Domestic Oil Supply and Demand a Year After the Earthquake

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More than a year has passed since the Great East Japan Earthquake inflicted devastating damage on our country. The effects of the earthquake in the energy sector are naturally most felt in the power generation sector, but the oil sector has also been considerably affected. This paper provides a review of the trends in supply and demand and the price of oil a year after the earthquake, and examines the expected role of oil in the future energy mix of Japan

1. Oil Supply and Demand After the Earthquake

1-1. Trends in Product Demand

To begin with, regarding the trend in the demand for petroleum products during the year after the earthquake, the sales amount of petroleum products in FY2011 fell slightly (-0.3%) by 490,000 kiloliters (KL) from FY2010 (Fig. 1). By product, the drop in naphtha is large and one reason for this is the suspension of operations at domestic ethylene plants after the earthquake, coupled with the downturn in the economy. Aside from this, gasoline and gas oil decreased year-on-year by 1,120,000 KL (-1.9%) and 300,000 KL (-0.9%), respectively. This is attributed to some increased demand in FY2010 brought by the introduction of a cap on highway tolls (the so-called 1,000 yen highway) under the Democratic Party of Japan's rule, and the historic heat wave that cloaked Japan in the summer of 2010, as well as the economic downturn after the earthquake. In fact, comparing this with the demand in FY2009 confirms that the decline for gasoline is only 430,000 KL (-0.8%) and for gas oil it actually shows an increase of 200,000 KL (+0.6%).

While demand for lighter petroleum products fell, heavy fuel oil was the only item for which demand grew in FY2011. This is, needless to say, because the demand for power generation fuel after the earthquake rose while operation of nuclear power plants fell. Until now, in the demand structure for petroleum products, the trend of "increase in clean oil" had been seen, where the share of the lighter petroleum products including gasoline and gas oil increase, while the share for heavy fuel oil fell; but the exact opposite demand pattern was observed in FY2011.

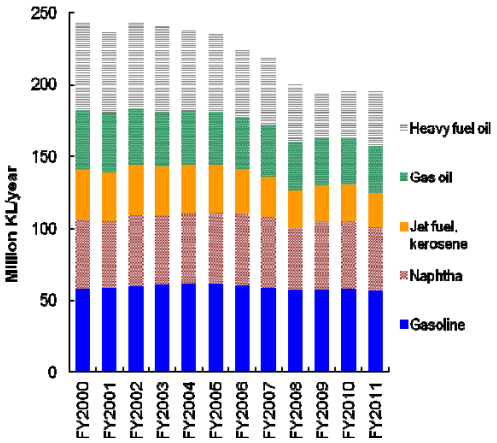
1-2. Trend in Power Generation Demand

For power generation, there was also a large increase in consumption ofdirect-burning crude oil. Fig. 3 indicates the trend in demand of heavy fuel oil and crude oil for power generation operators since FY2001. The movement in this demand is quite different from the demand for general petroleum products indicated in Fig. 1, and shows intense fluctuation year by year. This is because

oil-fired thermal power generation is mainly used for peak power demand, and is greatly affected by the operation status, temperature for each year, and peak power level. Oil-fired thermal power generation has from the past been used as a backup power source to cover fluctuations in operation of nuclear power plants. When the Tokyo Electric Power Co., Inc.'s nuclear power generation amount fell in 2003, and in the fall of 2007 due to the Niigata-ken Chuetsu-oki Earthquake, oil-fired power generation provided the last line of defense.

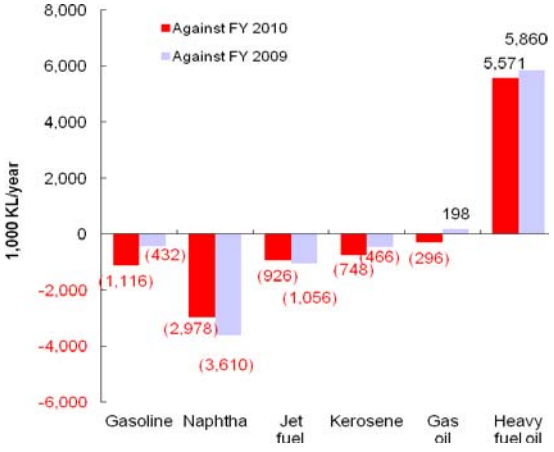
The demand for heavy fuel oil and gas oil for power generation operators in FY2011 was 23,530,000 KL (approximately 410,000 bbl/day), a significant year-on-year increase of 113%. At the time of writing this paper, final adjustments were being made for resuming the operation of reactors 3 and 4 of the Ohi Nuclear Power Station of the Kansai Electric Power Co., Inc. but even if they go online, there is sure to be further increase in oil demand for power generation toward the summer season.

Fig. 1. Change in sales of petroleum products



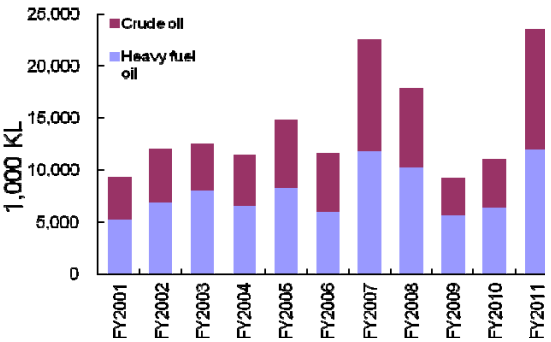
Source: Agency for Natural Resources and Energy

Fig. 2. Increase and decrease of petroleum products in FY2011



Source: Agency for Natural Resources and Energy

Fig. 3. Change in consumption of heavy fuel oil and crude oil by power generation operators



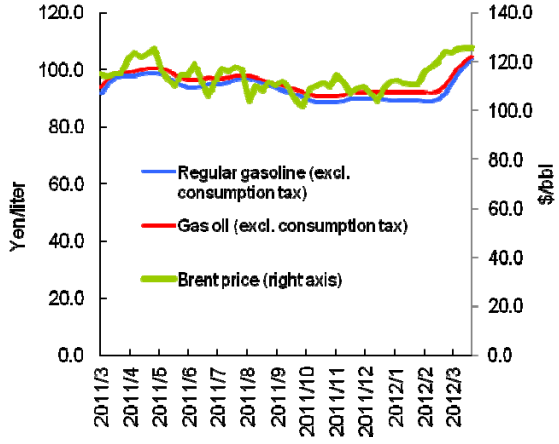
Source: Agency for Natural Resources and Energy

2. Trend in Oil Prices After the Earthquake

2.1. International Crude Oil Prices

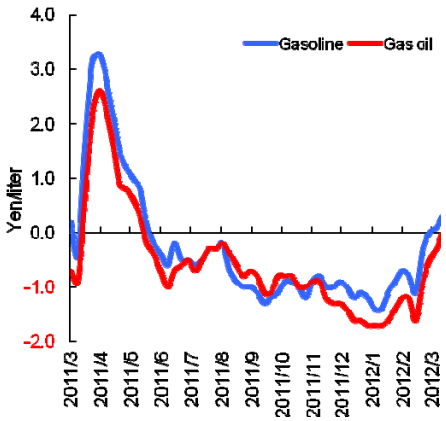
The international crude oil price (Brent) moved around $110-120/bbl in the year following the earthquake, and in a way it managed to stay very stable. During this period, factors such as the "Arab Spring" rise in anti-government movements in the Middle East and North Africa, increased international tension surrounding Iran's nuclear development, and the deepening of the European financial crisis had sometimes played a role in the fluctuation of crude oil price levels from time to time. On the other hand, except for the period immediately after, the massive earthquake did not have a large effect on the level of crude oil prices.

Fig. 4. Change of product and crude oil prices



Source: The Oil Information Center, ICE

Fig. 5. Change of national average and Tohoku area price difference



Source: The Oil Information Center

2-2. Domestic Product Prices

Domestic product prices more or less fluctuated in line with the level of international crude oil prices. The price level of petroleum products in Japan excluding consumption tax can be seen as following the movement of international crude oil prices for the past year (Fig. 4). In the Tohoku area, which incurred the greatest damage, due to distribution limitations after the earthquake there was a period when prices surpassed the national average, but this has now come down to that average, or in some cases even below it.

3. The Role of Petroleum in the Future Energy Mix

3-1. The Fourth "E"

Until now, in discussions on energy policy, the "three E's" of energy security, economic competitiveness, and environmental adaptability were considered to be the main pillars for policy objectives. Yet based on the experience with the earthquake, there is thought to be a need for positioning a fourth "E," emergency resilience, as a pillar in discussion on future energy policy.

The strength of emergency resilience is thought to consist of four characteristics.

1. Ease of storage
2. Ease of procurement
3. Ease of transportation
4. Ease of flexibility

The point here is that the most important characteristic in considering emergency resilience is ease of storage. Various countries have adopted a stockpiling system of maintaining a certain level of reserve in preparation for disruption of energy supply as a core emergency response measure. To actively use energy sources that excel in storability, which allows a certain level of stockpiling in huge quantities at a low cost, would lead to securing a sturdy and robust energy supply system in times of emergency.

The next important factor in thinking of emergency resilience is ease of procurement. If any disruption occurs in a specific energy source or its supply route, there will be a need to secure a large quantity of alternative supply sources in a short time. On this point, as an alternative source of energy, the existence of a large spot market capable of accommodating such large amounts of additional demand even under normal conditions is favorable. If the source of its procurement is available from globally integrated markets from anywhere in the world by payment of an appropriate amount in line with the market level, this will also lead to securing further procurement options, ensuring emergency resilience.

Ease of transportation is another important characteristic. In an emergency situation where existing transportation means are lost, energy supply requires a high degree of flexibility by which it can immediately be resumed using alternative means of transportation. Considering the importance of energy supply in social life, it is desirable to have a backup structure by which the alternative supply can immediately resume service in a very short time frame of one or two days rather than weeks.

Last of all, though this partly overlaps with the above items, ease of flexibility among operators is also a crucial perspective in considering emergency resilience. While they may compete with each other in normal times, if a structure is in place to flexibly accommodate the same energy among operators during an emergency situation, such as a drastic fall in domestic supply, the recovery strength of energy supply in times of emergency can be labeled as high.

3-2. Emergency Resilience and Oil

Needless to say, oil has the greatest emergency resilience characteristics of the above cases. Regarding storage, with the exception of some petroleum products, oil can be stored for long periods without quality deteriorating or quantity depleting. As of the end of March 2012, our country has a stockpile equivalent to 197 days of daily consumption. The high storability of oil is a great benefit to the energy supply's resilience in times of emergency. In the last year's earthquake, a prompt decision by the government to release the privately held stockpile had a significant effect in securing the supply of products to disaster-hit areas.

Regarding ease of procurement, oil has an internationally integrated market established around the world, with many trades taking place on the spot. It is flexible enough to be purchased from any location in the world if the economic terms work out. Another side to this is that because the market is globally integrated, a pricing mechanism will work enabling it to realize a supply and demand adjustment over a short period of time. In fact, when a series of large hurricanes hit the US in 2005, the US domestic refining capacity and pipelines were forced to suspend operations and stringent product demand drove up product prices inside the US. But as a result of these increases, product export to the US from various locations in the world increased and had the effect of balancing supply and demand in a short period. The current situation of the international oil market, in which the supply and demand conditions of a specific market enable adjustment of supply and demand on a global level through the price mechanism, is considered extremely effective in times of emergency.

Regarding ease of transportation, oil in liquid form under normal temperature does not require large-scale infrastructure for its transport. This is an advantage that it makes it relatively easier to secure alternative supply methods when existing supply methods (by trucks, barges, etc.) are lost.

Finally, regarding ease of flexibility, in the market inside Japan, product standards have been nearly unified among the oil companies, and petroleum products have extremely high flexibility in the sense they are actively traded by barter between companies even in normal times. In an emergency, products supplied by one company can easily be replaced by those from another company. A big advantage of oil is the fact that a flexible market does exist and that there are many players in the market facilitating such trade.

A traditional major concern in the discussions regarding energy security has been disruption of supply from overseas, especially from the oil-producing countries in the Middle East. The recent escalation in tensions between Iran and the US and European countries, as well as Israel, show that this perspective for sure remains extremely important. However, one of the lessons learned from this earthquake is the need to consider the energy supply over the full route of the chain of delivery to each individual citizen, the final consumer. In this aspect, emergency resilience should be considered an important pillar, equal to the existing three “E’s.”

This of course does not mean that economics and environmental adaptability can be taken lightly; it just means that emergency resilience is an index to be considered equally along with the other three “E’s.”

Oil is inferior to other energy sources in terms of carbon dioxide (CO_2) emissions and comparative economics, but as mentioned above, there is a large upside in the flexibility in its supply that far outweighs the others. The concept of maximizing the features of each form of energy is essential in considering the future energy mix. Given this situation, as a whole country study should take place on approaches to maximize the benefits of oil in the flexibility of supply. Discussions should be further made in detail on how to utilize this advantage in the total energy mix of the entire country.

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