

Oil Shale Activity in China

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Abstract

Due to the world's high crude oil price, China is paying more attention to oil shale in China. Recently, the China National Oil Shale Association was established. In 2005, the Fushun shale oil plant, under the Fushun Bureau of Mines produced 180,000 tons shale oil, operated with 120 Fushun retorts. (Each retort has the daily processing capacity of 100 t oil shale.). In Fushun, oil shale is the byproduct of coal mining. The production cost of shale oil is low, about 1,500 Chinese yuan per ton, while its selling price reaches 3,500 yuan per ton. The plant earns much money, and is willing to expand its shale oil production. Fushun Bureau of Mines signed a contract with a foreign company to build a Taciuk retort, with the daily processing capacity of 6,000 tons oil shale. Besides, Longkow Coal Mine, Shangdong Province, and Huadian, Jilin Province, intend to build an oil shale plant respectively, each with the yearly production of 200,000t shale oil.

China Petroleum University is the one institution dealing with the research and development of oil shale in China, and recently signed a contract with a Mongolian Company to make a feasibility study for Mongolian Khoot oil shale retorting commercialization.

History

In China, oil shale retorting to produce shale oil began in the 1920's; During the Japanese invasion of China, the shale oil industry was operated in Fushun, Liaoning Province. After the founding of the People's Republic of China in 1949, 100 Fushun type oil shale retorts and the related shale oil processing units were restored. Until the nineteen sixties, Fushun retorts increased to 266. The maximum annual shale oil production increased to 780,000 tons(Hou,1986).

In 1969, in Maoming, Guangdong Province, a new oil shale retorting plant was put into operation.(Hou,1986). With the discovery of Da Qing oil field in 1960's, the shale oil production declined and shut down in 1990's.

Oil Shale Reserves in China

The proven reserves of oil shale in China comprise about 36 billion tons. An extensive geological survey remains to be done. Major oil shale deposits are listed in Table 1 (Hou,1986; Dyni,2003).

Fushun Oil Shale Industry

Fushun West Open Pit Mine has the length 6.6 km and width 2 km; oil shale, with the overburden of clay, sand, and green shale, overlies on the coal bed, is the byproduct of coal mining; oil shale layer has the average thickness of 80m.

The Western Mine has been operated for 90 years; now 70 million tons oil shale remain as proven exploitable reserves, with the average Fischer Assay shale oil yield 6.5%. The Fushun East open pit has a huge quantity of oil shale reserves not mined yet. Fushun Shale Oil Plant under Fushun Bureau of Mines was built and began operation in 1991 (He 2004; Purga 2004).

Table 1: Oil shale resources in China

Province	Billion tons	Fischer Assay
Fushun, Liaoning	3.6	6.5%
Maoming, Guadong	4.1	7%
Huadian, Jilin	0.3	10%
Longkow, Shandong	0.1	14%
Nong An, Jilin	16.0	4.5%

By 2005, the plant had expanded and was equipped with 120 Fushun retorts, each with the daily capacity to process 100 tons of oil shale. Every 20 retorts share one condensation and recovery system. In 2005, 180,000 tons of shale oil were produced. The Fushun Retort has an upper oil shale pyrolysis part and a lower shale char gasification part.

Fushun shale oil is sold as fuel oil; part of the surplus retort gas with low heating value is used in an internal combustion engine for producing steam and power (Zhao, 2005). By using shale ash, a cement factory was built with yearly production of cement 90,000t; and a brick factory with yearly production of 60 million bricks.

Production cost of one ton of shale oil costs about 1,500 yuan, while the selling cost is about 3,500 yuan, the plant earns much money. Fushun Shale Oil Plant is planning to build an ATP retort, with daily processing of 6,000 tons particulate oil shale.

Maoming Oil Shale Industry

Maoming oil shale mining area takes the shape of 50km length and 7km width, dividing into 6 districts, with average Fischer Assay 7%, suitable for open pit mining.

From the 1960's to the 1990's, Maoming Petrochemical Comp. under SINOPEC built 64 Fushun Type retorts and 48 gas combustion retorts for producing shale oil (Hou, 1986). In Maoming the maximum annual shale oil production was 180,000t. But retorting was shut down in the 1990's. Recently Guandong Province is intended to use the Maoming oil shale fluidized bed combustion for producing power.

Longkow Oil Shale Project

In Longkow Mining area, Shangdong Province, oil shale coexists with brown coal, which has been mined underground for 30 years. Longkow oil shale has proven exploitable reserves of 0.1bt, with Fisher Assay 14%. Longkow Bureau of Mines has made oil shale project(Qian, 2003)

Yearly operations results in mining 2.5Mt oil shale, and processing of 2 Mt, which in turn produces 200,000 t shale oil; shale char mixed with particulate oil shale to burn in fluidized bed combustion for producing power; shale ash for building material.

Investment for shale oil production comprise 0.65 billion yuan. The feasibility study was approved by Shandong Provincial Development Committee. Longkow is intended to use Fushun Type retorting at first.

Huadian Oil Shale Development

Huadian oil shale reserves comprise about 0.3 billion tons, with Fisher Assay oil yield of 10.4%; Oil shale has been mined underground.

In 1996, 3 sets of 65t/h oil shale circulated fluidized bed combustion boiler were put into operation, with the capacity of 18,000 kilowatts (Jiang, 2004). Dozens of Fushun Type Retorts were operated by private companies to produce shale oil, with the production cost of 1,000 yuan per ton and selling cost 2,000 yuan per ton; but with serious environmental impacts.

Huadian Oil Shale Project

Huadian oil shale comprehensive utilization project was put forward in 2005 by Jilin Energy & Communication Corporation (the main investor) under the China Power Investment Corporation, in cooperation with the Jilin Municipal Government.

This project includes (Wang, 2005) yearly mining of 2.5 Mt oil shale; retorting of 2 Mt to produce 0.2 Mt shale oil, circulated fluidized bed combustion of 0.5 Mt shale char mixed with particulate oil shale used to produce power with the capacity of 2x50,000 kilowatts; shale ash for 1.2 Mt cement and other building materials;

Total investment is expected to be 2.7 billion yuan; the retorting part is expected to be 0.8 billion yuan; with the pay back period about 7 years.

For oil shale retorting, it is intended to utilize UTT technology. The pre-feasibility study of Huadian oil shale comprehensive project has been approved by China National Development and Reform Commission in Nov.2003; This project is in the feasibility study stage.

Other Potential Resources

In Mingxin, Gansu Province, coal and oil shale coexist in Hongshagong district. A Mingxin Mining Company is intended to exploit coal for producing methanol, and to mine oil shale for retorting for shale oil; Feasibility study for yearly production of 400,000 t shale oil is being made.

In Uromqi Xinjiang, Yongden Gansu, Yilan Heilongjiang there are plentiful oil shale reserves, with Fisher Assay 6-19%; It is believed that these reserves will be utilized in the near future (Qian, 2003). Chanpo, Hainan is also actively engaged in utilizing its coal and oil shale reserves.

China University of Petroleum

China University of Petroleum has been involved in the research and development of fossil fuel processing for more than 50 years. Its Applied Chemistry Department is the main institution dealing with oil shale in China

The university's oil shale experts undertake oil shale evaluation, consulting, and reviewing work for pre-feasibility and feasibility study and development projects for domestic and foreign countries.

Recently, signed contract with a Mongolian Company to make feasibility study for Mongolian Khoot oil shale deposit, and with a Indian Company for oil shale analysis.

Conclusion

Due to world's high crude oil prices, China is paying more attention to oil shale utilization, especially now that China imports large amounts of crude oil. China has plentiful oil shale; Fushun is expanding its shale oil production; Longkou, Huadian,

Maoming are planning to build oil shale retorting and/or combustion plants.

In 2005, the China National Oil Shale Association was established. China University of Petroleum undertakes oil shale education, evaluation, consulting and reviewing work for feasibility study and development projects for domestic and foreign countries.

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