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Oil Supply Resilience in ASEAN

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This report was prepared by the Working Group for the 'Oil Supply Resilience in ASEAN' under a research project of the Economic Research Institute for ASEAN and East Asia (ERIA). Members of the Working Group, who represent the participating East Asia Summit (EAS) region countries, discussed and agreed to utilize certain data and methodologies proposed. These data and methodologies may differ from those normally and/or officially used in each country and, therefore, the results presented here should not be viewed as official national analyses of the participating countries.

Foreword

The concept of resilience has gained wide attentions in the past 10 years. Its application extends to various disciplines – from civil engineering to infrastructure construction, macroeconomics, corporate strategy, and even psychology. The essence of resilience is to enhance not only resistance but also recovery capabilities. Higher resilience means that when one is impacted by a negative shock, the resilience itself can minimize the impact and recover the original status in a shorter period. Therefore, resilience has a comprehensive nature that includes both preventative actions from negative shock and mitigation actions of the negative impact.

Resilience is also a useful concept in the effort to enhance oil supply security. Building stockpiling or soil improvement to absorb the impact of earthquake is a traditional measure for oil supply security. The concept of resilience tells us that deploying 'hard' measures is very important but not sufficient enough to maintain a stable oil supply in case of emergency; 'soft' measures, such as streamlining communication and business continuity plan (BCP) to promptly restore the original supply, are equally important.

As a result of the Great East Japan Earthquake in 2011, Japan experienced supply disruption of oil products, gas, and electricity in some region. The government and the industry had a comprehensive review of their energy policies after the event. Domestic oil supply has been one of the issues, and a set of measures were taken to ensure the stable supply and the swift recovery in case of disruption. The concept of resilience was introduced in this context, and the concept is still evolving as will be mentioned in this report.

Meanwhile, oil demand in ASEAN countries is growing rapidly. Yet, oil stockpiling and other security measures have not been developed to the level of OECD countries. Many ASEAN countries are exposed to various risks of supply disruption, such as natural disasters, accidents, and terror attacks. This study reveals that the countermeasures and preparedness for these risks are not adequate.

Taking the above situation into consideration, this study aims to share with the ASEAN the experience of Japan in oil supply resilience. This includes understanding the current status of relevant oil supply security activities in the ASEAN region, identifying the required actions to enhance resilience in oil supply security, and finally, proposing measures to enhance oil supply resilience in the region. The oil supply resilience in Japan will be reviewed in Chapter 1 while the same resilience in Southeast Asia will be examined in Chapter 2. Both chapters will look at oil demand, industry structure, regulatory bodies, supply risks, and countermeasures. Chapter 3 will

summarize the discussion, analyse what additional measures are needed, and explore the possible areas for international cooperation.

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Dr Tetsuo Morikawa

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APSA	ASEAN Petroleum Security Agreement
ASCOPE	ASEAN Council on Petroleum
ASEAN	Association of Southeast Asian Nations
BCP	business continuity plan
DOE	Department of Energy, Philippines
E&P	exploration and production
EPU	Economic Planning Unit
ERIA	Economic Research Institute for ASEAN and East Asia
IEA	International Energy Agency
IEEJ	The Institute of Energy Economics, Japan
JCCP	Japan Cooperation Center Petroleum
LPG	liquefied petroleum gas
mb/d	million barrels per day
MEMR	Ministry of Energy and Mineral Resources
METI	Ministry of Economy, Trade and Industry
MOIT	Ministry of Industry and Trade, Viet Nam
MT	million ton
PAJ	Petroleum Association of Japan
PDCA	plan, do, check, action cycle

Executive Summary

The Great East Japan Earthquake resulted in supply disruption of oil products, gas, and electricity in the country. This incident prompted the government and the industries of Japan to alter the concept of oil supply security, and to prepare not only for supply risks abroad but also for those in Japan. The government and the industries introduced the concept of national resilience – a concept that intends to avoid the repetition of the cycle of destruction, recovery, and reconstruction. In line with the concept of national resilience, the government and the industries have implemented a set of measures to mitigate the damage and quicken the recovery.

This study found out that selected Association of Southeast Asian Nations (ASEAN) member countries, namely Cambodia, Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam, are aware of the external risks to oil infrastructure and supply chains. These include natural disasters and possible sabotages by terrorists. These selected ASEAN countries currently implement various countermeasures to these risks. The study also found out that while the general framework for emergency response has been developed in most countries, its functionality has not necessarily been tested in a real emergency situation or in exercises. Similarly, emergency plan, business continuity plan (BCP), and the like are available at major energy companies, but regular assessments, upgrades, and exercises are not necessarily implemented.

Oil supply resilience is a part of oil supply security, and there is a significant overlap between supply security and resilience in terms of countermeasures. This study revealed that the importance of oil supply resilience might not be fully recognized in the ASEAN region. While stockpiling and infrastructure development may be regarded as general measures for oil supply security, the more important measures for oil supply resilience are education, planning, and institutional and legal framework. The government should lay out institutional and legal frameworks first so that detailed policies can be effectively implemented and that division of roles can be specified. Upon such framework, industries can work on enhancing their resilience to natural disasters and other risk factors associated with oil supply. Making a BCP is the obvious area to start with, however, it is important to do it with a ‘plan, do, check, action’ (PDCA) cycle.

Given the scale of the potential negative impact and the existing framework in the ASEAN region, stockpiling is the obvious area for international cooperation in enhancing oil supply security and resilience. As far as capacity building for institutional and legal framework and for industry efforts like BCP, Japan could be of help to ASEAN member countries. Other cooperation areas include enhancing gasoline and diesel quality in the region.

Chapter 1

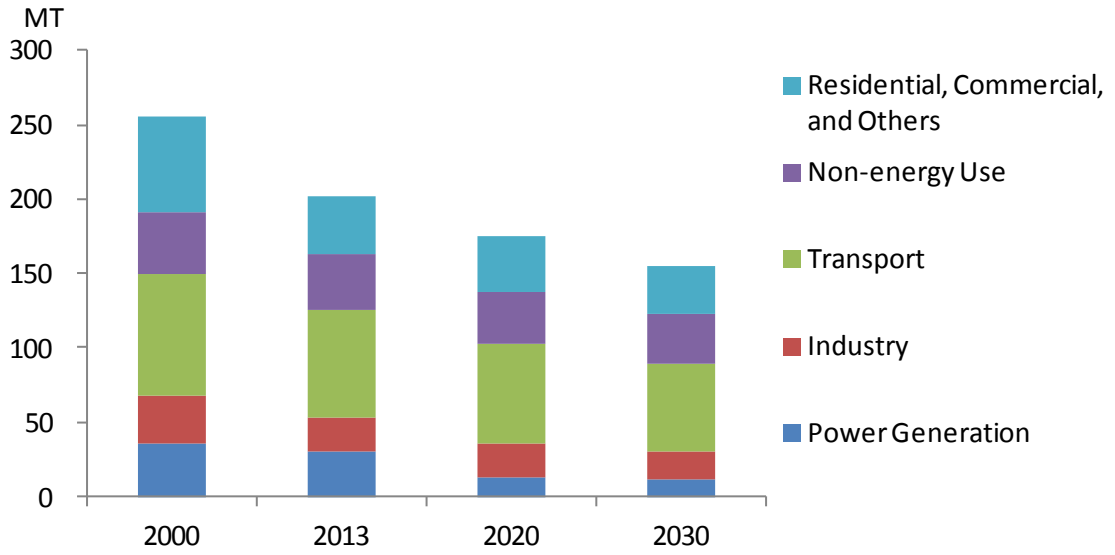
Oil Supply Resilience in Japan

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

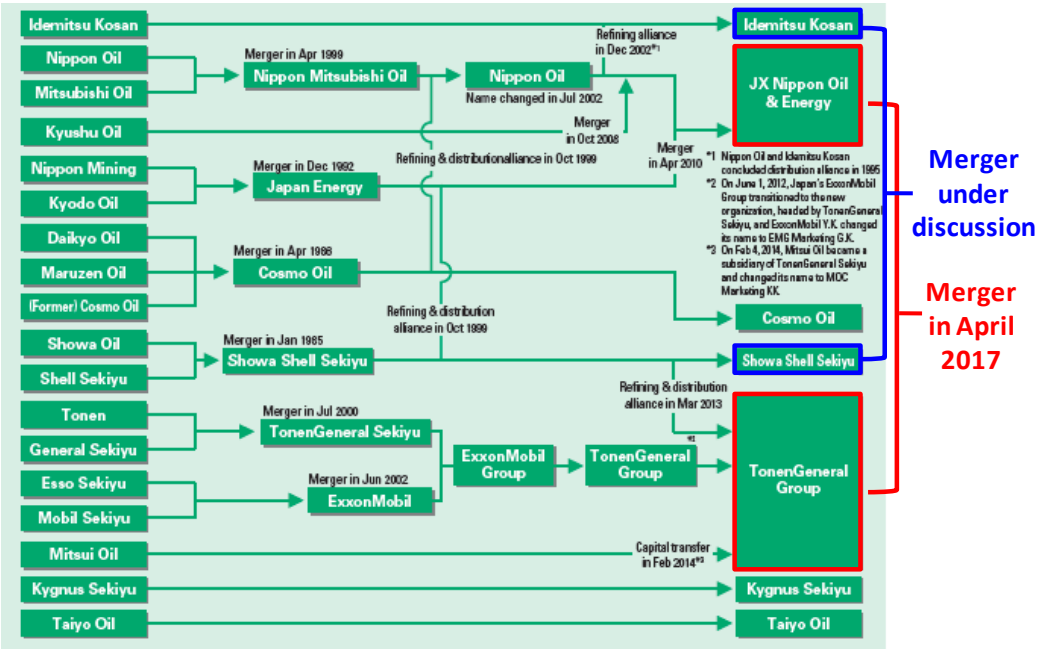
Lacking domestic resource, Japan is almost fully dependent on oil imports to satisfy its energy demand. According to the International Energy Agency (IEA), Japan imported 181 MT of crude oil

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.

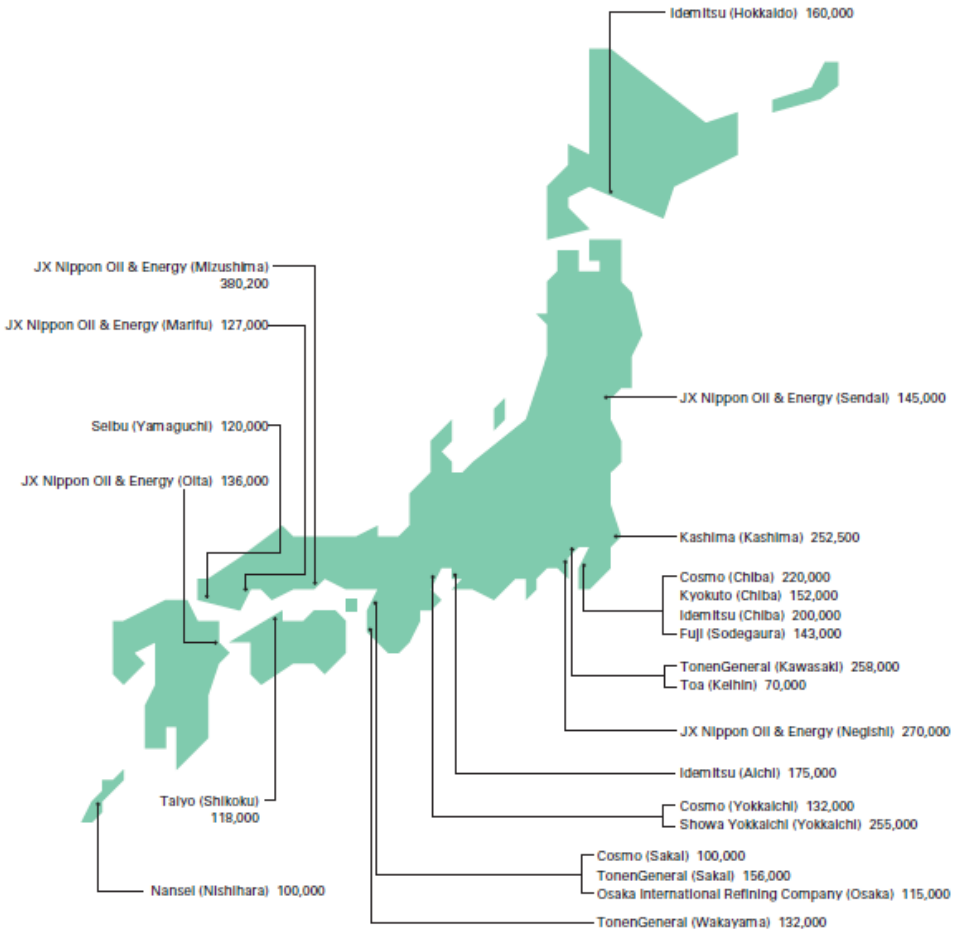
There are 23 refineries in Japan capable of refining 3.8 million barrels per day (mb/d) of crude oil. With decreasing demand, the capacity has been reduced significantly for the past decade. These refineries were given incentives in 2009 through the passage of the Law of Sophisticated Methods

[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

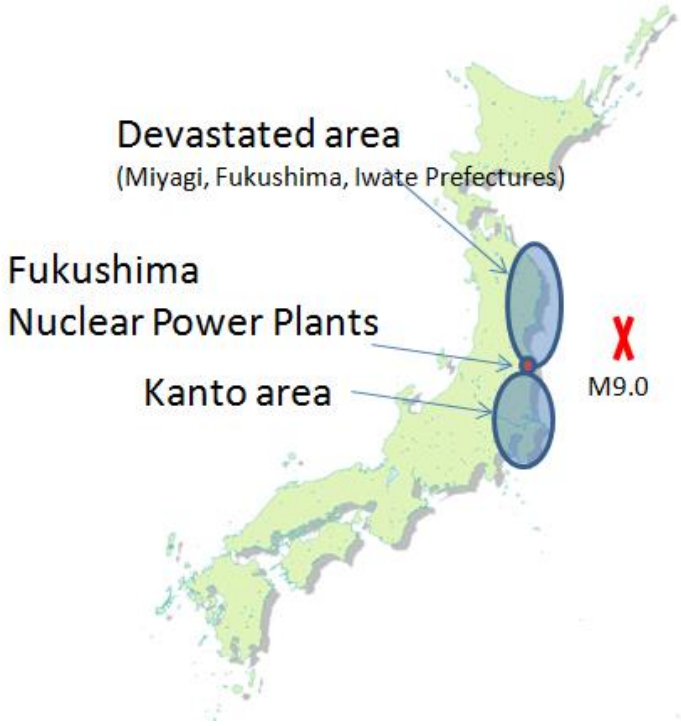
The Great East Japan Earthquake that occurred on 11 March 2011 was one of the most devastating natural disasters that Japan has experienced in decades. Its magnitude of 9.0 was the strongest ever recorded in the country. A huge tsunami hit a wide area on the Pacific coast. The Fukushima I Nuclear Power 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

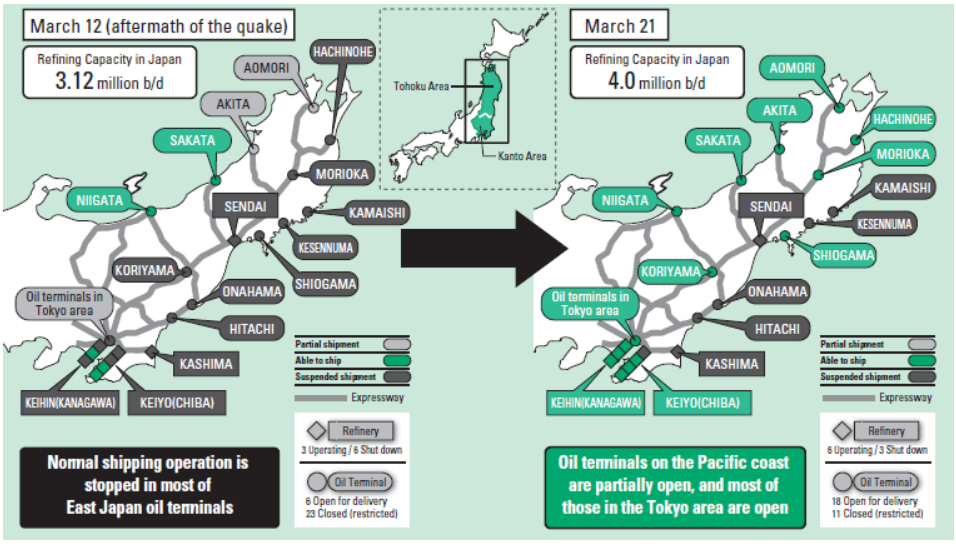
Measures	Contents
Revision of Oil Stockpiling Law	Amended Article 2 to include domestic supply disruption, not only disruption overseas
Establishing national oil product reserve	4 days product reserves in 10 regions
Enhancing resilience of refineries and terminals	Subsidies for emergency power generation 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.

Chapter 2

Oil Supply Resilience in Selected ASEAN Countries

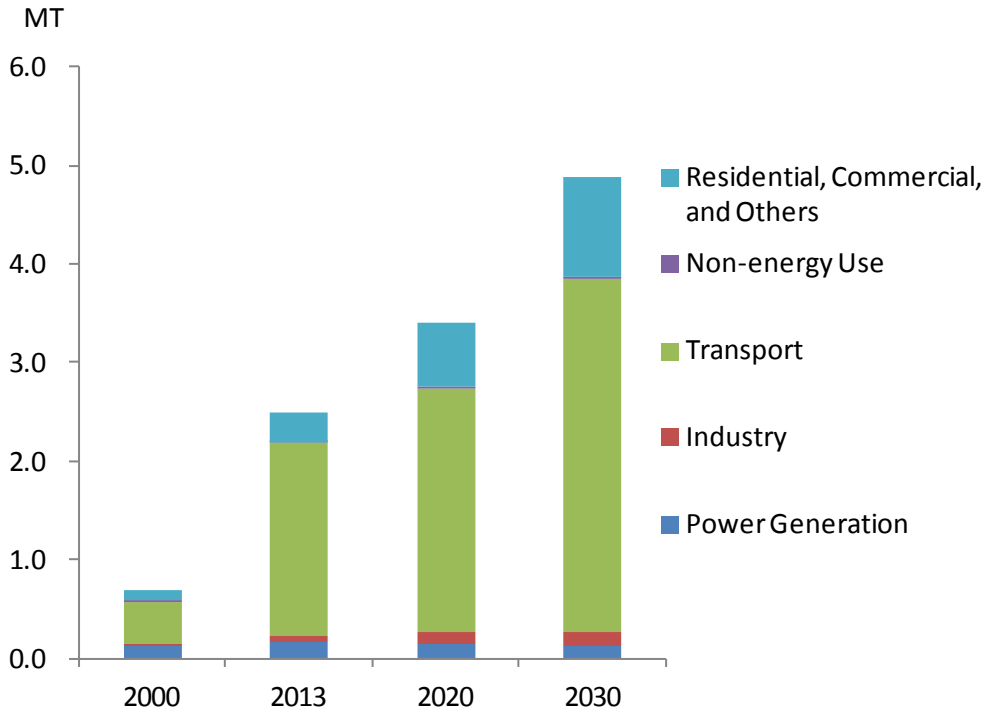
1. Cambodia

1.1. Oil in Cambodia

(1) Demand

Oil demand in Cambodia is modest but is growing fast. In 2000, the demand was less than 1 MT, but it more than tripled by 2013. The transport sector has been and will be the driver of the demand growth. In 2030, ERIA predicts that the demand will reach 4.9 MT, where 71% is expected to come from the transport sector.

Figure 2-1: Oil Demand by Sectors in Cambodia (2000–2030)



MT = metric ton.
Source: Economic Research Institute for ASEAN and East Asia (2016).

(2) Supply

Cambodia does not produce crude oil and does not have a refinery, hence, its oil demand is met by importing mainly from neighbouring countries. Exploration and production (E&P) activities are

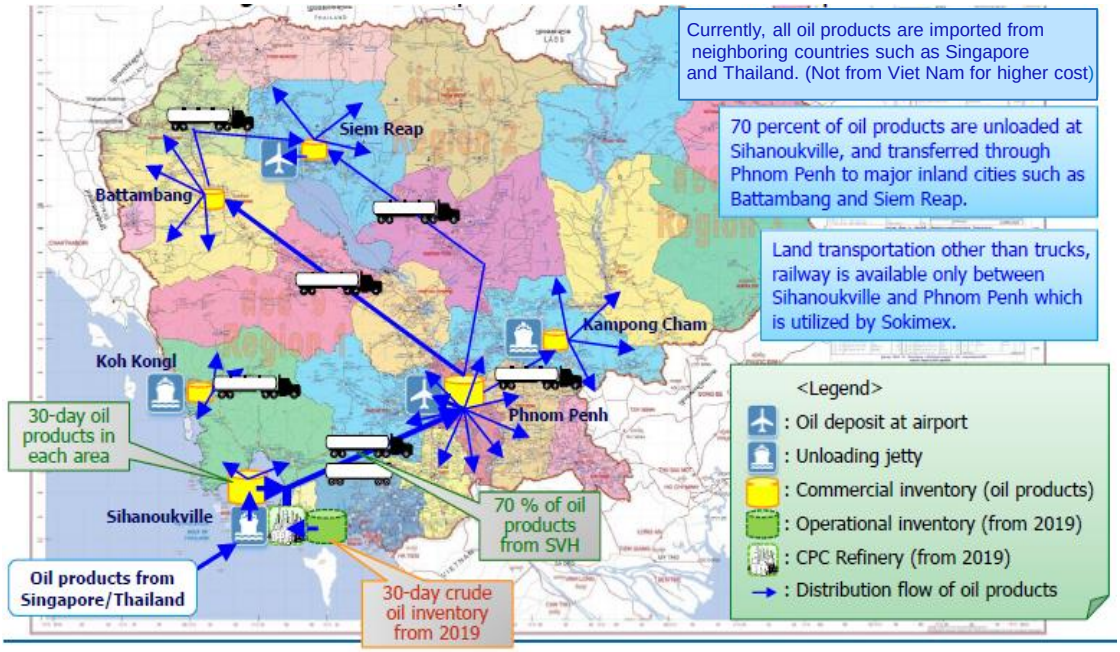
underway, especially offshore Cambodia, although it is not clear when and how much crude oil will be produced. The Cambodian Petrochemical Company and the China National Petroleum Corporation are planning to build the first refinery in Cambodia (Kang, 2016).[3] With a capacity of 2 MT for phase 1, the refinery will decrease the import dependency of Cambodia on oil products after its planned commercialization in 2018.

(3) Industry structure and regulatory bodies

Oil supply in Cambodia has been undertaken by private companies. Foreign companies like Chevron, Total, and PTT, as well as Cambodian suppliers like SOKIMEX and Tela have strong presence in the market. Although the government has considered establishing a national oil company, there is no such company in Cambodia so far.

According to the Ministry of Mine and Energy, 70% of the oil product import passes through Sihanoukville, the major port in Cambodia, and then transported to major cities like Phnom Penh mainly by lorry. Railways or barges are available in limited areas or routes.

Figure 2-2: Oil Supply Map in Cambodia



Source: Ministry of Mine and Energy (2017).

[3] 'Oil Refinery Will Lower Gas Prices, Government Says', *Cambodia Daily*, 6 May 2016. By Kang Sothear https://www.cambodiadaily.com/business/oil-refinery-will-lower-gas-prices-government-says-112238/

Energy policy in Cambodia is formulated and executed by the Ministry of Mine and Energy. Within the ministry, the General Department of Petroleum is in charge of the oil industry. Other ministries, such as the Ministry of Economy and Finance, are involved in energy price regulation and other affairs related to energy.

1.2. Oil supply resilience in Cambodia

(1) Identifying risks in oil supply disruption

Like many other countries in Southeast Asia, the climate in Cambodia is mostly tropical, with plentiful rainfall. Although the government recognizes foreign risks such as supply disruptions in the Middle East or in neighbouring countries that export oil products to Cambodia, flood is the major natural disaster in Cambodia, especially in the lower Tonlé Sap basin and the lower Mekong River provinces. The significant probability of flood combined with relatively underdeveloped state of the road system in the country result in the risk of oil supply disruption, especially the supply transported by lorry. This was evident when typhoon Ketsana hit the country in 2009. Hence, the government considers another mega typhoon as the worst scenario in terms of natural disaster in the country. In this scenario, typhoon and flood are assumed to damage not only roads but also the Sihanoukville port and railways, which will prevent oil transportation in Cambodia. It is expected to take 1 month before oil transportation can be resumed.

(2) Countermeasures to oil supply disruption

Currently, the government is working on improving road conditions and is developing other transport modes like railways and barges to diversify the mode of oil transportation. The disaster forecasting system and the emergency scheme for distributing fuel by various transport modes are intended to reinforce the oil supply resilience in the country.

Cambodia has not developed national oil stockpiling yet, nevertheless, the government requires private companies to have 30-day inventories of oil products at oil terminals. The government considers stockpiling – not only at oil terminals but also at refineries and national stockpiling sites – as the first priority in enhancing oil supply resilience in the country. The government also intends to build a pipeline from Sihanoukville to Phnom Penh, and from Phnom Penh to Siem Reap and other provinces to diversify the country's oil transport mode.

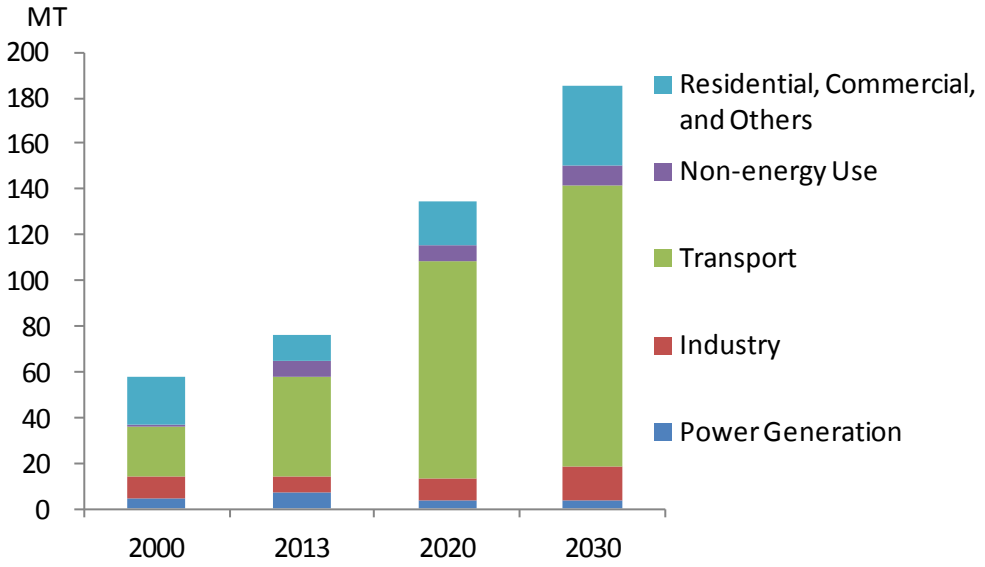
2. Indonesia

2.1. Oil in Indonesia

(1) Demand

With an oil consumption of 77 MT in 2013, Indonesia is the largest oil-consuming country in the ASEAN. Its oil demand, which increased by 2.2% per year since 2000, is expected to reach 185 MT in 2030. Transport is and will be the major consuming sector, sharing 56% of the total oil demand in 2013 and is expected to account for 66% of the total demand in 2030.

Figure 2-3: Oil Demand by Sectors in Indonesia (2000–2030)



MT = metric ton.

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

(2) Supply

Indonesia is the largest oil producer in the ASEAN region, although production has been on a downward trend since the 2000s. Production in 2013 was 42 MT, of which 16 MT were exported. Indonesia is also a major oil importer in the region to meet its growing demand. It imported 23 MT of crude oil and 32 MT of oil products, mainly gasoline and diesel in 2013.

According to IEA, Indonesia's crude oil production is expected to decrease to 0.5 mb/day (25 MT/year) in 2025, and production will be maintained at that level toward 2040. With rising import dependency, oil supply security is increasingly a concern in Indonesia's energy policy. Expanding the refinery capacity is underway to curtail product imports in the future. According to Pertamina, the state-owned oil company, there are six refineries in Indonesia with a total capacity of 1 mb/day (52 MT/year), well short of the product demand. Pertamina is implementing the Refinery Development Master Plan that involves debottlenecking of the existing five refineries to expand their capacity to 2 mb/day (100 MT/year) in 2025. For one of the refinery upgrade

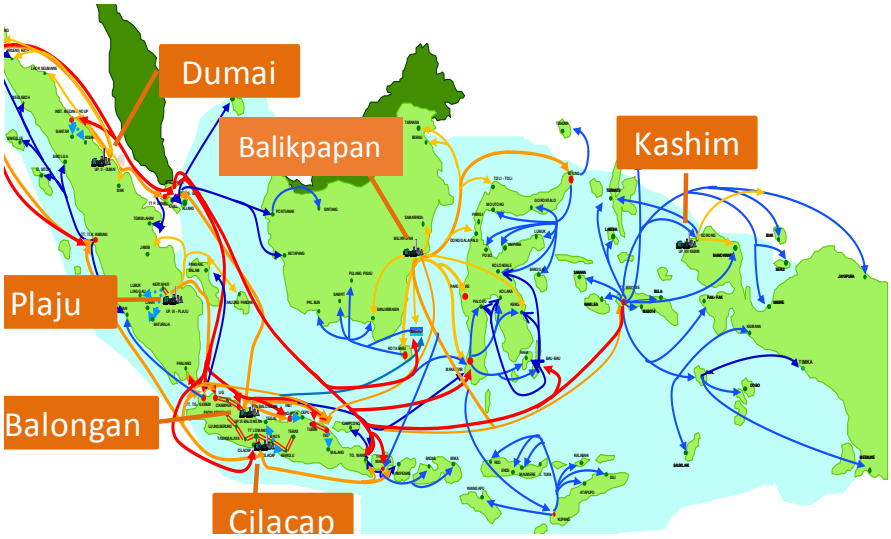
projects at Cilacap, Pertamina and Saudi Aramco signed a joint venture development agreement in December 2016. Under this agreement, Saudi Aramco will invest US$6 billion to upgrade the refinery in Java to enable it to refine 0.4 mb/day of Saudi crude oil in 2021 onward.

(3) Industry structure and regulatory bodies

Pertamina is the dominant oil supply company in Indonesia, supplying up to 95% of retail fuels and 75% of industry fuels. However, the Oil and Gas Law passed on 22 November 2011 stripped Pertamina of its monopoly status, allowing other oil companies to get their fair share of supply.

Since Indonesia is an archipelago and comprises many islands, sea transport is very important in the distribution of oil products in the country. Refinery locations are strategically determined and are not concentrated on any one major island to minimize the risk of supply disruptions.

Figure 2-4: Oil Supply Routes and Refineries in Indonesia



Sources: Ministry of Mineral Resources and Energy (2017), with additions from The Institute of Energy Economics, Japan.

While the National Energy Council (Dewan Energi Nasional) formulates energy policy principles, the Ministry of Energy and Mineral Resources (MEMR) is responsible for implementing specific energy policies in Indonesia. As far as oil is concerned, the Directorate General of Oil and Gas is in charge.

2.2. Oil supply resilience in Indonesia

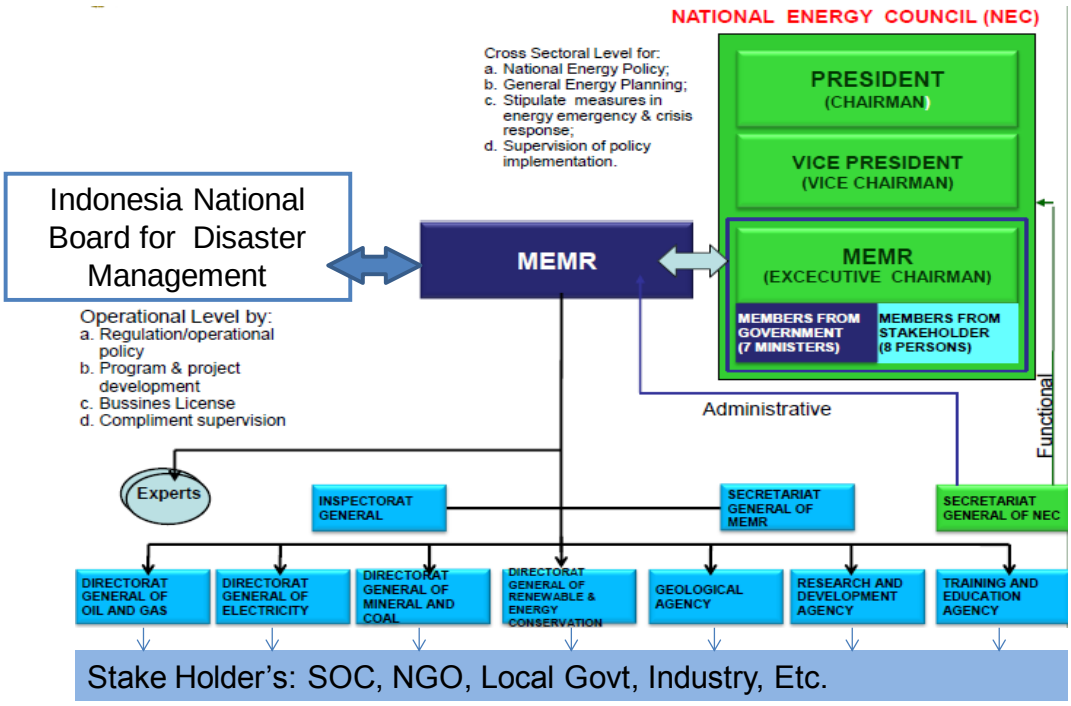
(1) Identifying risks in oil supply disruption

The MEMR identifies excessive demand hikes, natural disasters (tsunamis, earthquakes, and volcanic eruptions), market and industry emergencies, and political stability (instability) as major threats to oil supply in Indonesia. Although Pertamina also identifies earthquake and tsunami as major supply risks, it considers that Cilacap is the only vulnerable refinery for tsunami because of its location (facing the Indian Ocean where major tsunamis usually occur). The tsunami that hit Aceh in 2004 destroyed several oil tanks at an oil terminal, 9 gas stations, and 17 lorries, which resulted in damages worth US$30 million. To date, the most recent case of industry emergency occurred in 2011 and involved a fire at an oil tank of Cilacap refinery, but it had no significant impact on oil distribution since alternative supplies were available.

(2) Countermeasures to oil supply disruption

The MEMR is well aware of Indonesia's vulnerability in oil supply. The country is the largest oil consumer in the ASEAN region, and import dependency is rising. Many of its islands pose a challenge in terms of oil distribution especially during emergency situations. The country has developed an emergency response system at company, regional, and national levels. Existing laws provide for oil supply security, disaster mitigation, and emergency response plan. Therefore, Indonesia has fairly well institutionalized the oil resilience framework, However, so far, no detailed guidance for its implementation has been put in place. How workable this framework functions remains a question.

Figure 2-5: Emergency Responses System in Indonesia



MEMR = Ministry of Energy and Mineral Resources, NGO = nongovernment organization, SOC = State Oil Company

Source: Ministry of Energy and Mineral Resources (2017).

Most companies have emergency response plans to major accidents and oil spill. BCPs are in place, albeit at minimal level, as a part of Emergency Preparedness or of Safety Management System.

It is worth noting that refinery locations were strategically determined so as not to be affected by tsunami and other supply security risks. The MEMR employs domestic oil production increase, fuel diversification, demand management, and stockpiling as a broad policy to ensure oil supply security. On specific oil supply resilience, the MEMR recognizes several principles, such as promoting specific regulation and guidance, conducting resilience analysis of the entire fuel supply chain, preparing BCPs, exploring cooperation possibilities, regular reviews, and joint drills. However, one could argue that the policy details are not yet significantly developed.

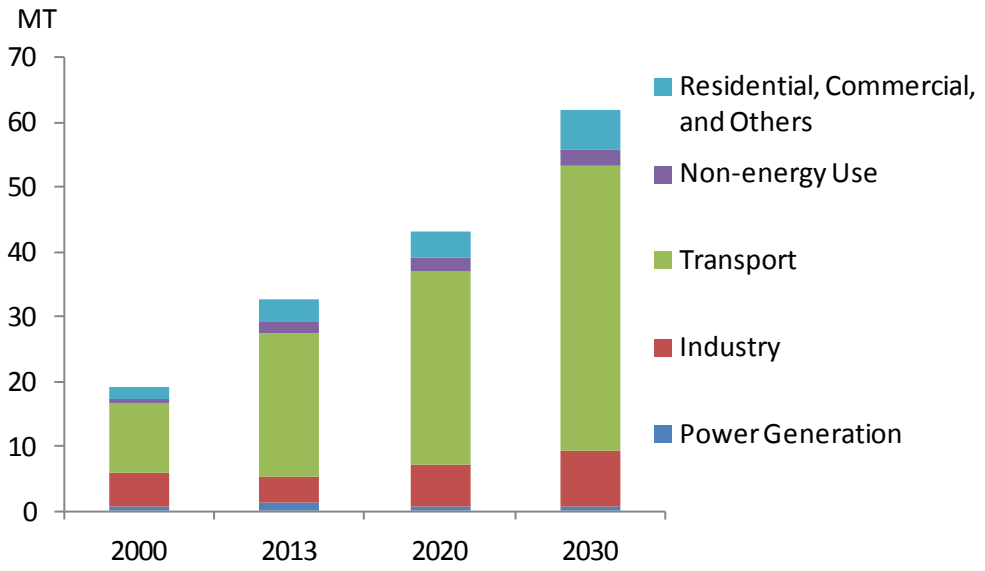
3. Malaysia

3.1. Oil in Malaysia

(1) Demand

Malaysia consumed 33 MT of oil in 2013. The demand has increased by 4%/year since 2000. As in the case of Cambodia and Indonesia, the transport sector of Malaysia has the largest share in oil demand (67% in 2013); followed by the industry sector (13%); and by the residential, commercial, and other sectors (10%). Future demand is also expected to grow by 4%/year, reaching 62 MT in 2030. Demand by sector in 2030 is likely to remain similar as that in 2013.

Figure 2-6: Oil Demand by Sectors in Malaysia (2000–2030)



MT = metric ton.
Source: Economic Research Institute for ASEAN and East Asia (2016).

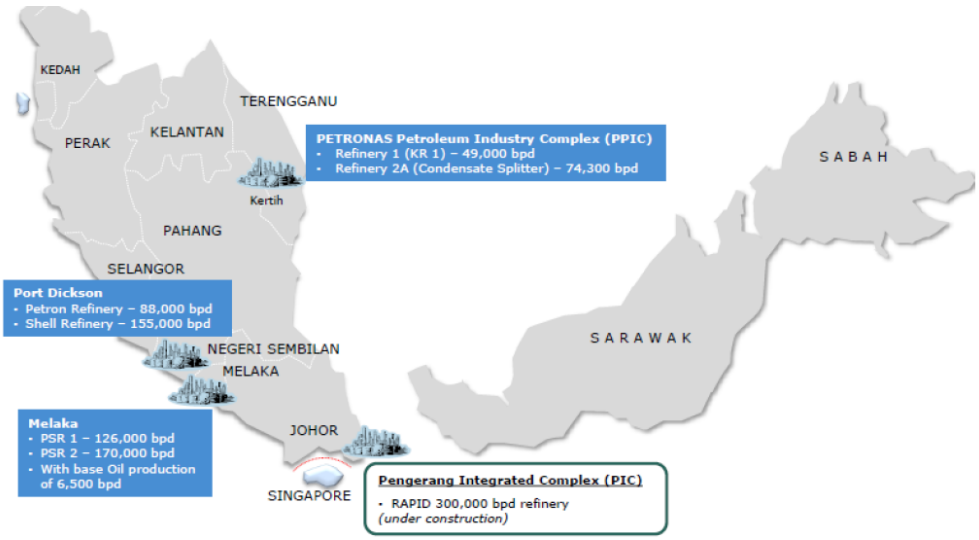
(2) Supply

Producing 30 MT of oil in 2013, Malaysia is the second largest oil producer in the ASEAN, next to Indonesia. Its practice of exporting and importing both crude oil and oil products has resulted in economic and product imbalances. In 2013, Malaysia exported 11 MT of crude oil but imported 9 MT of it. At the same time, it exported 12 MT of oil products, but imported 19 MT of said products.

Malaysia's crude oil production has been hovering at 30–35 MT/year for the past decade. Despite efforts by the government to stimulate E&P in the country, it is not likely that oil production will increase significantly, thus turning Malaysia into a net oil importer in the future.

There are three refineries in Malaysia at present, with a combined capacity of 0.65 mb/day (32 MT/year). To meet growing demand and to increase the export of oil products, the state–owned oil company, PETRONAS, is working to develop a refinery/petrochemical complex called RAPID in Johor. Like Cilacap in Indonesia, Saudi Aramco signed an agreement with PETRONAS to take part in this project, which will refine 0.3 mb/day of crude oil and produce 3.5 MT/year of petrochemical products.

Figure 2-7: Refinery Locations in Malaysia



Source: Economic Planning Unit (2017).

(3) Industry structure and regulatory bodies

Although the domestic oil market is open to competition, PETRONAS remains the dominant company in Malaysia's oil supply chain. The major international oil companies active in Malaysia include Shell, Chevron, oil trader Vitiol, the Philippine's Petron, and the Anglo-Australian multinational BHP.

Malaysia's energy policy is formulated and implemented by the Energy Section of the Economic Planning Unit (EPU) under the Prime Minister's Department. The Ministry of Natural Resources and Environment is in charge of upstream development. The Ministry of Energy, Green

Technology and Water is involved in electricity, water, and environmental issues. The Energy Commission is the main regulator of electricity and gas supply industries.

3.2. Oil supply resilience in Malaysia

(1) Identifying risks in oil supply disruption

The present Malaysian disaster management protocol at national level only covers flood, landslide, typhoon, earthquake, and industrial disaster (mechanical troubles, accidents, etc.). However, the EPU points out that these disasters have not significantly posed a threat to oil supply security in Malaysia. In addition, adequate crude oil production and bigger refinery capacity enable Malaysia to become a net exporter, which puts the country in a relatively favourable situation in terms of oil supply security. Nevertheless, the EPU is aware that supply disruption risks may come from natural and industrial disasters.

(2) Countermeasures to oil supply disruption

According to the EPU, general emergency response mechanisms and BCPs are in place at government agencies, PETRONAS, and at the electricity utility companies including the Tenaga Nasional Berhad (TNB). The Energy Commission has drafted a National Emergency Response Plan for the power sector, and is planning to draft such plans in 2017 for other sectors, including oil supply. Major companies, including PETRONAS, conduct periodic risk assessment and emergency drills. However, a national platform for a nationwide Disaster Risk Reduction Plan is not yet available. EPU understands that risk mapping and risk impact assessment are not consolidated at national level, which could cause inter-ministry coordination problem in case of emergency. The EPU recognizes the need to also conduct a national-level risk assessment on the energy sector, as the whole of Malaysia has relatively advanced in terms of awareness and implementation of oil supply resilience.

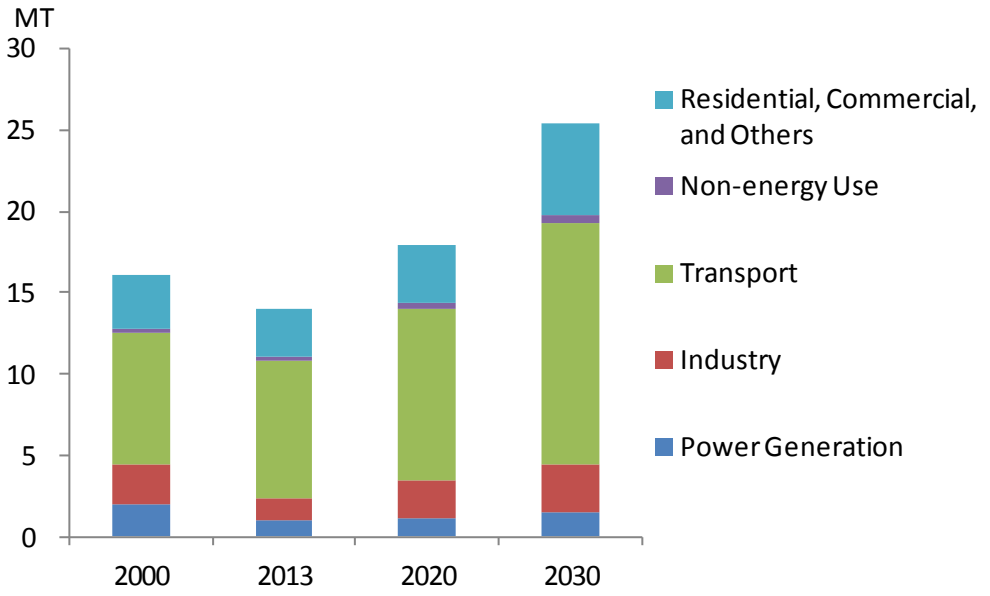
4. Philippines

4.1. Oil in the Philippines

(1) Demand

Oil demand in the Philippines slowed down for the past decade mainly due to higher oil price. The demand in 2013 was 14 MT, decreasing by 2 MT/year since 2000. The transport sector is the main oil consumer, with a demand share of 60% in 2013. ERIA expects the demand to grow by 4%/year to reach 25 MT in 2030. Share by demand among the sectors will remain largely unchanged.

Figure 2-8: Oil Demand by Sectors in the Philippines (2000–2030)



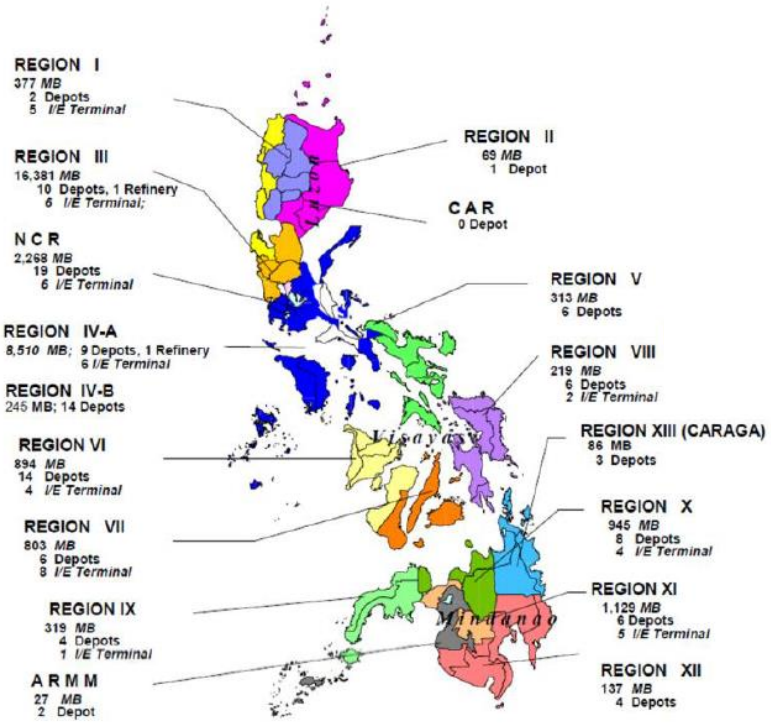
MT = metric ton.
Source: Economic Research Institute for ASEAN and East Asia (2016).

(2) Supply

The Philippines is heavily dependent on import to satisfy its oil demand. Domestic production in 2013 was 0.7 MT, only 5% of the demand. Crude oil and oil products import in 2013 were 7–8 MT each. With limited resource base, crude oil production in the Philippines is not likely to increase significantly.

There are two refineries in the Philippines with a total capacity of 0.29 mb/day (14 MT). Although Petron has a plan to build a refinery with a capacity of 0.25 mb/day, the actual commercialization timing is not yet clear. Thus, with increasing demand and stagnating domestic supply, the import dependency is likely to rise in the future.

Figure 2-9: Oil Infrastructure in the Philippines



Source: Department of Energy (2012).

(3) Industry structure and regulatory bodies

In the Philippine oil market, the Philippine National Oil Company (PNOC) is the main player. Nevertheless, since the market liberalization in the late 1990s, new players have entered the market. By 2014–2015, there were 249 active players in the market. Major players include Shell, PETRONAS, PTT, and Petron.

The Department of Energy (DOE) is the energy policymaking body in the Philippines. It also regulates the energy industry, as needed. On the other hand, the Energy Regulatory Commission monitors and sets the electricity rates, and the National Renewable Energy Board is the body created to research, develop, and promote the use of renewable energy.

4.2. Oil supply resilience in Philippines

(1) Identifying risks in oil supply disruption

Apart from external supply risks such as major reduction in the Organization of the Petroleum Exporting Countries (OPEC) crude output, the DOE identifies natural disasters, accidents, and terror attacks as major risks to oil supply in the Philippines. In particular, typhoons that hit the country around 20 times a year are considered the major natural disasters that cause infrastructure damage, flooding, and disruption of oil supply. For instance, when typhoon Yolanda or Haiyan struck in Leyte and nearby provinces in 2013, most of the oil infrastructure were

damaged and gasoline stations were shut down due to floods. It took several days before floods subsided and trucks became available to transport oil products to damaged areas.

(2) Countermeasures to oil supply disruption

The DOE has an existing Oil Contingency Plan that mainly addresses external threats, such as geopolitical conflict in the Middle East. In this plan, the government defines the priority of oil supply in the country. No such plan is available for internal threats. Nevertheless, at present, according to DOE, the National Disaster Risk Reduction Management Council headed by the Office of Civil Defense is in charge of addressing domestic threats caused by natural or man-made calamities. It is already communicating with other government agencies to identify their assignments in addressing the needs of the people in times of calamity. Each government agency is assigned responsibilities based on its mandate.

Although a similar kind of supply prioritization as defined by the Oil Contingency Plan could be deployed for internal threats that would be on condition of undamaged infrastructure. The DOE has required oil companies to maintain an inventory equivalent to 30 days of crude oil and petroleum products for refiners; 15-day equivalent of petroleum products for importers, and 7-day equivalent for LPG importers under the Circular on Minimum Inventory Requirement. It has also issued a Circular on Mutual Products Supply Agreement to ensure the continuous supply of oil. The DOE is aware of the need to streamline communication and coordination between government agencies and industries, and also of the need to assess the vulnerability of the entire oil supply chain. However, overall management of internal threats to oil supply is left to companies. Each oil company has its own BCP, but coordinated emergency exercises are not regularly conducted. The lack of nationwide coordination implies the need for government to take the lead in enhancing awareness and preparedness for oil supply resilience in the Philippines.

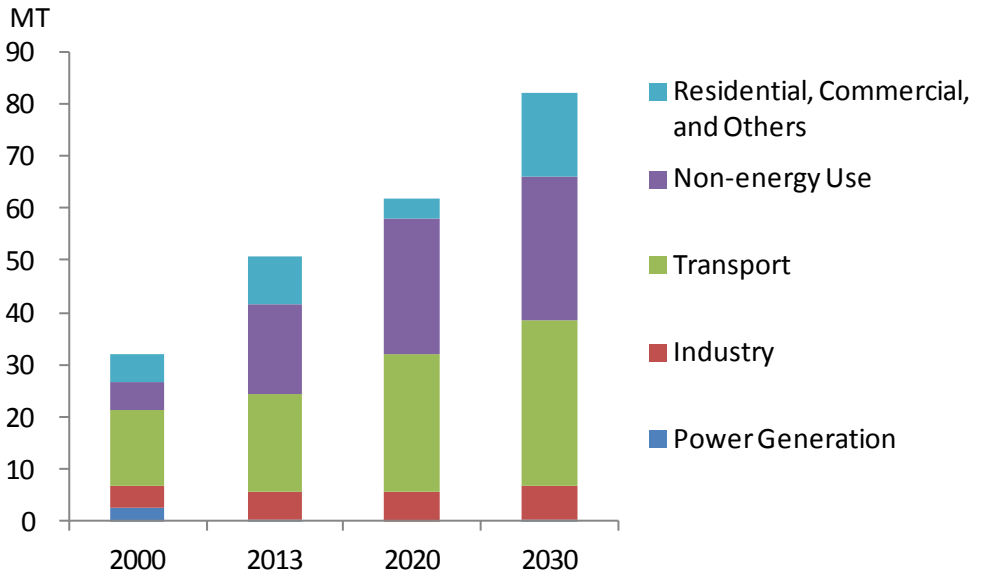
5. Thailand

5.1. Oil in Thailand

(1) Demand

Thailand is another major oil-consuming country in the ASEAN. Oil demand in the country in 2013 was 51 MT, the second largest after Indonesia. Like other countries in the region, the share of the transport sector was the largest (37% of total demand) in 2013. However, Thailand differs in terms of significant oil consumption for non-energy use (i.e. petrochemical feedstock) that accounted for 34% of the total demand in the same year. The increase in demand will accelerate in the future, reaching 82 MT in 2030. Transport and non-energy use will remain the main demand sectors.

Figure2-10: Oil Demand by Sectors in Thailand (2000–2030)



MT = metric ton.

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

(2) Supply

Producing 19 MT in 2013, Thailand is a substantial crude oil producer in the region. Production has increased gradually mainly due to aggressive E&P activities. However, domestic production accounts for only 33% of the total demand in 2013. The majority of demand is met by imports, mainly crude oil but also some products. Like in the Philippines, with declining reserves, crude oil production in Thailand is not likely to grow in the future.

Thailand has seven refineries with a combined capacity of 1 mb/day (54 MT/year), all located on the coast of Gulf of Thailand. Only after Singapore, Thailand is the second largest exporter of oil products in the region, exporting 13 MT in 2013 mainly to neighbouring countries.

(3) Industry structure and regulatory bodies

The state-owned PTT is the dominant oil company in Thailand, with its integrated operation from upstream to downstream. Through its subsidiaries, PTT controls five refineries. Although there is no concrete plan to build a new refinery, Bangchak, a PTT subsidiary, is considering an upgrading of its own refinery.[4] There is an oil pipeline network between refineries and demand areas (i.e. greater Bangkok), however, inland transportation is dependent on lorries.

The Ministry of Energy formulates and implements energy policy in Thailand. The Ministry of Natural Resources and Environment, on the other hand, is responsible for the sustainability of natural resources and environment in the country.

[4] 'Thailand's Bangchak reviewing refinery upgrade plan', *Hydrocarbon Processing*, 8 November 2016. http://www.hydrocarbonprocessing.com/news/2016/11/thailands-bangchak-reviewing-refinery-upgrade-plan

Figure 2-11: Oil Infrastructure in Thailand

Source: PTT (2016).

5.2. Oil supply resilience in Thailand

(1) Identifying risks in oil supply disruption

Like Cambodia and the Philippines, PTT is aware of oil supply insecurity arising from events such as political unrest and piracy in oil-exporting countries, particularly in the Middle East, and in the transportation routes. As far as internal security threat is concerned, PTT identifies tsunamis; storms; accidents; or sabotage at gas separation plants, refineries, pipelines, and other infrastructure as threats to oil supply in Thailand. PTT estimates that tsunamis and storms in the east coast of the gulf of Thailand would damage jetties and depots, which would reduce the oil products supply equivalent to 18% of total demand. Likewise, a disaster and/or sabotage at six gas separation plants would decrease the supply by 290 kilotons of LPG per month, which is 48% of the demand. Refinery locations are concentrated on the east coast, which constitutes a potential vulnerability of the oil supply resilience to tsunami and storm in the Gulf.

(2) Countermeasures to oil supply disruption

Major countermeasures considered by PTT include stockpiling, transportation switch, product swap among suppliers, and enhanced jetty. Along with Singapore, Thailand is the most advanced

in terms of oil stockpiling developments. The country currently holds 25 days of crude oil and oil products stockpiling, and intends to build up the stockpiling to 90 days. While oil product pipelines are available in the south of the country, PTT plans to extend the pipelines to inland cities. PTT also considers vessels as an alternative transport mode. PTT plans pipeline extensions to inland cities like Lampang and Khon Kaen, which are expected to contribute to diversifying the oil transport in the country. According to PTT, jetties are already tolerant of earthquakes of 7.2 in the Richter scale and to high tides of 5.2 meters. PTT has also developed business continuity management based on TIS22301. PTT explains that social unrest (such as the anti-government demonstrations during 2013–2014) necessitated companies to draw up BCPs. PTT also considers moving the taxation point to pipeline depot as an encouragement for companies to build inventory close to the demand site.

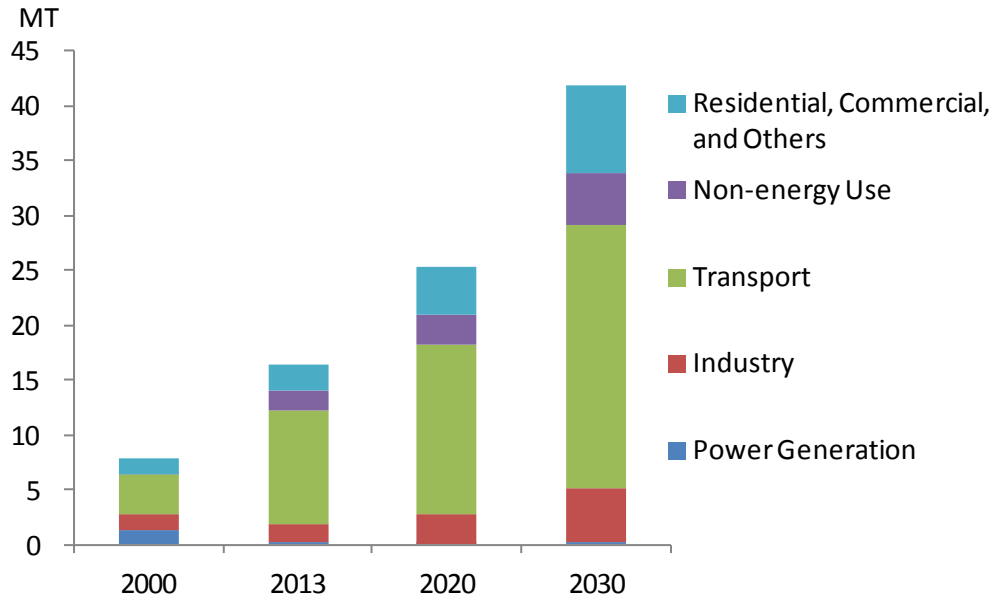
6. Viet Nam

6.1. Oil in Viet Nam

(1) Demand

Oil demand is growing strongly in Viet Nam. Its demand growth since 2000 is as high as 6% per year, which is one of the fastest in ASEAN member countries. In 2013, the demand was 16 MT, 64% of which was for the transport sector. ERIA foresees the demand to grow at 6%/year to reach 42 MT in 2030. Although the industry, residential, and commercial sectors will consume more oil, it is still the transport sector that is expected to be the biggest user of oil in Viet Nam.

Figure 2-12: Oil Demand by Sectors in Viet Nam (2000–2030)



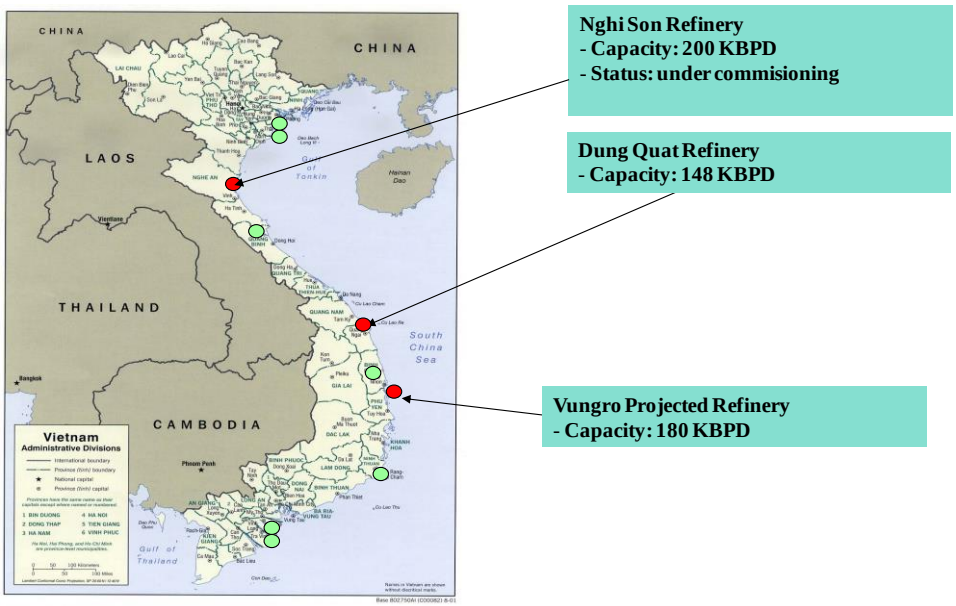
MT = metric ton
Source: Economic Research Institute for ASEAN and East Asia (2016).

(2) Supply

Viet Nam produced 18 MT of crude oil in 2013, the fourth largest in the ASEAN region after Indonesia, Malaysia, and Thailand. Almost half of the production was exported. Domestic production is expected to decline to 2 MT in 2030, according to the Asia Pacific Energy Research Centre. Therefore, rising dependency of Viet Nam on oil import is inevitable.

Viet Nam has one refinery – the Dung Quat – with a capacity of 0.15 mb/day capacity. The refinery is owned by PetroVietnam. The company plans to expand Dung Quat's capacity to 0.19 mb/day. Several new refinery projects are in various stages of progress. The Nghi Son project (0.2 mb/day) is already in the commissioning stage. The Vungro project (0.3 mb/day), the third refinery in the country, is targeted to start up in 2019. Other projects such as the Long Son, Hoi Nhon, and Van Phong are still in their planning stages. Nevertheless, with expanded Dung Quat, Nghi Son, and Vungro refineries, Viet Nam will have a refining capacity of 0.69 mb/day (34 MT/year) by 2030, which will decrease Viet Nam's oil imports.

Figure 2-13: Oil Demand by Sectors in Viet Nam (2000–2030)



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

(3) Industry structure and regulatory bodies

The oil industry in Viet Nam is controlled mainly by the state-owned PetroVietnam, which is an integrated oil company from upstream to downstream. Nevertheless, Viet Nam's upstream potential and strong oil demand growth attract foreign investments, such as BP, Gazprom, and PETRONAS in upstream; and Kuwait Petroleum Company, Idemitsu, and PTT in downstream.

The Ministry of Industry and Trade (MOIT) is the major regulatory body in Viet Nam. The MOIT is in charge of formulating and implementing energy policies as well as authorizing energy projects. The Ministry of Planning and Investment controls the budget allocation for each ministry and

approves foreign investments, thus, influencing the energy infrastructure developments in the country.

6.2. Oil supply resilience in Viet Nam

(1) Identifying risks in oil supply disruption

Although the MOIT is aware of supply insecurity factors abroad, it identifies earthquakes, hurricanes, floods, fires, mechanical problems, accidents, terror attacks, and poor communication as major threats to oil supply in Viet Nam. However, it is not clear as to what extent these insecurity threats could result in damage to infrastructure, oil supply, and to Viet Nam's economy in general.

(2) Countermeasures to oil supply disruption

Viet Nam is developing oil infrastructure to meet the growing demand. New refineries, in particular, will lessen dependency on import of oil products, increase the operational flexibility of oil companies, and therefore, enhance oil supply security in the country. The government is also keen on expanding the stockpile of oil to 9.3 MT or 90 days of the net import in 2025.

Table 2-1: Oil Stockpiling Plan in Viet Nam

Type of stock		Unit	2020	2025
Commercial stock		Mil. Tons	2.6	3.6
		Days of consumption	30	30
Processing stock	Crude oil	Mil. Tons	1.5	1.5
		Days of consumption	12.2	9.2
	Products	Mil. Tons	0.7	0.7
		Days of consumption	8.1	6.2
National stock	Crude oil	Mil. Tons	0.7	2.2
		Days of Consumption	5.8	12.4
	Products	Mil. Tons	0.4	1.3
		Days of consumption	5.0	10.4
Total oil stockpiling		Mil. Tons	5.9	9.3
		Days of consumption	61	68
		Days of net import	90	90

Sources: Ministry of Industry and Trade and PetroVietnam (2017).

To achieve oil supply resilience, the government has put in place a general institutional framework, such as communication channels, to deal with emergency situations. However, detailed coordination arrangements among government agencies, BCPs, and emergency exercises have not been developed to a significant extent.

Chapter 3

Summary and Way Forward

1. Summary

Chapter 1 described oil supply resilience in Japan. The Great East Japan Earthquake prompted the government and the oil industries to alter the concept of oil supply security, and to prepare for not only supply risks abroad but also risks within the country. The government implemented a set of measures to mitigate damage and quicken recovery by (i) revising the Oil Stockpiling Law, (ii) establishing a national oil product reserve, (iii) enhancing the resilience of refiners and terminals, (iv) developing core gas stations, (v) setting up a Joint-Operation Plan for Oil Supply in Disasters, (vi) enhancing inter-ministries cooperation, and (vii) promoting user's reserve. These measures aim not only to upgrade resilience to natural disasters but also to streamline the communication between industries and government agencies. Industry players are also implementing measures such as (i) enhancing the resilience of refineries and shipping facilities; (ii) strengthening the distribution network; (iii) building a cooperative relationship; and (iv) conducting joint exercises among the government, oil companies, and other relevant organizations. The BCP with PDCA cycle is one of the most illustrative measures that can be used after an earthquake. It emphasizes preparedness and streamlining of communication. One cannot emphasize enough that the government and the industry should work together in these measures. Thus, communication and coordination among various organizations are critical.

Chapter 2 examined oil supply resilience in selected ASEAN member countries. Unlike Japan, oil demand will grow strongly and import dependency will rise in Cambodia, Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam although the extent of demand growth and import dependency significantly vary between these countries. Transportation is the main demand sector in the region and is expected to remain so toward 2030, although demand will also increase in other sectors like residential, commercial, industry, and non-energy use.

National oil companies have strong presence in the oil industry in the region, with the exception of Cambodia. Therefore, it is usually the case that national oil companies are the owners and operators of the main oil infrastructure like refinery and oil terminal. Regulatory bodies are usually the ministry of energy and the like. However, no country has a specific ministry or minister that is in charge of national resilience and natural disaster management.

On oil supply resilience, all countries are aware of external risks (e.g. geopolitical tensions abroad), natural disasters, as well as accidents and sabotages at oil infrastructure and supply chains. For instance, Cambodia recognizes flood as a major threat; Indonesia, the Philippines, Thailand, and Viet Nam see sabotages and/or terror attacks as risks to oil supply in their territories. Malaysia, on the other hand, lists natural and industrial disasters in the disaster management protocol, but points out that these disasters have not caused a serious threat to oil supply in the country. Therefore, the details of risk identification obviously differ from country to country, depending on import dependency, geographical and climatic characteristics, the extent of infrastructure

developments, and the status of industrial and social stability. Nevertheless, most countries have experienced different degrees of oil supply disruptions, stemming from risks mentioned above.

All countries implement various countermeasures to oil supply disruption. Diversification and stockpiling are traditional and yet important countermeasures. Diversification can be implemented in transportation routes and modes (lorry, barge, and pipeline), as employed or planned by Cambodia, Indonesia, and Thailand. No countries in the ASEAN have national strategic oil reserve, but companies or importers are usually obliged to stock certain volumes. Malaysia, being a significant oil exporter, is the exception because there is no such obligation. Generally speaking, stockpiling has not been developed to the same extent as in OECD countries, and has remained an issue on oil supply security in the region.

The status of institutional framework is different between countries. While a general framework for emergency response has been developed in some countries, its functionality has not necessarily been tested in real emergency situations or in exercises. Indonesia for instance has institutionalized emergency response, but one could argue that detailed countermeasures have not been developed sufficiently. Meanwhile, Cambodia, the Philippines, and Viet Nam do not seem to have formulated emergency response structure designed to address domestic supply disruptions. The same can be said at the company level in these countries. Emergency plans, BCPs, and the like are available at major energy companies, such as Pertamina, PETRONAS, and PTT. However, regular assessments, upgrades, and exercises are not implemented. Lack of institutions, detailed countermeasures, regular assessments, and joint exercises suggest a poor level of preparedness, communication, and coordination in real oil supply disruptions.

2. Way forward

2.1. General policy for oil supply security

This report has focused on oil supply resilience in Japan and in selected ASEAN member countries. One could argue, in the meantime, that oil supply resilience is a part of oil supply security, and there is a significant overlap between supply security and resilience in terms of countermeasures.

Firstly, stockpiling is the typical countermeasure that addresses oil supply security and resilience. All countries recognize the need to develop stockpiling. Building stockpiling is a lengthy and costly business; however, it is the basis of any supply security policy. Many ASEAN member countries aim at further developing their stockpiling, and are encouraged to achieve their respective targets.

Secondly, infrastructure development is important, although each country has a different capacity to develop it. The development should include not only oil-related infrastructure such as refinery and pipeline but also general social infrastructure like roads and ports, which are prerequisites for oil transportation. Given the multi-utility of roads, ports, and other social infrastructure, it is the government's responsibility to develop such infrastructure. With strong demand growth, several major refinery projects in ASEAN member countries are underway, and many other oil-related infrastructure like pipelines, tanks, and depots. These infrastructure should obviously be disaster-proof and resilient to earthquakes, tsunamis, typhoons, floods, and other risk factors mentioned in the previous chapter.

2.2. Oil supply resilience to cope with internal risks

For oil supply resilience, planning, institutional and legal framework, and education are very important, aside from hardware such as refineries, tanks, and pipelines.

Chapter 1 described how Japan emphasized communication and coordination issues to be able to respond swiftly in emergency situations. While implementing recovery measures from the earthquake and tsunami, the government laid out institutional and legal framework first so that policies can be effectively implemented and that division of roles can be specified. Developing this framework is a time-consuming process, and governments in ASEAN member countries are encouraged to start the process before the next disaster happens.

In terms of institutional and legal framework, industries can work on enhancing their resilience to natural disasters and other risk factors associated with oil supply. Making a BCP is the obvious area with which to start. However, it is important to do it with a PDCA cycle. This is critical because risks and the business environment can change significantly over time. Therefore, regular assessment and joint exercise is important for any BCP to become updated and implementable.

2.3. International cooperation

This study revealed the different stages of oil supply resilience in selected ASEAN member countries. Given the wide range of supply resilience, capacity building is necessary for the government, industry officials, and their personnel to raise awareness and deepen their understanding of oil supply resilience.

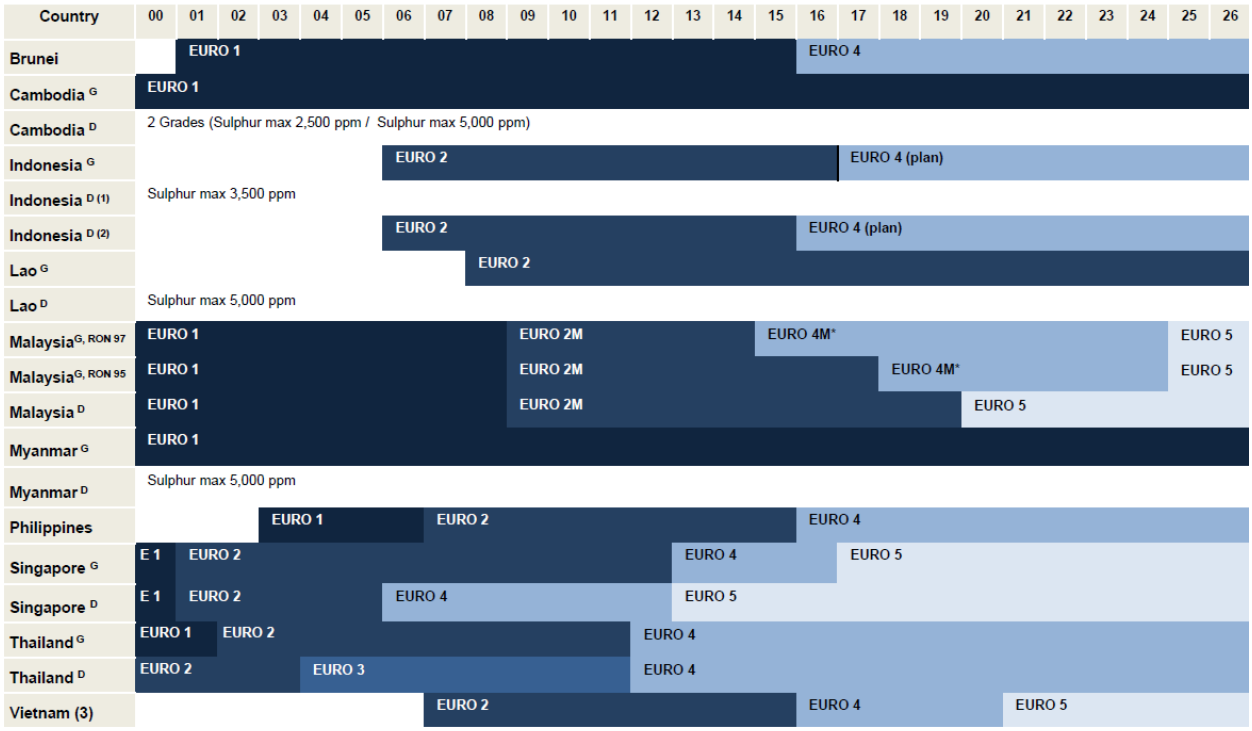
It is important to utilize or revitalize the existing institutional platforms that may be used for oil supply resilience. ASEAN member countries have been working on the ASEAN Petroleum Security Agreement (APSA) for many years, and these countries generally value such regional oil-sharing scheme. However, at the workshop in Bangkok in February 2017, the ASEAN Council on Petroleum (ASCOPE) revealed the uncertain future of APSA after it expires in 2023. The importance of APSA undoubtedly remains, but the uncertainty reflects varied views on the wide scheme among member countries of the ASEAN. Therefore, it may be realistic to start with an oil-sharing scheme by selected countries that are willing to participate. In this sense, it is worth considering an international cooperation on stockpiling facility and crude oil terminal in Kalimantan that Indonesia is planning to develop. Another example of existing platform is the Joint Organizations Data Initiatives by the United Nations, IEA, Asia-Pacific Economic Cooperation (APEC), and other international organizations that aim to develop oil and gas statistics worldwide. Statistics by itself does not enhance oil supply resilience. Nevertheless, it is important to have reliable and timely statistics on demand, supply, stock, and international trade of crude oil and oil products to help markets to function properly and, thus, avoid any unnecessary price shoot or collapse due to lack of market data.

In terms of institutional and legal framework and industry effort like BCPs, Japan could be of help to ASEAN member countries. METI already commits international cooperation on oil supply security with ASEAN through multiple channels. Japan Cooperation Center Petroleum expressed the possibility of giving training courses relevant to oil supply resilience. Japanese experience, especially on the importance of communication and coordination, can at least provide a platform framework that ASEAN member countries can customize and implement according to their own

situations and needs for their oil supply resilience. As far as the BCP is concerned, it is worth aligning any BCP with ISO 22301, which stipulates business continuity management for the sake of standardization across countries or even the region.

Other cooperation areas include gasoline and diesel quality standards in the ASEAN region. At the Bangkok workshop, PTT pointed out that the different qualities of gasoline and diesel undermine the flexibility of international transactions, and standardizing the quality will contribute to enhancing the liquidity of gasoline in the ASEAN region.

Figure 3-1: Gasoline and Diesel Quality Standards in ASEAN Member countries



Source: PTT (2017).

Oil supply security and resilience will remain pressing issues in the ASEAN region, given the strong demand for oil, the sluggish supply growth, and the various supply risks. Currently, the oil market is in a glut, but it will tighten in the future because of its cyclical nature. Some supply risks, such as natural disasters, are unfortunately inevitable. Therefore, governments and industries in the ASEAN region should be prepared and resilient to any forthcoming supply insecurities to minimize human casualties and to sustain a sound society and economy in their respective countries.

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Appendix Summary of the Workshop

Date: 15–16 February 2017

Venue: Courtyard by Marriott Bangkok, Bangkok, Thailand

Participants:

- Mr Koh Sila, Ministry of Mines and Energy (Cambodia)
- Dr Gusti Suarnaya Sidemen, Directorate General of Oil and Gas (Indonesia)
- Mr Ardhy N Mocobombang, Pertamina (Indonesia)
- Mr Ahmad Zuhairi Muzakir, Prime Minister's Department (Malaysia)
- Ms Wan Rufiza Wan Yusop, PETRONAS (Malaysia)
- Ms Corina Samsor, PETRONAS (Malaysia)
- Ms Melita V. Obillo, Department of Energy (Philippines)
- Mr Prasert Sinsukprasert, Ministry of Energy (Thailand)
- Dr Siri Jirapongphan, Petroleum Institute of Thailand (Thailand)
- Mr Dang Hai Anh, Ministry of Industry and Trade (Viet Nam)
- Mr Cao Tuan Si, PetroVietnam (Viet Nam)
- Mr Jun Okunishi, Ministry of Economy, Trade and Industry (Japan)
- Mr Masaaki Sugiyama, Petroleum Association of Japan (Japan)
- Mr Toshinobu Ishikawa, Japan Cooperation Center Petroleum (Japan)
- Mr Shinji Marumo, Japan Cooperation Center Petroleum (Japan)
- Mr Surachit Songcharoen, ASCOPE
- Mr Techin Arunakul, ASCOPE
- Mr Shigeru Kimura, Economic Research Institute for ASEAN and East Asia
- Mr Han Phoumin, Economic Research Institute for ASEAN and East Asia
- Mr Tetsuo Morikawa, The Institute of Energy Economics, Japan
- Mr Kiminori Maekawa, The Institute of Energy Economics, Japan
- Ms Tomoko Maruyama, The Institute of Energy Economics, Japan
- Ms Mari Yoshida, The Institute of Energy Economics, Japan

Day 1

Opening Session

Mr Kimura (ERIA) and Mr Sinsukpraser (Ministry of Energy of Thailand) welcomed all participants with sincere gratitude, and pointed out the importance to improve the resilience of oil supply in the ASEAN countries.

Session 1: Introduction

Mr Morikawa (IEEJ) briefed participants on the outline of the study. Mr Kimura suggested the study should consider not only national and international but also the regional aspects.

Session 2: Japan (Great East Japan Earthquake)

Mr Morikawa, Mr Marumo (JCCP), Mr Okunushi (METI), and Mr Sugiyama (PAJ) explained how the Japanese government and the oil industry coped with and learned from oil supply disruption due to the Great East Japan Earthquake in 2011. The major discussion points were as follows:

- Japanese refineries are basically located according to demand distribution. During the closure of Sendai refinery, the demand was covered primarily by raising output at other refineries. Increase in product imports was limited. The government temporarily relaxed stockpiling obligation of oil companies from 70 to 45 days to increase the product supplies.
- As for dividing the roles within the government, the Basic Act on Disaster Control Measures stipulates that the Cabinet Office and local government(s) are in command in case of emergency. The METI, other government agencies, and Self-Defense Force operate under the supervision of the Cabinet Office and local government(s). The Revised Oil Stockpiling Law sets a rule to establish the Joint Operation Room at PAJ, which has the key role in distributing oil products in case of emergency.
- The government traditionally anticipates oil supply insecurity abroad (such as the supply disruption in the Middle East), but after the earthquake in 2011, the scope of oil supply security expanded to include domestic aspects. Measures taken after the earthquake include product reserves, enhancing resilience of refinery and terminals, selecting 'core stations', and fuel reserves at user level.
- Industry standard was already in place before the 2011 earthquake to cope with earthquake and other supply insecurity risks. However, fine-tuning of such standard has been ongoing since 2011 to incorporate the lessons from the earthquake and other supply disruption cases.

Session 3: Oil Supply Resilience in Southeast Asia

Mr Songcharoen (ASCOPE, PTT) presented his view of oil supply resilience in the ASEAN, Mr Mocobombang (Pertamina) for Indonesia, and Mr Muzakir (EPU of Malaysia) for Malaysia. The major discussion points were as follows:

- ASCOPE described the outline of the ASEAN Petroleum Security Agreement (APSA), but revealed its uncertain future after the current agreement expires in 2023. ERIA argued the need to renew APSA.

- PTT identified tsunami and storm incidents; or sabotage at gas separation plants, refineries, pipelines, and other infrastructure as threats to the oil supply in Thailand. Major countermeasures include stockpiling (currently more than 25 days), transportation switch (e.g. lorry to railway), product swap among suppliers, and enhanced jetty. Business continuity plan (BCP) is already in place.
- Pertamina identified earthquake and tsunami as major supply risks in Indonesia. However, as far as refinery is concerned, Cilacap is the only refinery that is vulnerable to tsunami because of its location (facing the Indian Ocean). Refinery locations were strategically determined so as not to be affected by tsunami and other supply insecurity risks. The major countermeasure is stockpiling. The government is planning to establish a strategic petroleum reserve and a centrally crude terminal in Kalimantan, for which international cooperation is being sought.
- The Economic Planning Unit of Malaysia pointed out that the present Malaysian disaster management protocol at the national level only covers flood, landslide, typhoon, earthquake, and industrial disaster (mechanical troubles, accidents, etc.). These do not exclusively pose a threat to oil supply security in Malaysia but to economic stability and public order in general. BCP is in place at PETRONAS and electrical utility companies, including Tenaga Nasional Berhad (TNB). It is vital for the country to conduct a national-level risk assessment on energy sector. A study on this matter is being proposed.

Day 2

Session 1: Oil Supply Resilience in Southeast Asia

Mr Sila (Ministry of Mine and Energy of Cambodia), Dr Sidemen (Ministry of Energy and Mineral Resources of Indonesia), Ms Obillo (Department of Energy of the Philippines), Dr Jirapongphan (PTIT of Thailand), and Mr Anh (Ministry of Industry and Trade of Viet Nam) presented oil supply resilience in their respective countries. The major discussion points were as follows:

- The Ministry of Mine and Energy identified typhoon and flood as the main threats to oil supply in Cambodia. The government is working on upgrading roads, and developing other modes of oil transportation – such as railway and vessel – while setting further countermeasures such as developing oil terminals, refineries, strategic petroleum reserve, and onshore pipelines. The ministry values international cooperation, both bilaterally and multilaterally, like the ASEAN Petroleum Security Agreement/Coordinated Emergency Response Measures (APSA-CERM). A gas station is obliged to stockpile for its 30 days consumption but this regulation is not working (presumably due to lack of space and investment). Inter-ministry coordination, especially in terms of price regulation, is problematic due to political sensitivity.
- The Ministry of Energy and Mineral Resources identified excessive demand hike, natural disasters (tsunami, earthquake, and eruption), market and industry emergency, and political stability (instability) as major threats to oil supply in Indonesia. Emergency response system is available at company, regional, and national levels. Existing laws states oil supply security, disaster mitigation, and emergency response plan, but no detailed guideline is yet in place. Past oil supply disruption cases involved fuel switching (gas to diesel) at power plant, and oil transportation by air. The price policy (throughout Indonesia) creates difficulty in terms of fuel distribution in remote areas.

- The Department of Energy identified natural disasters, accidents, and terror attacks as major risks to oil supply in the Philippines. The department has an Oil Contingency Plan that outlines the supply priority of oil in the country, and encourages companies to hold inventories in vulnerable areas. It also issued circulars such as the Mutual Product Supply Accommodation and Minimum Inventory Requirement. A BCP is in place in the oil industry, but emergency exercises are not taken seriously by participants. The department is aware of the need to develop risk assessment, and improve communication and coordination among relevant entities.
- PTIT briefed participants on the developments of Thai oil security measures, such as stockpiling, and explained that social unrest (anti-government demonstration) necessitated companies to draw up BCP. PTIT also pointed out that different quality standards of gasoline could undermine the flexibility of the supply in the ASEAN region, and proposed to move the taxation point to pipeline depot to encourage companies to build inventory close to the demand site.
- The Ministry of Industry and Trade identified earthquakes, hurricanes, floods, fires, mechanical problems, accidents, terror attacks, and poor communication as major threats to oil supply in Viet Nam. A general institutional framework is in place to deal with emergencies. Stockpiling is the major countermeasure to oil supply insecurity, and the ministry calls for regional stockpiling initiatives.

Session 2: Possible International Cooperation

Mr Okunishi (METI) briefed participants on the oil stockpiling of IEA and the ASEAN, and pointed out that refinery capacity plays a key role in oil product disruption. Mr Ishikawa explained aspects of the HRD, Joint Technical Cooperation Programs, and other customized training courses at JCCP.

Wrap Up and Closing Activities

Mr Morikawa (IEEJ) summarized the discussion and requested participants to provide necessary information for the report that will be submitted to ERIA in June 2017. Mr Kimura (ERIA) and Mr Okunishi (METI) expressed gratitude for their participation and for the productive discussions during the workshop.