# Chapter 1

# Rising Oil Import Dependency and Oil Stockpiling in ASEAN

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# Chapter 1

# Rising Oil Import Dependency and Oil Stockpiling in ASEAN

The chapter sets the scene for the study in terms of demand and supply outlooks in ASEAN and the oil stockpiling situation. Referring to the Institute of Energy Economics, Japan's (IEEJ, 2022) *Energy Outlook 2022* and the International Energy Agency's (IEA, 2021a) *World Energy Outlook 2021*, we argue that, despite the decarbonisation trend, robust oil demand and declining regional crude oil production will inevitably result in rising oil import dependency in ASEAN. Most of the demand growth will be met by the Middle East. Major supply risks to be covered in this study are supply disruption in the Middle East, accident and blockage of sea transport choke points, and natural disasters in importing countries. The chapter also covers oil stockpiling in ASEAN countries, which is generally inadequate.

## 1. Rising Oil Import Dependency

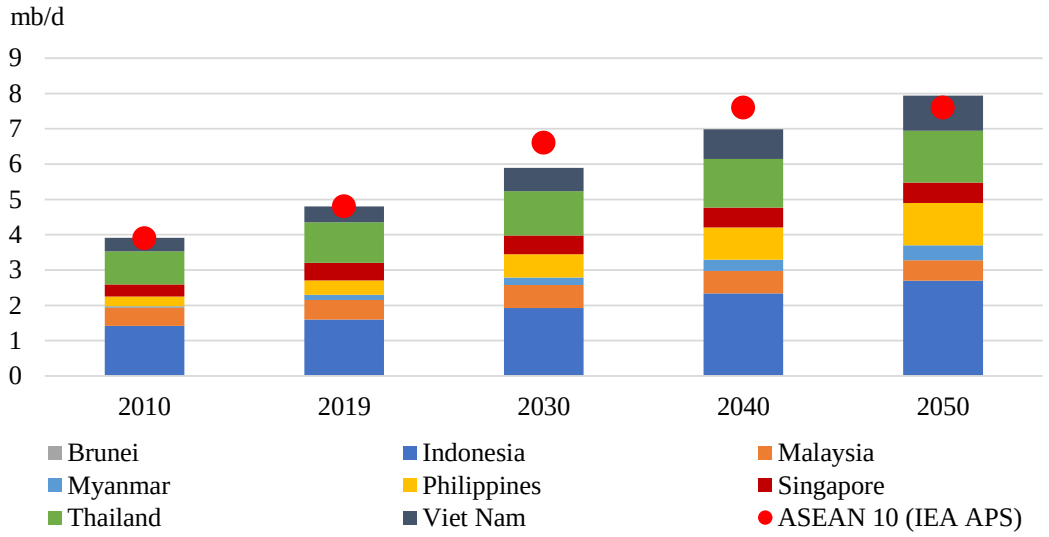
### 1.1. Demand Outlook

With robust economic growth, oil demand in ASEAN 8 is growing steadily.[1] In 2010–2019, the average annual growth rate was 2.3% and demand reached 4.8 million barrels per day (mb/d). Demand is likely to continue increasing and go up to 7.9 mb/d in 2050 (IEEJ, 2021). Indonesia, the Philippines, and Viet Nam will drive demand, altogether accounting for 78% of demand growth in ASEAN.

As decarbonisation is globalised, ASEAN countries now set ambitious targets to tackle climate change, which will not, however, necessarily decrease oil demand. According to the Announced Pledges Scenario (APS) (IEA, 2021a), even if all reduction targets are implemented on time and completely, oil demand will peak only around 2045 and go up to 7.6 mb/d in 2050 (Figure 1.1).

[1] The ASEAN 8 are Brunei, Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam. They accounted for 98% of ASEAN oil demand in 2019.

**Figure 1.1. Oil Demand in ASEAN**




IEA APS = International Energy Agency Announced Pledges Scenario, mb/d = million barrels per day.
Source: Institute of Energy Economics, Japan (2021); International Energy Agency (2021a).

APS covered greenhouse gas reduction targets as of mid-2022 and does not fully reflect the latest targets in ASEAN countries. From July to November 2021, Indonesia, Malaysia, Thailand, and Viet Nam announced net-zero targets by 2050–2065, which are not reflected in the APS. Whilst the targets are ambitious, governments have not outlined clear pathways or passed laws to achieve the goals. More important, the mid-term targets were not dramatically upgraded even in 2021 (Table 1.1). Therefore, despite the anticipated decarbonisation process, oil demand will not likely peak for years and oil security will remain a stringent policy issue.

**Table 1.1. Greenhouse Gas Reduction Targets by ASEAN Countries**

| | Target Year | Target |
|---|---|---|
| Brunei | 2030 | • -22% from BAU scenario in 2030 |
| Cambodia | 2030 | • -42% from BAU scenario in 2030 |
| Indonesia | 2030 & 2060 | • Unconditional: -29% by 2030<br>Conditional: -41% by 2030 with international support<br>• Net zero by 2060 |
| Lao People's Democratic Republic | 2030 | • Unconditional: -60% by 2030<br>Conditional: -63.5% by 2030 with international support |
| Malaysia | 2030 & 2050 | • -45% of emission intensity in 2030<br>• Net zero by 2050 |
| Myanmar | 2030 | • Unconditional: -244.52 MT $CO_2$e in 2030<br>Conditional: -414.75 MT $CO_2$e in 2030 |
| Philippines | 2030 | • Unconditional: -2.71% in 2030<br>• Conditional: -75% in 2030 with international support |
| Singapore | 2030 | • Peaking at 65 MT $CO_2$e in 2030<br>• Net zero as soon as viable in the second half of the century |
| Thailand | 2030 & 2065 | • -20% from BAU scenario in 2030<br>• Net zero by 2065 |
| Viet Nam | 2030 & 2050 | • Unconditional: -9% by 2030<br>Conditional: -27% by 2030 with international support<br>• Net zero by 2050 |

BAU = business as usual, MT $CO_2$e = million tonnes of $CO_2$ equivalent.
Source: United Nations Framework Convention on Climate Change (2022).

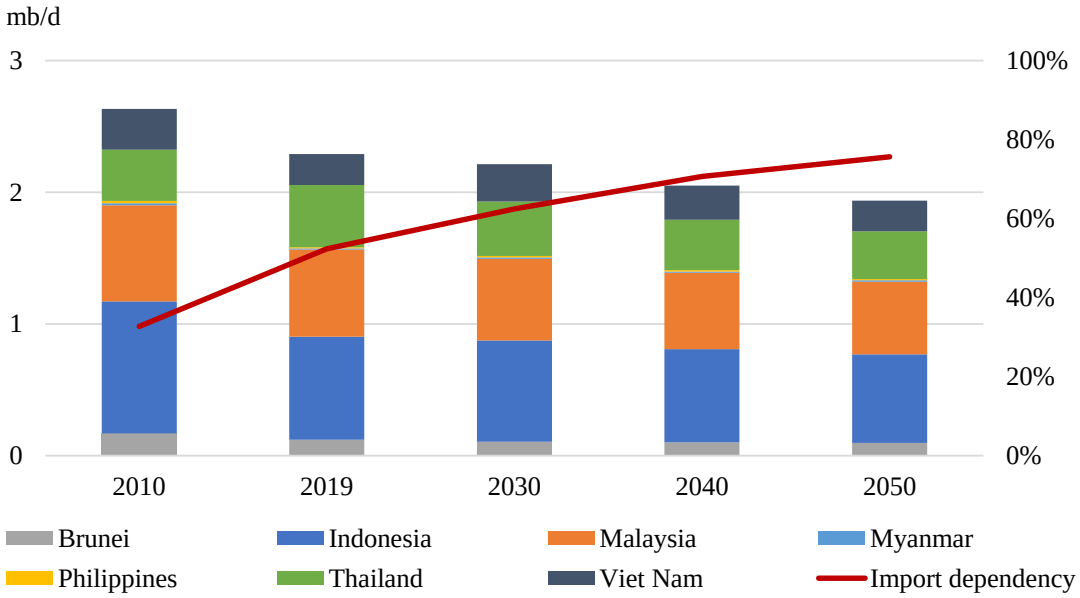
## 1.2. Supply Outlook

(1) Crude Oil

Crude oil production in ASEAN peaked in 2000 and has been declining since then. Production in 2019 was 2.3 mb/d, which is 13% lower than in 2010. Despite all efforts and policies, production will steadily decrease. IEEJ estimates that production in 2050 will be 1.9 mb/d. With steady demand growth, import dependency will inevitably rise. The import dependency

rate was modest at 19% in 2010 but will rise to as high as 76% in 2050 (Figure 1.2). Most crude oil is expected to come from the Middle East because of the potential of increasing production and competitiveness in the ASEAN market.

**Figure 1.2. Crude Oil Production in ASEAN 8**




mb/d = million barrels per day.
Source: Institute of Energy Economics, Japan (2021).

(2) Oil Products

There were 32 refineries in ASEAN as of 2019. All countries except Cambodia and Lao People's Democratic Republic have refineries. Total capacity as of 2019 was 5.3 mb/d and produced 3.6 mb/d of oil products. Singapore, Thailand, and Indonesia are the three largest refining countries, sharing 70% of total capacity (Table 1.2). Whilst refineries in Thailand and Indonesia primarily serve the domestic market, Singapore has long been a net exporter of oil products. Oil products produced in the region met 76% of demand in 2019.

**Table 1.2. Refineries in ASEAN**

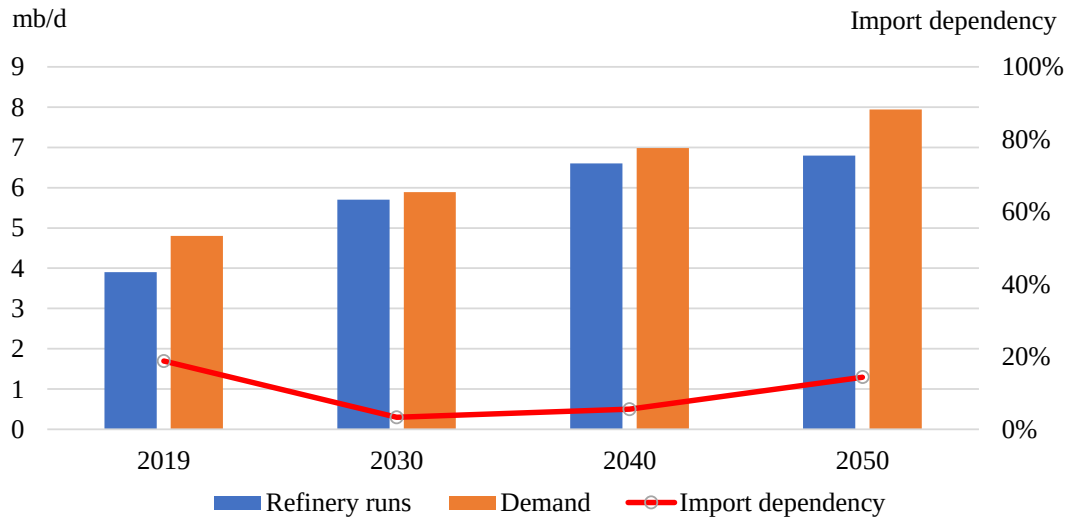
| | Number of Refineries | Capacity (kb/d) | Major refiners |
|---|---|---|---|
| Brunei | 2 | 129 | Shell, Zhejiang Hengyi Petrochemicals |
| Cambodia | 0 | - | Cambodian Petrochemicals |
| Indonesia | 8 | 1,114 | Pertamina |
| Lao People's Democratic Republic | 0 | - | - |
| Malaysia | 8 | 827 | Petronas, Saudi Aramco, Shandong Hengyuan Petrochemical |
| Myanmar | 2 | 32 | MPE |
| Philippines | 2 | 276 | Petron, (Shell) |
| Singapore | 3 | 1,331 | ExxonMobil, Shell, Singapore Refining |
| Thailand | 5 | 1,239 | PTT, ExxonMobil, Star Petroleum, Bangchak |
| Viet Nam | 2 | 331 | PetroVietnam, Idemitsu, KPC |
| ASEAN total | 32 | 5,279 | |

kb/d = thousand barrels per day, KPC = Kuwait Petroleum Corporation, MPE = Myanma Petrochemical Enterprise.

Source: Oil and Gas Journal (2020); International Energy Agency (2019); Institute of Energy Economics, Japan (2021).

Refining capacity in ASEAN will expand to 7.3 mb/d in 2050 and refinery runs will increase from 3.9 mb/d in 2019 to 6.8 mb/d in 2050 (average annual growth rate of 1.8%) (IEA, 2021a). Production of oil products in ASEAN will grow slightly faster than demand (average annual growth rate of 1.6% per annum) although the region will remain a net importer of oil products until 2050. Holding a certain amount of product stocks will, therefore, be important to mitigate possible oil supply disruption.

**Figure 1.3. Refinery Runs and Oil Demand in ASEAN**



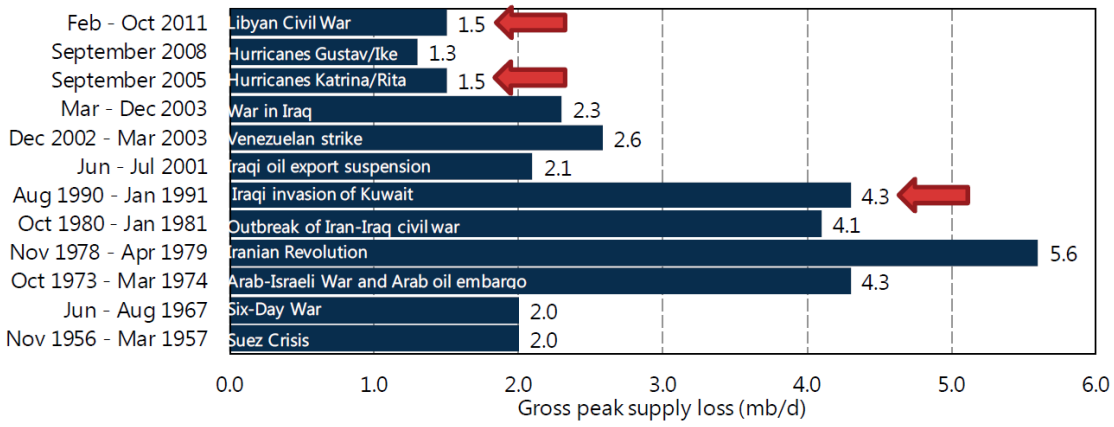

mb/d = million barrels per day.
Source: International Energy Agency (2021a).

## 2. Oil Supply Risks for ASEAN

### 2.1. Major Oil Supply Disruptions in the Past

Supply disruptions, major or minor, happen frequently for various reasons. Major disruptions up until 2011 are summarised in Figure 1.4, often caused by deterioration of security: revolutions, wars, or strikes in major oil-producing countries, whose impact was immense. The Arab–Israeli war and Arab oil embargo caused the first oil crisis, which resulted in establishing the IEA by the Organisation for Economic Co-operation and Development countries. During the Iranian revolution, as much as 5.6 mb/d or almost 9% of the world's total supply was lost, directly causing the second oil crisis, which doubled oil prices.

**Figure 1.4. Major Oil Supply Disruptions**




mb/d = million barrels per day.
Source: International Energy Agency (2014).

Disruptions did not end in 2011. Sanctions by the United States (US) and the European Union (EU) on Iran decreased Iranian production by almost 1 mb/d from 2011 to 2013. Revived US sanctions in 2016 slashed Iranian production by almost 1.5 mb/d from 2017 to 2019. The Houthi attack on Saudi oil facilities led to a 5.7 mb/d production loss in 2019 (Reuters, 2019).

Similarly, US sanctions on Venezuela had a huge impact on oil production there. It once produced more than 3 mb/d in mid-2000 but production went under 1 mb/d in 2019. Relatively minor disruptions have happened in recent years, such as military action in Iraq in early 2020 and Hurricane Ida in the US in 2021. There is no denying the possibility of future supply disruptions. Since predicting when and how such disruptions will happen is difficult, oil stockpiling in consuming countries is justified.

### 2.2. Oil Supply Risks and Oil Stockpiling as a Countermeasure

Energy security is 'the uninterrupted availability of energy sources at an affordable price' (IEA, 2022a). Energy insecurity is caused by extreme tightening of demand and supply and skyrocketing prices. Major risks and countermeasures are summarised in Table 1.3.

**Table 1.3. Oil Supply Risks and Countermeasures**

| | Supply Disruption Risks | Countermeasures |
|---|---|---|
| Upstream (exporting countries) | • War<br>• Terror (including cyber) attack<br>• Industry strike<br>• Underinvestment | • Security enhancement<br>• Supply expansions |
| Midstream (transport) | • Piracy and terror (including cyber) attack<br>• Tanker accident<br>• Sea blockage | • Security enhancement<br>• Tanker re-routing |
| Downstream (importing countries) | • Natural disaster<br>• Refinery accident<br>• Terror (including cyber) attack | • Natural disaster proof infrastructures<br>• Demand control<br>• Stockpiling |

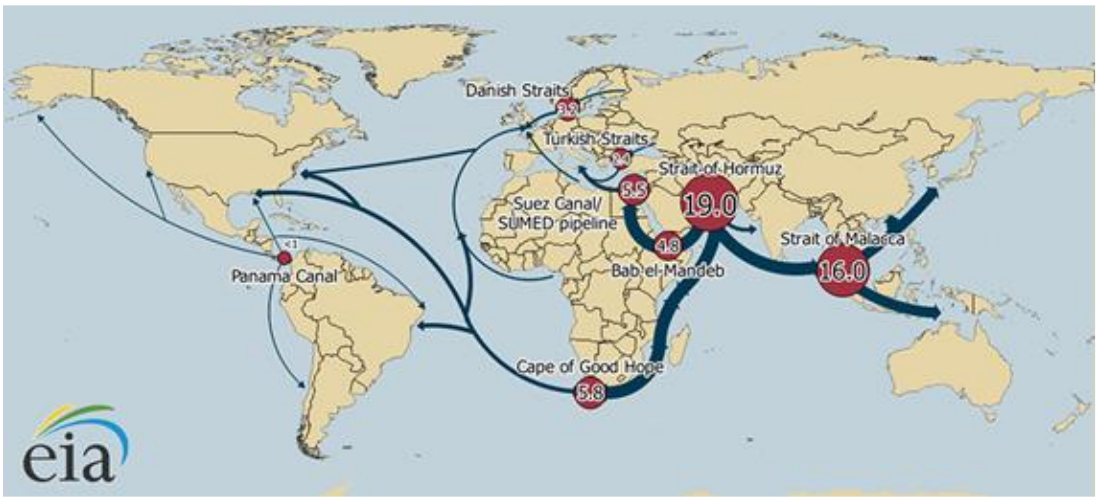
Source: Author.

Considering past supply disruptions, various upstream risks such as wars, terror attacks, or industry strikes remain major risks. Underinvestment (or overinvestment) is arguably part of the market cycle, however, especially in the context of decarbonisation. Underinvestment

could become more serious because environmental concerns and uncertain future oil demand could hold back steady upstream investment.

Because most crude oil and oil products are transported by tankers to the ASEAN region, sea transport safety is a significant risk of oil supply. Whilst Energy Information Administration (2017) cites several choke points for oil transport, the Strait of Hormuz and Strait of Malacca are the main ones from the Middle East. The safety of tanker transport in the South China Sea has become a great concern. China claims sovereignty over maritime areas inside the so-called nine-dash line, and tensions are mounting between China and its neighbours and between China and the US. Because of its location and lack of alternative sea transport routes, Viet Nam would be the most affected if the South China Sea were to be blocked.

**Figure 1.5. Maritime Oil Choke Points**




Source: Energy Information Administration (2017).

In importing countries, natural disasters and refinery accidents might be major risks. Natural disasters such as earthquakes, tsunamis, volcanic eruptions, and floods have often caused major supply disruptions in ASEAN countries (ERIA, 2017). Climate change could aggravate typhoon and flood risks. Amongst the three countries in chapter 2, the Philippines is particularly vulnerable since it is seen to have the fourth-highest climate risk in the world (Germanwatch, 2021).

Countermeasures are mainly defensive, either in the form of security and infrastructure enhancement, re-routing of transport, or demand control. Stockpiling is considered a last resort, and, therefore, is of immense importance in securing oil supply.

# 3. Developing Oil Stockpiling in ASEAN

## 3.1. Status of Oil Stockpiling in ASEAN

The importance of oil stockpiling as a policy tool to tackle supply insecurity is well recognised in ASEAN countries. All ASEAN countries legislate and implement oil stockpiling, most of which is held by industry players. Viet Nam is the only country that has government stockpiling or strategic petroleum reserves (SPR), targeting expansion to 20 days of net imports in 2025 (Ministry of Industry and Trade [Viet Nam], 2022). Other countries are considering more government involvement. Indonesia plans to introduce Energy Buffer Reserves whereby oil is provided by the government. However, the plan is delayed due to the budget constraints (Ministry of Energy and Mineral Resources [Indonesia], 2022). The Philippines is considering introducing SPR with the 2021 department circular on the SPR Program (Department of Energy [Philippines], 2022). Stockpiling schemes and implementation differ country by country, but many countries oblige oil companies to stockpile different amounts, depending on the oil product or business segment (e.g. importer, refiner, distributor). Indonesia obliges oil companies to have storage capacity but has no rule on how much oil should be stockpiled. Whilst the actual stockpiled amount is not often disclosed, IEEJ assumes that most ASEAN countries hold 20–50 days of demand, mostly as oil products.

**Table 1.4. Oil Stockpiling in ASEAN Countries**

| Component | BRN | CAM | INA | LAO | MAS | MYA | PHI | SIN | THA | VNM |
|---|---|---|---|---|---|---|---|---|---|---|
| ▪ Gas and Oil products Stockpiling Policy | N/A | N/A | Yes | N/A | N/A | Yes | Yes | N/A | Yes | Yes |
| ▪ Infrastructure ownership | Private | Private | Private | Private | Private | National, Private | Private | N/A | Private | National, Private |
| ▪ Private Mandatory Stocks (days of domestic demands) | 31 days | 30 days | 14-23 days | 10-21 days | 30 days | N/A | 15-30 days | 90 days | 3.5-21.5 days | 10-40 days |
| ▪ Form of stocks | Refined Oil (Product) | Refined Oil (Product) | Refined Oil (Product) and Crude | Refined Oil (Product) and Crude | Refined Oil (Product) | Refined Oil (Product) | Refined Oil (Product) | Refined Oil (Product) | Refined Oil (Product) and Crude | Refined Oil (Product) and Crude |
| ▪ Strategic Petroleum Reserves / National Mandatory Stocks | No | Currently doing FS on SPR | Currently drafting Bill on Energy Buffer Stock | Currently under discussion | No | Currently emergency stock of 60 days (by MOEE) | Currently doing FS on SPR | No | Currently doing Study on SPR | Yes. |
| ▪ Target | N/A | Private: 30-40 days for products, and 25-42 days for crude SPR: 35 days of consumption (Products & Crude) by 2035 | Private: 30 days of consumption SPR: 30 days of consumption | 30 days by 2020 3 months by 2025 5 months by 2030 | N/A | 30 days by 2020 45 days by 2045 90 days by 2050 | SPR: 30 days of consumption by 2020 | N/A | N/A | Private: 55 days SPR: 14 days (products) and 6 days (crude) and to reach 90 days of net imports by 2020 |
| ▪ Development Priority | High | High | High | High | Low | Moderate | Moderate | Low | High | High |

BRN = Brunei Darussalam, CAM = Cambodia, INA = Indonesia, LAO = Lao People's Democratic Republic, MAS = Malaysia, MYA = Myanmar, PHI = Philippines, NA = not applicable, SIN = Singapore, SPR = strategic petroleum reserves, THA = Thailand, VNM = Viet Nam.
Source: ASEAN Centre for Energy (2021).

### 3.2. Stockpiling Options for ASEAN Countries

(1) National Initiative

Oil stockpiling primarily aims to address supply shortage of oil for domestic use. The domestic oil industry or government is the main body in charge of developing, maintaining, and releasing stockpiled oil. Most oil stockpiling around the world was developed by oil industries and governments on their own.

Holding a certain amount of stock is normal in the oil industry to adjust demand and supply. Advanced economies usually developed oil stockpiling based on industry stock. For instance, Japan initiated stockpile development in 1972 when the government recommended that oil companies hold 60 days of imports. In 1975, the oil companies were obliged by law to hold 90 days of imports.

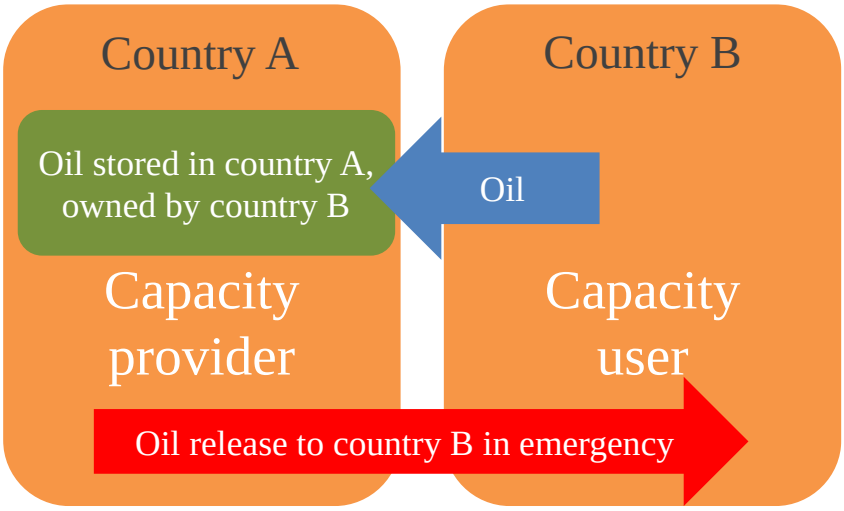
With the first oil crisis, in 1973, Organisation for Economic Co-operation and Development countries founded the IEA to coordinate energy security and policy amongst its members. Emergency response systems and oil stockpiling have been central to the IEA's role and holding 90 days' stock of net imports is a condition for IEA membership. Government intervention in oil stockpiling was increasingly called for and several countries introduced government stocks in the 1970s. The US established its SPR in 1975 and Japan followed in 1978. Although oil stockpiling in IEA member countries was developed in line with IEA guidelines, the individual member country legislates on, invests in, and owns the facility and stocked oil.

(2) International Ticket Stockpiling

Ticket stockpiling is 'stockholding arrangements under which the seller agrees to hold (or reserve) an amount of oil on behalf of the buyer, in return for an agreed fee' (IEA, 2022b). Tickets are instruments to outsource stockpiling to other countries. Should the ticket stockpiling be conducted between two countries, both governments typically agree on the stockpiling of a specific amount before agencies (usually oil companies or specific entities in charge of oil stockpiling) in the two countries make a contract (Figure 2.4).

The ticket stockpiling system has been widely used in Europe. In Asia and the Pacific, Japan implements ticket stockpiling for New Zealand. The governments of Japan and New Zealand made an agreement in 2007, and a Japanese oil company and the Government of New Zealand subsequently made a contract, under which New Zealand would pay a ticket fee and the Japanese oil company would promise to supply petroleum products to New Zealand in case of emergency (Figure 1.6).

**Figure 1.6. Concept of Ticket Stockpiling**



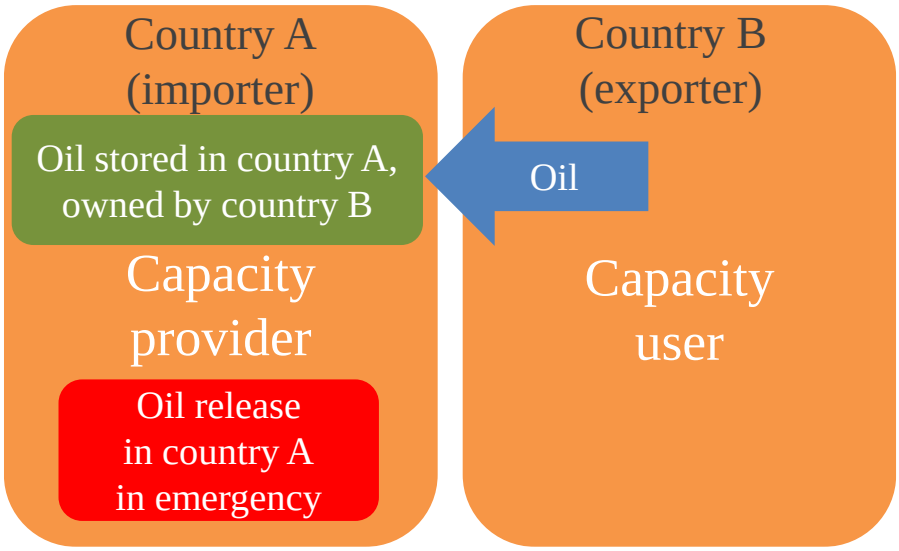

Source: Author.

A prerequisite of ticket stockpiling is that the capacity provider already has storage capacity and other infrastructure. Ticket stockpiling does not require capacity users (ticket buyers) to bear capital expenditure (e.g. tanks, jetties, pumps), although the actual ticket cost depends on a bilateral contract between the capacity provider and user. International ticket stockpiling could evoke national security concerns because oil is stored in another country, especially if it is far away. Therefore, many IEA countries set the upper limit of ticket stockpiling at 10% of required oil stock. Ticket stockpiling offers a cheaper way of stockpiling and could play a supplemental role in ASEAN.

(3) Joint Stockpiling with Crude Oil Exporter

Another form of international oil stockpiling is joint stockpiling with a crude oil exporter. The exporter stores its crude oil in an importing country in exchange for giving the importing country first drawing rights in case of emergency. The exporter can store oil for free, under the condition that the reserves can be called upon in case of an emergency. The reserves can be classified as strategic and commercial and enable an importing country to add to their SPR at a reduced cost (KAPSARC, 2017). The exporter benefits from the commercial use of the storage facilities close to key consumption centres and promising new market areas.

**Figure 1.7. Concept of Joint Stockpiling**




Source: Author.

Joint stockpiling is growing in Asia.[2] The Republic of Korea (henceforth, Korea) pioneered joint stockpiling with crude oil exporters when it signed a deal with Kuwait in 2006 to store 2 mb of crude oil at the Korea National Oil Corporation's facilities in Korea. It signed a deal in 2016 with Iran to store 2 mb of crude oil. Japan followed in 2009 when it agreed with the United Arab Emirates on joint stockpiling, and now has similar agreements with Saudi Arabia and Kuwait. India signed an agreement with the United Arab Emirates in 2017.

[2] Another form of importer–exporter joint venture is a refining and petrochemical facility that usually has a storage facility. An example is Nghi Son Refinery Petrochemical in Viet Nam, a joint venture of Petro Viet Nam, Kuwait Petroleum Corporation, Idemitsu, and Mitsui Chemical.

**Table 1.5. Joint Stockpiling between Crude oil Exporters and Asian Importers**

| Importing Country | Exporting Country | Year of Initial Deal | Volume (million barrels) |
|---|---|---|---|
| Japan | UAE | 2009 | 6.3 |
| | Saudi Arabia | 2010 | 8.3 |
| | Kuwait | 2020 | 3.1 |
| Republic of Korea | Kuwait | 2006 | 2.0 |
| | UAE | 2012 | 6 |
| | Iran | 2016 | 2 |
| India | UAE | 2016 | 6 |

UAE = United Arab Emirates.
Source: King Abdullah Petroleum Studies and Research Center (2017); Ministry of Economy, Trade and Industry (Japan) (2020).

Although details of the agreements are not disclosed, the basic arrangement is that the importing country bears the capital expenditure (CAPEX) and the operating expenditure and the exporting country owns the oil. The importing country does not need to purchase oil and still has the first drawing right to the oil in case of emergency. Such joint stockpiling benefits exporters and importers. It gives exporters better access to the demand market at a low cost. Exporters who joint-stockpile their crude oil in importing countries can deliver the crude oil instantly, without long-haul transport. Joint stockpiling provides crude oil exporters a low-cost method of defending their market share in Asia (KAPSARC, 2022). In return, importing countries can expand their stock without initial oil purchase,[3] the largest part of stockpiling cost. Importing countries can 'de-risk' Middle East crude oil since it has already transited the critical choke points of the straits of Hormuz and Malacca (KAPSARC 2017). Strengthening ties benefits importer and exporter, providing supply and demand security of oil. Joint oil stockpiling could have strategic and economic value and create a win–win situation for exporter and importer.

[3] Payment is made when the importing country draws the oil out of the facility.