CHINESE CURRENT OIL SHALE BUSINESS

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Exploration enhanced

- Detailed exploration and evaluation have been conducted for the Biluocuo and Shengli river oil shale located in the south Qiangtang depression, Tibet, China, by Chengdu Institute of Geology and Sichuan University.

- Several hundred million ton reserves of oil shale were proved for above deposits.
Detailed exploration and sample evaluation of the Permian oil shale located at the Sangonghe and Ergonghe in the northern foot of Bogda Mountain, Xinjiang, China, have been carried out by China University of Geosciences and Exploration Research Institute, SINOPEC.

The oil content is about 5.1%. The reserves are estimated to 4.4 billion tons.
In China, there are 7 oil shale retorting factories: Fushun, Huadian, Wangqing, Beipiao, Longkou, Yaojie and Dongning, distributed in 5 provinces.

Fushun retort (or modified Fushun retort) is the main technology used in China.

Oil contents of typical oil shale used for commercial retorting in China are as follows:

<table>
<thead>
<tr>
<th>Fushun</th>
<th>Beipiao</th>
<th>Huadian</th>
<th>Longkou</th>
<th>Dongning</th>
<th>Yaojie</th>
<th>Wangqing</th>
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</thead>
<tbody>
<tr>
<td>6.5%</td>
<td>5%</td>
<td>10%</td>
<td>15%</td>
<td>8%</td>
<td>10%</td>
<td>6%</td>
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</tbody>
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• In China, the shale oil production increased every year. In the last year, shale oil production was more than 600 thousand tons. In 2011, it is estimated to produce about 650,000 tons of shale oil, equivalent to about 13,000 bbl/d.
Fushun Bureau of Mines will produce largest amount of shale oil in China, about 350,000 tons in 2011 (6800 bbl/d).

The total oil shale consumed is about 10 million ton each year.
Previously Fushun west open pit mine has been excavated. The oil shale of East open pit mine (with the Fischer Assay only 5.5%) begins to be mined.
The ATP unit imported by Fushun has been operated for the cold test. About 1 hundred million USD has been invested totally.
In Longkou coal mining company, there is an oil shale retort plant with a capacity of 60,000 ton shale oil each year.

The plant has 40 Fushun retorts as two block.
First block (20 retorts) was operated in 2009
Second block (20 retorts) was operated in May, 2011
Shale oil content is highest in China (~15%).

The plant is near the sea. So, shale oil is directly sold as marine fuel oil.

There is a plan to import Galoter technology from Estonia.
In Huadian, a power station has been operating for 14 years.

There are three circular fluidized-bed boilers for combusting oil shale.

The capacity is 65t/h vapor for each.
In Huadian, there are 3 private companies. They use 30 Fushun retorts to produce 50,000 ton shale oil each year.
Hongsheng Energy Company has finished the construction and installation of 24 modified Fushun retorts at the end of July, last year.

Each retort has the capacity of 300 ton oil shale per day.

The plant has been put into the operation at present.
In this retort, there are two sections: the upper one is a cylinder type, like the Fushun retort, for oil shale retorting, and the lower one is a square section used for semicoke cooling.

- Retorting gas is indirectly heated in the tubular furnace and recycled into upper section to heat oil shale.
- The semicoke will be used as the feedstock of power station.
- Shale ash will be used for building material.
In Yaojie, Gansu coal company, cooperating with Sanjiang coal chemical company, has installed 8 oil shale retorts.

The plant has been successfully operated at the end of July, last year.
This retort has been widely used in the west of China from 2000, and exported to Kazakhstan and Budan for coal retorting.

Now the modified square retort is successfully used for oil shale retorting.
In Beipiao, Liaoning province, Beipiao Coal Mining Co. have operated 44 Fushun retorts since this August.

50,000 ton shale oil was produced each year.
In Beipiao, Kangping Coal Co. is constructing 60 Fushun retorts. They will be finished in this year.

Also, Shunjiu Oil Shale Co. plans to construct 44 Fushun retorts.

And Fuxin Coal Co. plans to construct 40 Fushun retorts.
In Wangqing, Longteng Energy Company has built 40 Fushun retorts to produce about 50,000 t shale oil each year.
This company constructed an oil shale power plant in 2009.

There are 2 circular fluidized bed boilers with the vapor generation capacity of 35 t/h (electricity 6000 kW).

Particular oil shale (<10 mm) is used for electricity generation

Oil shale lump (10-75mm) is used for shale oil production.
In Jimsar County, Xinjiang, 24 modified Fushun retorts will be established by the company of Liaoning Chengda. The daily capacity is 300t.

At the middle of next year, shale oil will be produced.
In Suiyuan, Guangdong province, one circular fluidized-bed boiler for combusting Maoming oil shale was constructed in 2008 with a capacity of 65t/h vapor generation.
In Maoming, Guangdong province, Guangdong Power Group plans to build a large power station. The construction was being carried out in September, this year.

This project has got the permission of National Environmental Department.

In first phase, investment is about 600 million USD for 420,000kW. Oil shale consumption will be 6 million tons each year.

Total investment is about 1400 million USD for 1.26 million kW. About 20 million ton oil shale will be used.

Circular fluidized bed boiler will be used for power generation from oil shale combustion.
Daqing Oil Company (belongs to CNPC) is constructing a commercial plant with the daily capacity of 2000 tons oil shale using solid heat carrier retort.

This plant is being constructed and will be put into the operation next year.
In Harbin, Heilongjiang province, China National Coal Corporation has finished the operation of pilot fluidized-bed retorting with the capacity of 50 ton oil shale per day.
Pilot material:
The oil content of oil shale is about 10%. The particle size of oil shale is below 3mm.

Composition of device:
- power
- reaction
- combustion
- condensing
- recover
- Data Conditioning System.
Harbin, Heilongjiang Province, North

- **Reactor:**
  - Inner diameter: 1m
  - Height: 18m

- **Combustion:**
  - Inner diameter: 1.95m
  - Height: 16m
Harbin, Heilongjiang province, North

- Washing tower:
  - Inner diameter: 0.8m
  - Height: 13m
The Luoyuan Petrochemical Engineering Company has undertaken the design work for building a demonstration fluidized retorting unit with the capacity of 2000 ton powdered oil shale per day, for China Coal Group Longjiang Coal Chemical Company. It is based on the results of the pilot unit developed by Longjiang Company.
Advantage:

- High utilization rate of raw materials: ~95%
- Short time for the retorting: 2~5min
- Shale oil yield: ~90%
- The component of shale oil is light. More gasoline and diesel were obtained.
- Lower carbon residual content in ash
The Hailiang group Co., Ltd. was established in August 1989. The headquarters of group is located in Zhejiang province, China.

A formal oil shale production project has been signed between Hailiang Group and Beipiao coal company. The shale oil production will be about 300,000 ton per year.

Hailiang Group has made a contract with Tongchuan, Shanxi province. They plan to use Tongchuan oil shale for shale oil production.
China University of Petroleum is continuing the fundamental research, analysis, evaluation and development work for several domestic and foreign oil shale deposits, and has conducted the hydrotreating of several shale oils in China.

Northeast Dianli University has conducted the oil shale fluidized bed combustion tests and microwave pyrolysis research in laboratory scale.

Dalian University of Technology has done the recovery research for aluminum oxide from the shale ash.
Professor Jialin Qian, as chief editor has published a book in June, 2010, written in English. This book is titled *Oil Shale-Petroleum Alternative*, published by China Petrochemical Press. The English edition with the help of Dr. Jeremy Boak has been sold at 30th Oil Shale Symposium and also would be available at this Symposium.
A Chinese popular book, titled *Oil Shale*, written by senior engineer Mr. Shi was published in 2010 by China Petrochemical Press.

A Chinese professional book written by Prof. Zhaojun Liu, titled *Oil Shale in China* was published in 2010 by China Petroleum Press.

Besides, a Chinese professional book, titled *Feasibility study on the development of Chinese oil shale industry* written by Mr. Jiajiang Zhang and Prof. Jialin Qian was published in 2010 by China Geological Press.