Chapter 1

Oil Supply Resilience in Japan

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Chapter 1

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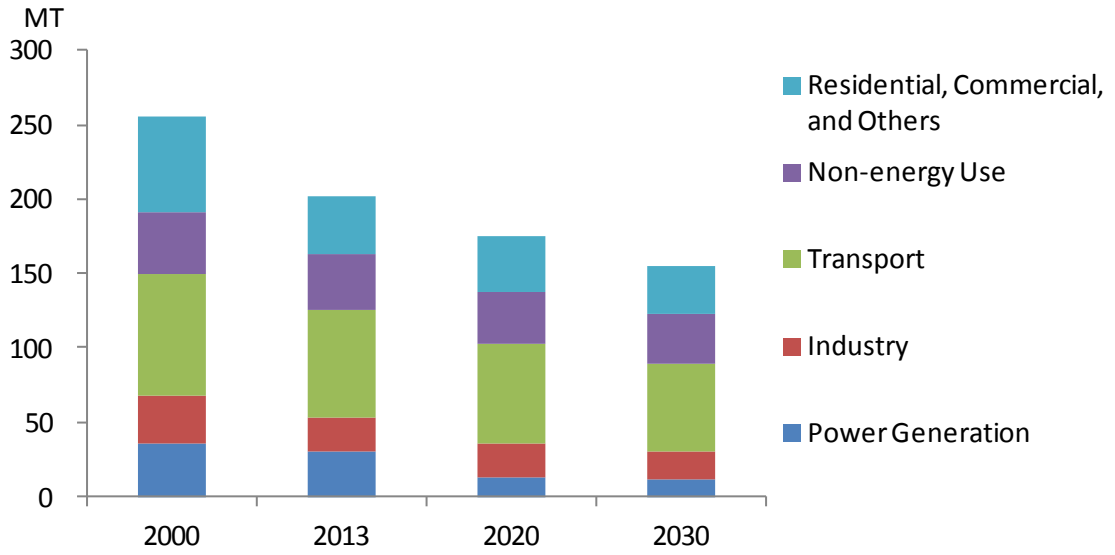
1. Oil in Japan

1.1. Demand

After peaking in the mid-1990s, Japan's oil demand has since been on a downward trend. Between 2000 and 2013, the demand has decreased by 0.9%/year to 202 metric tons (MT) in 2013. The transport sector had a share of 36% of the total oil demand in 2013, followed by residential share at 20%, and by non-energy use (mainly feedstock for petrochemicals) at 19% in the same year. According to Economic Research Institute for ASEAN and East Asia's (ERIA) 'Energy Outlook and Energy Saving Potential in East Asia' (2016), the demand is expected to decrease by 1.6%/year to 155 MT in 2030.

Figure 1-1: Oil Demand by Sectors in Japan (2000–2030)



MT = metric ton.

Source: Economic Research Institute for ASEAN and East Asia (2016).

1.2. Supply

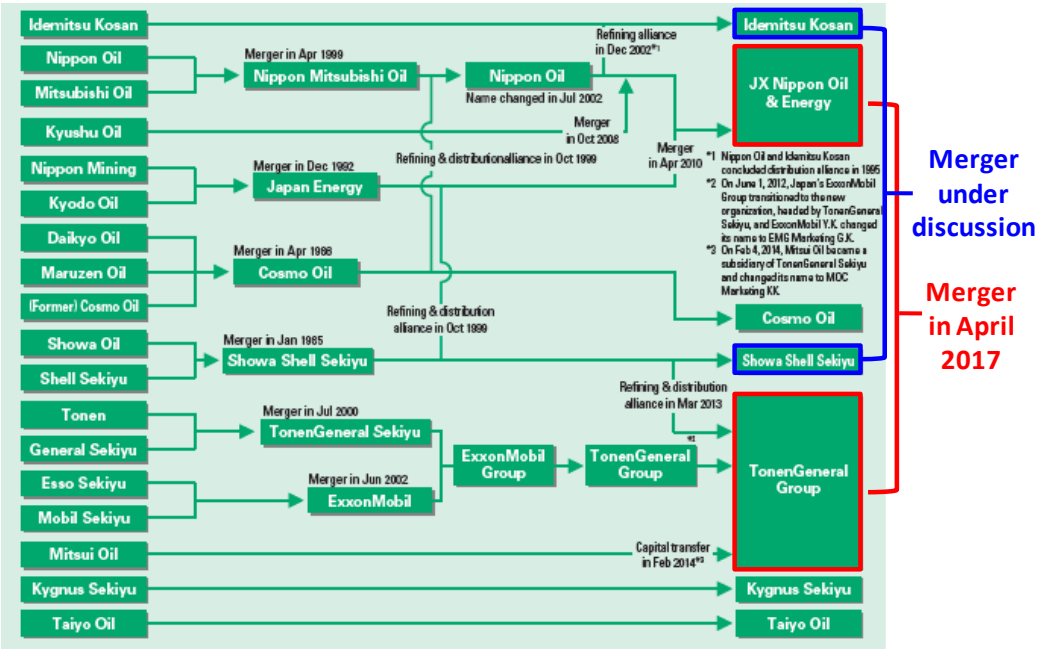
Lacking domestic resource, Japan is almost fully dependent on oil imports to satisfy its energy demand. According to the International Energy Agency (IEA), Japan imported 181 MT of crude oil

and 47 MT of oil products (mainly naphtha and liquefied petroleum gas [LPG]) in 2013.[1] While Japan will continue to depend on imported crude oil and oil products, the increase in its share of oil product imports will depend on the extent of refinery capacity reduction, domestic demand structure (e.g. diffusion of eclectic vehicles, plug-in hybrid and fuel cell vehicles, gasification of industry, and domestic energy needs), and the competitiveness of domestic refinery in the international market.[2]

1.3. Industry structure and regulatory bodies

The number of oil companies in Japan has decreased significantly since the 1980s. The Petroleum Association of Japan (PAJ) cites the mergers of the major industry players and the intensifying competition as main reasons for this industry consolidation. The merger of Exxon and Mobil in 1999 resulted in the creation of ExxonMobil Japan (renamed as Tones General in 2002). Intensifying competition especially since 1990s is undoubtedly the main reason for the merger JX and Tonen General in 2017, and that of Idemitsu and Showa Shell, which is currently under discussion.

Figure 1-2: Reorganization of Oil Company in Japan



Sources: Petroleum Association of Japan (2015) with addition from The Institute of Energy Economics, Japan.

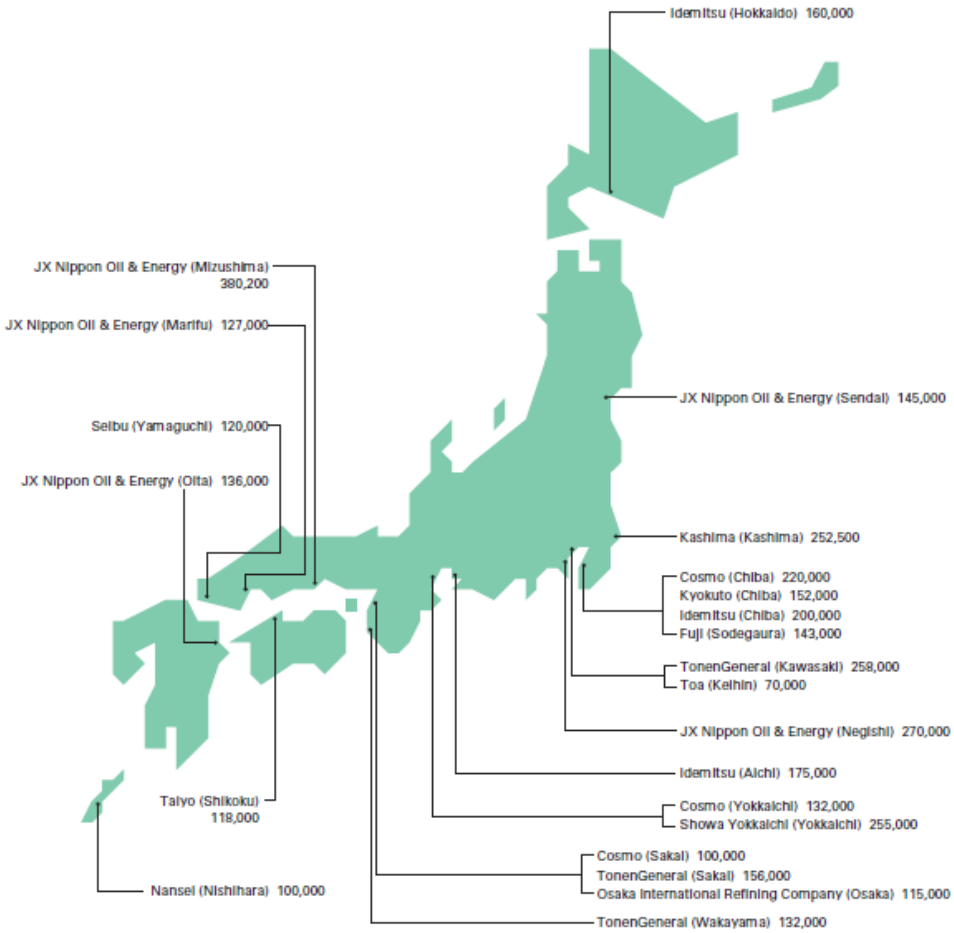
There are 23 refineries in Japan capable of refining 3.8 million barrels per day (mb/d) of crude oil. With decreasing demand, the capacity has been reduced significantly for the past decade. These refineries were given incentives in 2009 through the passage of the Law of Sophisticated Methods

[1] The discrepancy between the ERIA demand and the IEA supply figures mainly arises from oil products export, and international bunker and aviation.

[2] Japanese refineries exported 47 MT of oil products in 2013. With the weak domestic demand, they intend to increase oil products export, especially to Southeast Asia. The government, however, recognizes that refinery competitiveness is a prerequisite to increasing products export amid the competition with other exporters in Asia and the Middle East.

of Energy Supply Structures. These refineries were constructed near major cities (demand areas) to minimize internal transportation cost.

Figure 1-3: Refineries in Japan



Sources: Petroleum Association of Japan (2015) with addition from The Institute of Energy Economics, Japan.

The Ministry of Economy, Trade and Industry (METI) has the overall responsibility for the energy policy in Japan. Other ministries, such as the Ministry of Environment; Ministry of Education, Culture, Sports, Science and Technology; Ministry of Land, Infrastructure, Transport and Tourism; and Ministry of Foreign Affairs have some role in energy policies in terms of climate change, energy research and development, and resource diplomacy. As far as oil supply resilience is concerned, it is the minister in charge of Building National Resilience and the Cabinet Secretariat that make decisions and direct relevant government agencies like METI. The detailed development of policy making and institutional arrangements will be discussed in the next section.

2. Oil supply resilience

2.1. The Great East Japan Earthquake and the oil supply disruption

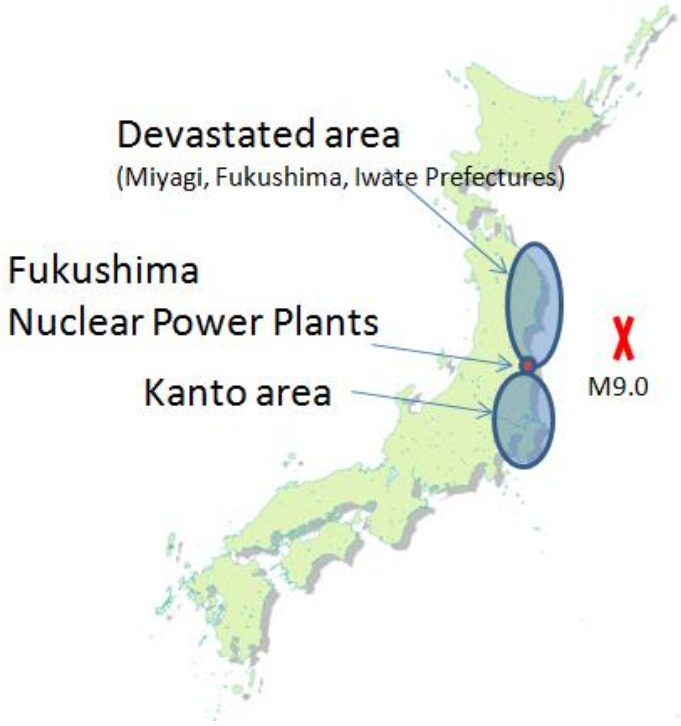
The Great East Japan Earthquake that occurred on 11 March 2011 was one of the most devastating natural disasters that Japan has experienced in decades. Its magnitude of 9.0 was the strongest ever recorded in the country. A huge tsunami hit a wide area on the Pacific coast. The Fukushima I Nuclear Power Plant, damaged by the earthquake and tsunami, failed to cool down its reactor, resulting in nuclear meltdown, explosion, and the release of radioactive materials.

Hardest hit by the earthquake and tsunami was the Tohoku region. The government confirmed that 15,890 people were killed mainly by the tsunami, and 2,589 people were still missing. The number of evacuees by the end of 2016 has decreased but remains high at 13,000. The earthquake damaged a wide range of infrastructure, industries, houses, and other social capital. Supply disruptions occurred not only of oil products, which will be examined later in this chapter, but also of electricity, gas, water, food, various industrial materials, and daily commodities. The government estimated that the economic damage of the earthquake was in the range of ¥16–25 trillion (US$150–230 billion) (Cabinet Office, 2011). The Research Institute of Economy, Trade and Industry estimated that the earthquake, tsunami, and nuclear accident lowered the gross domestic product growth in 2011 by 1.3% points (RIETI, 2012).

The oil industry was no exception to the damage. Six refineries were automatically shut down during the earthquake. This decreased the refining capacity in the country by 1.3 mb/day (30% of the total). The Sendai refinery was the most damaged because it was also hit by tsunami and fire. Although three refineries were back in operation within 10 days after the earthquake, it took almost a year before Sendai was restarted.

The distribution network of oil products was also destroyed. Oil terminals for both onshore and offshore transports halted operation mainly due to blackout and damages of the berths and tanks. Ports, roads, and railways were also damaged, preventing the distribution of oil products. At the retail level, 40% of the service stations were closed because of the damage and lack of oil products. Due to the efforts of industries and government agencies, 90% of the gas stations were reopened within a month.

Figure 1-4: Great East Japan Earthquake and Devastated Areas



Source: Ministry of Economy, Trade and Industry (2017).

Apart from the physical damages, there was wide communications failure and inadequate coordination among government agencies and local government authorities. For example, the PAJ cited that the delayed traffic permits for lorries slowed down oil distribution.

2.2. Government and industry measures after the Great East Japan Earthquake

The enormous loss caused by the earthquake showed that the traditional measures for oil supply security were not working, and both government and industry had to formulate new countermeasures. In this section, government and industry measures will be described separately, but it is worth emphasizing that the government and industry need to work together in these measures and that communication and coordination among various organizations are critical.

(1) Government measures

Reviewing the enormous damages caused by the Great East Japan Earthquake, the government realized that conventional disaster prevention measures, which were mainly infrastructure developments, could not overcome the cycle of destruction, recovery, and reconstruction. As a result, the government started to promote a concept of national resilience, which intends to avoid repeating the cycle through continuous improvement and assessment of countermeasures.

Resilience is a wide concept applicable to health care, psychology, ecosystem, economics, engineering, and many other fields. When applying this to risk management in natural disasters, the basic understanding is that natural disasters by themselves are unavoidable, but being prepared for such disasters can limit the loss and quicken the recovery. With that understanding, the government has developed a policy framework on national resilience. Following the Abe Cabinet's inauguration in 2012, the 'Minister in charge of Building National Resilience' was established. In 2013, the 'Basic Act for National Resilience', the fundamental law on national resilience, was formulated. This act requires the government to develop 'Fundamental Plan for National Resilience', which is considered as the 'umbrella plan' that serves as guideline for the other specific plans (including energy) at both central and local governments.

Figure 1-5: Policy Framework of National Resilience in Japan

Source: Cabinet Secretariat (2014).

Alongside the basic framework of national resilience, the government took specific emergency measures after the earthquake The METI outlined seven measures to enhance oil supply resilience (Table 1-1). Overall, these measures aim at addressing domestic supply risks of oil products, not only the overseas supply risks that were originally considered in terms of supply security, but also at ensuring that oil products are supplied where they are most needed in an emergency. In line with these aims, the measures undertook a revision of the Oil Stockpiling Law, established a national oil product reserve, developed core gas stations, and launched a promotion of the user's reserve. The traditional measure of improving earthquake resistance was upgraded by enhancing the resilience of refiners and terminals. Other measures aimed at streamlining

communication between industries and government agencies were put in place. For example, the Joint-Operation Plan for Oil Supply in Disasters was intended to enhance cooperation between and among different ministries.

Table 1-1: Government Measures to Enhance Oil Supply Resilience after the Great East Japan Earthquake

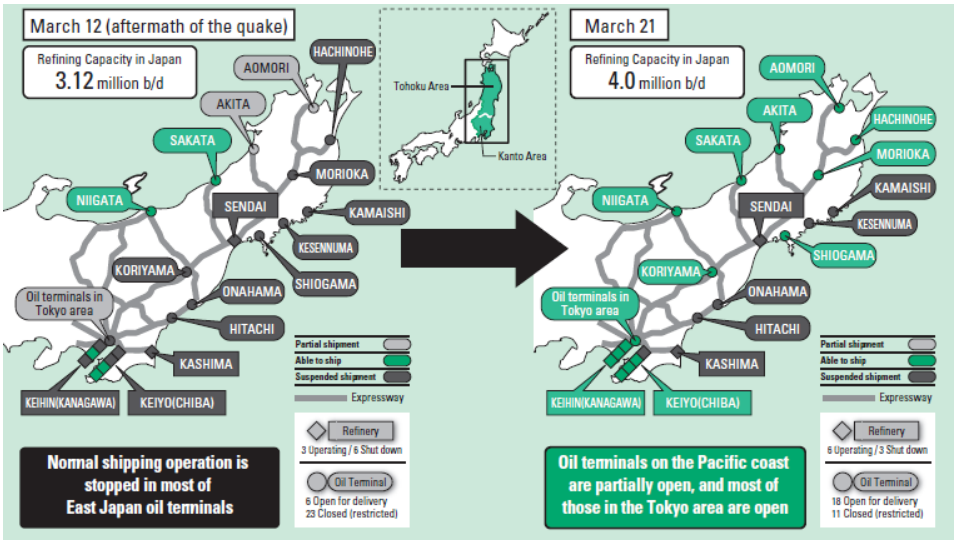
Measures	Contents
Revision of Oil Stockpiling Law	Amended Article 2 to include domestic supply disruption, not only disruption overseas
Establishing national oil product reserve	4 days product reserves in 10 regions
Enhancing resilience of refineries and terminals	Subsidies for emergency power generation equipment, emergency communication system, drum-filling shipment facility, and 57 other items
Developing core gas stations	Designated about 600 gas stations with power generator, large oil tanks, and emergency telecommunication systems
Obliging companies to set up 'Joint-Operation Plan for Oil Supply in Disasters'	Establishing 'Joint Operation Room' at the Petroleum Association of Japan for oil distribution and communication with the government in an emergency
Enhancing inter-ministries' cooperation	Especially with the Ministry of Transport and the Ministry of Defense for the distribution of oil products in an emergency
Promotion of user's reserve	Subsidies for the installation of tanks and power generators at schools, community centres, hospitals, and other eligible facilities

Source: Ministry of Economy, Trade and Industry (2017).

(2) Industry measures

As mentioned earlier, the oil refineries were temporarily shut down during the earthquake, and the distribution network was destroyed, which caused widespread supply disruption of oil products especially in the hardest-hit Tohoku region. The PAJ set up an operations room that took control of emergency distribution 24 hours a day, in coordination with oil companies and government agencies. Significant operations of refining and distribution terminals were resumed within 10 days after the earthquake. The industry players also raised output at undamaged refineries and deployed a large convoy of lorries, freight trains, and vessels to transport oil products into the disrupted areas. Due to these efforts, oil supplies in Tohoku recovered fully almost 1 month after the earthquake.

Figure 1-6: Emergency Response to Oil Supply Disruption after The Great East Japan Earthquake



Source: Petroleum Association of Japan (2015).

PAJ now recognizes four needs for the oil industry to mitigate damages from an earthquake. These are (i) enhancing the resilience of refineries and shipping facilities; (ii) strengthening of distribution network; (iii) building a cooperative relationship; and (iv) joint exercises among the government, oil companies, and other relevant organizations. Based on these lessons, the oil companies have undertaken a set of measures (Table 1-2). While enhancing the resilience of refineries and shipping facilities may be described as a conventional measure, some of its features, like being equipped with emergency power and communication tools, are modifications that better address earthquake and tsunami risks. These features are also applicable to the distribution network. On the other hand, communication, planning, and drills are also considered important in an emergency. The business continuity plan (BCP), information sharing, and joint exercises are intended to enhance preparedness and coordination among different organizations in the public and private sectors.

Table 1-2: Industry Measures to Enhance Oil Supply Resilience after the Great East Japan Earthquake

Measures	Contents
Enhancing the resilience of refineries and shipping facilities	Anti-seismic reinforcement, liquefaction countermeasure, and safety shutdown of refinery and oil terminals
Strengthening of distribution network	Strengthening the function of receiving and shipping oil products (e.g. emergency power generator, emergency communication tool, facility of drum shipment)
Building a cooperative relationship	Constant review and improvement of business continuity plan (BCP), including affiliated companies
	Information sharing about the fuel supply of important facilities (e.g. hospitals) with local government.
Joint exercises among the government, oil companies, and other relevant organizations	Planning and undertaking drills based on 'The Oil Supply Coordination Plan in Disaster'

Source: Petroleum Association of Japan (2017).

A BCP warrants further explanation. It is one of the essential elements of any risk management, not just in oil supply resilience. As the name suggests, a BCP aims at ensuring critical services even during adverse events. Assessing the risks to which a business is exposed, a BCP typically defines the priority of goods and services a business is engaged in, evaluates the loss that could be incurred by the risks, and specifies the roles and responsibilities of a person and/or a team in the business. Usually, preparing a BCP entails education, training, and review. In this sense, a BCP is based on a so-called plan, do, check, action (PDCA) cycle. In the case of Japan's oil companies, BCPs cover the entire supply chain (refineries–transportation–gas stations) and aim to ensure the availability of 50% of oil supply to maintain social functions in emergency cases, like a huge earthquake. Each company conducts BCP training regularly.