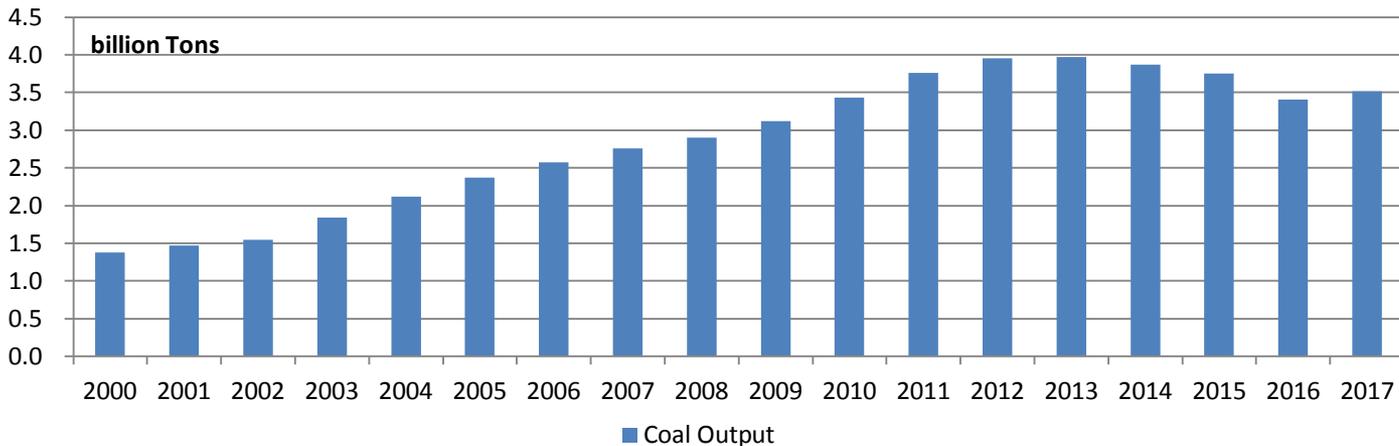
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- 1. Overview of CBM/CMM in China**
- 2. The Status of AMM Development**
- 3. The Potential of AMM Project**
- 4. Conclusion**

1 Overview of CBM/CMM in China

■ Coal output in China

- China's coal output in 2017 was 3.52 billion tons. With the adjustment of energy industrial structure and the overcapacity reduction since 2014, the coal output in China had been decreasing continuously for 3 years from 2014 to 2016 and 2017 had seen a slight growth.



Coal Output from 2000 to 2017 in China

1 Overview of CBM/CMM in China

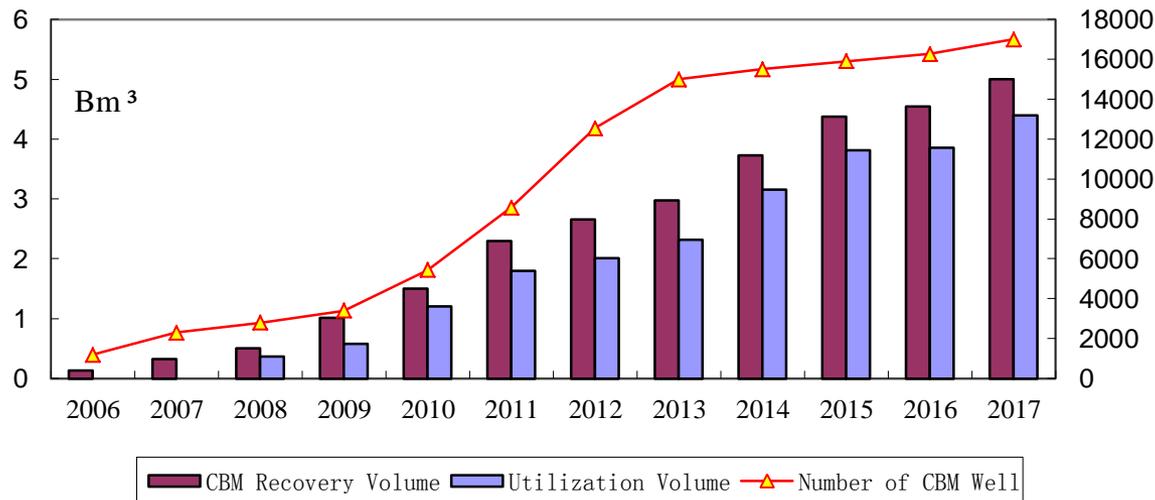
■ Drainage and utilization volume of CBM/CMM

- In 2017, the total volume of CBM/CMM reached 17.8 billion m³ and the utilization volume was 9.3 billion m³
- Increase of respectively 26% and 61% compared those in 2012.
- The cumulative use of 41 billion m³ of CBM/CMM from 2013 to 2017 is equivalent to saving 50 million tons of standard coal and reducing 620 million tons of carbon dioxide emissions.

1 Overview of CBM/CMM in China

■ CBM Production and utilization volume

- The total number of CBM surface wells has exceeded 17,000 by the end of 2017
- The proved geological CBM reserves have been up to 703.3 billion m³. The production capacity is 9.5 billion m³.
- The CBM production and utilization volume was respectively 5 billion m³ and 4.4 billion m³ in 2017, up by 87% and 119% compared with 2012.

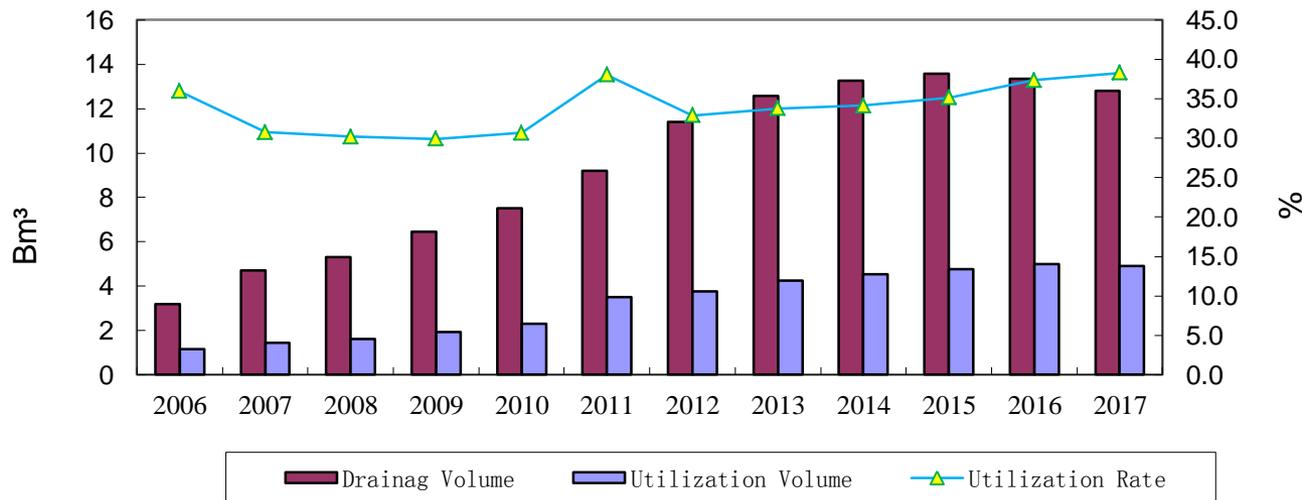


CBM Production Volume from 2006 to 2017 in China

1 Overview of CBM/CMM in China

■ CMM Drainage

- The CMM drainage volume had raised 3.2 times from 3.2 billion m³ to 13.57 billion m³ from 2006 to 2015, and the utilization volume had raised 4.15 times from 1.15 billion m³ to 4.77 billion m³.
- In 2016 and 2017, under the guidance of the national policies to limiting overcapacity and close small and unsafe coal mines, the drainage volume of CMM had also declined slightly in China .

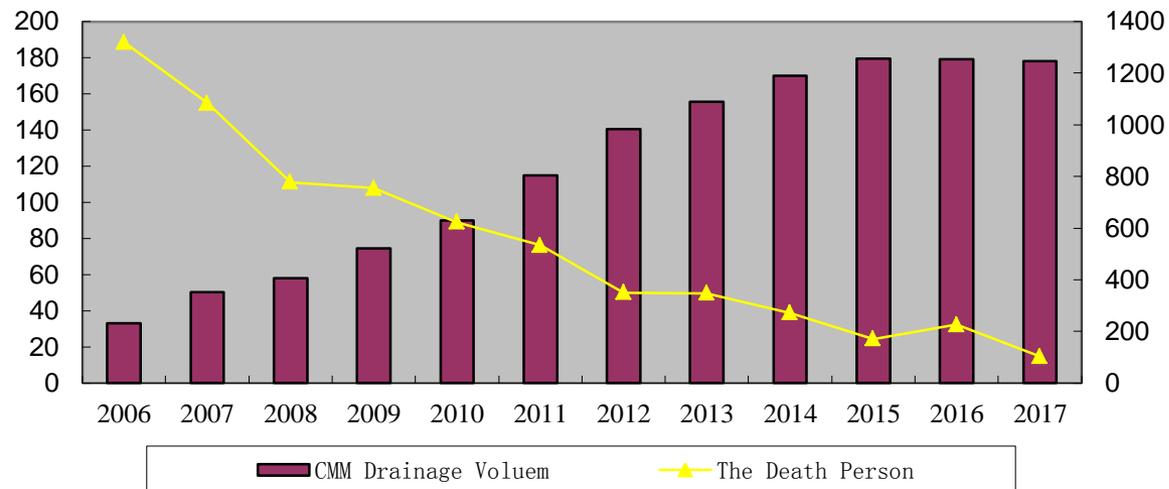


CMM Drainage Volume from 2006-2017 in China

1 Overview of CBM/CMM in China

■ Fatality caused by coal mine gas accidents

- With the rapid increase of the CBM/CMM drainage and utilization, the fatality caused by gas accidents has dropped strikingly .
- The fatality had declined from 1,319 in 2006 to 103 in 2017 and declined by 11.8 times.



Fatality of coal mine gas accidents has dropped with the increase of gas drainage volume from 2006-2017

1 Overview of CBM/CMM in China

■ The 13th Five-Year Plan the Development and Utilization of CBM and CMM(2016-2020)

- The CBM/CMM drainage volume up to 24 billion m³, among which 10 million m³ will CBM production, the utilization rate of above 90%
- The CMM drainage volume up to 14 billion m³ with the utilization rate of above 50%, the installed capacity of CMM power generation units up to 2.8 million kW and the number of household users above 1.68 million.

1 Overview of CBM/CMM in China

■ The 13th Five-Year Plan the Development and Utilization of CBM and CMM

- The utilization of abandoned coal mine methane(AMM) become a new growth point in the CBM industry.
- Plann to select a number of abandoned coal mines with sufficient AMM resources and sustainable recovery conditions and build up a number of demonstration projects.
- Plann to research, develop and promote the recovery and utilization technologies of AMM.

2 The Status of AMM Development and Utilization

■ The Status of AMM Development and Utilization

- 2.1 Necessity of development
- 2..2 Research projects
- 2.3 Development policies
- 2.4 Case study

2 The Status of AMM Development and Utilization

2.1 Necessity of AMM development

■ With the overcapacity reduction, lots of coal mines had been closed in recent years

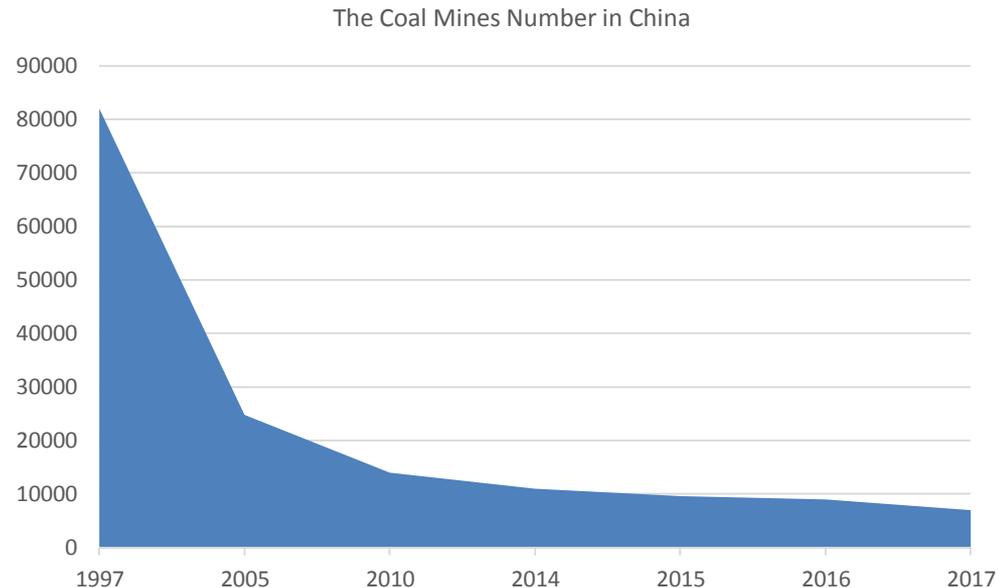
■ 2005: about 24,800 coal mines

■ 2010: about 14,000 coal mines

■ 2015: 9,624 coal mines

■ 2016: 9,000 coal mines

■ 2017: 7,000 Coal mines



2 The Status of AMM Development and Utilization



■ The Distribution of Closed Mines

- The abandoned coal mine are mainly located in these provinces,
 - Shanxi, Hunan, Guizhou, Sichuan, Yunnan, Heilongjiang, Chongqing, Hebei, Liaoning and Shaanxi, which will be the important areas for AMM development.



2 The Status of AMM Development and Utilization

■ Trend of Coal Mine Closure

- 9 provinces, including Shanxi and Inner Mongolia, will reduce the coal production capacity of more than 60 million tons in 2018.
- During the “13th Five-year Plan” period and in the future, the quantity of coal mines will be further reduced with structural reform of coal industry and the overcapacity reduction.

Province	Capacity
Shan Xi	2300
Hebei	1062
Guizhou	1000
Anhui	690
Gansu	471
Shandong	465
Inner Mongolia	405
Chongqing	197
Yunnan	58
Total	6648

2 The Status of AMM Development and Utilization



■ 2.2 CCII Undertook SPF Projects

- ✓ Policy Recommendations to Improve China's AMM Extraction and Utilization(2014)
- ✓ Feasibility Study of Pilot Project on AMM Development and Policy Recommendation for AMM Development and Utilization in China
- ✓ Utilising UK Expertise to Promote the Commercialisation of Abandoned Mine Methane (AMM) Recovery in China



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On-site Investigation

2 The Status of AMM Development and Utilization



■ Key Research Project of China Academy of Engineering (CAE)- Strategic Research on Coal Mine Safety and Resources Reuse of Abandoned Mines(2017)

- Research on resource development and utilization strategy for abandoned mine in China
- Technical roadmap of national strategy of mine safety and abandoned mine resource development and utilization in China



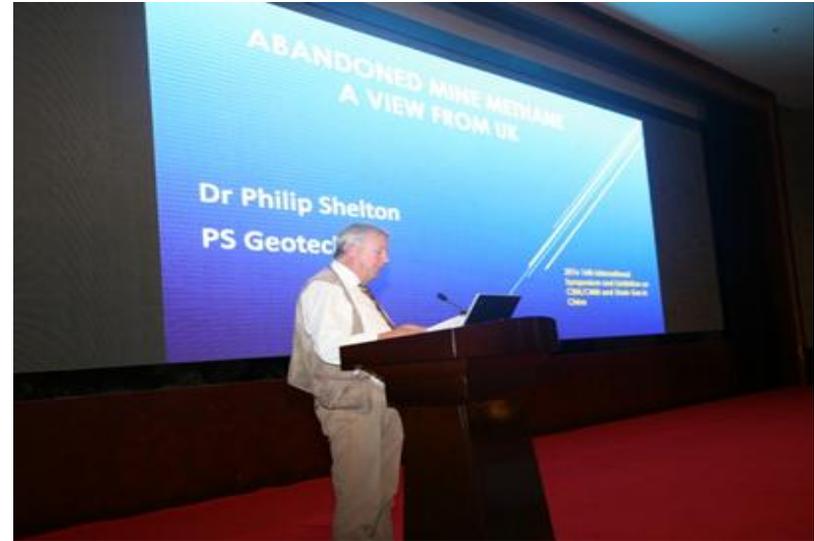
2 The Status of AMM Development and Utilization



■ Workshop on AMM Recovery and Utilization in China



Liu Wen'ge, Vice President of CCII is delivering a speech



UK Expert, Dr. Philip Shelton is delivering a speech



USA Expert, Michael Cote is delivering a speech

2 The Status of AMM Development and Utilization



■ 2.3 AMM Development Policies

- ✓ AMM recovery and utilization demonstration projects are listed in the “13th Five-year Plan for CBM /CMM Development and Utilization” (November 2016)
- ✓ Listed as one of key works in coal mine methane management and CBM development and utilization in 2016 by National Energy Administration(NEA) (2016);

2 The Status of AMM Development and Utilization



■ 2.4 Case Study of AMM Development

- **Case1: AMM Project of Wulan Coal Mine in Ningxia Province**
- **Case2: AMM Project of Shanxi Jincheng Anthracite Coal Mining Group**

2 The Status of AMM Development and Utilization



■ Case1: AMM Project of Wulan Coal Mine in Ningxia Province

- Owned by Shenhua Ningxia Coal Industry Group Co., Ltd., Wulan Coal Mine is located at the north end of Hulustai Mining Area in the North Helan Mountain
- The coal mine was constructed on July 1, 1966 and put into operation on June 30, 1975.
- Wulan Coal Mine came to a complete stop in exploitation in late 2015 and the mine was closed completely in early 2016.

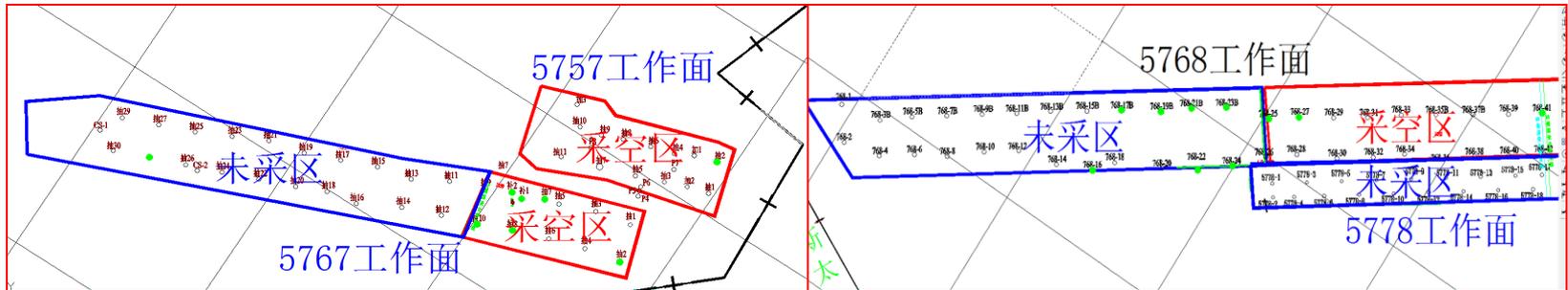


Location of Wulan Coal Mine

2 The Status of AMM Development and Utilization



- From April to May in 2006, **108 surface boreholes** had been drilled for the CMM disaster Control and prevention
- There are **19** working boreholes , as well as **68** boreholes are good casing but with no gas production.



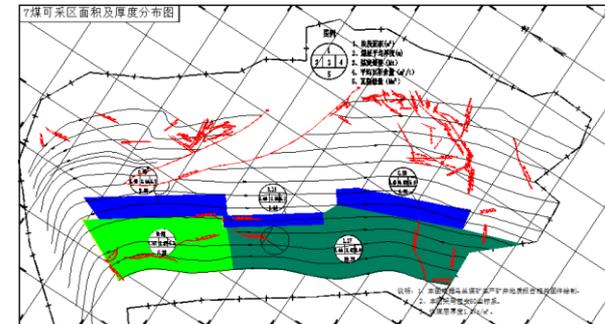
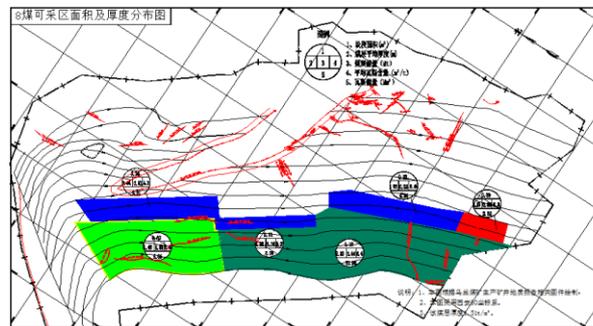
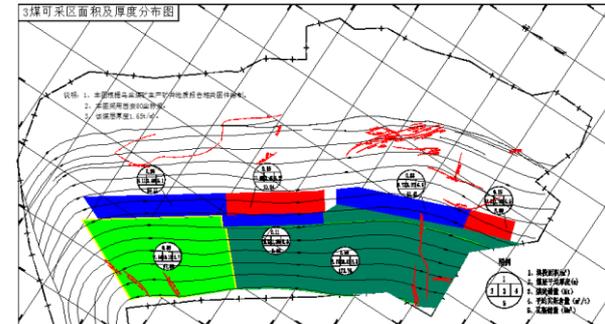
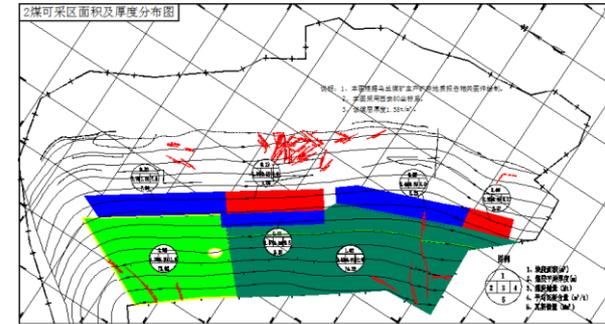
The Distribution of Surface Well

2 The Status of AMM Development and Utilization

■ Estimated Gas Resources

$$W_k = W_1 + W_2 + W_3$$

- Gas resources totally 683.83Mm³, including 28.63Mm³ in the gob, 541.23Mm³ of in the non-mining area and 113.97Mm³ in the surrounding roof.



2 The Status of AMM Development and Utilization



■ Utilized Equipment

- In 2010, 16 sets of 500kW low concentration gas generators with were installed in phase I.
- In 2013, 6 sets of 700kW low concentration gas generators were installed to have a total installed capacity of 12.2MW in phase II.
- The utilized equipment operates well and has access to the power grid.



2 The Current Situation of AMM Development

■ Utilization Benefits

- Annual energy output of 85.8 million kwh and annual electricity sales of 81.94 million kwh
- Annual CO₂ emission reduction of 495,000 tons

■ Challenges

- Increase the AMM production
- Increase the number of the working boreholes by workover

2 The Status of AMM Development and Utilization

■ Case2:AMM Project of Shanxi Jincheng Anthracite Coal Mining

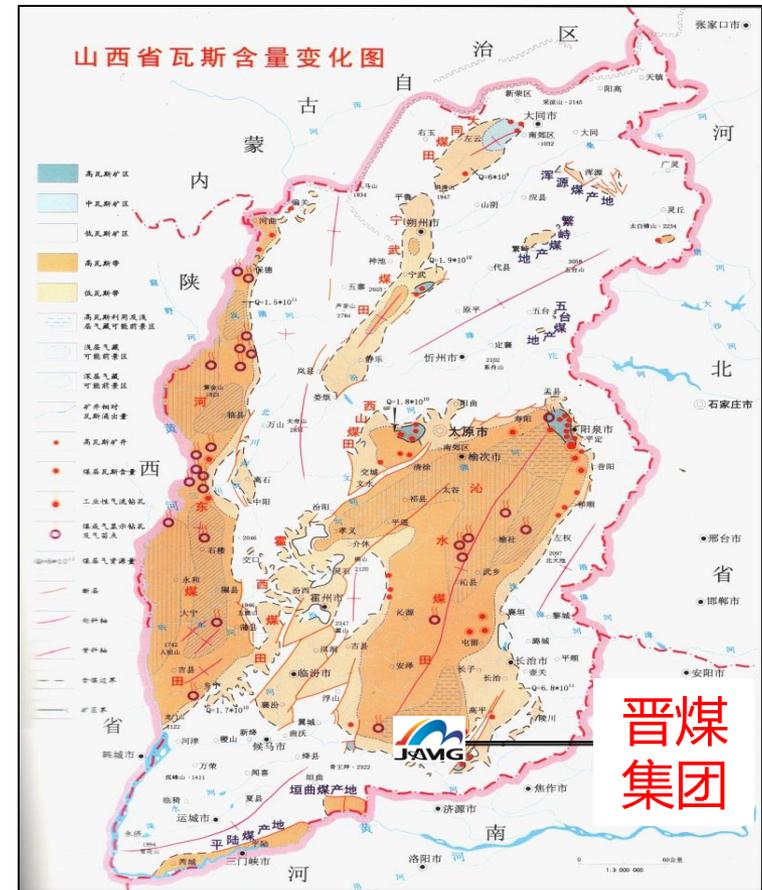
Group

● AMM resources in Shanxi Province

- ✓ As of the end of 2013, Shanxi totally has over **4,700** abandoned coal mines covering about **5,000 km²**

● AMM resources in Jincheng Mining Area

- ✓ As of the end of 2013, Jincheng mining area totally has over **1,700** abandoned coal mines covering about **1,500 km²**

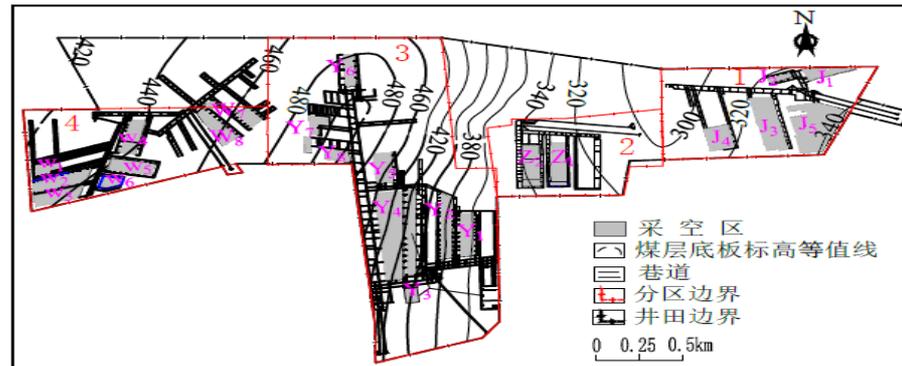


2 The Status of AMM Development and Utilization



■ Basic Information of AMM in Jinsheng Coal Mine

- Mine field area **6.5 km²**, mining area **4.96 km²**
- Coal production was **900,000t/a**, closed in November **2011**
- Mining in the 3[#] coal seam, and residual coal resource/reserve is **51.30Mt**, and recoverable reserve is about **15.107mt**, total AMM resource is about **587 million m³**, in which adsorbed gas resource is **584 million m³**, free gas resource is **3.64 million m³** and the resource abundance is **0.902 × 10⁸m³/km²**



Distribution of Gob Area in Jinsheng Coal Mine

3 The Potential of AMM Development

■ 3.1 Prediction of AMM Resources in China

- The number of abandoned coal mines is huge in China.
- Remaining coal and AMM resources: There are up to 42 billion tons of coal reserves and close to 500 billion cubic meters of AMM resource in the abandoned coal mines in China.

3 The Potential of AMM Development

■ 3.2 Potential Development Projects

- ✓ Nanshan Coal Mine of Heilongjiang Longmei Hegang Mining Industry Co., Ltd.

Nanshan Coal Mine plans to be closed officially in the end of **2017**, which is gassy and outburst coal mine

- ✓ Lishu Coal Mine of Heilongjiang Longmei Jixi Mining Industry Co., Ltd.

Lishu Coal Mine of Jixi Mining Group was officially shut down in **March 2016**, which is a gassy coal mine.

3 The Potential of AMM Development

■ 3.2 Potential Development Projects

- ✓ Yongan Coal Mine, Songshu Town Coal Mine and Daoqing Coal Mine of Jilin Tongkuang Mining Industry Company have been closed between 2015 and 2016.



3 The Potential of AMM Development

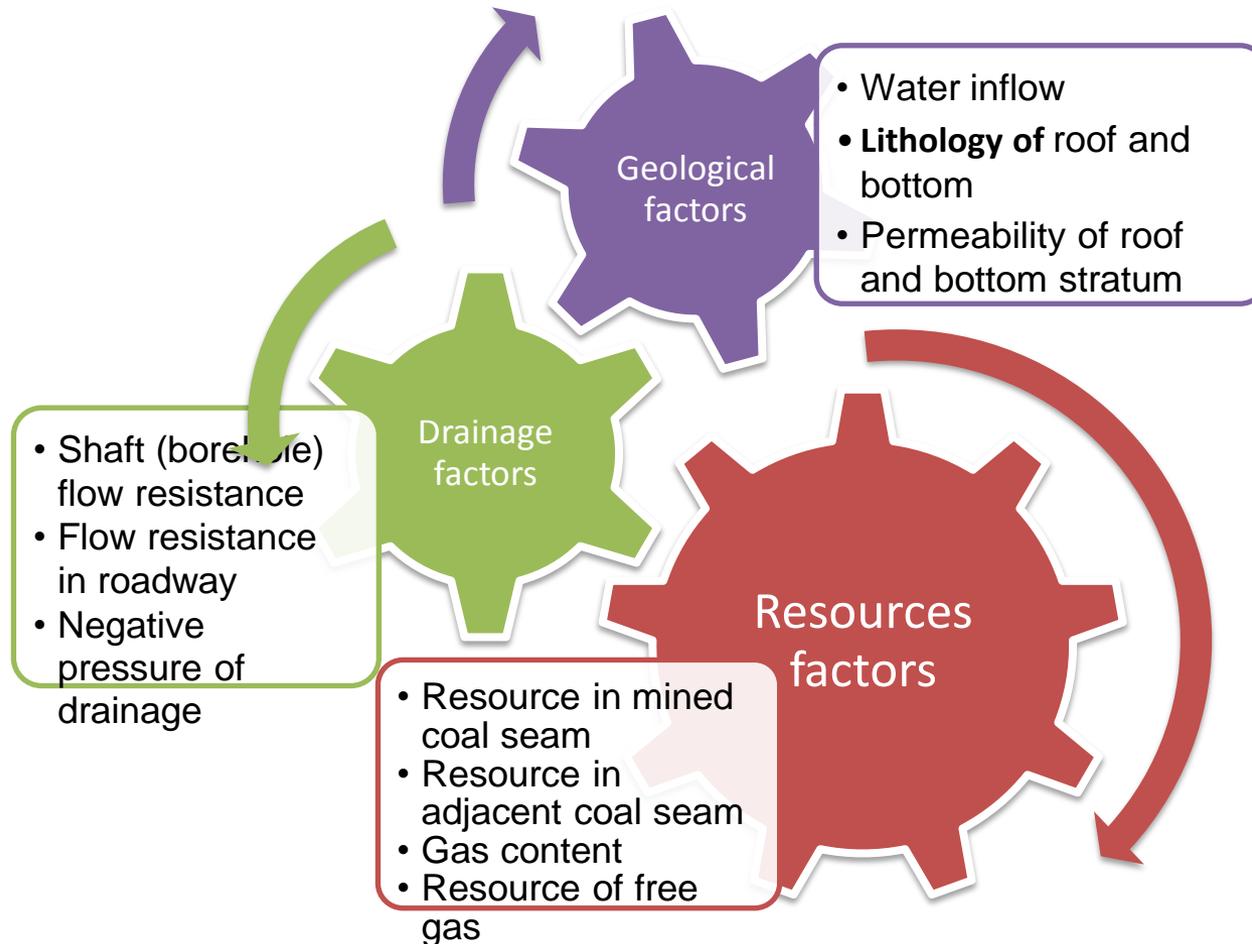
■ 3.2 Potential Development Projects

- ✓ Shanxi Coal and Chemical Industry Group: Chenjiashan Coal Mine of Tongchuan Mining Industry Co., Ltd. and Xiangshan Coal Mine of Hancheng Mining Industry Co., Ltd.

Chenjiashan Coal Mine and Xiangshan Coal Mine are about to be closed during the “13th Five-year Plan” period

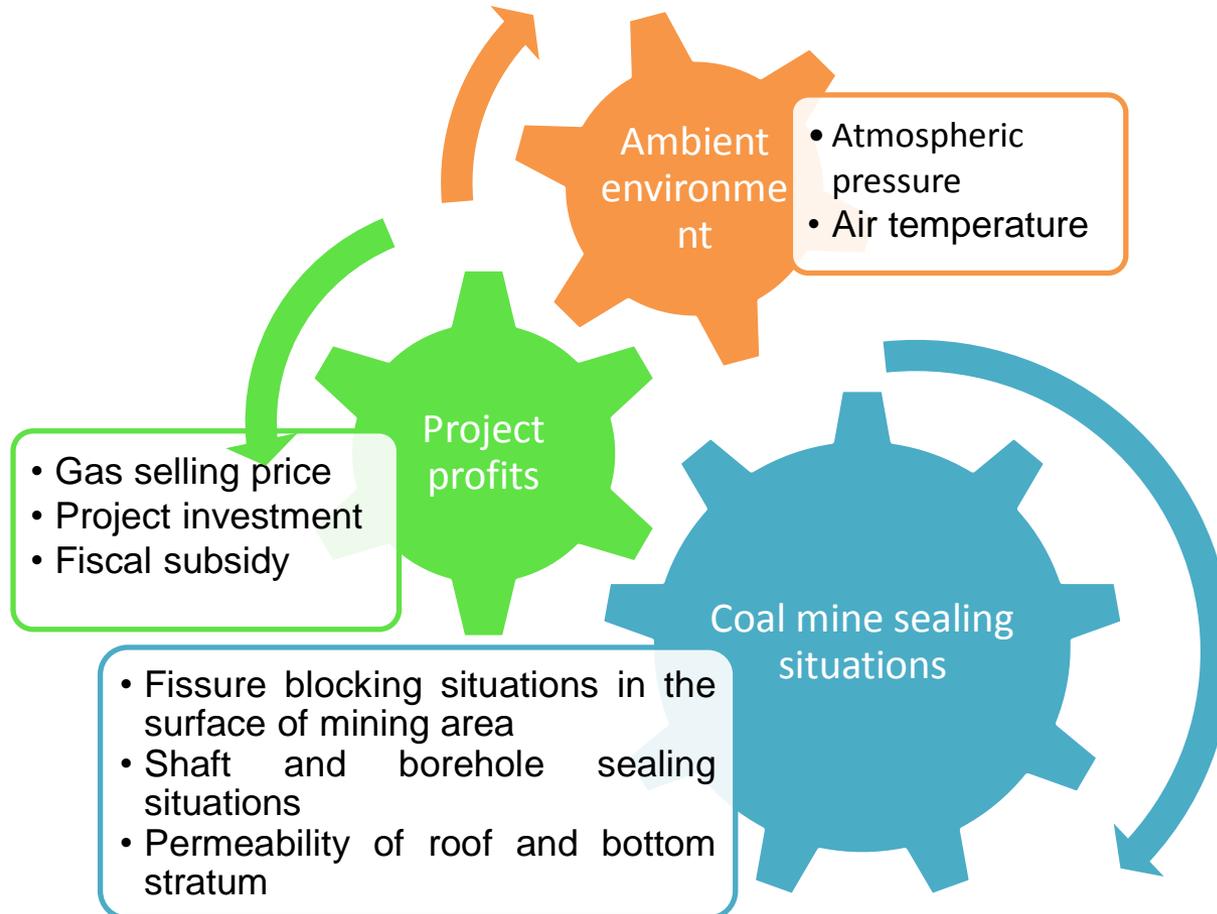
3 The Potential of AMM Development

■ 3.3 Influential Factors for AMM Project Development



3 The Potential of AMM Development

■ 3.3 Influential Factors for AMM Project Development



4 Conclusion

- **4.1 Great potential in China for AMM development**
- **4.2 Government has been paying great attention on AMM resources development and utilizations**
- **4.3 More and more Chinese companies have strong interest in AMM development**
- **4.4 More study and research on this fields conducted by national research institutes**

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