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## **Regional Energy Trade and The Refining Industry in Northeast Asia**

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Today, my assignment is to talk about the outlook of the refining industry in Northeast Asia.

### 1.1 Energy Outlook of Asia

At first, a brief glance at the Asian energy outlook. This is the forecast by our institute as of April this year. The energy consumption of Northeast Asia will grow fast especially led by the strong growth of China.

### 1.2 Petroleum Demand of Northeast Asia

In Northeast Asia, Japanese oil demand is on a declining trend, Korean oil consumption is modestly increasing and Chinese oil demand is growing.

### 1.3 Petroleum Outlook of Northeast Asia

As oil consumption of Northeast Asia recorded 13 million BD in 2005, it will reach 18 million BD in 2020 and 20 million BD in 2030. Since Chinese oil production will be leveling off at around 4 million barrels per day, the region's oil import will grow fast. It will increase more than 5 million barrels per day by 2020.

### 1.4 Refinery Capacity of Northeast Asia

The refining capacity of Northeast Asia was just below 15 million BD. Japan refining capacity has declined since the second oil crisis, while Korea's has increased considerably in the 1990s. China has increased refining capacity by 50% in the past decade, but this has not caught up with the demand increase.

The refining capacity of Japan and China are smaller than the domestic demand, that is, these countries are in a product import position. Korea is in a product export position having substantially increased its refining capacity in the 1990s.

## 2.1 Light-Heavy Spread of Oil Price

An important price trend is the price spread of light and heavy crude oils. It may be about 2-4 dollars per barrel when evaluated per technical cost considering cracking and desulfurization treatments. However, it expanded abnormally in 2004 and is currently at around 8-10 dollars per barrel. This may reflect a worldwide shortage of cracking, desulfurization and hydro-treating capacity.

## 2.2 Era of High Energy Price

According to Japanese import statistics, oil is leading the energy price hike. The oil price surpassed the LNG price in 2003 and the gap is widening. The coal price is going up, but it is absolutely cheaper than other fuels. A curious phenomenon here is that power companies are enjoying the advantageous position of using nuclear and coal resources. Slow demand is also relieving them from the investment burden. In fact, Japanese power companies are lowering their tariffs.

## 2.3 Facts and Concerns

In summary, the facts are that the petroleum demand of Northeast Asia will increase more than 5 million BD by 2020. Korea may have some surplus refining capacity for the time being, but not very big. The closest mega-oil-supplier for incremental demand is the Middle East. This would incur increase of heavier and high-sulfur crude oil input. Finally, the widening light-heavy price spread of crude oils will enhance investment in secondary facilities.

Therefore, our concerns are that we need to expand refining capacity to accommodate increasing demand, and secondly, that refineries should prepare for processing of increasing imported crude oils. This will in turn require sophisticated facilities for cracking, desulfurization and treating.

Now, let us look into more details.

## 3.1 Petroleum Demand Structure

The International Energy Agency (IEA) forecasts, and we agree, that future petroleum demand will occur mainly in the transport sector. Internal combustion engines may continue to be the main player for mobile vehicles for several decades to come, although we see possibilities for hybrid cars, bio-fuels, CNG/DME, etc.

On the other hand, at fixed facilities of plants, buildings and houses, it is easier to switch to other fuel sources such as natural gas, coal, nuclear, bio-fuels and renewable energies. Thus, oil demand would

converge in the transportation sector.

### 3.2 Heavy Fuel being driven out

Looking into composition of petroleum product demand, the share of heavy fuel oil is less than 20% already in Northeast Asia. However, considering the recent trend of price diversification among energy sources, oil and gas based IPPs are being knocked down. Fuel oil demand will be further eroded by coal, gas and nuclear.

### 3.3 Demand Trends Among Products

In the case of Japan, demand for light products such as gasoline and naphtha is relatively steady. However, middle distillates demand is turning downward in recent years.

### 3.4 Middle Distillates Being Driven Out

Higher energy prices have intensified price competition. In the market, middle distillates and LPG are apparently inferior to LNG based city gas, and city gas is in turn inferior to electricity. This tendency is now amplified not only by the economic theorem of superior/inferior goods but also by actual price trend.

Overall demand for oil and gas may be eroded by electricity. But among oil and gas, LNG based gas or indigenous gas will take over the demand for kerosene, LPG and heating gas oil.

### 3.5 Motor Fuel Quality Regulation

Another important factor is the environmental requirement to improve motor fuel quality. Japan has realized “sulfur free” gasoline and diesel gas oil as of January 2005, which means a sulfur content of less than 10 ppm. To improve air pollution by NO<sub>x</sub> originating from motor vehicles, the catalyst is vulnerable to sulfur, and so low-sulfurization fuel is necessary. China also plans to accelerate low-sulfurization to realize the Euro-3 standard by 2010. This will require a grand scale upgrading of secondary refining facilities.

### 3.6 Refining Facility: China vs. Japan

So, what is the current status of secondary facilities?

In China, domestic crude oils are low sulfur, paraffinic. Thus, refineries have adopted cost effective cracking methods such as FCC. In contrast, as Japan had to import high sulfur Middle East crude oil, there is an extreme contrast in the secondary facility composition. At present, desulfurization and

hydro-treating capacity is quite limited in China.

### 3.7 Challenges: Asia and Japan

In summary, for Asia as a whole, we need to accommodate the rapidly growing oil demand in China and India. And, improving motor fuel quality is an urgent environmental requirement, which will require huge investment and sophisticated technologies.

In contrast, oil demand is decreasing in Japan. Core demand will converge to transport fuel and petrochemical feedstock. This will cause idle capacity, spur thorough cracking of residue and produce excess middle distillates.

### 4.1 Product Supply Structure

The Japanese product balance will be changing as shown in this chart. The key driver is the “thorough cracking of heavy residue”, which will, as a basic tendency, decrease LPG and naphtha import and fuel oil export, and increase export of Mogas and middle distillates. The recent price diversification among energy sources may cause the same tendency in Korea and China.

### 4.2 Refining Business Trend

From the foregoing review, oil demand would converge to lighter products. The market price spread among oil, coal and natural gas will transform to urge noble use of conventional oil, reflecting difficulties of producing light petroleum products like gasoline and gas oil.

This background will encourage construction of more FCCs with advanced hydro treating. Then, thorough cracking of residual oil will produce LPG, FCC gasoline and olefins, and wide range of middle distillates. While olefins would be utilized as petrochemical feedstock, a wide range of middle distillates may become available in the Asian market from Japan and Korea. This would alleviate abrupt investment requirements in emerging markets like China and India. However, to utilize the situation as a smart business model, we need standardized grades and segregated handling facilities for such middle distillates.

### 4.3 Advanced Residue Conversion

The most likely advanced residue conversion may be the combination of residue gasification and advanced hydro treating of cracked distillates as shown here. This combination will produce high quality products utilizing hydrogen from Pitch oil/ Petro-cokes gasification. Manufactured gases will also be used in CCGT for power generation and/or synthesis of GTL/DME.

#### 4.4 Noble Use of Middle Distillates

In conclusion, I would like to point out that the contemporary petroleum demand tendency will require deep and thorough cracking of heavy residue and this would in turn make wide range of middle distillates. They would become available for trading in the Asian market.

To smartly handle these barrels minimizing quality give-away, we need standardized specifications of gas oil corresponding to quality groups. At present, we do not have clear definitions common for the Northeast Asian market.

Under the circumstances, establishing standard grades for international trade will be an important agenda for Asia. To utilize every type of middle distillates without quality give-away, two or three grades may be examined, for example, such as high quality diesel for high-speed motor vehicles, regular gas oil for low duty engines and heating oil with relatively loose specification. I hope that experts from the oil industry will take this issue seriously and explore the right solution for the Asian oil market.

Thank you for your kind attention.