

Development of the CBM Industry in China and Policy Evaluation

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Abstract. This paper reviewed the development process of Coalbed Methane (CBM) industry of China, and divided it into two phases——starting phase and initialization phase of commercialization. At the same time, the major problems and industry policies of every phase were listed, and the relationship between the policy and development of the industry was then analyzed based the list. Finally, the author evaluated those policies of purpose, means and result and outlook the development prospect of the CBM industry in China.

Keywords: CBM •industry policy• development phases

1. Introduction

CBM is a double-edged sword. On one hand, it is the crime culprit of gas explosion in coal mine, while it is also a kind of high-quality energy or chemical materials on the other hand. The resource assessment of CBM in China showed that the total reserves of CBM in this nation reached 36.81 trillion cubic metres, while the minable was 10.87 trillion cubic metres which ranked NO.3 in the world.

Compared with the resource with substantial deposits, the CBM industry in China started late and developed slowly which has a large distance with those nations that have the relatively mature industry just like USA, Canada and so on. However, the CBM industry in China would have vast development prospects if those problems will have been solved properly.

Mentioned with the history that CBM was explored and studied in China, it can be traced back to early years of the new nation. But the topic of CBM extraction was not proposed by some scholars including Zhang Suian until 1983. After lengthy exploration, groping and researching, China United Coalbed Methane Corporation (CUCMC) was allowed to establish by the State Council (SC). CUCMC works on exploration, exploitation, delivering, marketing and utilizing CBM, and has the exclusive right of foreign cooperation to explore, exploit and produce CBM. The establishment of CUCMC marked that exploitation and utilization of CBM in China had entered to a new stage, and built a strong foundation for that CBM in China turned into a real sense of the industrialization age.

From the establishment of CUCMC, the CBM industry in China has already achieved much from nothing. The data in 2012 displayed that the output of CBM in this nation reached 12.5 Billion cubic meters, including 2.57 Billion cubic meters extracted on the ground and 9.94 Billion cubic meters extracted in underground. The amount of utilization of CBM in China is 5.2 Billion cubic meters as well.

On the basis of the progress of geological research and exploration for CBM, Qin Yong[1] divided the development time into three phases(Table 1): the first phase is the one that surveyed the resource of CBM and geological conditions and tested exploration for CBM; the second phase is the one that groped the reservoir forming conditions of CBM and initialized the industrialization; the third phase is the one that deepened and extended the reservoir forming conditions and developed commercialized production of CBM at top speed.

Table 1 The phase of the development of the CBM industry in major countries

	Phase 1	Phase 2	Phase 3
USA	1970-1980	1981-1988	1989 to now
Canada	1978-2001	2002-2004	2005 to now
China	1981-2002	2003 to now	

According to above-mentioned opinion, he thought the CBM industry today in China would still stay in the second phase for a long time. Reviewed the history of geological research and exploration for CBM in China, Qin Yong divided it into three stages: the first stage is from 1981 to 1999, in which the reserves and the hosting patterns were tried to discuss in geological research, the areas of CBM were searched for in exploration, and development testing was started to grope; the second stage is from 2000 to 2002, in which Geological control mechanism and characteristics were mentioned in geological research, general survey was done in exploration, while development testing didn't make any great achievement; the third stage is from 2003 to now, the reservoir

forming condition and mechanism were got down to research in geological research, detailed survey was done in exploration, commercialization began to appear.

On the basis of the experience of the CBM industry in China and the commercialization levels, its development process could be divided to two phases since 1996:

The first phase, starting phase (1996-2005)

The second phase, initialization phase of commercialization (2006 to now)

Although the CBM industry in China has developed for nearly 20 years, it don't enter the golden time for development yet after hard and long starting phase. Not only CBM is under the awkward situation that is dispensable as a kind of renewable source, but also the progress of commercialization developed very slowly encountering bottlenecks. It is not hard find that many old problems occurred in starting phase have not been solved well when we look back the history of the industry, while the new problems begin to appear continually. We can sum them up in 5 main points:

The first one, the fund of the industry development is insufficient. As an emerging industry, the CBM industry has long periods of production, major technological hurdles and low prospective earnings in short order. As a result, it's hard to attract domestic investment except foster capital from the government. Although domestic investors start to pay attention to it with the development of this industry, the investment market remains disordered and small-scale.

The second one, the technology level is low. The study on CBM started late in China, so foreign technologies were widely used in actual operations. However, the results were frequently poor. Both scientificity and standardability of basic research in this nation aren't so good which are far away from the technical demand of the industry. In addition, the storage condition of CBM in China is truly complex, and coal bed permeability is low, which increase difficulties in drainage. Therefore the technical question becomes even more crucial.

The third one, the mining rights overlap problem between coal and CBM is a big barrier for the development of CBM. According to ore resources law in China, CBM belongs to the gas minerals whose mining right should be certificated by national level government institutions, while coal belongs to the solid minerals whose mining right should be certificated by ministerial or provincial level government institutions. But CBM is the kind of gas which is usually on the coalbed, so the enterprises, including CBM exploration and coal exploration, often affect and interact each other.

The forth one, income from investments in CBM is affected by its low price. Relative to the rising price in international market, the price of natural gas in China is very low. In 2013, the civilian price of natural gas in Beijing is 2.28 yuan, and the price for business and industry is 3.25 yuan (Table 2). Because CBM's market share is very small, the price is dominated by conventional gas.

But the cost to exploit CBM in the same output is 4.5 times more than conventional gas, for which the profit margin of CBM is squeezed seriously. Furthermore, the price of natural gas is fixed by government, so the tight control of local governments is another important reason of low price.

Table 2 price of natural gas in Beijing
Origins of data: Document 573 (2007), Document 1720 (2010), Document 1967 (2012), Beijing Municipal Commission of Development and Reform.

Classification	Price (yuan)	
home		2.28
Industry and commerce	Industry	3.23
	Public service	3.23
Power generation (including heating and refrigeration)	Heating	2.67
	Refrigeration	2.67
	Combined heat and power generation	2.67
Compressed natural gas	Gas primary filling station	2.62
	Gas secondary filling station	5.12

The last but not least, utilization rate of CBM in China is low. The data showed that the utilization rate of CBM in ground was 74%, while the utilization rate of CBM in underground was only 33.3% in 2012. Many mines didn't extract gas at all. The reason is CBM in many mines, whose concentration is less than 8%, can not be used for civil use or internal combustion engine; at the same time, the purification technology of CBM has not been popularized in the practice because of its insecurity and diseconomy.

2. The Development of the Industry Policies of the CBM Industry in China

2.1 Starting Phase (1996-2005)

The establishment of CUCMC marked the opening of the industrialization of CBM in 1996. In this phase, it built a strong foundation for the development of

the CBM industry that large-scale explorations were carried out and technologies were researched in China.

Government provided effective guarantee for the development of the industry by relevant laws and regulations. But the industry faced shortages of capitals and technologies in the beginning. As a result, government decided to choose the strategy of foreign cooperation in starting phase. When the industry started, strong funding and advanced technology from abroad played a crucial role in industrialization of CBM. So the major objective of government policies is encouraging foreign cooperation and the main method is tax preference.

(1) Encouraging Platform

Art. 35 of Coal Industry Law of the People's Republic of China (PRC) (1996) regulation, government encourages coal mine enterprise in coal washing and dressing and integrated exploitation and utilization of CBM, coal gangue, coal slime, stone coal and peat.

The Tenth Five- year Plan for National Economic and Social Development (2001) mentioned that energy construction need exert the superiority of resource, optimize energy structure, improve utilization efficiency, construct highly efficient and productive mines and exploit CBM.

(2) Supporting Preferential Tax Policy for Foreign Cooperation of the CBM Industry

Ministry of Finance (MF) and State Administration of Taxation (SAT) announced (1996) that the income tax of the CBM enterprise who is Sino-foreign cooperation can enjoy the tax preference policy that can be exempted for the first 2 years and halved for the next 3 years.

MF and SAT regulated (1997) that the added-value tax (VAT) rate of CBM extraction on the ground which is Sino-foreign cooperation is 5% in kind; the added-value tax rate of CBM extraction on the ground which is self-supporting is 13%, while 8% would be reimbursed then.

In the same year, SC adjusted the tax policy for using capitals and equipments from abroad better: Starting on January 1, 1998, the Chinese government has exempted equipment imports for foreign-funded projects encouraged by the state from import tax and VAT.

2.2 Initialization Phase of Commercialization (2006 to now)

On November 1, 2005, the first-stage project of Qinnanpanhe, the first national high-tech industrialization demonstration project of development and utilization of CBM in China, was completed, which start commercialization of the industry in China and marked a new phase of large-scale development and utilization of the energy.

The phase experienced 11th Five-Year Plan period and 12th Five-Year Plan period, when the industry attracted more attention at the national level. Government had already introduced policies to speed up drainage and utilization of CBM for 2 times, and even the output and utilization rate were defined in 12th Five-Year Plan period. In view of the problems including capital,

technology, mineral rights overlap, price and utilization rate, government introduced a series of industry policies to solve them and meet the needs of rapidly developing.

(1) Quickening the Extraction and Utilization of CBM (2006-2012)

- Guidance Document

In 2006, Several Opinions about Quickening the Extraction and Utilization of CBM, issued by General Office of the SC (GOSC), could be seen as a guidance document of the industry, which included measures to encourage the industry development and deal with various problems:

Quickening the extraction and utilization of CBM is an important reflection of “people-oriented” idea, scientific development and conservation-minded society. It should be obeyed that “extraction first, treatment and utilization simultaneously” policy, gas explosion prevention, making a full use of resources and the protection of the environment. Usufruct outlay of exploration rights and usufruct outlay of mining right of the CBM enterprise could be applied for a reduction or exemption by regulation until 2020.

Fiscally, governments at all levels should be required to offer fund and loan with discounted interest; meanwhile offered preferential tax policy to the extraction and utilization of CBM.

Technically, the technology research would be intensified further, the input in it would be increased as well.

To deal with mineral rights overlap, the new exploration should reconnoiter and estimate both CBM and coal, and then measure reserves. Faced the mine whose CBM is eligible to be extracted, the utilization plan of them must be made together, and the CBM extraction on ground is priority.

In utilization of CBM, the power which is generated by CBM can be for self use, and the excess would be sold preferentially that can avoid market competition.

National Energy Administration (NEA) decided to select some eligible emphasis areas of the CBM extraction to achieve the target made in 2010 responding “extraction first, treatment and utilization simultaneously” policy in 2009:

The number of CBM mines whose output is more than 100 million cubic meters would reach 18, the amount of civilian users would reach 2 million, the generator capacity will be more than 1.5 million kw and more than 50% of power generation assemblies could combine cooling, heat and power. In 2015, the number of CBM mines whose output is more than 100 million cubic meters would reach 36, that will reduce the harm of gas fundamentally and protect the environment effectively.

National Development and Reform Commission (NDRC) made (2011) the development plan of the CBM industry in the 12th Five-Year Plan period:

The output of CBM must reach 30 billion cubic meters, including 16 billion cubic meters on ground whose utilization rate is 100% and 14 billion cubic meters in underground whose utilization rate is more than 60%.

- Encouraging the CBM Extraction

MF, General Administration of Customs of PRC (GAC) and SAT together announced (2006) that import tax and VAT of oversea equipments imported by CUCMC which couldn't be produced interiorly and would be used for CBM exploration could be exempted in the 11th Five-Year Plan period. Other CBM enterprises can also enjoy the tax preference policy after application and approved by relevant departments. In 2011, the three departments extended the period for tax exemption to 2015.

MF and SAT adjusted (2007) the tax policy in order to quicken the extraction of CBM:

The CBM enterprises, the ordinary VAT payer, can enjoy the policy of VAT rebates, and the refunds should be used in technical research and expanded reproduction without enterprise income tax.

The dedicated devices bought by independent accounting CBM enterprises could accelerate depreciation with double-declining-balance method or sum-of-the-years-digits method. The method could be decided by enterprises themselves.

To independent accounting CBM enterprises who invest in home equipments of technological transformation project, 40% of the investment could be offset by the newly increased enterprise income tax in the same year.

To the CBM enterprises whose financial accounting system is sound, their technological development expense could enjoy plus pre-tax deductions for enterprise income tax by 50% of the actual amounts based on 100% deducted.

The CBM extraction on ground needn't pay resource tax.

MF decided (2007) to provide fiscal subsidies for the CBM enterprises, and the standard is:

Central finance institution provides 0.2 yuan per cubic metre, while local finance institutions can provide suitable ones according to local condition.

- Encouraging Foreign Cooperation

The Ministry of Commerce (MC), NDRC and Ministry of Land and Resources (MLR) together announced that MC and NDRC will select several enterprises which are competent and experienced to cooperate with foreign enterprises on CBM extraction. In 2010, government allowed China National Petroleum Corporation (CNPC), the China Petrochemical Corporation (SINOPEC) and Henan Provincial Coal Seam Gas Development and Utilization Corporation to cooperate with foreign enterprises on CBM extraction in the areas approved by SC. The exclusive situation in foreign cooperation of CUCMC had been broken.

- Increasing Utilization Rate of CBM

CBM power generation, one part of comprehensive utilization planning, was promoted (2007) by NDRC. It can avoid market competition and peak modulation, beyond that electrical network enterprises should provide convenience for CBM power plants' system access. The price of power generated by CBM can enjoy the subsidy 0.25 yuan per kilowatt hour.

NDRC emphasized (2007) the management system of the CBM price:

The ex-factory price of CBM for civilian use should be contracted by supply and requisitioning parties.

The local governments must free the price control as soon as possible.

The sale price of CBM for civilian use which isn't in the public gas distribution network yet should be contracted by supply and requisitioning parties; the one in the public gas distribution network should be set on the basis of the pricing principle of substitutes just like conventional natural gas, coal gas and liquefied gas.

Government should strengthen the management of gas companies in order to reduce the distribution cost. Meanwhile the price of CBM for civilian use should be monitored to maintain regular price order.

- the Mining Rights of CBM Protection

MLR introduced (2007) policies to solve the problem of comprehensive exploration and exploitation:

The comprehensive CBM exploration should be encouraged.

The mining rights setting of both coal and CBM should be considered together. In the district of CBM enrichment, the extraction area should be defined, in which there won't be mining right of coal before the CBM extraction is finished.

To deal with mineral rights overlap, the new exploration rights and mining rights of coal are forbidden to enter the CBM area. If the two including CBM enterprises and coal enterprises have contracted with each other, they should strictly obey the contract to exploit the resources together. When the mineral rights overlap occurs without any contact, the two sides need reach a development agreement under "the CBM extraction first" principle.

(2) Further Quickening the Extraction and Utilization of CBM (2013 to now)

GOSC issued (2013) Several Opinions about further Quickening the Extraction and Utilization of CBM (Document 93):

The supporting power from financial fund should be enhanced, including raising the subsidy standard, providing central financial incentives, increasing investment from central finance and so on. Besides tax policy should be improved, which includes improvements of the preferential policy of VAT and income tax.

The market pricing mechanism of CBM is defined, and the local governments are ordered to free the price control as soon as possible. The sale price of CBM for civilian use which isn't in the public gas distribution network yet should be contracted by supply and requisitioning parties; the one in the public gas distribution network shouldn't be lower than price of natural gas. In addition, CBM power generation is supported, whose price is set under "reasonable cost add reasonable profit" principle.

To encourage large-scale development, infrastructure constructions such as gas line network will be planed and constructed, which could support the distribution system of gas in every large coal mining to connect with each other

and encourage small and medium coal mining to join up and build gas gathering and transportation system. Private capital would be encouraged to participate in the exploration, extraction, storage, distribution and pipeline construction of CBM. Financing institutions must enhance the finance support level to the development of the industry.

The coordinated development system of coal and CBM must be built to design mining area and schedule. In the areas which are planned to mine within 5 years, coal mining will have priority over CBM extraction, while the CBM extraction must be guaranteed. Nevertheless, In the areas which are planned to mine 5 years later, it should stick to “the CBM extraction first” principle.

In technological innovation, the government will continue to implement the national science and technology plans and support research on fundamental theories and key technologies much better. At the same time, the innovative platform and research institution about CBM would be encouraged to be built as well.

3. Policy Evaluation

3.1 Policy Evaluation in Starting Phase

In the starting phase of CBM in China, the fundamental objective of government policies is to accomplish industrialization of CBM. CBM, which triggered gas explosion that endangered miners' safety, was just seen as a harmful gas until 1990s. Therefore all the government policies were enacted to prevent gas explosion. With the development of CBM industry in USA, Canada and so on, China, in which there are large reserves, certainly expected to use the new energy better in industrialization and commercialization. Actually, the first issue of industrialization was to achieve roles transfer from the harmful gas to high-quality energy, that needed be guided by these authoritative methods including legislation and National People's Congress. Of course related policies were just a few words but elaborations or systems in the beginning.

In the phase, another important purpose of industry policies is to encouraged the industry in foreign cooperation. On account of starting late, poor foundations and low level of technologies, the government decided to choose foreign cooperation strategy to make better use of strong capitals and advanced technologies from abroad to accomplish industrialization.

The industry policies in this phase, whose means aren't so diversified, haven't formed a effective policy system. The main method of government is the combination of direct intervention and indirect guidance—— on one hand, CUCMC was invested in by government which works on exploration, exploitation, delivering, marketing and utilizing CBM, and has the exclusive right of foreign cooperation; on the other hand, foreign cooperation is

encouraged by economic means just like fiscal measures and foreign trade measures.

In effect, the CBM industry in China accomplished start-up with capitals and technologies from abroad successfully under policies' guidance. But the shortages of fund and technology haven't been solved radically which would be the leftover problem in the next phase.

3.2 Policy Evaluation in Initialization Phase of Commercialization

(1) Quickening the Extraction and Utilization of CBM

The industry policies of CBM in this phase had become an interconnected system but discrete and independent individuals. Several opinions about quickening the extraction and utilization of CBM (2006), which includes clauses in allusion to development and main problems of the industry, is a guiding policy. In the following years, relevant government sectors issued a series of policies on the basis of the guiding policy, thereby a policy tree that was composed of a guiding policy trunk and specific policies branches was grown.

The commercialization of CBM in China had started but remained a low level at that time attributed to the various problems of development. As a result, the main target of policies was to solve those problems. In addition to the problems of capital and technology, there were new ones in the process of commercialization, including the mining rights overlap, low price and utilization rate. These problems were seen as the bottleneck of commercialization, so the target of policies in this phase was chosen very reasonably. Moreover the goal of development in the policies became measurable and definite in the period of 12th five-year plan fixing the ambiguous one before.

Compared with the last phase, the policy means were more diversified——administrative means had be used except economic means including fiscal measures, foreign trade measures and financial measures.

To deal with the remaining problems of capital and technology, the government paid more attention to domestic powers under the precondition of extended foreign cooperation: on one hand, governments at all levels were required to offer fund and loan with discounted interest; on the other hand, the CBM enterprises were encouraged for equipment replacement and technology innovation. In foreign cooperation, the exclusive situation in foreign cooperation of CUCMC has been broken, with it competitive mechanism was introduced.

Facing the new problems of commercialization, fiscal means and administrative means were used except for the remaining tax adjustment. The industrial subsidy standard was determined to encourage enterprises work on the industry. Even more important, powerful administrative means were safeguards to increase utilization rate and solve the mining rights overlap problem.

Under the guidance of industry policies, the extraction and utilization of CBM in China developed to a certain extent, and commercialization started even if it was still immature. In the face of the remaining problems of capitals and technologies, it couldn't avoid reliance on foreign enterprises yet although domestic powers were begun to be noticed. So the focus of policies was still on encouraging foreign cooperation. Actually, more foreign cooperation projects arose to break the exclusive situation in foreign cooperation of CUCMC.

Subsidies for the CBM enterprises were concerned by government, but the amount is far from enough. Relevant policies on utilization, although which played a positive role partly, weren't able to turn the underutilization situation around fundamentally because of the too bad foundation.

Overall, the industry policies in the phase gave us a sense of national determination in developing the CBM industry obviously, under the guidance of which commercialization started slowly. Meanwhile, the government had realized the problems of the industry correctly and made the corresponding measures. Unfortunately, those problems had been mitigated but not solved completely on account of poor foundation, no feasible way, insufficient implementation and so on.

(2) Will Document 93 Could Open a New Phase of the CBM Industry?

Document 93 was released to further speed up the development of the CBM industry and open the era of rapid development in commercialize. Viewed from the history of the industry, the driving force of development is the government policies, while document 93 is another guiding document to drive the industry to enter a new phase. And the reason why it is an improvement and sublimation compared with the past is: prop dynamics of fiscal means are enlarged; the market pricing mechanism of CBM is determined; private capital is encouraged to invest; the development program of coal and CBM is emphasized; the technological innovation program is more concrete. Based on previous experience, relevant departments would establish corresponding policies according to document 93 in the next few years, that will be incorporated into an integrated policies system to drive the industry to realize rapid development in commercialize.

However, predictably the road to commercialization in China must be bumpy although those corresponding policies haven't been established yet. The main questions are:

The fiscal income for subsidy isn't enough, so the subsidized isn't widespread yet;

Domestic investments remain weak, and the government alone cannot solve the problems completely—— although private capital have been noticed, they are small-scale and unprofessional who may cause blind and disorderly investment;

The government can't hold the internal mechanism of the industry development, and administrative instructions can't guarantee that the industry would develop continuously, healthily and stably.

There isn't a set of complete legal system for the industry development besides economic means, administrative means and so on.

With the increased importance from government, the industry would have more powerful motive force of development and broader prospect. Without doubt the various problems which would spring up in the process of development should be solved one by one. Meanwhile the government policies would play the most crucial role, therefore their implementation effects could decide the development of the industry in some sense. So the question if document 93 could open a new phase of the industry need be judged by implementation effects of the following policies. In the long term, it need policies to change the role from source power of development to guidance and norm that the CBM industry want to mature.

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