Chapter 2

Basic Concept of an Oil Strategic Stockpiling System

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Chapter 2

Basic Concept of an Oil Strategic Stockpiling System

This chapter outlines the basic concept of an oil strategic stockpiling system regarding ownership, storage options, and nationality. It also describes stockpiling schemes in IEA countries. The stockpiling system amongst these countries varies depending on the oil fundamentals of each country, such as import dependency, refining capacity, and interconnection with neighbouring countries.

1. Oil Stockpiling Types

1.1. Ownership

Having a certain 'commercial stock' is a standard practice in the oil industry, and not necessarily for supply security purposes. For instance, oil companies typically build stocks in spring and autumn to meet summer and winter peak demand. Once companies stock excess oil because of regulatory obligations, companies are said to 'stockpile' or build 'stockpiling'. Nevertheless, the commercial stock is usually included in the total stockpiling quantity (days).

Industry stockpiling is obviously owned by private or state-owned companies, more precisely, oil producers, importers, refiners, or distributors. Public stockpiling is called 'Strategic Petroleum Reserves' or SPR. As this name suggests, public stockpiling is specifically for oil security of supply, and its quantity changes little, regardless of the demand fluctuations. Governments usually own public stockpiling. But some European countries established a dedicated agency for oil stockpiling, named 'Central Stockpiling Entity', which controls public stockpiling on behalf of the government.

Table 2.1. Oil Stockpiling by Ownership

Industry	Public
Commercial Stock	
Stockpiling obliged by government	Stockpiling by government or stockpiling agency (Strategic Petroleum Reserves: SPR)

Source: Authors.

1.2. Storage Options

Oil stockpiling can be differentiated by where storage is built. The most common method is onshore tanks, typically at refineries, import terminals, and other dedicated sites. Occasionally, offshore floating storage is utilised where land availability is limited. Oil can be stored underground where a suitable geological structure is in place, typically rock caverns. Underground storage with suitable geological structures is common in the US and Europe. For example, all the US SPR is stored in underground storage.

Figure 2.1. Oil Storage Options

Onshore tanks

Underground

Offshore tanks

Sources: DOE (2022), JOGMEC (2022a), JTC (2022).

1.3. Nationality[3]

1) National initiative

Oil stockpiling aims to address the supply shortage of oil in a country. Therefore, the domestic oil industry or government is naturally the main body in charge of developing and maintaining stockpiling and releasing stockpiled oil. Most oil stockpiling worldwide was developed by domestic oil industries and governments.

As mentioned earlier, holding a certain amount of stock is standard in the oil industry to adjust demand and supply. Therefore, many countries developed oil stockpiling first based on commercial industry stock by obliging oil companies to hold a particular stock and introducing government stock or SPR later.

[3] This section draws heavily from ERIA (2022).

2) International initiatives

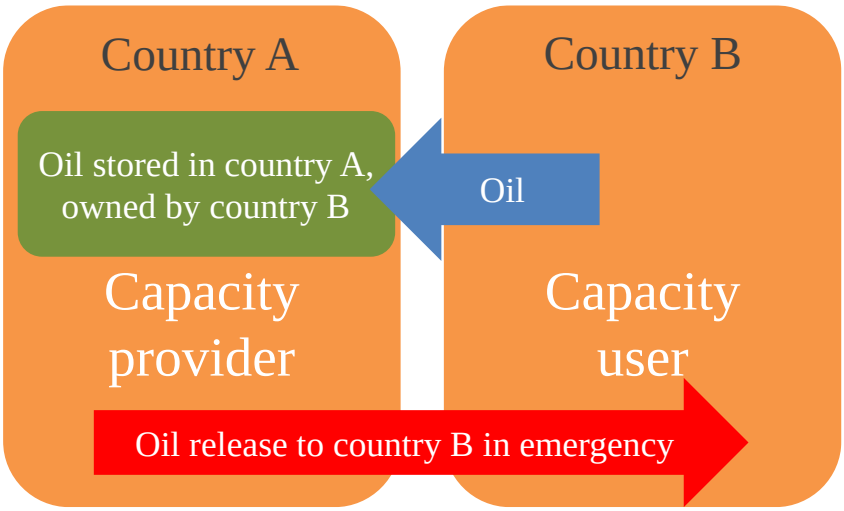
While national initiatives are and will be the mainstream of oil stockpiling worldwide, there are international initiatives involving foreign governments or companies in ticket stockpiling and joint stockpiling.

a) 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 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.

Ticket stockpiling is widely used in Europe. In Asia-Pacific, Japan implements ticket stockpiling for New Zealand. The governments of Japan and New Zealand made an agreement in 2007. Thus, a Japanese oil company and the Government of New Zealand subsequently made a contract under which New Zealand would pay a ticket fee. The Japanese oil company promised to supply petroleum products to New Zealand in an emergency.

Figure 2.2. Concept of Ticket Stockpiling



Source: Authors.

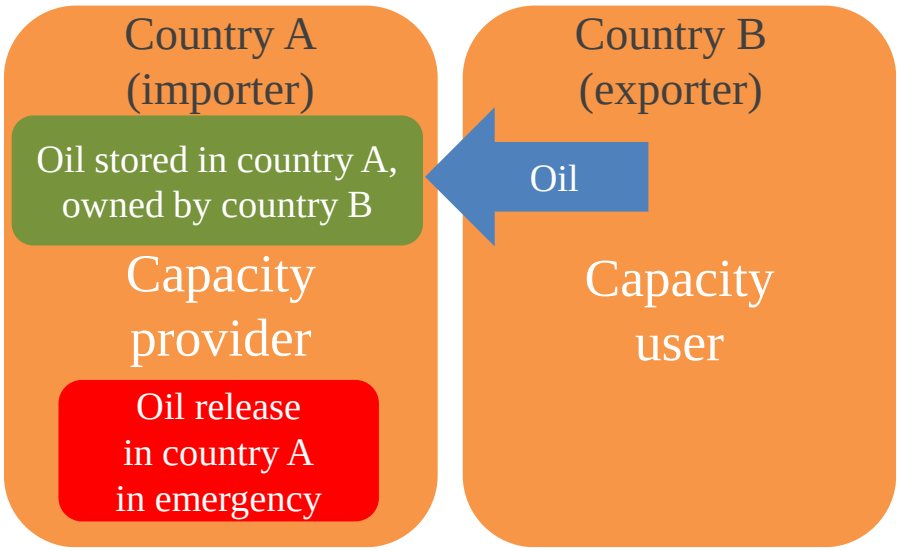
A prerequisite of ticket stockpiling is that the capacity provider already has storage capacity and other infrastructure. Ticket stockpiling does not require capacity users (ticket buyers) to bear the capital expenditure (CAPEX) (e.g. tanks, jetties, pumps). However, ticket costs depend on a bilateral contract between the capacity provider and the user. In addition, international ticket stockpiling could evoke national security concerns because oil is stored in another country, especially if said country is far away. Nevertheless, ticket stockpiling is cheaper and could play a

supplemental role for many countries, including Myanmar.

3) Joint stockpiling with oil exporters

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 keep 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, enabling an importing country to add to its SPR at a reduced cost (KAPSARC, 2017). The exporter benefits from the commercial use of the storage facilities close to the demand areas.

Figure 2.3. Concept of Joint Stockpiling with Crude Exporter



Source: Authors.

Joint stockpiling is growing in Asia. For example, Japan, Korea, and India have agreements with crude exporters in the Middle East. However, it is essential to note that substantial crude demand (i.e. refineries with significant utilisation rates) is a prerequisite for joint stockpiling to attract crude exporters.

Joint stockpiling with product exporters is theoretically possible, although the author cannot confirm the existence of such a scheme for public stockpiling. Oil exporters, importers, or both commonly build or lease storage capacity in an importing country for commercial operation. If the importing country's government can adequately incentivise product exporters and importers to stock excess products for supply security, that would be joint stockpiling of products. As with joint crude stockpiling, an importing country could offer free storage to the exporter as an incentive. However, this scheme will not work unless it is commercially viable for the exporter. Thus, governments must create a stable and favourable investment climate before inviting

exporters to participate. Oil stockpiling alone has no commercial value, so governments must align commercial viability with oil supply security policy.

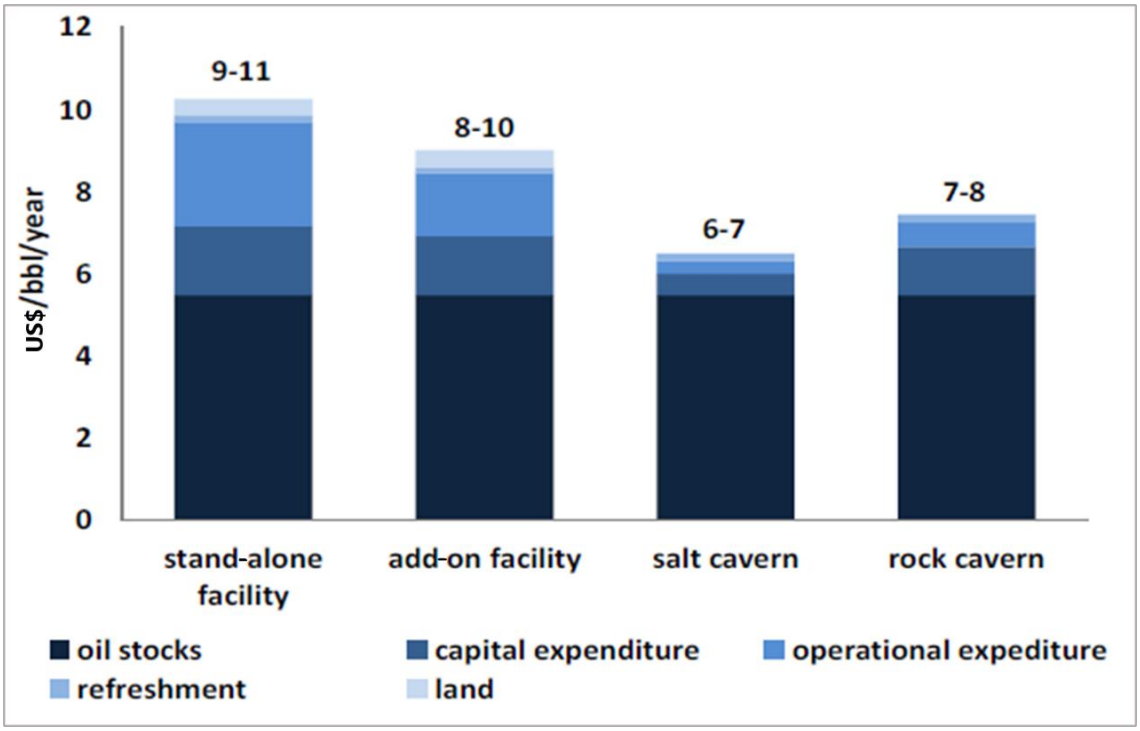
2. Earlier Studies on the Cost and Benefit of Oil Stockpiling

2.1. IEA Studies

As an organiser of the oil emergency response of its member countries, the IEA conducts studies on oil stockpiling, such as the cost–benefit analysis first published in 2013 (IEA, 2013) and updated in 2018 (IEA, 2018).

The 2013 study conducted a quantitative analysis and compared the cost and benefit of holding oil stockpiles. Depending on facility type, the cost is estimated at US$6–US$11 per barrel. The salt cavern is the cheapest, and the stand-alone facility is the most expensive. Oil stocks (commodity cost) are the largest cost component.

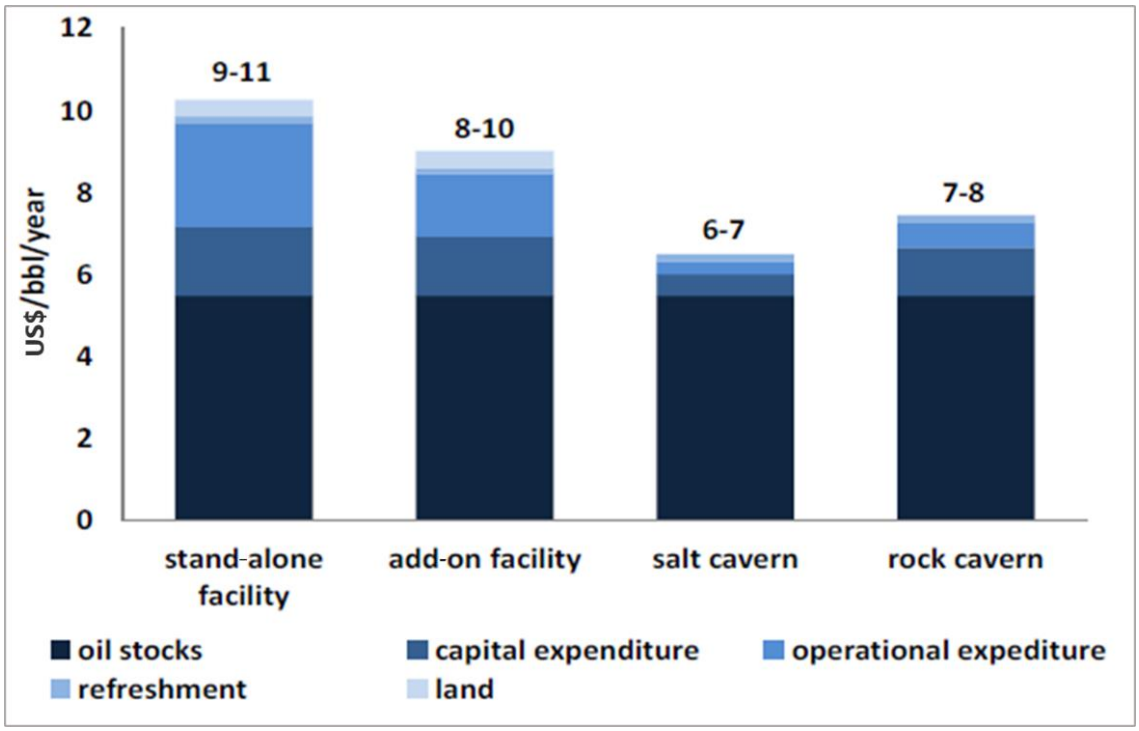
Figure 2.4. Oil Stockpiling Cost by Facility Type



bbl = barrel.
Source: IEA (2013).

The 2013 study evaluated the benefit of oil stockpiling, using the estimated economic loss to the world caused by oil supply disruptions. The study concluded that the net benefit of oil stockpiling ranges from US$11 to US$14 per barrel for IEA countries and US$20 to US$23 per barrel for non-IEA countries.

Figure 2.5. Cost–Benefit Comparison



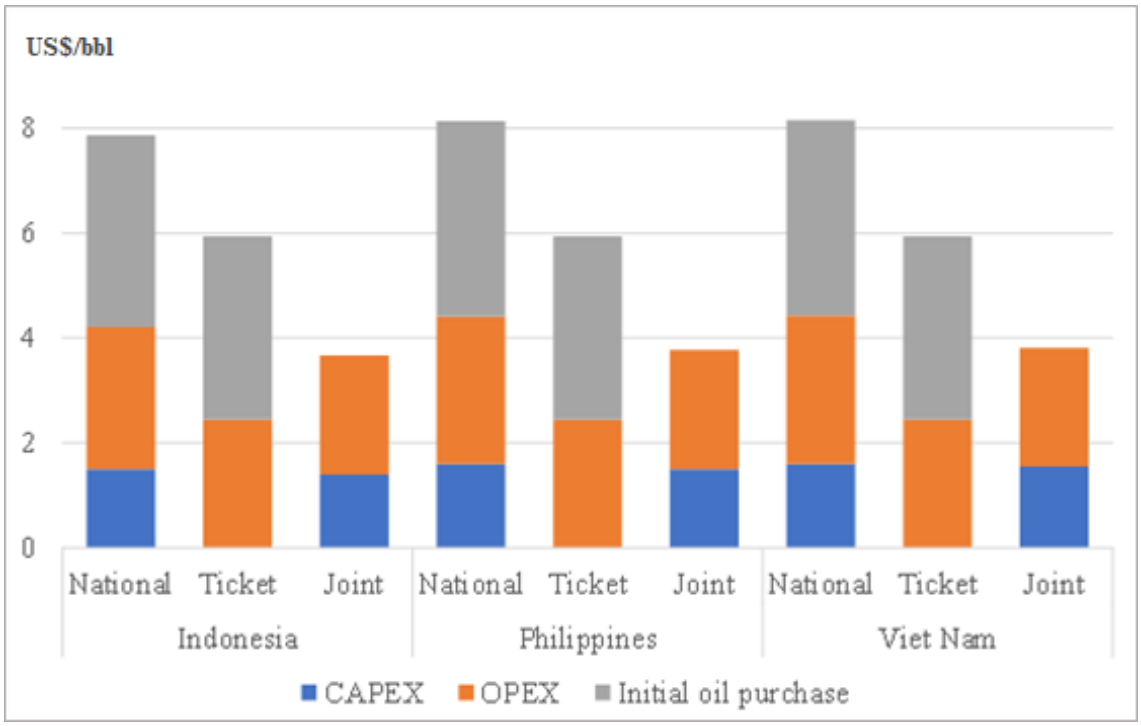
bbl = barrel.
Source: IEA (2013).

The IEA updated the study in 2018 to consider changes in the oil market, such as the growing presence of the US as an oil-producing country and volatile oil prices. Some assumptions of the cost–benefit calculation have changed, but the basic methodology remains the same. This IEA study reaffirms that the benefit of stockpiling outweighs the cost.

2.2. ERIA Study

While the IEA studies considered IEA member countries, ERIA (2022) focused on three ASEAN countries: Indonesia, the Philippines, and Viet Nam. This study also considered different stockpiling schemes, like ticket and joint stockpiling, because they are much cheaper. While a national initiative costs US$7.9–US$8.2/bbl, ticket stockpiling costs US$5.9/bbl. According to the analysis, joint stockpiling is the cheapest at US$3.7–US$3.8/bbl.

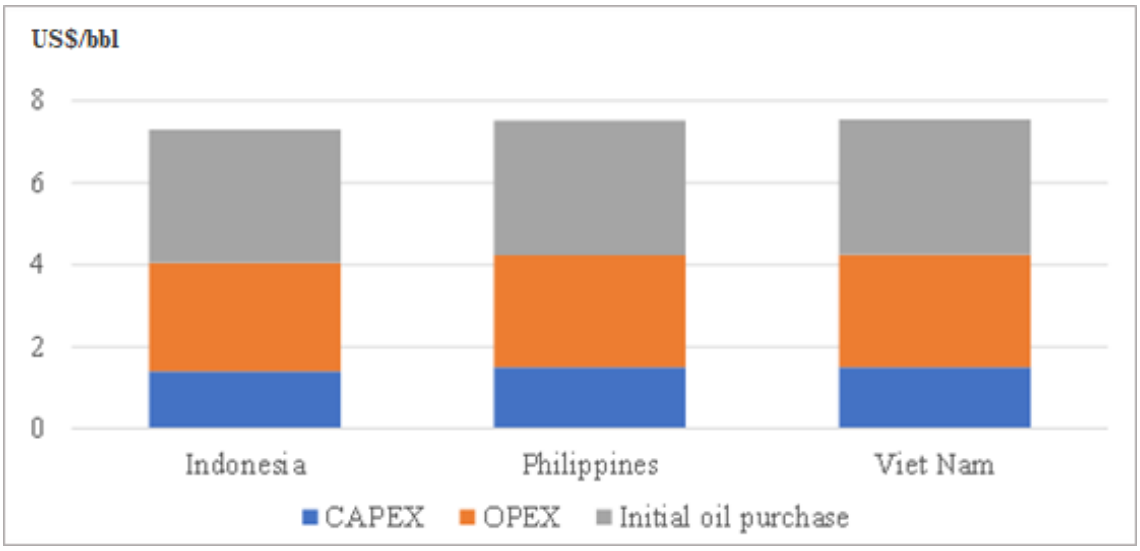
Figure 2.6. Oil Stockpiling Cost in Indonesia, the Philippines, and Viet Nam, by Development Option



bbl = barrel.
Source: ERIA (2022).

Considering that national initiative is and will be the main option when a country develops oil stockpiling, this study assumes that a 90-day stock will consist of 75 days of national development, 10 days of joint stockpiling, and 5 days of ticket stockpiling. The unit cost of this combination will be US$7.3–US$7.6/bbl.

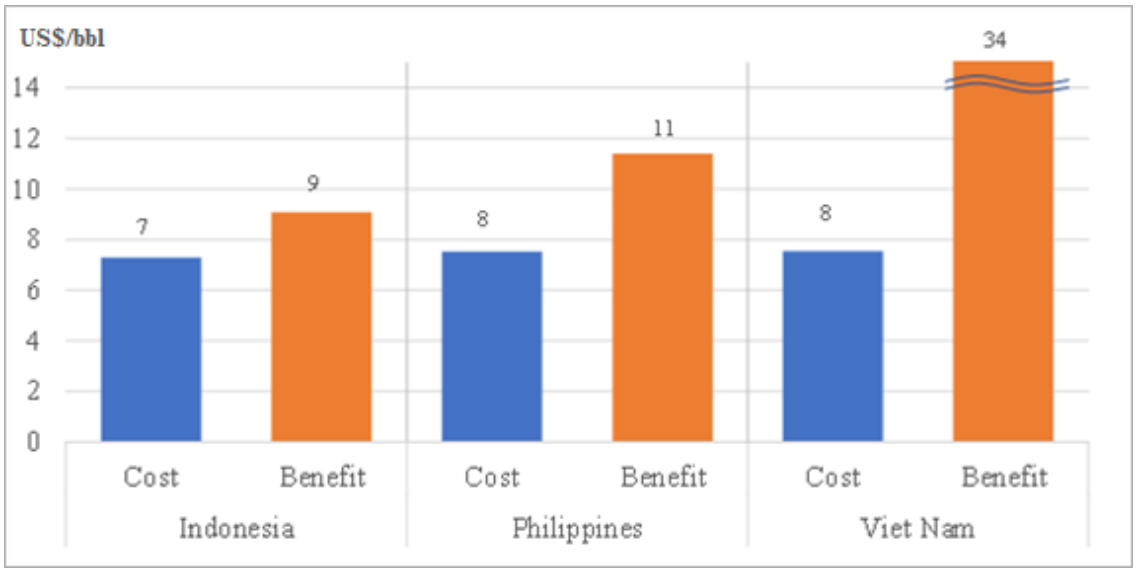
Figure 2.7. Average Oil Stockpiling Cost in Indonesia, the Philippines, and Viet Nam



bbl = barrel, CAPEX = capital expenditure, OPEX = operational expenditure.
Source: ERIA (2022).

The same ERIA study included a benefit analysis, which assumed different disruption scenarios with the probability of 4% per year and no disruption case. The benefit is estimated at US$9.1/bbl for Indonesia, US$11.4/bbl for the Philippines, and US$34.4/bbl for Viet Nam, which exceeds the cost for these countries. The benefit in Viet Nam is exceptionally high, mainly because of the large disruption volume in the South China Sea blockade.

Figure 2.8. Cost–Benefit Comparison of Oil Stockpiling in Indonesia, the Philippines, and Viet Nam



bbl = barrel.
Source: ERIA (2022).

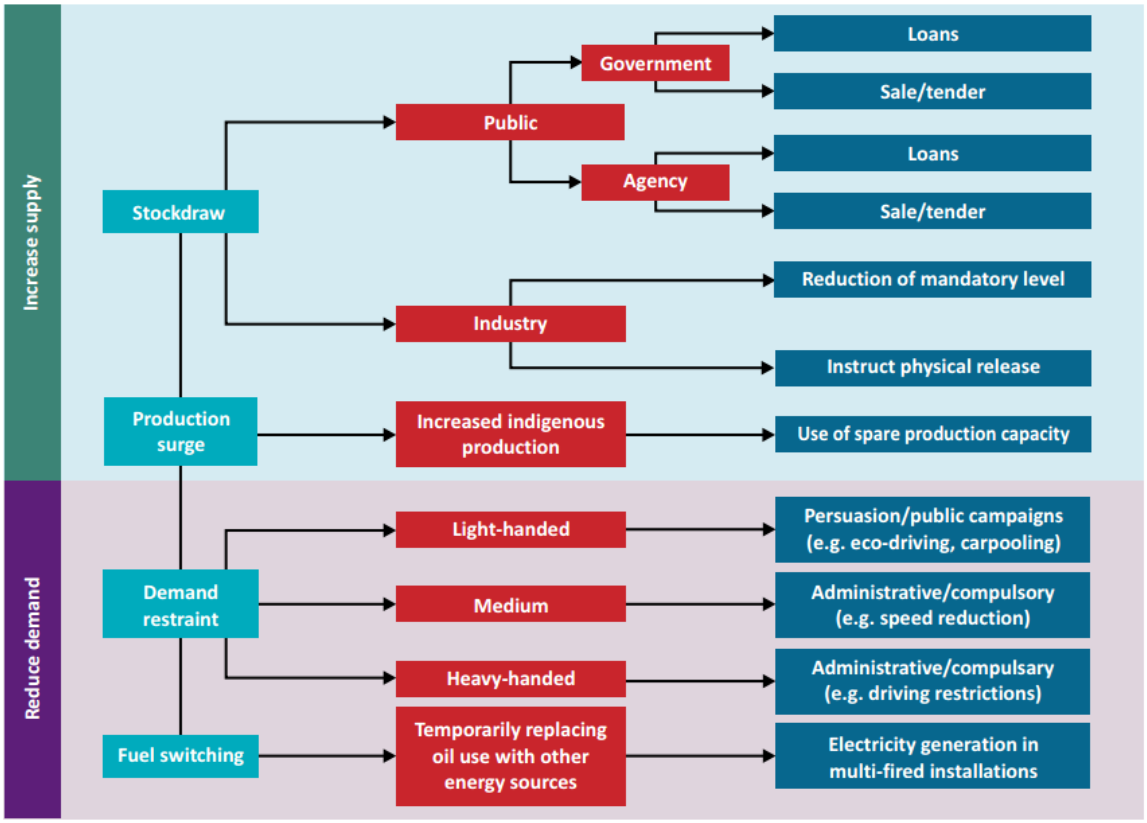
3. Oil Stockpiling in the IEA

3.1. IEA Emergency Response System

Established by the OECD in 1974, the IEA currently has 31 member countries. While IEA's work areas expanded over the years, oil security and stockpiling remain the organisation's core functions. IEA stockpiling is important because it has a long history, covers most of the world, and discloses key information on stockpiling. Therefore, understanding the IEA scheme is helpful for Myanmar in designing its oil stockpiling.

Chapter 1 already mentioned the history of the IEA stockpiling scheme briefly. The IEA scheme is a part of the emergency response framework, whereby oil stock draw and production surges are envisaged as measures to increase supply. It is worth noting that the member countries can reduce demand to secure the supply for consumers who most need it, like households or the public sector. However, demand reduction is not the scope of this study.

Figure 2.9. Emergency Response Framework by the IEA



Source: IEA (2015a).

According to its governing board's decision in 1984, the IEA considers the following issues to assess supply disruption (IEA, 1995):

- origins and causes of the disruption and their probable evolution; its magnitude (after taking into account alternative supply potential); and its probable duration;
- the general state of the world economy;
- probable impact of the supply disruption on particular countries, given the circumstances of their energy economies;
- the current nature and condition of the oil markets, including seasonal factors, and any pertinent situation in any segment of the oil markets;
- current available stock levels and the speed at which they effectively can be brought into the marketplace;
- the probable effects of any actions pursuant to the December 1981 Decision or under the IEP;
- availability, timing, and quantitative effectiveness of oil consumption reduction measures; and
- any other factors which appear to be material in the circumstances

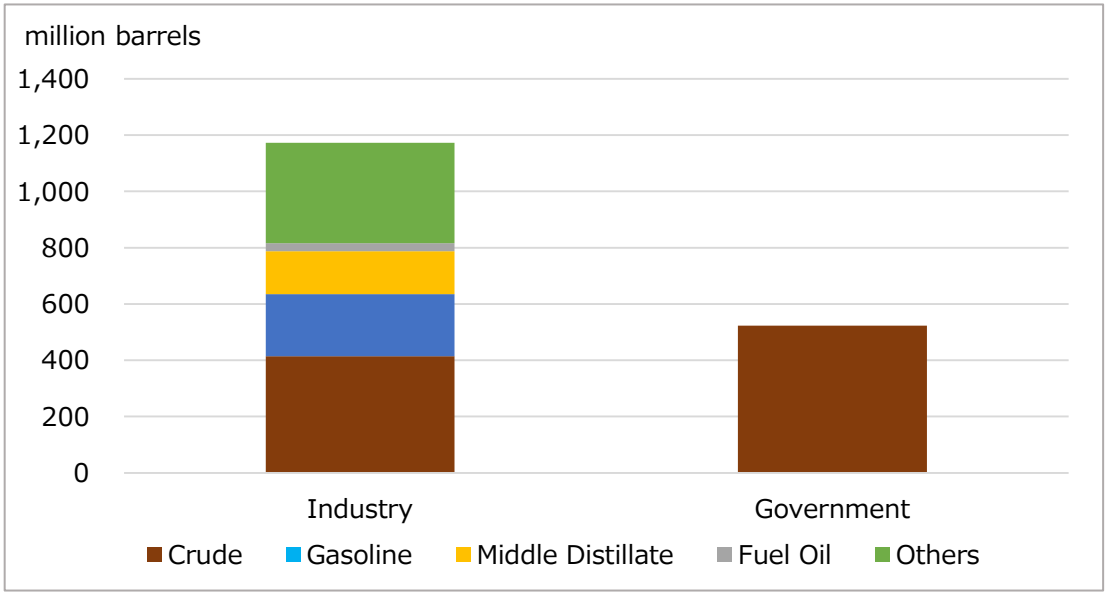
No numerical standards are given here. The IEA governing board assesses all the above issues and determines what action, including stock release, would be advisable to the member countries. For the sake of flexibility, the IEA stock release decision now is not restricted to the extent of supply loss. On the other hand, we can also say that the decision criteria are intentionally ambiguous.

3.2. Individual IEA Member Country and Region

(1) US

The oil stock in the US, which is the largest oil producer and consumer, is also the largest in the world. The total stock amount as of May 2022 was 1,696 million barrels (mb), comprising 1,173 mb of industry stock and 523 mb of SPR. The US has no industry stockpiling obligations, so the industry stocks are commercial. SPR quality is all crude because of the country's cheaper storage cost and adequate commercial product stock. Four SPR sites are all underground facilities in the Gulf region because of lower cost, safety, and good connection to pipelines and ports.

Figure 2.10. US Oil Stock, as of May 2022



Source: IEA (2022c).

Figure 2.11. SPR Sites in the US

Source: DOE (2022).

SPR was first proposed in 1944 but established in 1975 by the Energy Policy and Conservation Act of 1975. This comprehensive law, enforced only 2 years after the first oil crisis, enhances energy security by covering SPR, domestic production stimulation, energy efficiency, and crude

oil export ban. In formulating the Act, industry stockpiling obligation was discussed but dropped due to strong opposition from the industry, which distrusted government intervention, and objected cost burden.

Two supplemental stockpiling measures have a substantial demand, specifically for the country's northwest region. The first is the Northeast Home Heating Oil Reserve, established in 2000 to enhance heating oil supply security in the northwest region that relies on heating oil for space heating in winter. The second is the Northeast Gasoline Supply Reserve, established in 2012 to address regional gasoline supply shortages. Under these two schemes, 1 mb of heating oil and 1 mb of gasoline are stored in the northeast.[4]

As for international cooperation, the US has a ticket stockpiling agreement with Australia. (DOE, 2020). The details of the agreement, including quantity and cost, are not disclosed. A similar agreement is discussed with India (Reuters, 2020).

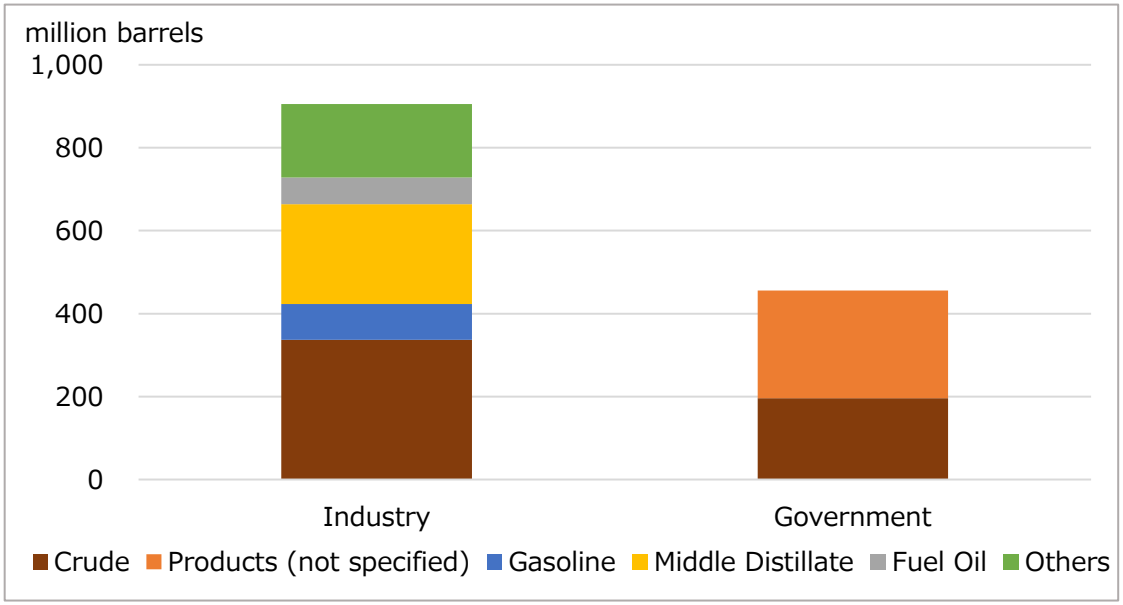
(2) OECD Europe

While OECD Europe shared 13% of the world's oil demand in 2021, its production share was less than 1% in the same year. The EU has always been a significant net importer of oil. The import dependency has been over 90% for the past 10 years. The total stock amount as of May 2022 was 1,361 mb, comprising 905 mb of industry stock and 456 mb of public stockpiling.[5] One difference from the US is that public stockpiling includes products in Europe. The interpretation here is that having products enables quick action to address product shortages rather than having only crude that requires refining to produce gasoline or any other products to reach final consumers. Considering product stockpiling is more costly, having public product stockpiling reflects a sense of supply insecurity in Europe. Public stockpiling locations are understood to scatter across the region, mainly in the form of onshore tanks and underground facilities. However, many countries do not disclose the exact locations for security reasons.

[4] However, these reserves are counted as industry stocks in the IEA statistics.

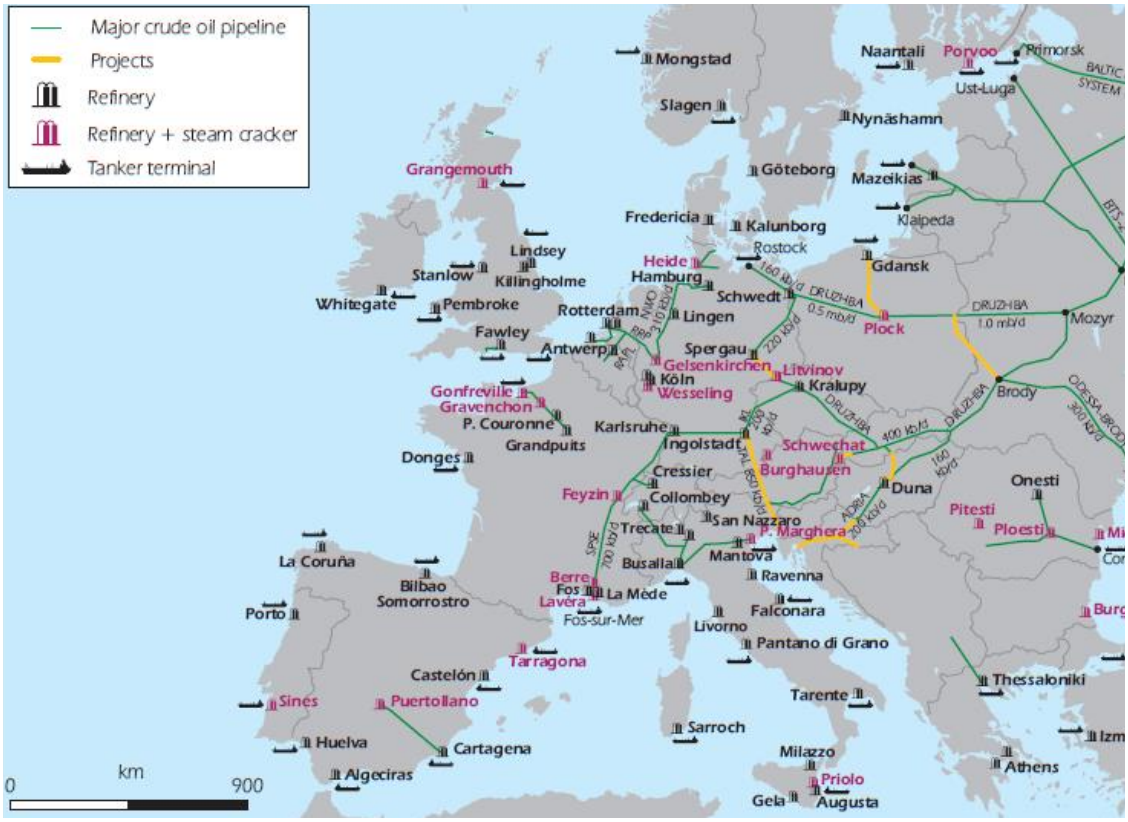
[5] While the term 'SPR' is common to refer to government stockpiling, European Union (EU) countries tend to use 'public stockpiling'.

Figure 2.12. Oil Stock in OECD Europe, as of May 2022



Source: IEA (2022c).

Figure 2.13. Oil Infrastructure in Europe



Source: IEA (2015b).

Being concerned over oil supply security, France and Italy were the first countries that introduced industry oil stockpiling, as mentioned in the previous chapter. After that, individual legislation was gradually integrated into a common framework of the EU. The integration process started in 1968 when European Economic Community (EEC) stockpiling directive (68/414/EEC) was formulated. This directive obliged member countries to stock 65 days of consumption irrespective of industry or public and crude or products. Stock days were increased to 90 days in 1973.

One characteristic of European oil stockpiling is that the EU recommends the central stockpiling entity (CSE), which specialises in oil stockpiling owned by an either national or private entity or mixture. Promoting CSE reflects the lack of a dominant oil industry player and the need to streamline the decision-making process of emergency response. Another distinctive point is that ticket stockpiling is widely used in Europe. Considering many small countries with limited oil infrastructure in the region, ticket stockpiling makes sense for efficiency.

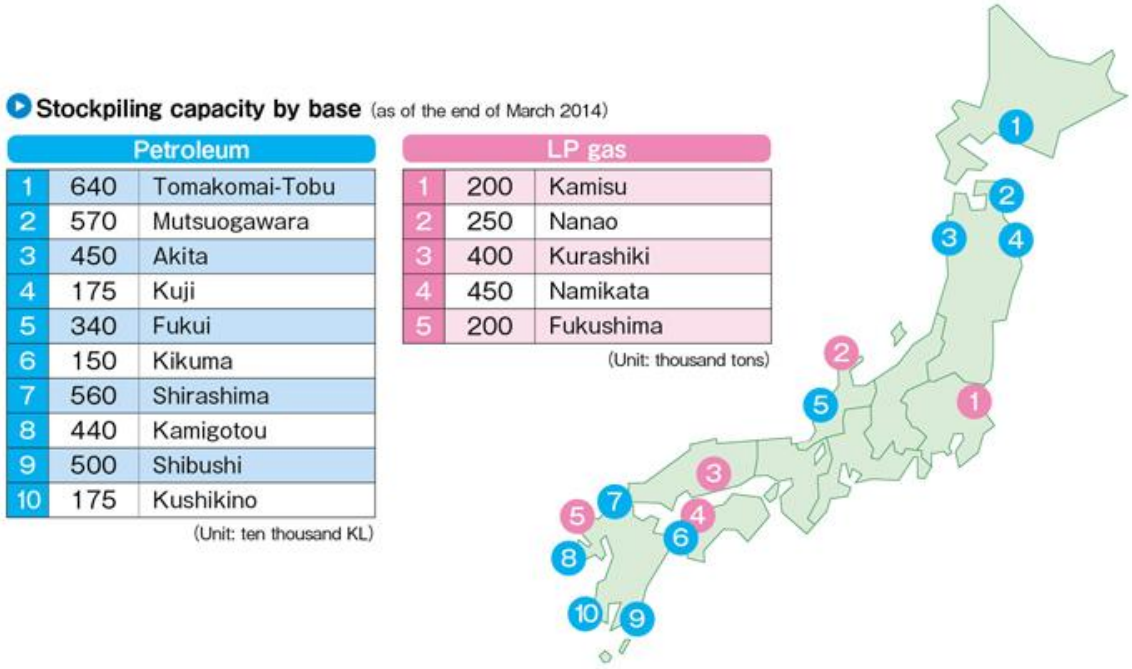
(3) Japan

Japan consumed 3.4 mb/d of oil in 2021, ranking the country as the sixth-largest consumer, sharing 4% of the world's total consumption. With negligible domestic production, oil import dependency is almost 100%. Therefore, like in Europe, oil supply security has been a serious policy issue for the country.

The total stock amount as of May 2022 was 506 mb, comprising 203 mb of industry stock, 294 mb of government stockpiling, and 9 mb of joint stockpiling with crude exporters in the Middle East. Most government stockpiling is crude, but the government also holds some liquefied petroleum gas.

As for government stockpiling, there are 10 sites for crude and 5 sites for LP gas. Storages are onshore and two offshore floating tanks due to limited land availability. In addition, five underground facilities are also in operation. Small land requirements, safety, and little impact on the landscape are advantages of underground facilities (JOGMEC, 2022a).

Figure 2.14. Government Oil Stockpiling Sites in Japan



Stockpiling capacity by base (as of the end of March 2014)

	Petroleum	
1	640	Tomakomai-Tobu
2	570	Mutsuogawara
3	450	Akita
4	175	Kuji
5	340	Fukui
6	150	Kikuma
7	560	Shirashima
8	440	Kamigotou
9	500	Shibushi
10	175	Kushikino

(Unit: ten thousand KL)

	LP gas	
1	200	Kamisu
2	250	Nanao
3	400	Kurashiki
4	450	Namikata
5	200	Fukushima

(Unit: thousand tons)

Source: JOGMEC (2022b).

Although the government recommended industry stockpiling in 1972, the first oil crisis in 1973 and the establishment of the IEA in 1974 triggered the actual legislation. Japan needed to harmonise its stockpiling policy with IEA standards, and the government obliged companies to hold 90 days of consumption in 1975. In addition to industry stockpiling, government stockpiling was introduced in 1978. With the building up of government stocks, the industry stockpiling obligation was eased to 70 days in 1987. The Ministry of Economy, Trade, and Industry (METI) has jurisdiction over oil stockpiling. The state-owned Japan Organization for Metals and Energy Security (JOGMEC) is responsible for the actual stockpiling operation.

Japan started joint oil stockpiling first with Abu Dhabi's ADNOC in 2009, then with Saudi Aramco in 2010, and Kuwait's KPC in 2020. Japan has a ticket stockpiling agreement with New Zealand, although the details are not disclosed to the public.

Table 2.2. Joint Stockpiling Agreements between Japan and Middle East Crude Exporters

Exporter	Year of Initial Deal	Volume (million barrels)
ADNOC (Abu Dhabi)	2009	6.3
Saudi Aramco	2010	8.3
KPC (Kuwait)	2020	3.1

Sources: KAPSARC (2017), METI (2020).