CURRENT STATUS OF CHINESE OIL SHALE BUSINESS

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1. OIL SHALE DEPOSITS IN CHINA
There are 47 oil shale basins in China.

According to the quantities and utilization of the sources, these basins can be classified into four categories:
Oil Shale deposits in China

Class I indicates basins with significant proven oil shale resources that have been mined and processed, such as:

- Jimsar Area
- Haishiwan Area
- Dalianhu Area
- Fushun Basin
- Luozigou Basin
- Huadian Basin
- Huangxian Basin
- Maoming Basin
Oil Shale deposits in China

Class II indicates basins with significant proven oil shale resources, which have not been mined and processed, such as:
Class III indicates basins with a small amount of proven resources, which have not been mined and processed, such as:
Class IV indicates basins that have not been investigated, such as:

- Laoheishan Area
- Sichuan Basin
2. EXPLORATION ENHANCEMENT
A new plan of exploration and evaluation has been conducted for Wutu oil shale deposit located in Shandong province, China, by Longkou Coal Mining Group.

About 290 million tons of reserves were predicted in this area.
In the west of China, Liaoning Chengda Co. Ltd plans to establish a shale oil business. Fist phase: 9.2013. Total shale oil production: 1.5~2 million tons /y

In Shanxi province, oil shale will be explored and mined by Hailiang group.
3. SHALE OIL PRODUCTION IN CHINA
In China, the shale oil production increased every year.

- In 2012, China is estimated to produce about 700,000 tons of shale oil, equivalent to about 14,000 bbl/d.

- In the last year, shale oil production was more than 650 thousand tons.
In China, there are 10 shale oil retorting plants in operation.
Oil contents of typical oil shale used for commercial retorting in China are as follows:

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Oil Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fushun</td>
<td>6.5%</td>
</tr>
<tr>
<td>Beipiao</td>
<td>5%</td>
</tr>
<tr>
<td>Huadian</td>
<td>10%</td>
</tr>
<tr>
<td>Longkou</td>
<td>15%</td>
</tr>
<tr>
<td>Dongning</td>
<td>8%</td>
</tr>
<tr>
<td>Yaojie</td>
<td>10%</td>
</tr>
<tr>
<td>Wangqing</td>
<td>6%</td>
</tr>
<tr>
<td>Jimsar</td>
<td>7%</td>
</tr>
</tbody>
</table>
Fushun, Liaoning province, Northeast

- Fushun Bureau of Mines produced the largest amount of shale oil in China, about 350,000 tons in 2011 (6,800 bbl/d).
- The total oil shale consumed is about 10 million tons each year.

- The ATP unit imported by Fushun has undergone cold testing.
In April 2012 Fushun began to build a shale oil refinery with processing capacity of about 400,000 tons per year. Construction will be completed in this year, and the main products of shale oil will include propylene, liquefied gas, clean fuel, etc.
At the Longkou Coal Mining Company, there is an oil shale retort plant with a capacity of 120,000 tons of shale oil per year.

- The plant has 40 Fushun retorts in two blocks.
- The first block (20 retorts) started operation in 2009.
- The second block (20 retorts) started operation in May 2011.
Longkou, Shandong province, East

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

- They plan to import Galoter technology from Estonia.
Huadian, Jilin province, Northeast

- In Huadian, a power station has been operating for 14 years.
- There are three circular fluidized-bed boilers (CFB) with total capacity of 195t/h steam for combusting oil shale.
- There are 3 private companies. They use 30 Fushun retorts to produce 50,000 tons shale oil per year.
Liaoning Chengda Co. has constructed 24 retorts designed by themselves as of July, 2010.

The plant has been put into operation at present. The total capacity of this plant is 2.4 million tons.
In this retort, there are two sections:
- The upper section is cylindrical, like the Fushun retort, for oil shale retorting
- The lower section is square, and is used for semi-coke cooling.

Retorting gas is indirectly heated in the tubular furnace and recycled into upper section to heat oil shale.

The semi-coke will be used as the feedstock of power station.
Shale ash will be used for building material.
This shows the SJ square retort, which has been widely used in the west of China since 2000, and exported to Kazakhstan and Budan for coal retorting.

Now a modified SJ square retort has been successfully used for oil shale retorting.

Yaojie coal electricity group Co., Ltd built 8 SJ square retorts to process Yaojie oil shale. The plant has been successfully operated since the end of July 2010, with capacity of 400 tons per day for each retort.
In Beipiao, Liaoning province, 44 Fushun retorts have been operated by Beipiao Coal Mining Co. since August 2011, and another 40 Fushun retorts will be constructed in future.

Kangping Coal Co. plans to construct 40 Fushun retorts.

Also, Jiushun Oil Shale Co. also has an program to construct 44 Fushun retorts.
Wangqing, Jilin Province, Northeast

- Particulate oil shale (<10 mm) is used for electricity generation
- Lump oil shale (10-75mm) is used for shale oil production.

- 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 CFB with the steam generation capacity of 35 t/h (electricity 6000 kW).
In Jimsar Country, Xinjiang, 32 retorts designed by Liaoning Chengda are being constructed now, and will be finished in September, 2013, with total capacity of 3.5 million tons.

The total capacity of this plant will reach to 7.0 million tons in 2014.
Maoming, Guangdong province, South

- In SuiChi country, Guangdong province, one CFB for combustion of Maoming oil shale was constructed in 2008 (with a capacity of 65t/h steam generation).

- Guangdong Power Group planned to build a large power station in Maoming. The construction was being carried out in September, 2011.
  - In the first phase, investment is about 600 million USD for 420,000 kW. Oil shale consumption will be 6 million tons each year.
  - In the second phase, total investment is about 1400 million USD for 1.26 million kW. About 20 million tons oil shale will be used.
4. NEW TECHNOLOGY
Daqing Oil Company (owned by CNPC) is constructing a demonstration unit with daily capacity of 2000 tons oil shale using solid heat carrier retort.

This plant is being constructed and will be put into operation next year.
In Harbin, Heilongjiang province, China National Coal Corporation has finished the operation of a pilot fluidized-bed retort with the capacity of 50 tons of oil shale per day.

- Composition of this device: power, reaction, combustion, condensing, recover and data conditioning systems.
- Oil content of oil shale: 10%.
- Size <3mm
Combustion:
Inner diameter: 1.95m
Height: 16m

Reactor:
Inner diameter: 1m
Height: 18m
Harbin, Heilongjiang Province, North

Washing tower:
Inner diameter: 0.8m
Height: 13m
Advantages:

- High utilization rate of raw materials: ~95%
- Short time for retorting: ~2-5 min
- Shale oil yield: ~90% (vs Fischer Assay)
- The shale oil is light, with more gasoline and diesel obtained.
- Lower carbon residual content in the ash
5. RESEARCH WORK
China University of Petroleum, Beijing has continually devoted resources for the analysis and evaluation of oil shales both from China and from foreign countries, such as, North Korea, Mongolia, Myanmar, Cameroon, etc.

Some other investigations were also carried out, including the utilization of shale ash, hydrotreating of shale oil, fluidized retorting of oil shale, etc.

In addition, more than ten universities and research institutions are conducting oil shale R&D now in China.
7. BOOKS PUBLISHED
Books Published

- Professor Jialin Qian, as chief editor has published a book in June, 2010, written in English.
- The English edition with the help of Dr. Jeremy Boak has been sold at the 31st Oil Shale Symposium and also will be available at this Symposium.
Books Published

- A Chinese popular book, titled *Oil Shale* (Chinese version), written by senior engineer Mr. Shi was published in 2010 by China Petrochemical Press.

- A Chinese professional book written by Prof. Zaojun Liu, titled *Oil Shale in China* (Chinese version) was published in 2010 by China Petroleum Press.

- In addition, a Chinese professional book, titled *Feasibility study on the development of Chinese oil shale industry* (Chinese version), written by Mr. Jiajiang Zhang and Prof. Jialin Qian was published in 2010 by China Geology Press.
Thank you!