

# Petroleum Industry in Japan 2024

Petroleum Association of Japan **Fuel+**





# Preface

This brochure, *Petroleum Industry in Japan*, has been continuously issued by the Petroleum Association of Japan (PAJ) for more than a half century, with the aim of providing consumers and other stakeholders with up-to-date information on the Japanese industry and the industry's initiatives.

Under the acceleration of global actions to combat climate change, the Japanese government, too, declared in October 2020 its aim to achieve "Carbon Neutrality by 2050." In response to this, PAJ formulated its "Vision for Carbon Neutrality in the Petroleum Industry"





(what the industry should aim to be) in March 2021, and is taking on the challenge of undertaking various initiatives to contribute to the realization of a carbon neutral society.

This brochure is revised from time to time to provide explanations in a concise and easy-to-read manner regarding the various trends surrounding the petroleum industry. We hope this brochure will help give you a sound understanding regarding oil and the petroleum industry in Japan.

December 2024

\* The PDF data of this brochure and JPEG data of the charts and graphs appearing therein can be downloaded from PAJ website.  
\* Due to rounding off, the displayed totals may not always match the sum of the displayed columns.

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## 1. A Vision for Carbon Neutrality in the Japanese Petroleum Industry

In October 2020, the Japanese government declared that Japan would realize "Carbon Neutrality by 2050." In response to this, the Petroleum Association of Japan (PAJ) renewed its "Long-term Low Carbon Vision for the Petroleum Industry" in 2019, and newly formulated the "Petroleum Industry's Vision toward Carbon Neutrality." Furthermore, the vision was revised in December 2022, based on the realization of innovative technology development, etc.

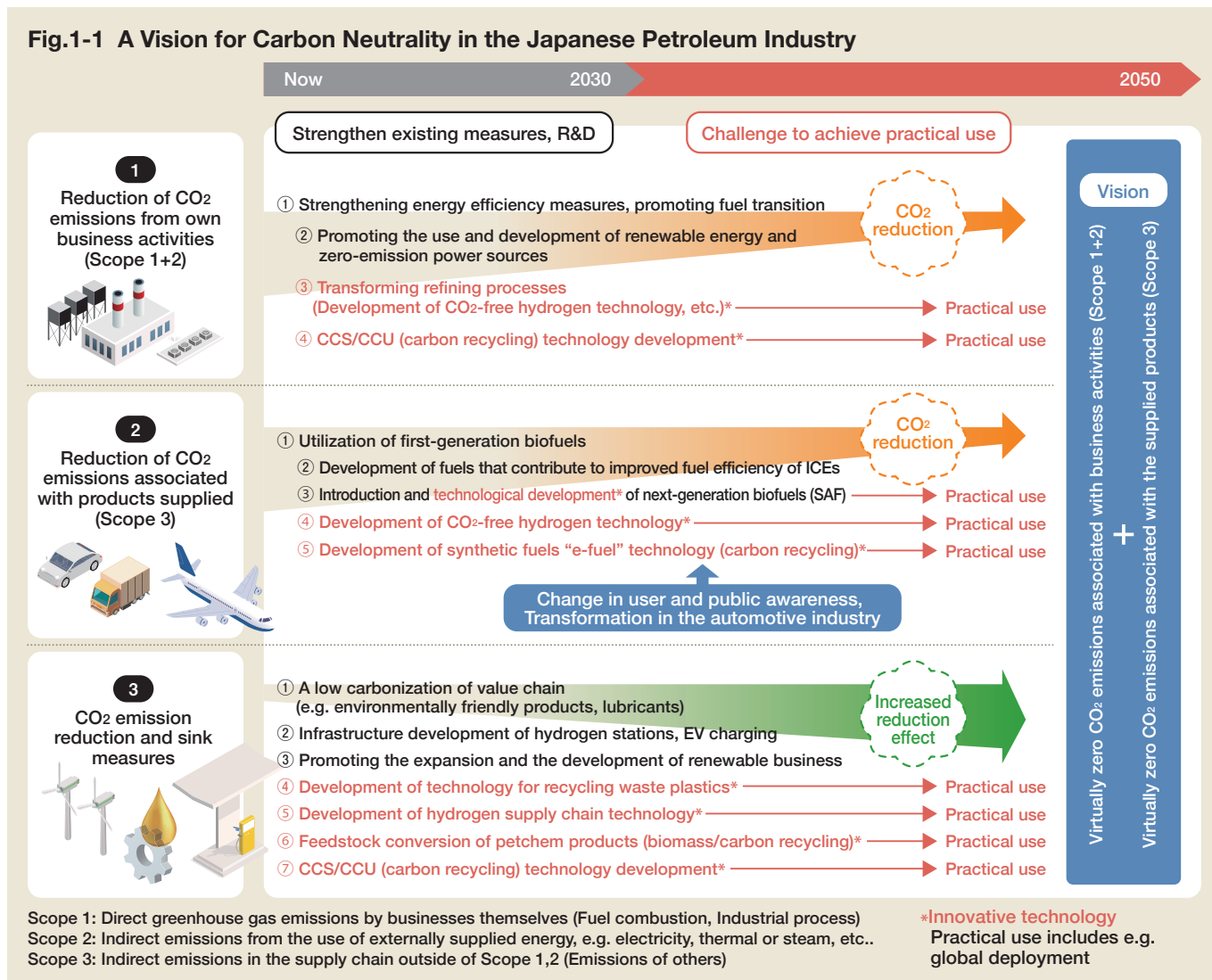
The biggest point of this vision was the aim of achieving virtually zero CO<sub>2</sub> emissions (carbon neutrality) associated with business activities (in other words, Scope 1+2). In addition, the December 2022 revision included the additional challenge of achieving virtually zero CO<sub>2</sub> emissions that are associated with the supplied products (Scope 3).

To achieve this, the petroleum industry as a whole will

have to take on the challenge of not only strengthening existing measures, such as promoting energy conservation and the use and development of renewable energy, but also carrying out "innovative technology development" by 2030, such as the reform of the refining process through technological developments, including the use of CO<sub>2</sub>-free hydrogen, and the carbon recycle (CCS and CCU), and subsequently put them into societal implementation by 2050.

In addition, as measures for CO<sub>2</sub> emission reduction and carbon sinks, the development of infrastructure, such as hydrogen fueling stations and EV charging stations, expansion of the renewable energy business, development of waste plastic recycling technology, and conversion of raw materials for petrochemical products to next-generation biomass, will contribute to the realization of carbon neutrality in society as a whole.

Fig.1-1 A Vision for Carbon Neutrality in the Japanese Petroleum Industry



## 2. History of Initiatives of Global Warming Issues

The Petroleum Association of Japan (PAJ) formulated the “Petroleum Industry’s Voluntary Action Plan for Global Environmental Conservation” in 1997 and engaged in efforts to save energy at refineries until FY2012.

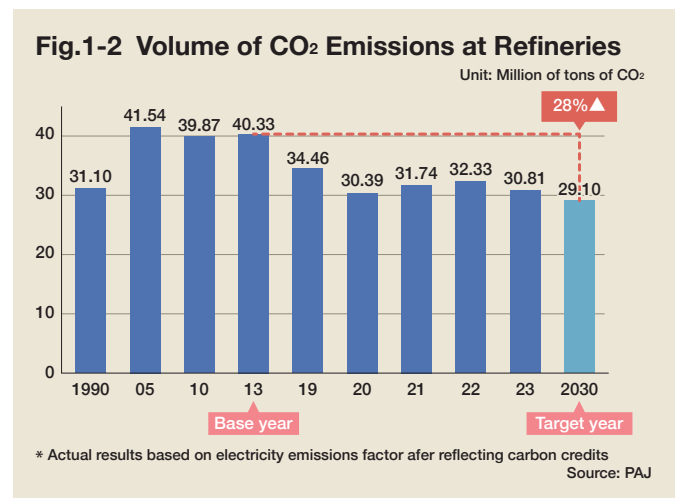
These efforts were followed in 2010 by the formulation of the “Petroleum Industry’s Action Plan for a Low Carbon Society,” announcing the goal to “achieve an energy saving volume of 530,000 kℓ of crude oil equivalents (volume from energy saving measures) at refineries by the end of FY2020 through energy saving measures from FY2010 onwards.” As a result of such efforts, an energy saving volume of 551,000 kℓ was reached in FY2016, realizing our goal.

With regard to initiatives for FY2020 and beyond, the “Petroleum Industry’s Action Plan for a Low Carbon Society – Phase II” was formulated in 2015, with “the achievement of energy saving of one million crude oil equivalents at refineries in FY2030 compared with FY2009 by means of energy saving initiatives enacted from FY2010 onward” being announced as a goal. In FY2021, an energy saving of 712,000 kℓ was reached.

In 2020, hearing that the Japanese government declared Japan would realize “Carbon Neutrality by 2050,” PAJ revised its “Action Plan for a Low Carbon

Society” to the “Carbon Neutral Action by the Petroleum Industry” in 2021. Furthermore, in 2023, PAJ transitioned to total volume of CO<sub>2</sub> emissions, in order for its numerical targets to conform with the national targets.

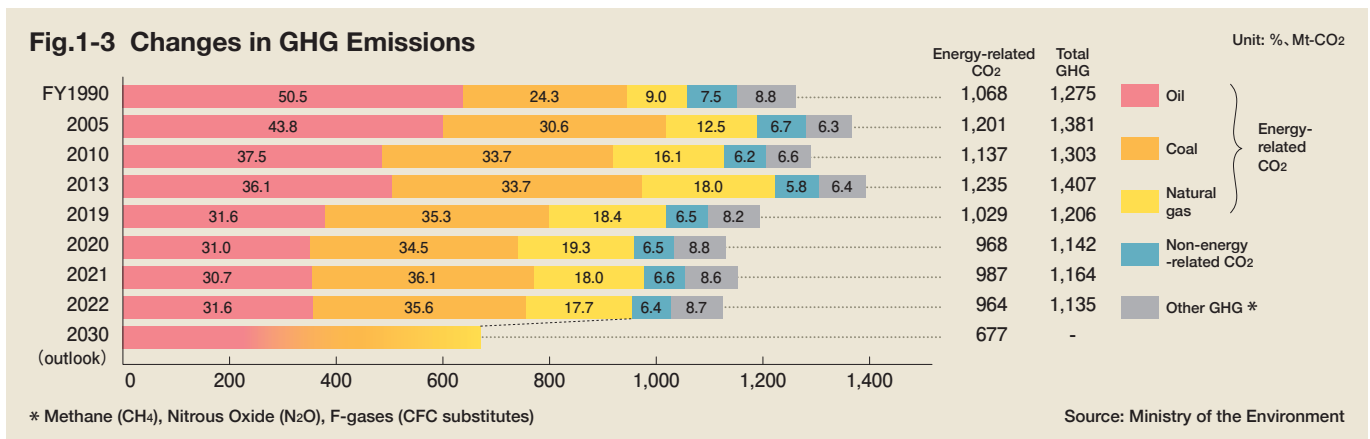
At present, the target is “to realize total volume of CO<sub>2</sub> emissions of 29.10 million tons for 2030 (28% reduction compared with FY2013). Total volume of CO<sub>2</sub> emissions in FY2023 was 30.81 million tons (a reduction of 23.6% compared with FY2013, with rate of progress towards goal of 84.7%).



## 3. Changes in GHG emissions

The quantity of greenhouse gas (GHG) emissions in Japan was approximately 1,135 million tons of CO<sub>2</sub> (actual FY2022 figures of CO<sub>2</sub> equivalent), with energy related CO<sub>2</sub> accounting for over 90 percent of these CO<sub>2</sub> emissions. Energy related CO<sub>2</sub> emissions for FY2022 was 964 million tons, which was a decrease of 2.3% YOY, and a 22% decrease compared to the most

recent peak in FY2013. While CO<sub>2</sub> emissions increased temporarily due to the impact of nuclear power plants being shut down after the Great East Japan Earthquake, emissions have been on a downward trend thereafter as a result of the decrease in energy demand, spread of renewable energy, and low-carbon power generation from the restart of some nuclear power plants.



## 4. Roadmap for "Transition Finance" in Oil Sector

In order to achieve carbon neutrality, the Ministry of Economy, Trade and Industry (METI) formulated a sector-by-sector roadmap for "transition finance" to decarbonization, based on the ministry's view that it is important to promote financing for transition efforts to steadily move toward decarbonization in industries that emit large amounts of CO<sub>2</sub>. The roadmap for the oil sector was compiled in February 2022 as information for oil companies to consider their climate change countermeasures by using transition finance and also for financial institutions and others to determine the eligibility of the strategies and initiatives of oil companies. The "Technology Roadmap," which sorted out the implementation years for each low-carbon and decarbonized technology, is also consistent with the "Vision for Carbon Neutrality in the Petroleum Industry" compiled by PAJ.

To achieve virtually net zero CO<sub>2</sub> emissions in the oil sector, it is essential not only to work toward low-carbon and decarbonization of the refining processes, but also to advance the transition with all options in mind, including the launching of CCS, CCU, and other decarbonizing technologies, and the shifting to a decarbonized fuel supply system, such as biofuels and synthetic fuels.

On the other hand, the basic concept of the roadmap is that even when moving forward with the transition, the

key prerequisite is the stable supply of oil, and this must be taken into consideration by each company when it develops its transition strategy and when financial institutions, etc. make a decision about the appropriateness of the company's procurement of funding.

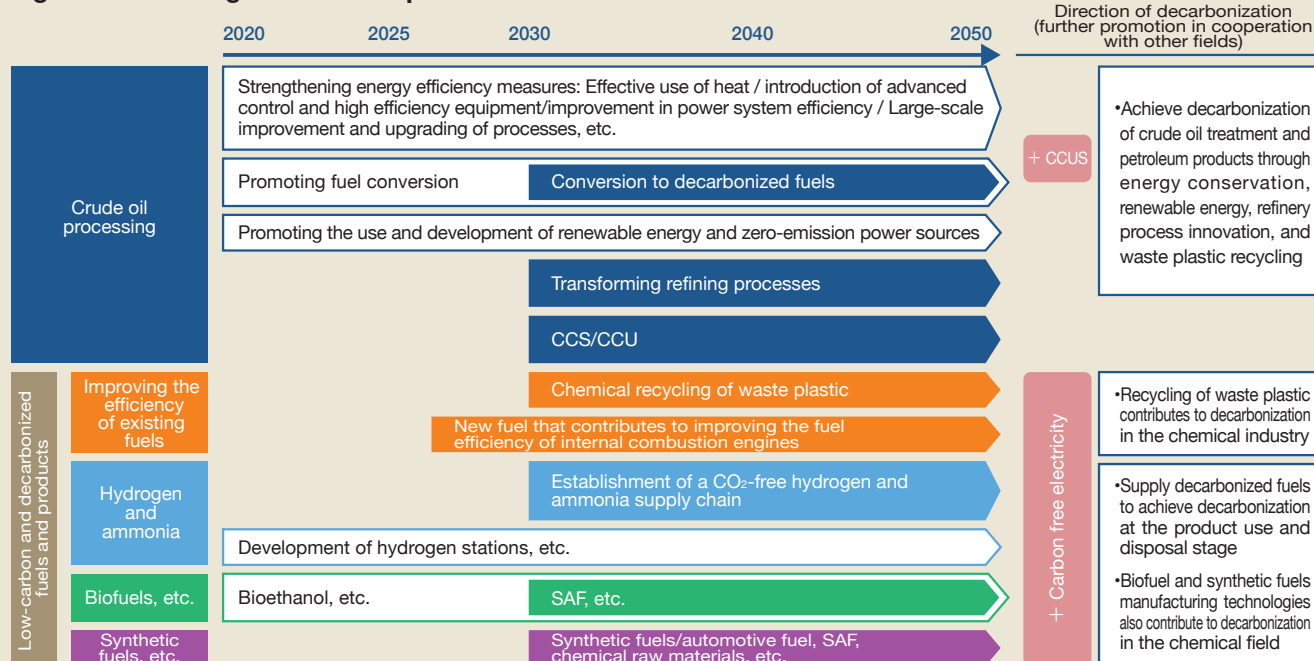
Oil companies are also establishing plans that conform to the roadmap and raising funds that utilize transition financing, with the aim of transforming their business portfolio, and engaging in efforts to realize carbon neutrality.

Fig.1-4 Direction toward CN for Petroleum ,etc.

Major sources of emissions	Crude oil processing	Product combustion
Overview	Use of heat during petroleum refining, and emissions from electricity self-generation	Emissions from combustion of petroleum products produced by the oil industry
Percentage of emissions*	Approx. 4%	Approx. 93%
Direction toward low carbonization and decarbonization	<ul style="list-style-type: none"> <li>• Energy conservation and higher efficiency</li> <li>• Conversion to low-carbon and decarbonized fuels</li> <li>• Introduction of CO<sub>2</sub> capture, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Conversion to low-carbon and decarbonized fuels (Hydrogen and ammonia/Biofuel/ Synthetic fuels/Low-carbon fuel)</li> </ul>

\* The remaining approx. 3% comprising Others (emissions from transportation and mining, etc.) falls outside the scope of this roadmap.  
Source: Based on Roadmap for "Transition Finance" in Oil Sector, Feb., 2022, METI

Fig.1-5 Technological Road Map to Low-Carbon and Decarbonization in Oil Sector



Source: Based on Roadmap for "Transition Finance" in Oil Sector, Feb., 2022, METI

## 5. Utilization of Biomass Fuels

Biomass fuels can be produced from renewable materials, such as agricultural crops and trees, and are considered to be a form of energy that is effective for global warming measures as the quantity of CO<sub>2</sub> emissions generated when they are combusted is not counted. The implementation target amount of biomass fuels for transportation use was set in the Kyoto Protocol Target Achievement Plan (April 2005) at 500,000 kℓ of crude oil equivalents.

In January 2006, based on the request of the Agency of Natural Resources and Energy, the petroleum industry made the decision to “blend 210,000 kℓ of crude oil equivalents of bio-ethanol, as bio-ETBE, with gasoline in FY2010,” with the aim of cooperating in the achievement of this government plan. After the test marketing of bio-gasoline (containing bio-ETBE, ethyl-tertiary-butyl-ether) in FY2007 and FY2008, the petroleum industry introduced 200,000 kℓ of bio-ETBE in FY2009, a year before full-scale introduction in FY2010.

Furthermore, it was stipulated in the “Criteria for Use of Non-fossil Energy Sources” in the Law Concerning Sophisticated Methods of Energy Supply Structures in November 2010 that approximately 820,000 kℓ of bio-ethanol (500,000 kℓ of crude equivalents) should be

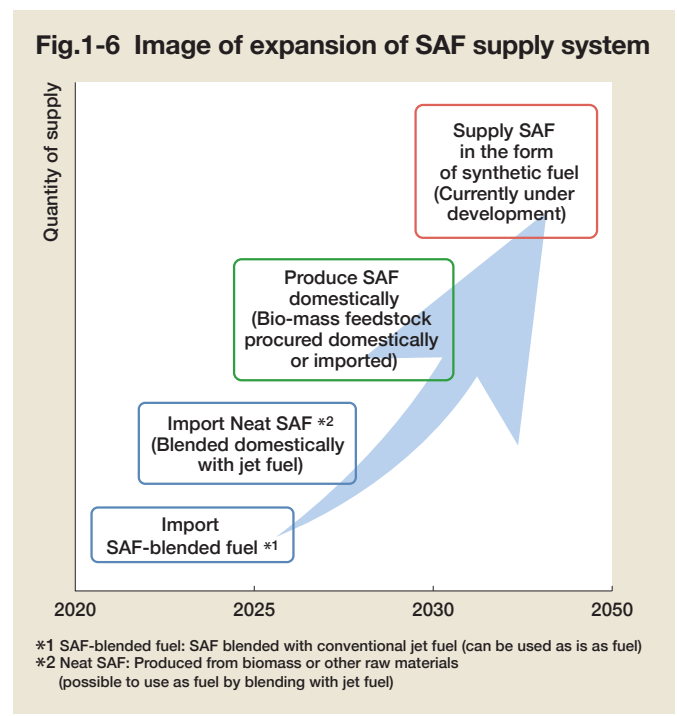
blended directly with gasoline or in the form of bio-ETBE for use as automobile fuel in FY2017, with the target volume for each fiscal year set in phases. The petroleum industry has been steadily achieving this target using the bio-ETBE method.

The “Technical Review Committee for the Utilization of Biofuels in Japan” was established in December 2017, in order to compile the basic ideas for the development of criteria for FY2018 and beyond. In consideration of the issues of almost complete dependence on imports, relatively high raw material cost, and competition with food, the committee decided that the period for the next criteria should be a “transitional period,” in which the establishment of a system for the full-scale introduction of cost-effective, eco-efficient bio-ethanol (domestic production and next generation) was given the highest priority from the perspective of the 3E (Energy security, Environmental concern and Efficient supply). According to the criteria indicated in April 2018, an annual target volume of 500,000 kℓ of crude oil equivalents was to be maintained for five years until March 2023. Subsequently, in the criteria indicated in April 2023 as well, an annual target of 500,000 kℓ of crude oil equivalents is to be maintained for five years until March 2028.

## 6. Introduction of Sustainable Aviation Fuel (SAF)

The criteria that took effect on April 1, 2020, set an annual target of 10,000 kℓ (ethanol equivalents) for the five years from FY2023 to FY2027, for petroleum refiners for the utilization volume of next-generation bio-ethanol. This amount is counted in the overall target of 500,000 kℓ of bio-ethanol (crude oil equivalents). In addition, for bio-jet fuel that is used on and after April 1, 2023, it has become possible for ethanol converted to calorific value to be counted as part of the target amount of bio-ethanol.

With regard to jet fuel, in December 2021, the Ministry of Land, Infrastructure, Transport and Tourism formulated a process chart for promoting decarbonization in the field of aircraft operation and set a goal of “replacing 10% of jet fuel used by Japanese airlines with sustainable aviation fuel (SAF) by 2030.” Initiatives are underway in the petroleum industry, as well, to build a system that will enable stable production of SAF domestically by 2030, and will start production and supply of SAF in Japan in 2025.



## 7. Key Features of Synthetic Fuels

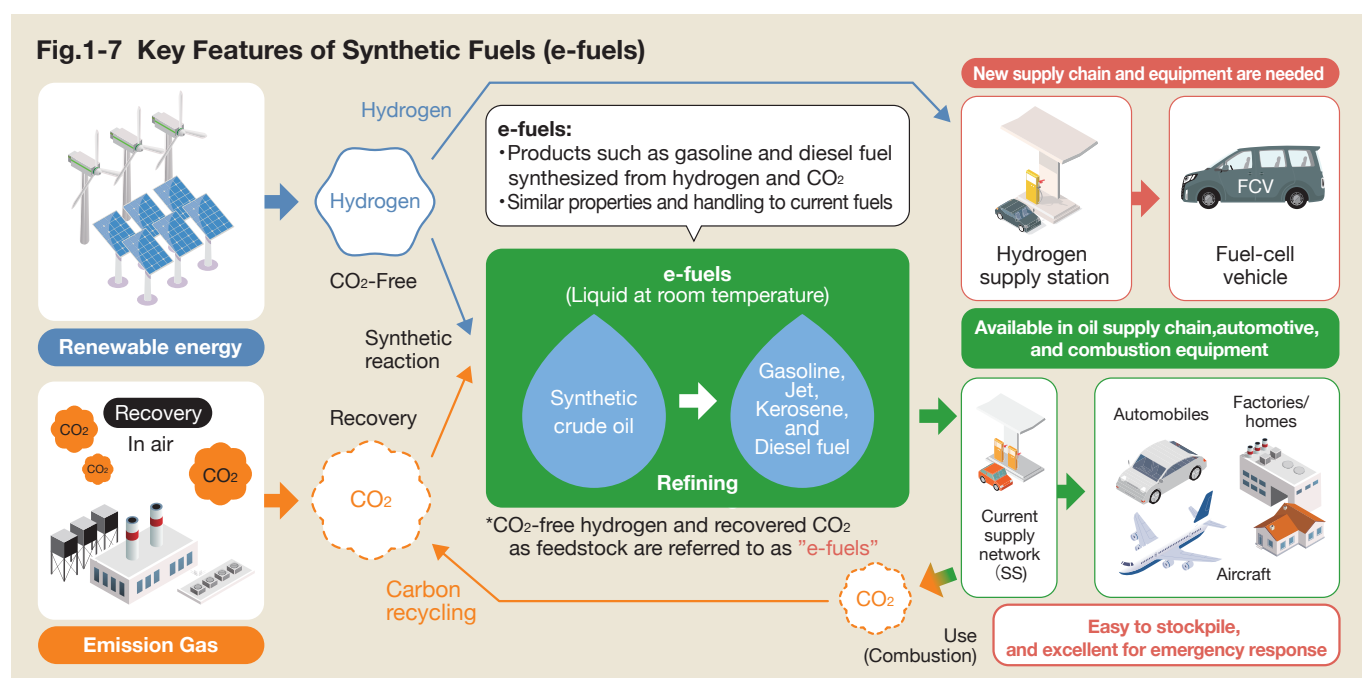
Synthetic fuels (e-fuels) is a fuel made by combining CO<sub>2</sub> and hydrogen. It is a clean fuel that can be used without increasing atmospheric CO<sub>2</sub> emissions by extracting hydrogen through electrolysis using electricity derived from renewable energy sources. As e-fuels is a liquid at room temperature, it has high energy density and is also excellent in terms of portability and ease of handling.

Moreover, e-fuels is being developed with the aim of having properties that are similar to already existing gasoline and diesel fuel. For this reason, e-fuels has the advantage of being able to be used by itself, as well as being blended with existing gasoline or diesel fuel for use in vehicles and combustion equipment with conventional

internal combustion engines (ICEs), and with regard to its supply infrastructure (tank trucks, service stations, etc.), as well, the existing oil supply chain can be used as is. In other words, even in the “transition period” toward carbon neutrality, e-fuels has the excellent characteristic of providing a stable supply while holding down the increase in the burden to the public.

The Government aims to commercialize synthetic fuels by the first half of 2030s.

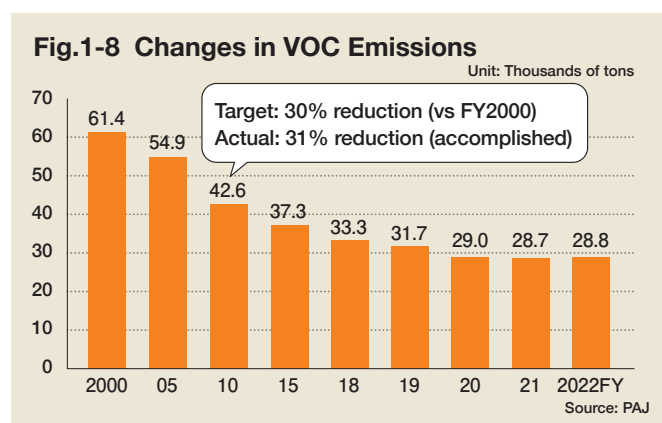
September 2024 saw the completion of the first synthetic fuel manufacturing demonstration plant in Japan that could carry out the integrated refinement of fuel synthesized from CO<sub>2</sub>-free hydrogen and recovered CO<sub>2</sub>.

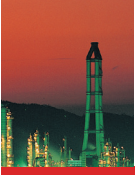


## 8. Volatile Organic Compounds (VOC) Reduction Measures

To control VOC emissions, crude oil tanks and gasoline tanks, etc., at refineries and oil terminals have a sealed floating roof or internal floating roof. In addition, VOC emitted by railroad tank cars, tank trucks, etc., when transporting products is recovered by a vapor recovery system.

PAJ is undertaking efforts to control VOC emissions under its Voluntary Action Plan. VOC emissions in FY2022 totaled 28,800 tons, a 53% reduction compared with FY2000.





## 1. Japan's Oil Stockpiling System

In response to OECD's recommendation in 1962 obliging member countries to hold oil stockpiling level at a 60-day equivalent to the nation's oil demand, the Energy Committee of the Industrial Structure Council made a proposal in December 1963 regarding the necessity of oil stockpiling.

When the Third Middle East War broke out in 1967, Japan's sense of crisis rose rapidly, as it was already dependent upon on oil for 65% of its primary energy, and it essentially began its oil stockpiling system from FY1972.

The first oil crisis occurred in 1973, causing great turmoil worldwide, including Japan. For this reason, the "Expansion Plan for Private Sector Oil Stockpiling Obligation to 90 Days" was announced in October 1974 to develop a system to strengthen oil stockpiling in Japan. In November 1974, the International Energy Agency (IEA) was established as a subordinate office under the Organization for Economic Co-operation and Development (OECD). With the promulgation of the Petroleum Reserve Law in 1975, measures were legislated by the government to set stockpiling targets; put an obligation on oil refiners, distributors, and importers, etc., of petroleum to hold oil stockpiling at least above the level of their basic obligation volumes; and lower the basic obligation volume for a fixed period, especially when it is deemed necessary to secure a stable supply of oil in the event of an oil supply shortage in Japan. After coping with the second oil crisis in 1979, the 90-day equivalent oil stockpiling system (the private sector's 90-day equivalent volume obligation) was established in April 1981.

Government stockpiling by the Japan National Oil Corporation (currently Japan Organization for Metals and Energy Security: JOGMEC) was started in 1978. The government oil stockpiling target of 50 million kℓ was achieved in February 1998. During this 20-year period, ten national oil stockpiling bases were constructed across the country. As a result of the expansion of government stockpiling, the private-sector stockpiling was reduced by four days each year from 1989 to 1993, and since then a 70-day equivalent oil stockpiling system (the private sector's 70-day equivalent volume

obligation) has been maintained. From FY2015, a method to calculate the government stockpiling level was changed from quantity-based to days-based, and it was decided to secure an amount equivalent to about 90 days of net crude oil imports, including half of the total from joint stockpiling with oil-producing countries.

With the abolition of the Petroleum Industry Law at the end of December 2001, the Petroleum Reserve Law was renamed the Oil Stockpiling Act. In order to ensure the fulfillment of oil stockpiling obligations as well as strengthen the foundations for emergency responses, the following provisions were amended by the new act:

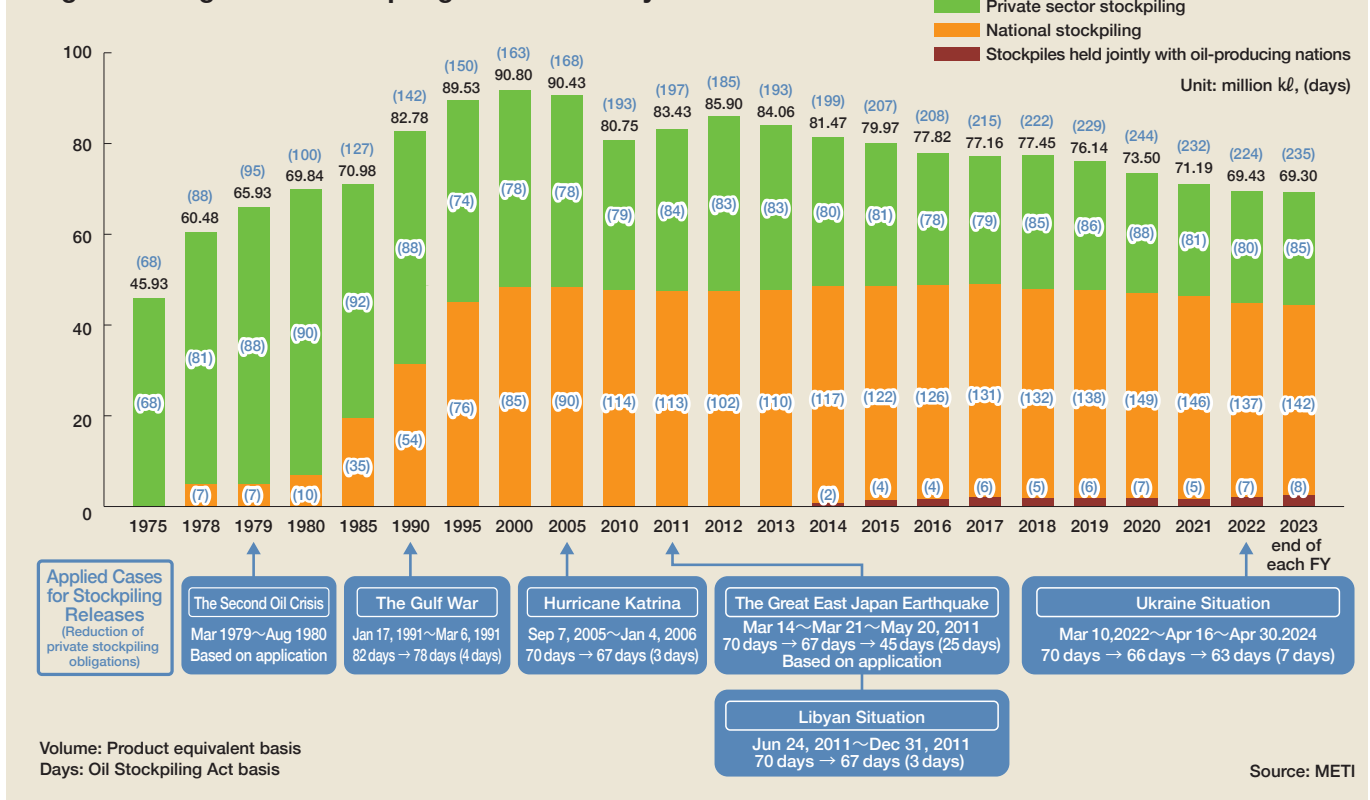
- ① Notification requirements for business commencement of oil refiners, distributors and retailers; clarification of registration requirements for oil importers
- ② Clarification of the provisions concerning a release order of government oil stockpiles by the Minister of Economy, Trade and Industry (METI)
- ③ Recommendation to increase the crude oil processing volumes above planned volumes

Subsequently, the government oil product stockpiling system was introduced in view of the need to establish a more flexible oil stockpiling system. As a result, kerosene stockpiling has been implemented since 2009. (As a result of the Great East Japan Earthquake, the Oil Stockpiling Act was amended in 2012, leading to the stockpiling of four fuel products, with gasoline, diesel fuel, and heavy fuel oil A, for which there were substantial emergency supply requests when disaster struck, being added to the stockpiling of kerosene.)

In addition, the Japanese government initiated a joint stockpiling project with oil-producing countries. In the project scheme, oil-producing countries could reserve their crude oils in Japan and use them commercially under normal circumstances; however, in an emergency, Japanese oil companies would receive preferentially crude oil supply from their reserves under the project agreement. Such joint crude oil stockpiling in Japan was started with Abu Dhabi National Oil Company (ADNOC) in 2009, Saudi Arabia's state-owned oil company (Saudi Aramco) in 2011 and Kuwait Petroleum corporation (KPC) in 2020.



Fig.2-1 Changes in Oil Stockpiling Volume and Days



## 2. Release of Oil Reserves in an Emergency

Under the IEA’s cooperative emergency response measures (a mechanism in which IEA member countries coordinate to release their oil stockpiles), steps to draw down the private sector oil stockpiling obligation volume may be taken.

When the Gulf Crisis broke out in 1990, the private-sector stockpiling obligation volume was lowered from January to March 1991, in accordance with the IEA’s decision, as a part of the international coordination system. In addition, in August 2005, when oil production and refining infrastructure was devastated in the U.S. Gulf of Mexico by Hurricane Katrina, private-sector stockpiles were reduced for approximately four months, and Japanese primary oil distributors (Motouris) exported gasoline to the U.S. as an emergency measure.

In June 2011, when a civil war erupted in the OPEC member country of Libya, the supply of crude oil from that country was disrupted. As a result, the private-sector stockpiles were lowered for about six months as part of the IEA’s cooperative framework. In 2022, in light of the turmoil in the oil market caused by Russia’s invasion of Ukraine, the IEA held its Extraordinary Ministerial Meeting on March 1 and agreed on a

coordinated oil release from emergency reserves in order to stabilize the energy market. An additional coordinated release of oil was agreed upon on April 1. In response to this, the private-sector obligation volume was lowered from March, and it was decided in April to further reduce the private-sector obligation volume as well as to release oil from government stockpiles.

Fig.2-2 Location of National Stockpiling

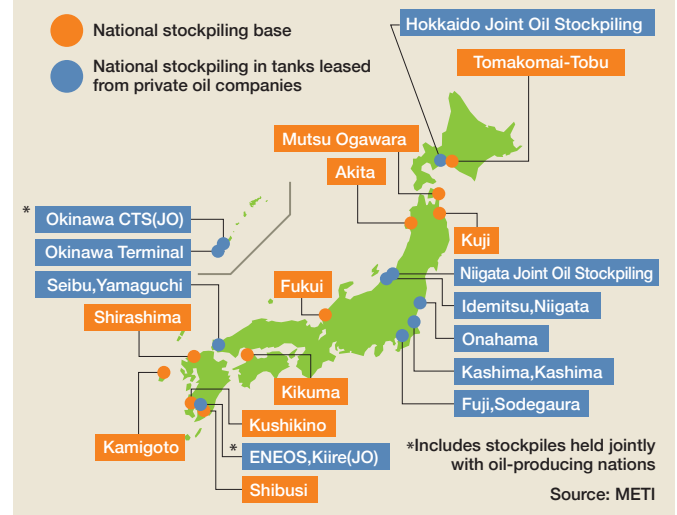


Fig.2-3 Current Status of Oil Stockpiling in Japan (as of Apr 2024)

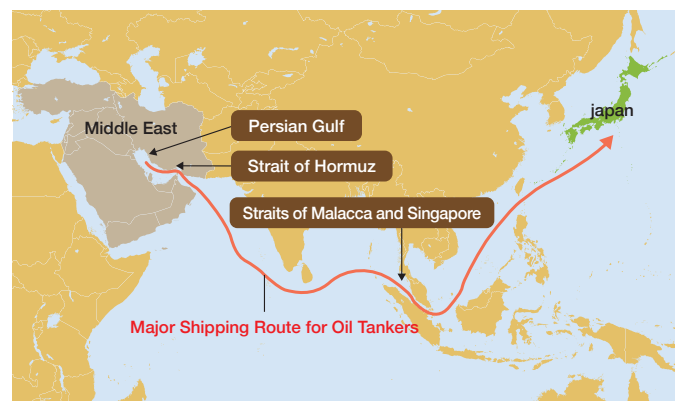
	Private sector stockpiling	National stockpiling	Stockpiles held jointly with oil-producing nations
Stockpiling Target	70 days of domestic demand	90days of net import	(Half can be counted as part of the national stockpile)
Stockpiling Quantity	85 days 25.02 million kl	142 days 41.83 million kl	7 days 2.18 million kl
Composition	Crude oil : 40% Oil products: 60%	Crude oil : 97% Oil products: 3%	Crude oil:100%
Holding Method	Through production and distribution processes	In sealed designated storage tanks (Oil products are held through production and distribution processes)	Through commercial stocks of oil-producing countries
Holding Location	Private sector tanks in refineries and oil terminals	① Tanks of national stockpiling bases ② Tanks borrowed from private sector	Private sector tanks contracted by oil-producing countries
Administrative Body	Oil refiners and importers	①10 national stockpiling bases ②Private oil companies	Private oil companies (Management consigned by national oil companies of oil-producing countries)
Effect of Stockpile Release (Reduction)	① Prompt supply to distribution markets as a large part of stockpiles are held at refineries and oil terminals ② Flexible release of stockpiles depending on crude procurement status and seasonal demand fluctuation	① Strong psychological effect on the market when the government announces its decision to release its stockpiling to increase oil supply in the market ② Crude oil has to be transported from the stockpile sites to refineries ③ Oil products are stockpiled in private tanks at refineries, etc., and can be supplied promptly	① Private oil tanks are leased to national oil companies of oil-producing countries. The companies use the tanks as storage bases for East Asia, while giving priority to the supply of stocks to Japan in the event of a shortage of supplies to Japan ② Crude oil has to be transported from the stockpile sites to refineries
Cases of Stockpile Release (Reduction)	① 2nd Oil Crisis (Mar 1979~Aug 1980) ② Gulf Crisis (Jan~Mar 1991) ③ Hurricane Katrina aftermath (Sep 2005~Jan 2006 ) ④ The Great East Japan Earthquake (Mar~May 2011) ⑤ Libyan situation (Jun~Dec 2011) ⑥ Ukraine situation (Mar 2022~Apr 2024)	① Ukraine situation (Apr 2022~Sep 2022) Discharge of 9 million barrels of crude oil by September 2022	None
Financial Measures	Subsidy for oil purchasing costs and tank construction costs	Government's budget (Part of product cost)	Subsidy for tank leasing costs (Part of product cost)

### 3. Oil Sea Lane

The route from the Middle East to Japan is 12,000 km. Tankers departing from inside the Persian Gulf pass through the Strait of Hormuz, taking three weeks to arrive in Japan.

In 2019, an incident occurred in which Japan-related vessels were attacked in the Middle East region. In response to this, the Japanese government approved measures to allow the Maritime Self-Defense Force to carry out information-gathering activities, etc., in the seas in the Gulf of Oman, the northern part of the Arabian Sea and the Gulf of Aden starting in 2020 to ensure the safety of the shipping lane.

Fig.2-4 Oil Road from the Middle East



## 4. The Great East Japan Earthquake and Amendment of the Oil Stockpiling Act

In the aftermath of the Great East Japan Earthquake of March 11, 2011, the supply of electricity and city gas came to a standstill. Oil played a significant role as the most independent and distributed disaster-resistant source of energy because of its excellent accessibility, storage, and portability as fuel for emergency power generation at hospitals, heating at evacuation centers (kerosene heaters), and emergency vehicles.

On the other hand, shipping bases, such as refineries and oil terminals, and also service stations (SS) suffered severe damage from the earthquake. Six of the nine refineries located in the Kanto and Tohoku regions halted production (equivalent to about 30% of Japan's total refining capacity), and almost all of the oil terminals on the northern Pacific coast were also unable to carry out product shipment. Consequently, although there were adequate inventories, because harbor facilities, roads, and other forms of social infrastructure were paralyzed, and there were also logistic problems, there was a temporary lack of supply of petroleum products in some regions.

The government received about 5,000 requests for various emergency relief supplies from the disaster areas, of which about 1,400 of them, or 30 percent, were for petroleum fuels. The Petroleum Association of Japan (PAJ) set up an operation center to cope with urgent support requests from the Prime Minister's Office and METI, and responded promptly on a 24-hour basis.

Although there was not yet at the time an institutional framework based on laws, regulations or agreements, various cooperative systems were built that went beyond the boundaries of companies, such as five companies jointly using the oil terminals of two companies in the affected area that were of a large scale and had recovered quickly.

Based on responses at the time, "The Oil Stockpiling Act" was amended in 2012 to make it possible to release government oil reserves not only at times when there is an oil supply shortage of oil from overseas, but also at times when there is a shortage of oil in certain areas regions of Japan due to a disaster.

**Fig.2-5 Response to the Great East Japan Earthquake**

- Strengthen production system of refineries in operation (Raising operating rate, increasing production capacity, etc.)
- Urgent import of gasoline and restricting product export (Increasing domestic supply)
- Shipping petroleum products to disaster area from western Japan and Hokkaido (Coastal tanker, tank car and tank truck)
- Cooperation among oil companies in the disaster area. (Joint use of oil storage facilities)
- Shifting of tank trucks from western Japan to the disaster area (Special engagement of approximately 300 trucks)
- Public relation activities in the disaster area for relieving consumers' anxiety such as informing them of service stations in operation

## 5. Information Sharing with Local Authorities

Because oil retailers in the regions also suffered damage from the Great East Japan Earthquake, the Motouris responded to emergency supply requests for petroleum products from local authorities in the disaster-stricken areas via the central government for critical institutions such as hospitals. Amidst the confusion at the time of the disaster, however, incorrect or inadequate information given by those making the request about the facilities or equipment (kind of fuel, tank capacity, shape of tank inlet, etc.) that are needed to provide a stable supply led to some problems with a portion of the delivery.

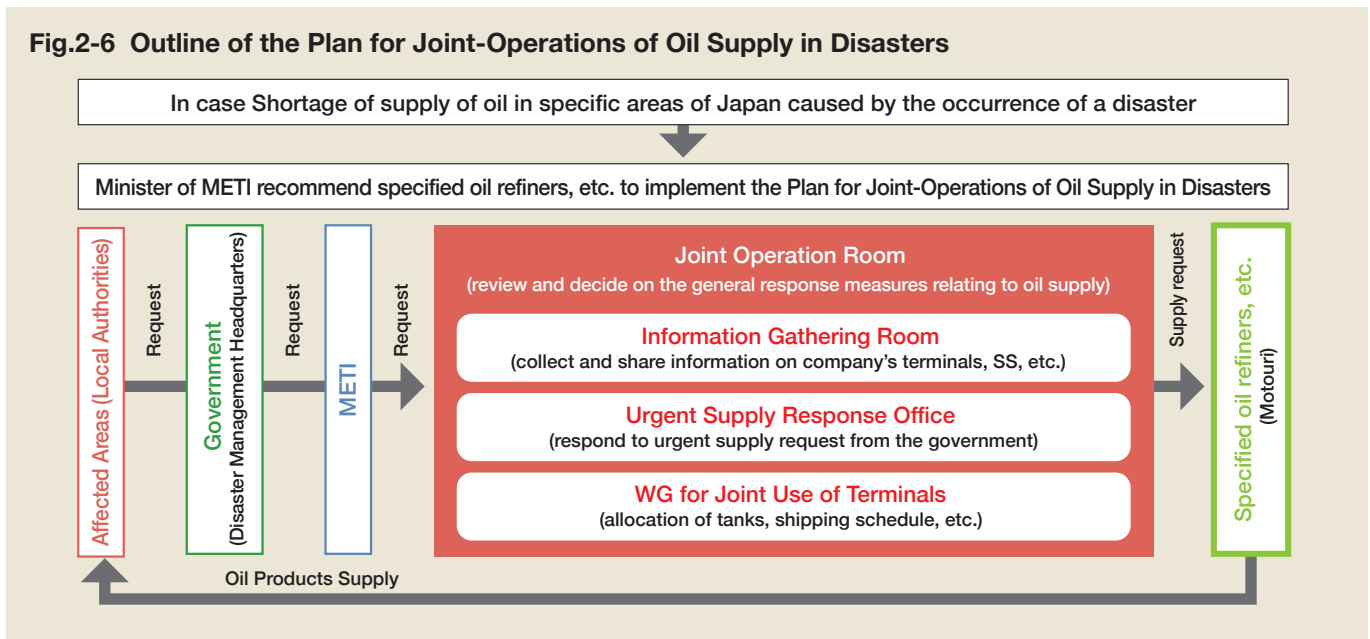
As preliminary preparation for responding quickly and smoothly to urgent requests for supply from areas affected by a disaster in the future, PAJ has been implementing initiatives since 2012 to share in advance necessary information about fuel supply with key facilities designated by prefectures, etc. In addition to concluding a memorandum with all of the prefectures\* by the end of FY2017 to share information, initiatives under the same provisions are being carried out with government agencies and designated public institutions.

\* An agreement concerned with the same initiatives was concluded with the Tokyo Metropolitan Government in 2008.

## 6. Plan for Joint-Operations of Oil Supply in Disasters

Based on the amended Oil Stockpiling Act, in anticipation of a large-scale domestic disaster that could cause a shortage of oil supply to a particular region, oil refiners and Motouris jointly formulated the “Oil Supply Coordination Plan in Disaster” to ensure a stable supply, and submitted it to the Minister of METI. In the event a large-scale disaster occurs, the Minister can advise refiners and Motouris to carry out the measures specified in the plan. In that case, it is stipulated that the

companies establish a joint operation room to serve as a command center to respond to the disaster in order to: (i) collect and share information on each company’s shipping terminals, logistics, affiliated SS, etc., (ii) respond to urgent supply requests for petroleum products received via the government, and (iii) share the use of shipping terminals of the companies when their own shipping facility is no longer available due to damage or other reasons.



## 7. Response of the Petroleum Industry at the Time of Kumamoto Earthquake

The Kumamoto earthquake, which struck on April 16, 2016, was the first disaster for which the “The Plan for Joint-Operations of Oil Supply in Disasters” of the Oil Stockpiling Act was put into action.

In line with this plan, PAJ held joint operation room meetings every day from the day of the disaster until April 21 to share information on shipping facilities and distribution of each oil refinery and Motouri, as well as engage in discussions and make decisions on response policies as the oil industry, based on the government’s response policy measures.

Specifically, on the day of the disaster, PAJ confirmed with the member companies that there was no major damage to their shipping terminals or distribution channels in the region. The member companies reinforced their shipping capabilities to ensure the supply of oil to the affected areas by continuously using

backup tank trucks from the surrounding areas and extending the operating hours of their shipping terminals. They also shared information on the business operation status of their affiliated SS in and around the affected areas, aiming at early restoration of operations at SS where operations had been restricted or suspended. Furthermore, with regard to emergency power transmission to power lines by high-voltage generator trucks, an action that was carried out by electric power companies as a measure to deal with widespread power outages in the Aso area, PAJ responded to urgent requests for the supply of diesel fuel, which was used as fuel to generate electric power. Through such prompt and appropriate response in the Kumamoto earthquake, the industry was able to secure oil supplies to the disaster areas from an early stage.

### 8. Measures to Bolster Oil Supply Infrastructure

Since the Great East Japan Earthquake, maintaining and strengthening the supply chain (supply network) to ensure a stable supply of fuel to end consumers has been revealed as a critically important issue for the petroleum industry, and efforts have been made to strengthen the emergency response capabilities of both facilities and systems.

In terms of facilities, the industry has been carrying out seismic retrofitting construction, waterproofing work on electrical equipment, and installing emergency power supplies at shipping terminals. At all of the refineries operating in Japan, various works were carried out to meet earthquake-resistant and liquefaction standards that exceed the requirements of existing laws and regulations. In addition, as there were many urgent requests for small-lot drum deliveries to sites where tank trucks could not unload fuel, drum-filling facilities were maintained and expanded. At service stations (SS), disaster response measures were initiated to install a back-up power source, put hand-driven pumps in place, store emergency use materials, and prepare SS as

temporary evacuation sites.

On the system side, as considerable time was needed for collecting and sharing information between the oil companies and shipping bases in the disaster-stricken area after the earthquake, a system was built to consolidate information at PAJ from the oil companies at the time of an emergency, by securing and strengthening transmission and communication methods, such as deploying satellite phones. Moreover, in December 2013, PAJ drew up BCP (Business Continuity Plans) guidelines for oil supply, with each member company formulating its own BCP in accordance with the guidelines.

After the Great East Japan Earthquake, the petroleum industry spent approximately ten years carrying out measures to strengthen shipping bases in preparation for earthquakes and tsunamis (seismic sea waves). Since 2021, the industry has been carrying out efforts to further strengthen capabilities for dealing with disasters caused by heavy rains and typhoons as well, which have been increasing recently.

### 9. Safety Measures at Refineries

Facility layouts at oil refineries are planned so that legally mandated safe distances are kept not only between the petroleum processing and storage sites and the nearby residential areas, but also between the facilities themselves to ensure safety from fire and explosion accidents. In addition, each plant facility and storage tank is also designed to comply with the seismic design standards. Periodic overhaul inspections, shutdowns, inspections during operation, daily inspections, etc. are conducted at refining facilities and storage tanks, in an effort to detect abnormalities at an early stage that could lead to accidents. Also, in order to minimize damage in the event of an abnormality, an emergency shutdown system and an initial fire extinguishing system have been installed. In-house disaster prevention organizations and joint disaster-prevention organizations consisting of regularly trained disaster prevention personnel have been established to ensure that the company can respond appropriately and quickly in the event of an accident, such as a fire or oil spill. These organizations are equipped with large chemical fire engines, elevated water spraying vehicles, foam liquid carriers, oil booms, and oil recovery

equipment and vessels, etc.

PAJ formulated its “Voluntary Action Plan on Industrial Security” in August 2013. Thereafter, the plan is reviewed annually and revisions are made accordingly. The basic concept behind this plan is to set the industry’s specific goal as “Zero Serious Accidents” and implement measures based on a risk-based approach that invests finite resources in effective safety measures according to the magnitude of the risk.

In recent years, there have been changes in the environment in the field of industrial safety, such as advances in innovative technologies and shortages of safety personnel. Taking these circumstances into consideration, the Ministry of Economy, Trade and Industry (METI) decided to re-examine the safety regulations system and begin deliberations in 2021 on promotion of smart safety.

As a result of the deliberations, it became possible for “business operators that are able to independently ensure safety” to shift to self-management type of safety, under appropriate auditing by the government. The High-Pressure Gas Safety Act was revised in 2022, with the new system going into effect from December 2023.



## 1. Changes in Petroleum-related Regulations

Under the Petroleum Industry Law, which was enacted in July 1962 as a fundamental law, regulations for the petroleum industry in Japan have been implemented with securing a stable supply of petroleum as the highest priority. Thereafter, the Petroleum Reserve Law, the Gasoline Retail Business Law, and the Provisional Measures Law on the Importation of Specific Refined Petroleum Products (Fuel Import Restriction Law) were enacted, and a broad range of regulations, including administrative guidance, have been placed on the importing, refining, manufacturing, and marketing of petroleum.

However, as advances have been made in stages for petroleum-related regulatory reforms in line with the

globalization of the Japanese economic society, in addition to ensuring a stable supply, realizing an efficient supply based on market principles became the goal of petroleum policy. With the repeal of the Fuel Import Restriction Law in March 1996 (liberalization of petroleum product imports) and the Petroleum Industry Law at the end of December 2001 (abolition of oil supply and demand adjustment regulations), the petroleum industry was liberalized, except for regulations regarding stockpiling (the Oil Stockpiling Act) and fuel quality (the Fuel Quality Control Act).

Thereafter, against the backdrop of liberalization and a decrease in demand for oil, the rationalization of facilities, etc. proceeded.

**Fig.3-1 Changes in Petroleum-Related Regulations and Regulatory Reform**

Jul '62	Enactment of Petroleum Industry Law	Dec '01	Repeal of Petroleum Industry Law
Dec '73	Enforcement of two laws for emergency responses	Jan '02	Enactment of New Oil Stockpiling Act
Apr '76	Enactment of Petroleum Reserve Law	Feb '09	Partial Revision of Act on Quality Control of Gasoline and Other Fuels (Registration and Quality Assurance Obligation of Processors)
May '77	Enactment of Gasoline Retail Business Law	Aug '09	Act on the Promotion of Use of Non-fossil Energy Sources and Effective Use of Fossil Energy
Jan '86	Enactment of Provisional Measures Law on Importation of Specific Refined Petroleum Products (Fuel Import Restriction Law)	Jul '10	Notification of Criteria for Judgment Concerning Promotion of Effective Use of Fossil Energies (Raise Installation Ratio of Heavy Oils Cracking Units to about 13% by Mar. 2014)
Jul '87	Automatic Approval for Installation of Product Upgrading Facilities	Nov '10	Notification of Criteria for Judgment for Using Non-fossil Energies (Set Target Volumes for Using Bio-ethanol for Mixing with Gasoline by Mar.2018)
Mar '89	Abolition of Guidance on Gasoline Production Quota	Feb '11	Mandatory measures for prevention of leakage from SS underground tanks
Oct '89	Abolition of Guidance on Kerosene Inventory Build-up for Winter	Nov '12	Amendment of Oil Stockpiling Act
Mar '90	Abolition of Guidance on SS Construction (Scrap-and-Build Rule) and on Transfer of SS Brand between Primary Distributors	Jul '14	Notification of Criteria for Judgment Concerning Efficient Use of Crude Oils, etc. at oil refiners (Raise Installation Ratio of Residual Oil Processing Units to 50% by Mar. 2017)
Sep '91	Flexible Approval for Installations of Crude Processing Facilities	Oct '17	Notification of Criteria for Judgement Concerning Efficient Use of Crude Oils, etc. at refiners (Raise Processing Ratio of Vacuum Distillation Units to about 7.5% by Mar. 2022)
Mar '92	Abolition of Guidance on Crude Processing (Throughput)	Apr '18	Notification of Criteria for Judgement for Using Non-fossil Energies (Set Target Volumes for Using Bio-ethanol for Mixing with Gasoline by Mar. 2023)
Mar '93	Abolition of Tariff-quota System (TQ) for Heavy Fuels	Apr '20	Notification of Criteria for Judgement for Using Non-fossil Energies (Set Target Volumes for Using next-generation Bio-ethanol during 2023 and 2027)
Mar '96	Repeal of Fuel Import Restriction Law (Import liberalization of fuel products)	May '22	Amendment of Act on the Promotion of Use of Non-fossil Energy Sources and Effective Use of Fossil Energy (Compatibility of Effective Use of Fossil Energy and Environmentally Friendly Use of Energy Sources)
Apr '96	Enactment of Act on Quality Control of Gasoline and Other Fuels by revising Gasoline Retail Business Law	Apr '23	Notification of Criteria for Judgement for Environmentally Friendly Use of Energy Sources (Set Target Volumes for Using Bio-ethanol for Mixing with Gasoline by Mar. 2028)
Apr '96	Amendment of Petroleum Reserve Law		
Jul '97	Automatic Approval of Petroleum Product Exports (Export Liberalization of Fuel Products)		
Dec '97	Abolition of SS Certificate System for Fuel Supply-source by its Branded Primary Distributor		
Apr '98	Lifting of the Ban on Manned Self-service SS		

## 2. Petroleum Industry Reorganization Movements

In view of the flow of global realignment of Western oil majors and fierce competition in the domestic oil market after the abolition of the Fuel Import Restriction Law, the movement toward reorganization of domestic oil refiners and primary oil distributors (Motouri) became increasingly active. In the wake of the merger of Nippon Oil and Mitsubishi Oil in April 1999, reorganizations took place on a scale and at a speed that were unprecedented.

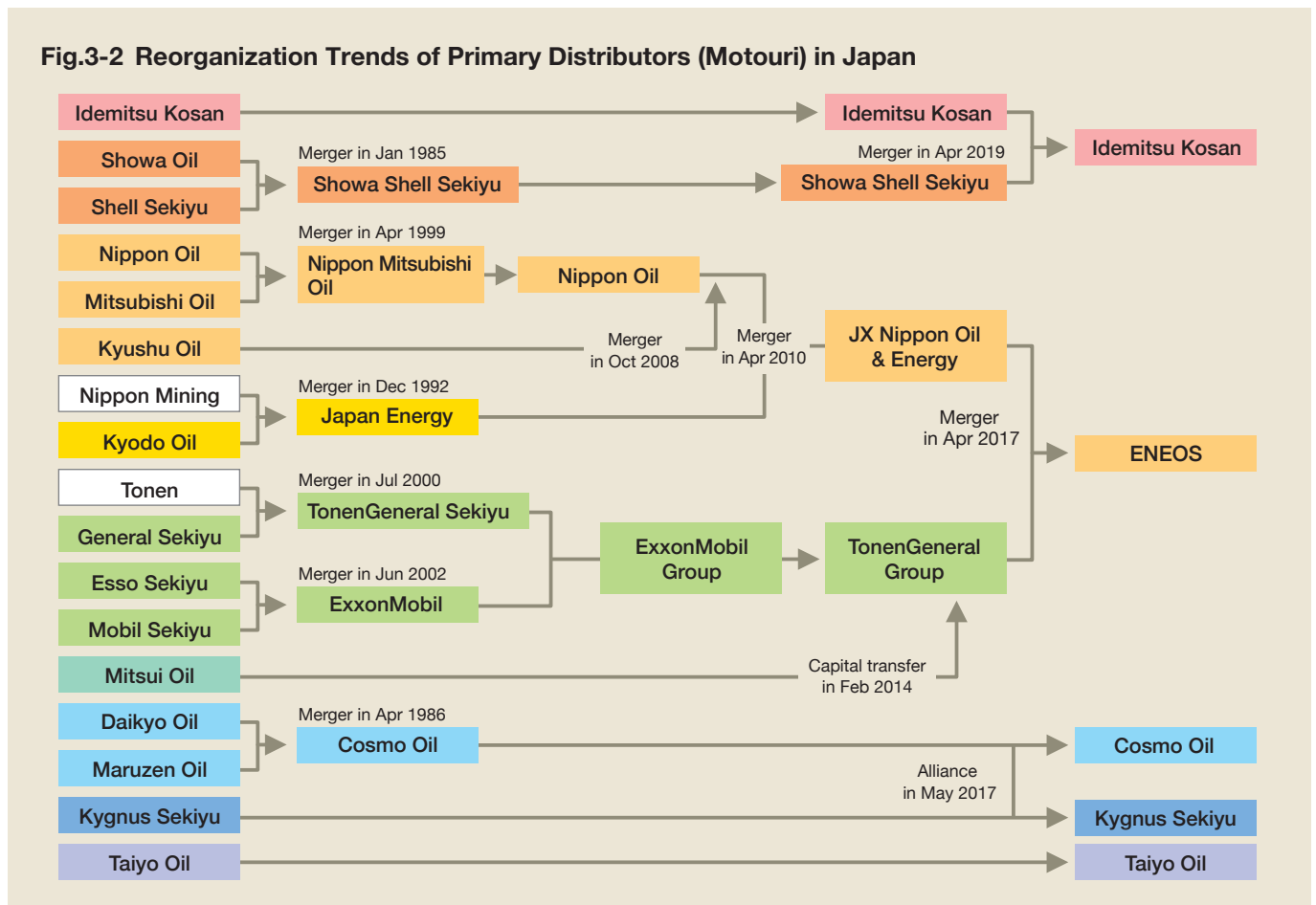
In June 2002, Esso Sekiyu, Mobil Sekiyu and other affiliated companies were integrated into the newly established ExxonMobil Y.K. In 2008, crude oil prices soared and competition became fierce in the overall energy market, and it was against this background that Nippon Oil merged with Kyushu Oil in October of that year. Furthermore, even more consolidations and corporate efforts aimed at greater rationalization and streamlining were carried out. For example, JX Nippon Oil & Energy was established in July 2010 as a result of the business integration with Japan Energy and Nippon Oil, which had up to that time a business alliance with

Japan Energy covering a wide range of fields, from upstream operations to refining and distribution operations, fuel cell business, and technology development. Then in June 2012, the ExxonMobil Japan Group changed its domestic capital ties, and with new Japanese capital, started up the TonenGeneral Group, with TonenGeneral Sekiyu at its core.

Thereafter, more business alliances and business integrations were carried out with the aim of further strengthening competitiveness by streamlining product supply and logistics. In February 2017, Cosmo Oil and Kygnus Sekiyu entered into a capital and business alliance, and in April of the same year, JX Nippon Oil & Energy\*<sup>1</sup> and TonenGeneral Sekiyu merged to form ENEOS\*<sup>2</sup>. Furthermore, the business integration of Idemitsu Kosan and Showa Shell Sekiyu in April 2019 resulted in the consolidation of Japan's Motouris into five companies.

\*1 In January 2016, JX Nippon Oil & Energy changed its name to JX Energy.

\*2 In June 2020, JXTG Energy changed its name to ENEOS.



### 3. The Strategic Energy Plan

The Basic Act on Energy Policy, enacted in June 2002, emphasizes the three basic principles of energy policy (the “3E”) of ensuring a stable energy supply (Energy security), compatibility with the environment (Environment), and making use of market mechanisms (Economic efficiency), and also stipulates the formulation of the Strategic Energy Plan (SEP), which lays out the basic direction of energy policies, as well as mandating the review of the Plan at roughly three-year intervals.

In the 4th SEP, formulated in April 2014 after the Great East Japan Earthquake, the basic stance of the energy policy was "S+3E," which placed top priority on ensuring a stable energy supply based on the premise of ensuring “Safety,” realizing energy supply at low cost through improved economic efficiency, and at the same time, achieving environmental conformity.

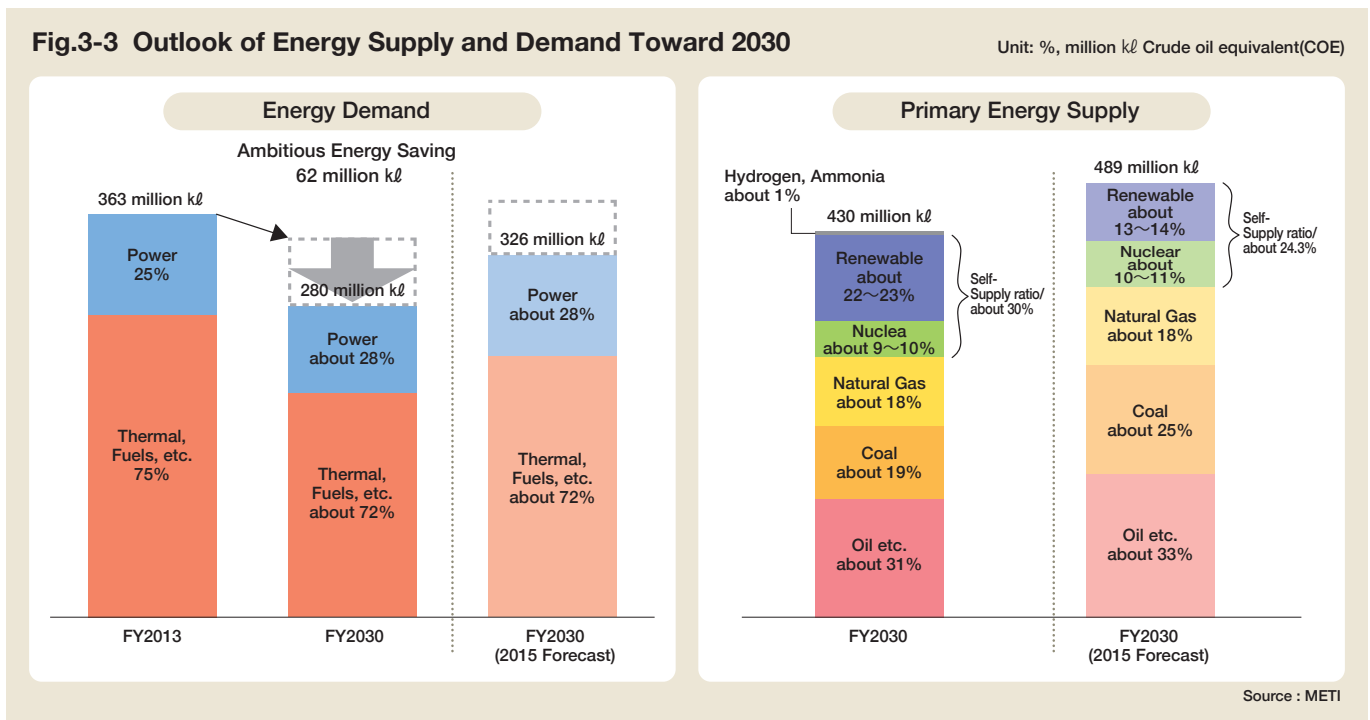
The 6th SEP, which was approved at a Cabinet meeting in October 2021, continued to focus on the simultaneous achievement of "S+3E" as the basic stance of the energy policy. Because of petroleum’s portability and ease of storage, and its mobility, such as the ability to respond to the need for fuel at a disaster-stricken area immediately after a disaster occurs, it is regarded as “the last bastion” of energy supply in times of disaster. And petroleum is positioned as “an energy source that is indispensable to the lives of people and for economic activities,” and as an energy source that has a wide range of fuel and material

applications that contributes to the energy supply not only in ordinary times but also in times of an emergency.

Moreover, as it is deemed important to ensure a robust oil supply system that can respond not only in ordinary times but also in times of emergencies with an eye to 2030, the necessity for further strengthening the supply network to cope with disasters, maintaining oil stockpiling levels, initiatives for improving productivity and strengthening competitiveness, and decarbonization of refineries by means of energy saving and CO<sub>2</sub>-free hydrogen is mentioned.

In conjunction with the formulation of the 6th SEP, the outlook for the supply and demand of energy was revised, based on the raising of greenhouse gas reduction targets for 2030 (46% reduction compared with FY2013). In the new supply and demand outlook, oil will account for around a 31% share of the primary energy supply in FY2030.

With regard to the subsequent 7th SEP, it is mentioned that greenhouse gas reduction targets for FY2040 and makeup of electric power for realizing those targets will be formulated based on changes in the situation after the 6th SEP, such as heightened geopolitical risk and increase in demand for electric power due to advances in DX. Discussions aimed at revisions by the end of 2024 are underway.





### 4. Promotion of Effective Use of Energy Sources

In July 2009, the former Act on the Promotion of Development and Introduction of Alternative Energy, which only aimed to reduce dependence on oil, was reexamined, and Act on the Promotion of Use of Non-fossil Energy Sources and Effective Use of Fossil Energy Materials by Energy Suppliers (Sophisticated Methods Act) was enacted to urge energy suppliers (electric power, city gas and oil) to expand the use of non-fossil energy resources, as well as to promote the effective use of fossil energy resources.

The “Criteria for Judgment by Oil Refiner Concerning the Effective Utilization of Crude Oil, etc.” (The First Ministerial Notice on Sophisticated Methods Act) was announced in July 2010, in which oil refiners were given the target of raising the nation’s facilities installation rate of heavy oil cracking units (about 10% in 2010) to about 13% by FY2013, with each oil refiner being obligated to achieve an improvement rate that was in line with its facilities installation rate.

Each oil refiner made an effort to raise the installation rate of heavy oil cracking units by means of (1) the reduction of crude distillation units, and (2) a combination of constructing new and building up existing heavy oil cracking units. Consequently, the average facilities installation rate of Japan’s heavy oil cracking units improved to around 13% as of the end of FY2013.

In July 2014, the Second Ministerial Notice on Sophisticated Methods Act stated that the definition for the facility installation rate (a target indicator) would be the residual oil processing unit installation rate (about 45% as of FY2014), which comprises the facility installation rate with the addition of heavy oil direct desulfurization units, fluid catalytic cracking units, and solvent deasphalting units, with the target for the facility installation rate being raised to around 50% by FY2016. Oil refineries are obligated to achieve facility improvement and be in line with the facility installation rate, and as a means of achieving the target, some flexibility was permitted regarding facility capacities through collaboration between refineries, and business restructuring. Oil refineries are obligated to achieve

facility improvement and be in line with the facility installation rate, and as a means of achieving the target, some flexibility was permitted regarding facility capacities through collaboration between refineries, and business restructuring.

Moreover, each oil refiner had to also show the business restructuring policies that form the foundation for facility optimization, and periodically report to METI on the status of those initiatives towards achieving the target. As a result of initiatives by each oil refiner, the average facility installation rate of residual oil processing units reached 50.5% at the end of FY2016.

In May 2017, the Natural Resources and Fuels Subcommittee of the Petroleum Council’s Advisory Committee for Natural Resources and Energy set forth its basic approach of “urging the effective utilization of heavy oil cracking units through improvement of the capacity utilization rate, collaboration among refineries, capacity expansion, etc., to realize further utilization of heavy oil cracking capabilities.” This was set forth in the Third Ministerial Notice on Sophisticated Methods Act announced in October 2017. Oil refining companies were obliged to achieve an increase in their vacuum-residue (VR) oil cracking rate that was in accordance with their actual performance. The target index was to raise the VR processing rate to about 7.5% in FY 2021. As a result of initiatives by each refiner, the VR processing rate in FY2021 was 8.1%.

Taking the 6th SEP, etc., into consideration, the purpose of Sophisticated Methods Act was revised in May 2022 from "promotion of use of non- fossil energy sources" to "environmentally friendly use of energy sources," while maintaining "effective use of fossil energy materials".

Based on this, for the subsequent Fourth Ministerial Notice, initiatives for reducing CO<sub>2</sub> emissions in the refining process have been newly added to the evaluation indicators, in addition to improvements made to the residual oil processing capabilities that are in line with the thinking of the Third Ministerial Notice. The Fourth Ministerial Notice went into effect in December 2024 for the five-year period from FY2024 to FY2028.

### 5. Various Petroleum-related Taxes

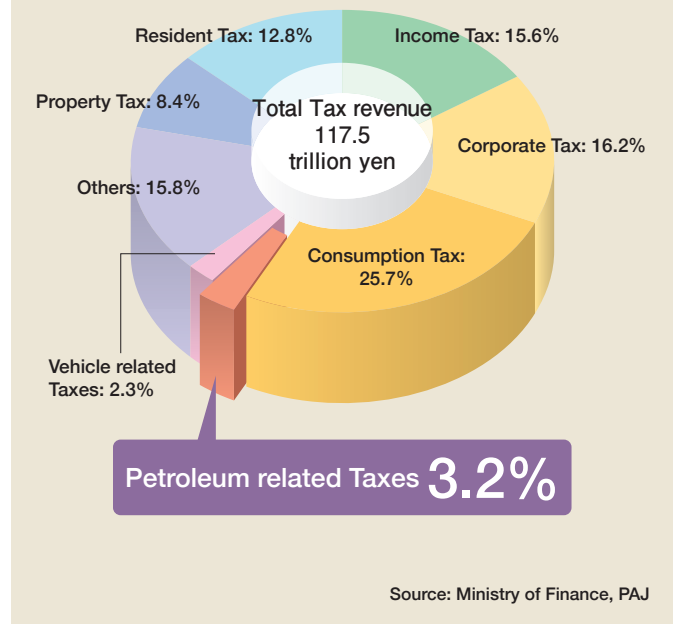
Various taxes are levied on oil in multiple stages. First, customs duty (currently levied only on imported petroleum products) and a petroleum and coal tax are levied on crude oil, which is the raw material for petroleum products, and petroleum products at the import stage.

The petroleum and coal tax is applied to financial resources for promoting stockpiling and development of oil. In 2012, it was decided to add a tax rate corresponding to the amount of CO<sub>2</sub> emissions because of “a special taxation for global warming countermeasures,” with the tax being 2,800 yen/ℓ since April 2016.

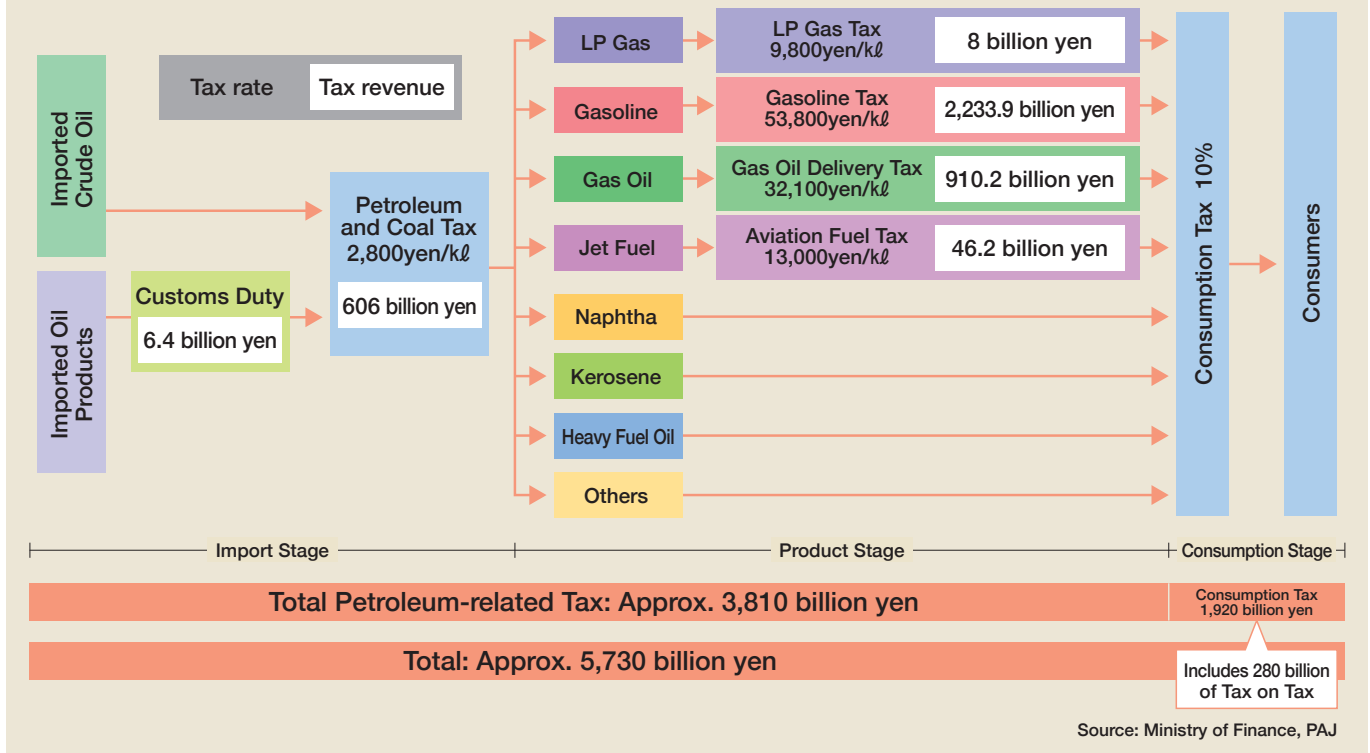
By the time the petroleum becomes products that are delivered to consumers, individual indirect taxes, such as gasoline tax (a gasoline tax and local gasoline tax), gas oil delivery tax, aviation fuel tax, and liquefied petroleum gas tax (tax applied only to LPG used for automobiles) are levied. These various petroleum-related taxes amount to about 3,810 billion yen, which account for approximately 3.2% of the total national and local tax revenue. If the consumption tax of approximately 1,920 billion yen (levied on the sale of petroleum products that include various taxes on petroleum) is added to these

petroleum-related taxes, the total tax related to petroleum amounts to about 5,730 billion yen.

**Fig.3-4 Proportion of tax revenue accounted for by petroleum-related taxes (initial budget for FY2024)**



**Fig.3-5 Multiple Types and Stages of Taxation of Petroleum-related Taxes (initial budget for FY2024)**



## 6. Gasoline Tax and Gas Oil Delivery Tax

The basic tax rates of the gasoline tax and gas oil delivery tax are 28,700 yen/kl and 15,000 yen/kl, respectively; however, with the application of the provisional tax rate, those tax rates become 53,800 yen/kl and 32,100 yen/kl, respectively, for the time being.

In 1949, the gasoline tax, which had existed before the war, was reinstated to secure general postwar financial resources. In 1954, the gasoline tax was designated as a specific revenue source for road construction (hereinafter referred to as the road specific revenue source), and together with the local road tax (gasoline is subject to taxation) established the following year, the entire amount was allocated to road maintenance and improvement. In addition, the gas oil delivery tax was introduced in 1956 as a local tax and specific revenue source for road construction in order to balance the tax burden between gasoline and gas oil. Thereafter, in 1974, in response to requests for securing revenue sources for road construction, etc., a provisional tax rate that was added on top of the gasoline tax and local road tax was applied, and in 1976, the provisional tax rate was applied to the gas oil delivery tax as well. These provisional tax rates were subsequently raised to secure the financial resources needed for road construction and

maintenance. Consequently, the tax rate for petroleum taxes reached a level much higher than the regular tax rates.

At the time when the consumption tax was introduced in 1989, adjustment measures with the existing individual indirect taxes (e.g., double taxation on consumption tax to be abolished by being absorbing into consumption tax, or the duplicate consumption tax portion to be reduced while maintaining the double taxation) were taken, in order to not increase the tax burden on consumers. However, the petroleum tax burden was neither abolished nor reduced on the grounds that those taxes were used as the road specific revenue source. Therefore, the consumption tax portion was added to the sales price of fuel in which petroleum taxes were included as simple double taxation and deferred. In 2009, though the road specific revenue source system was abolished (incorporated into a general revenue source), no specific adjustment measures were taken with regard to the consumption tax and petroleum taxes (the local road tax was renamed the local gasoline tax). The provisional tax rates were abolished in April 2010, but the existing provisional tax level was to be maintained for the time being.

**Fig.3-6 Tax Rate of Gasoline Tax and Gas Oil Delivery Tax**

		Basic Tax Rate (a)	Special Provisions for Tax Rate (b)	Additional amount (b-a)
Gasoline Tax	Gasoline Tax Local Gasoline Tax	24,300 yen/kl 4,400 yen/kl	48,600 yen/kl 5,200 yen/kl	24,300 yen/kl 800 yen/kl
	Total	28,700 yen/kl	53,800 yen/kl	25,100 yen/kl
Gas Oil Delivery Tax		15,000 yen/kl	32,100 yen/kl	17,100 yen/kl



## 1. Supply and Demand of Energy

Final domestic energy consumption in FY2022 was 306 million kℓ Crude Oil Equivalent (COE), a 3.3% decrease year-over-year (YOY). Broken down by energy source, petroleum consumption was 143 million kℓ COE, a decrease of 2.5% YOY.

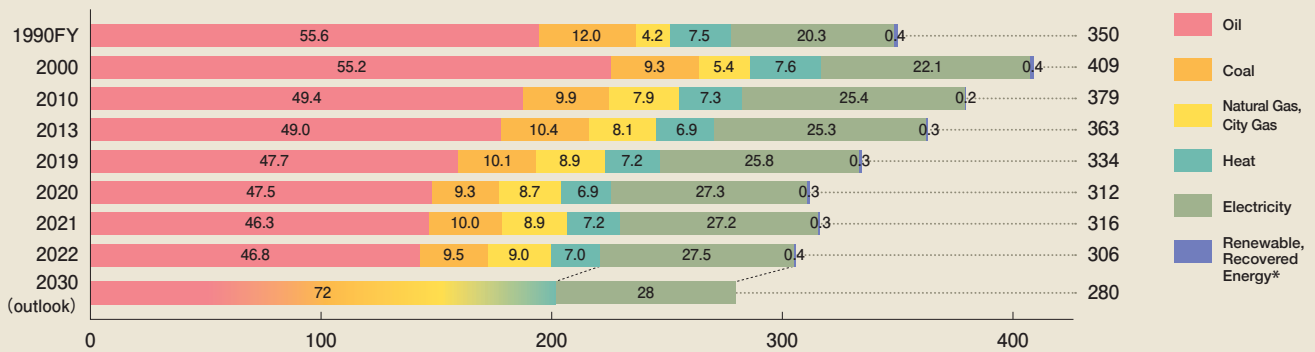
Domestic primary energy supply was 473 million kℓ COE, decrease of 2.1% YOY. Of this amount, petroleum supply was 171 million kℓ COE, a decrease of 2.1%

YOY, with its share of the total energy supply being 36.1%, the same level compared with the previous fiscal year.

The amount of electric power generated was 1,011 billion kWh, a decrease of 2.2% YOY. The proportion of the power supply configuration accounted for by oil-fired thermal power generation was 8.2%, a YOY increase.

**Fig.4-1 Changes in Final Energy Consumption**

Unit: %, million kℓ Crude oil equivalent(COE)

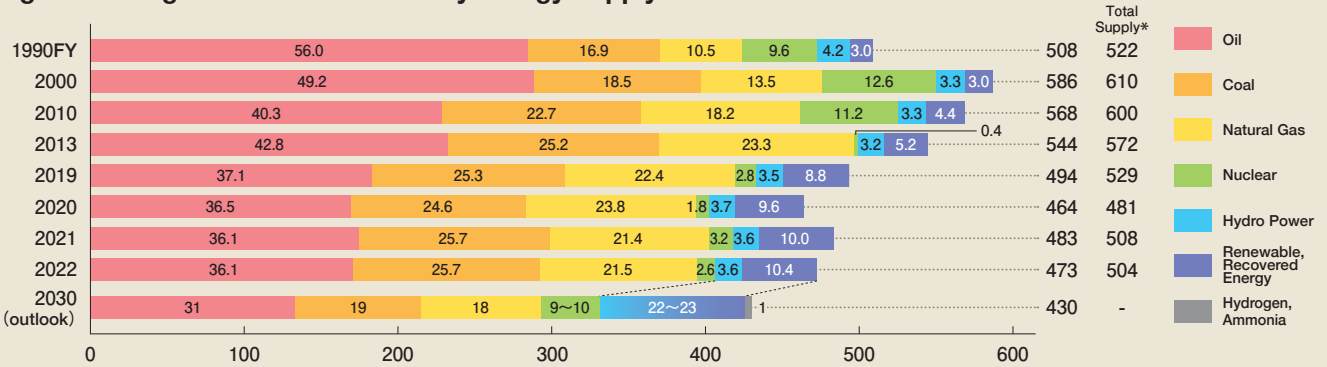


\* Effective recovery use of wasted energy

Source: METI

**Fig.4-2 Changes in Domestic Primary Energy Supply**

Unit: %, million kℓ Crude oil equivalent(COE)

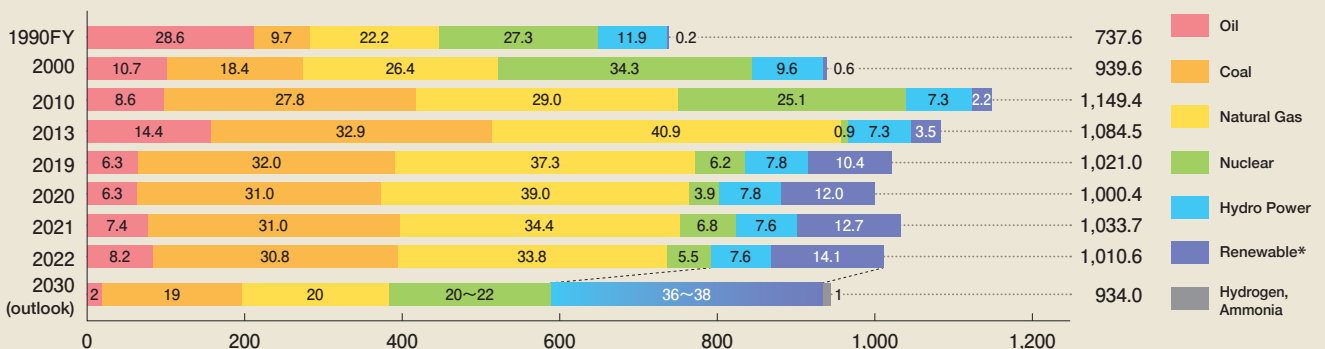


\*Primary Domestic Energy Supply is total supply minus exports and changes in inventories

Source: METI

**Fig.4-3 Changes in Generated Electric Energy by Power Source**

Unit: %, billion kWh

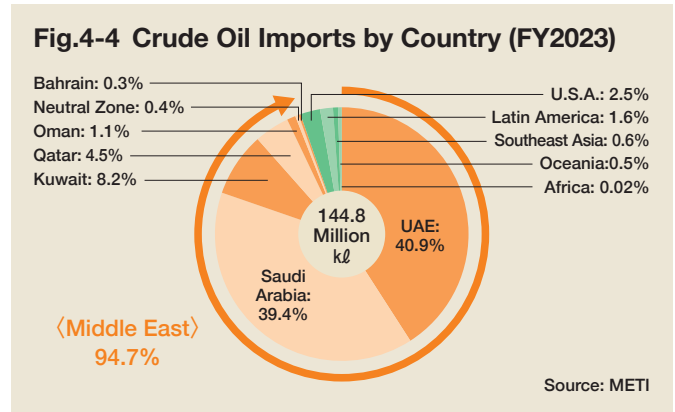


\* Solar, Wind, Geothermal and Biomass

Source: METI, FEPC (Federation of Electric Power Companies)

## 2. Crude Oil Imports

Japan imported 144.8 million kl of crude oil in FY2023, a decrease of 7.5% YOY. The crude oil import volume by region showed that Middle Eastern oil producing countries accounted for 94.7%. The countries from which Japan imported crude oil, shown in order of volume, were the United Arab Emirates (40.9% of total imports), Saudi Arabia (39.4%), Kuwait (8.2%), and Qatar (4.5%). The top two countries accounted for approximately 80% and the four countries accounted for more than 90% of Japan’s total crude oil imports.

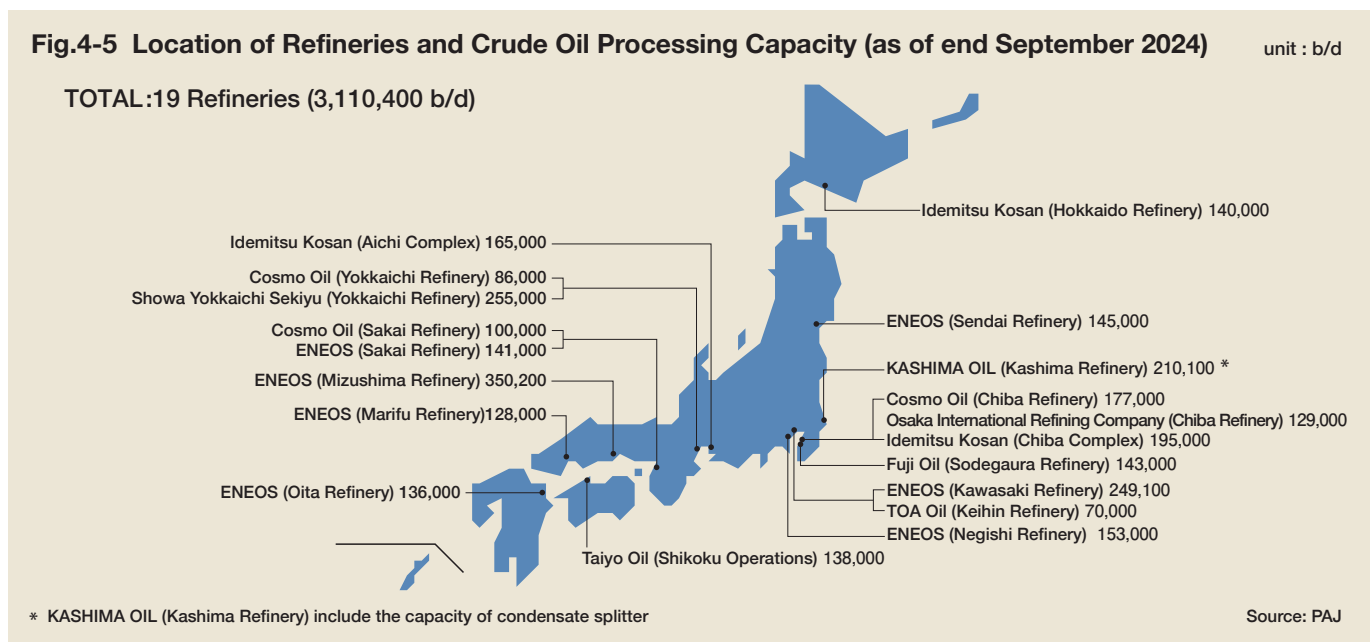


## 3. Petroleum Supply System in Japan

One method used for supplying petroleum products is to import petroleum products themselves, and another method is to import crude oil and refine it domestically to produce petroleum products (refining oil in the consumption locale method). Refining oil in the consumption locale is the principal method used in Japan. This method has many advantages, such as making it possible to reduce procurement costs by importing a massive amount of crude oil using very large tankers, to adjust the production proportion of petroleum products to a certain degree in line with the domestic demand structure, to easily adjust product quality to comply with domestic environmental standards, and to be in a favorable position to respond to emergencies.

As the domestic crude oil output in Japan in FY2023 was 392 thousand kl, which represents only 0.3% or the equivalent of about one day’s worth of the 145 million kl of Japan’s crude oil processing volume, almost all of Japan’s crude oil is imported from overseas. Consequently, all of Japan’s refineries are located in coastal areas. As of the end of September 2024, a total of 19 refineries have a crude oil processing capacity of 3.11 million barrels (495 thousand kl) per day.

Together with the continuing decline in demand for petroleum products, the number of refineries and the crude oil processing capacity are also on a downward trend.



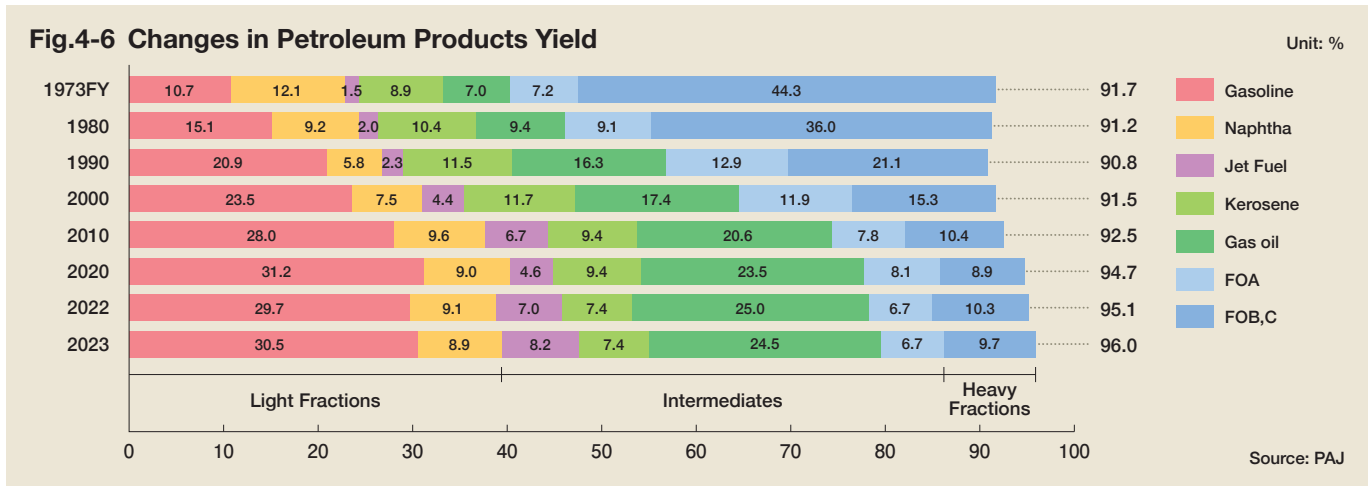
### 4. Production of Petroleum Products

The principal crude oil refining processes, from the processing of crude oil at the refinery to the production of petroleum products, involve (1) “distillation” to separate the raw material into various components by using different boiling points, (2) “desulfurization” to remove sulfuric components from the raw material, (3) “cracking” to convert the raw material to a lighter (lighter molecule) structure, and (4) “reforming” to change the chemical bonding of the crude oil.

Petroleum has the characteristic of producing “co-products,” in other words, producing multiple products (gasoline, kerosene, gas oil, heavy fuel oil, etc.) at the same time from crude oil, with each product being produced in certain proportions (yield), and it is

impossible to produce only a specific product from crude oil. Recently, on the other hand, in terms of demand, the proportion of so-called “white oil,” such as gasoline, kerosene, and gas oil, is increasing. Consequently, efforts are being made to deal with changes in demand by selecting lighter crude oil and cracking heavy oil for use as the base material for gasoline, kerosene, etc.

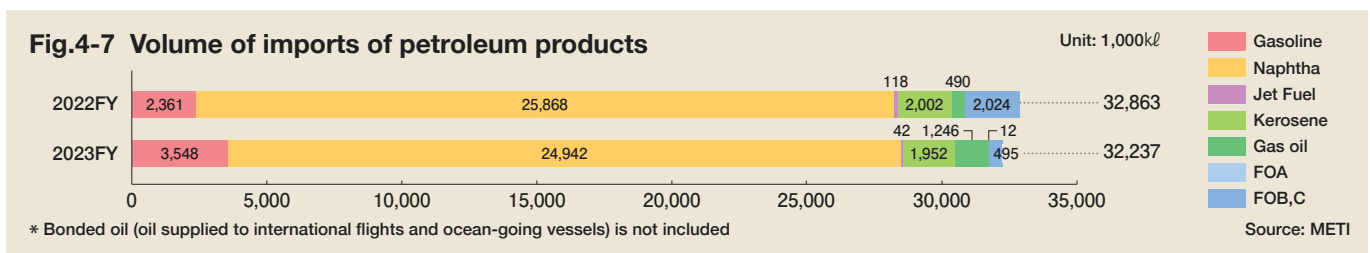
Production of petroleum products (fuel oil) in FY2023 was 141 million kl, a decrease of 6.2% YOY. The production yields were about 39% for the light fractions, about 47% for four intermediate products, and about 10% for heavy fractions, with the total production of fuel oil amounting to approximately 96%.



### 5. Import of Petroleum Products

In Japan, where refining oil in the consumption locale is the principal method used, the import of petroleum products plays a supplementary role, with imports primarily from South Korea and other neighboring countries in Asia being carried out as needed. However, naphtha is an exception, and Japanese petrochemical companies import their own naphtha as a raw material for petrochemical products, such as ethylene, from

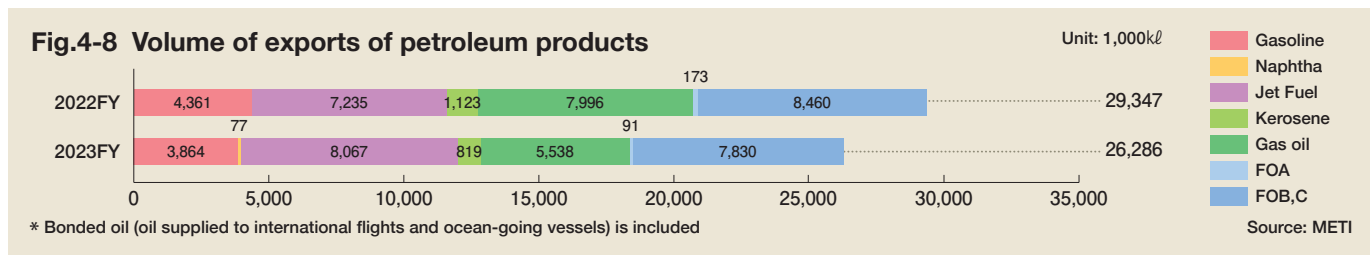
various countries. For this reason, approximately 70% of domestic demand is covered by imports, making naphtha far and away the largest imported petroleum product. Moreover, jet fuel and heavy fuel oil, etc., that are imported (bonded import) for refueling aircraft flying international routes and ocean-going vessels are not included in the volume of aforementioned imported products.



## 6. Export of Petroleum Products

As for the quantity of exports of petroleum products broken down by fuel product, jet fuel, heavy fuel oil B and heavy fuel oil C, and diesel fuel account for large proportions. This is because the volume of jet fuel supplied domestically to international flights and heavy fuel oil produced in Japan that is supplied to ocean-going vessels are considered to be exports (bonded exports). Regarding the stable supply of jet fuel to

international flights, there are various issues over the entire supply chain, such as a transportation system from refineries and refueling systems at airports. The petroleum industry is making every possible effort to secure the necessary volume of aviation fuel by engaging in imports as needed, while continuing to make domestic production its base.

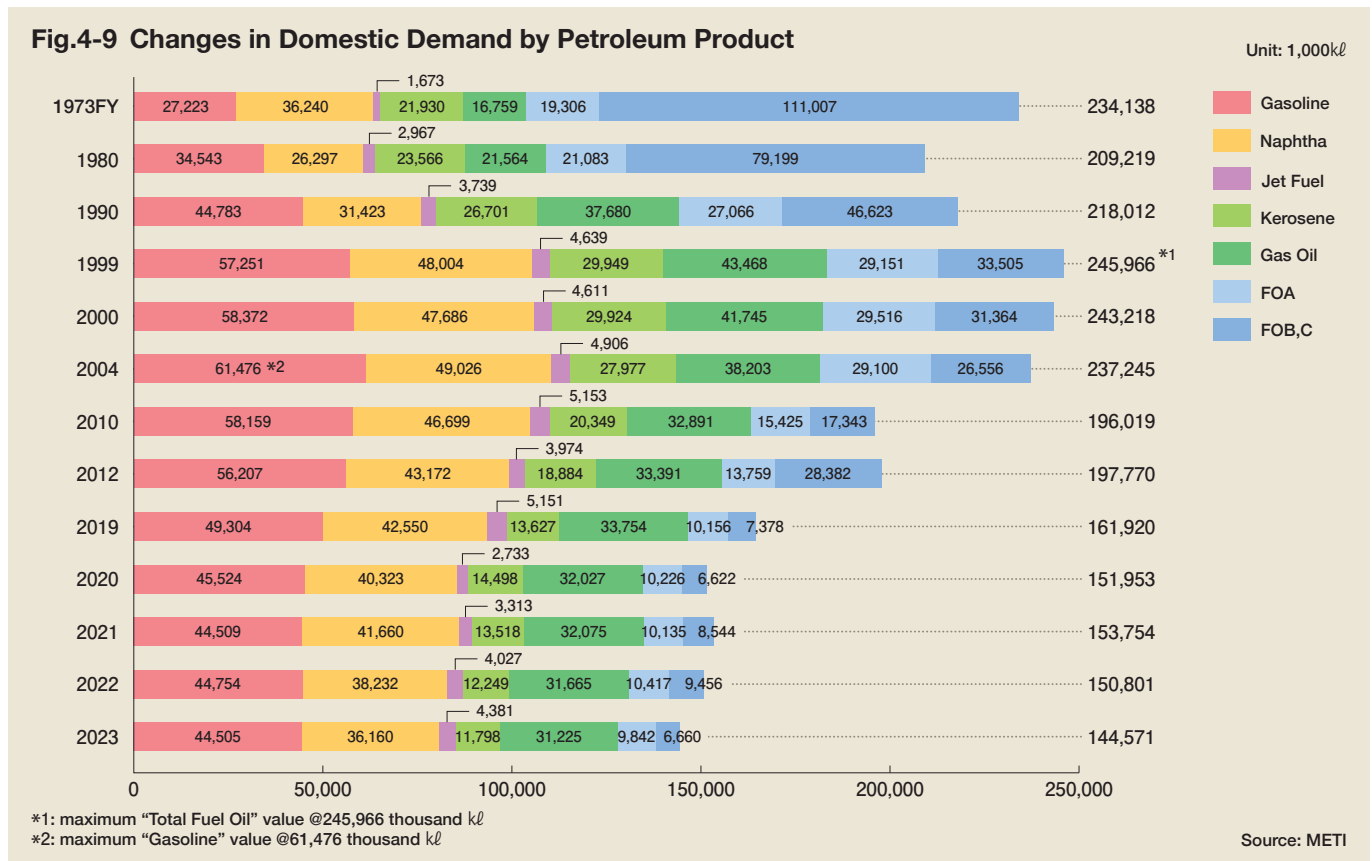


## 7. Demand for Petroleum Products

Of the total demand for oil in FY2023, fuel oil incurred a decrease of 4.1% YOY to 144.6 million kl.

Due to such factors as a declining population, advances in energy saving technologies, improvement of

fuel efficiency, and promotion of fuel conversion, the demand for petroleum products is in decline. Demand has fallen 41% from its peak in FY1999 and is expected to continue to decrease going forward.



## 8. Petroleum Logistics in Japan

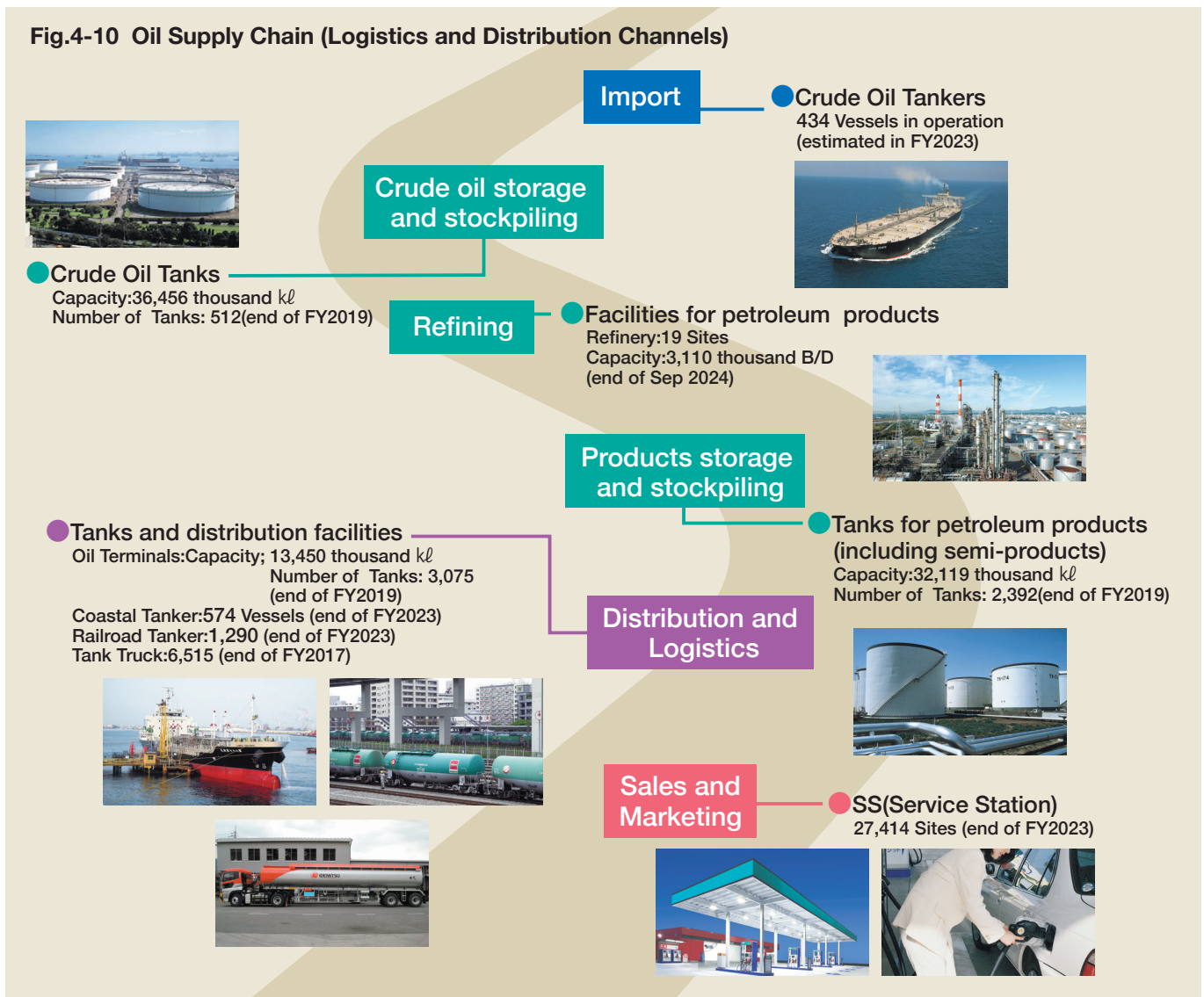
Petroleum products that have been produced at refineries are delivered to users or service stations (SS), which are sales offices, either directly from the refineries or from oil terminals, which are transshipment stations. The delivery methods employed to deliver the petroleum products include coastal tankers, railroad tank cars, tank trucks, etc., depending on the location of the delivery destination, the handling volume, and the transportation distance, etc.

A coastal tanker is used for marine transportation between seaside districts in order to transship oil from a refinery to an oil terminal, or delivering oil directly from a refinery or an oil terminal to users. This method is excellent for large-volume and long-distance transportation. The amount transported by one tanker is about 1,000 to 7,000 kℓ.

Railway transportation, which is used to transship oil from seaside refineries to oil terminals in inland areas by trains made up of special freight wagons called railroad tank cars, makes it possible to transport vast quantities of petroleum products at one time to inland areas. The amount transported by one railroad tank car is about 60 kℓ, and about 1,200 kℓ by one train.

A tank truck is used to deliver oil from refineries or oil depots to SS and users. The amount transported by one vehicle is about 20 kℓ, which is less than the amount transported by coastal tankers or railroad tank cars, but tank truck transportation has the distinct advantages of being superior in terms of mobility and flexibility.

Thus, various means of transportation are used to deliver oil to consumers.





## 9. Changes in the Business Environment Surrounding Service Stations (SS)

Domestic gasoline sales volume is showing a downward trend due to structural factors, such as population decline and improved fuel efficiency of vehicles. Moreover, an increase in next-generation vehicles, such as electric vehicles (EV), plug-in hybrid vehicles (PHV), and fuel cell vehicles (FCV), are seen as factors for a further decline in gasoline sales in the future. With fierce market competition due to declining petroleum fuel demand and the heavy burden of measures against accidental oil spills from underground tanks (UGT), the number of SS peaked at 60,421 at the end of March 1995, but has continuously declined, falling to 27,414 at the end of March 2024. The Agency for Natural Resources and Energy (ANRE) under METI surveyed the number of “SS depopulated areas” where there were three or fewer SS in a single municipality, and found that there were 358 municipalities at the end of March 2023, an increase of five from the end of the previous fiscal year.

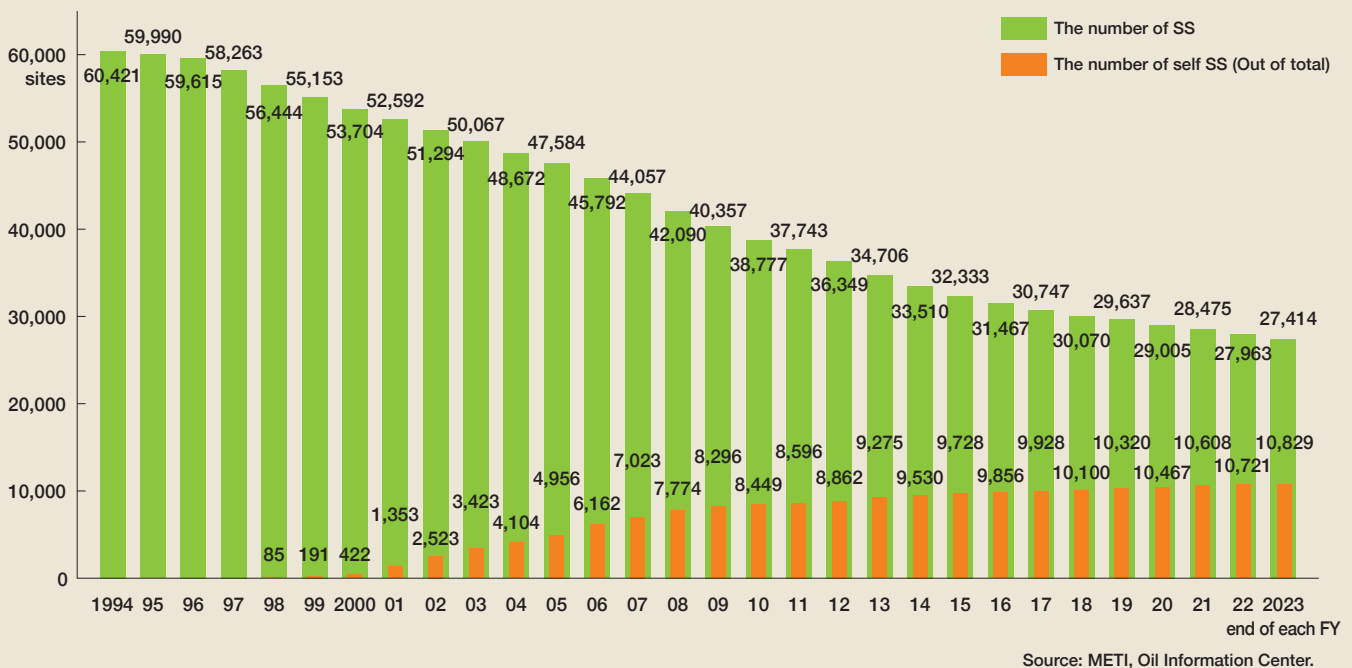
While the number of SS is decreasing, attention is turned to SS every time a big natural disaster occurs, because SS serve as bases for supplying fuel. The Kumamoto Earthquake of April 2016 prompted the government to promote the establishment of “Local Community SS,” which has private power generating equipment so that fuel can continue to be provided to

local residents in the disaster-stricken area, even during a power outage, for as long as possible. As of the end of August 2024, there were 14,318 Local Community SS, which is more than half of all the SS in the country.

On the other hand, deregulation brought about the introduction of manned self-service SS, where SS attendants with certain qualifications oversee how refueling is being done by drivers. Since the introduction of this system in April 1998, it has become possible to carry out operations at such SS more efficiently than full-service SS, with the number of manned self-service SS increasing to 10,829 as of the end of March 2024, accounting for approximately 40% of the total number of SS.

Moreover, for improved efficiency and diversification of operations at SS, it has been possible since April 2019 to conduct outdoor sales of goods, etc., at SS, and for attendants at self-service SS to use tablet devices, etc., for issuing refueling permission, etc. In addition, promoting the strengthening of added-value sales at and streamlining the management of SS in order to respond to changes in the business environment have become an issue. With regard to this, various measures are underway at SS, including the setting up of other types of businesses in SS, such as a convenience store, or handling car leasing, etc.

Fig.4-11 Changes in Service Stations (SS)



## 10. The Fuel Quality Control Act

The import of petroleum products was liberalized with the abolition of the Provisional Measures Law on the Importation of Specific Refined Petroleum Products (Fuel Import Restriction Law) at the end of March 1996. The Act on the Quality Control of Gasoline and Other Fuels (Fuel Quality Control Act) was enacted to replace the Gasoline Retail Business Law, to maintain the quality of gasoline, kerosene, and diesel fuel in Japan, where the quality is already among the highest in the world. The new act specified the existing quality standards as compulsory ones from both environmental and safety standpoints, and obliged oil refiners, distributors, and retailers to maintain such quality standards.

The act also introduced the display of a Standard Quality (SQ) certificate at service stations for fuels that satisfied the standard quality requirements.

At first, compulsory standards were specified on eight items for gasoline quality, and on three items each for diesel fuel and kerosene quality. The Fuel Quality Control Act has been amended since then, as various new importers entered the market, and new regulatory items

were added as a result of problems that were not initially envisioned and also the emergence of new eco-friendly fuels. For example, as a measure to deal with engine fires and other accidents caused by imported fuel with a high concentration of alcohol (more than 50% of the content was alcohol), an amendment was drawn up in August 2003 that added the two items of oxygen content (1.3 mass percent or less) and ethanol (3 mass percent or less) to compulsory standards for gasoline, and banned the sale of fuel with a high concentration of alcohol for ordinary gasoline-powered vehicles.

Furthermore, as a part of preparing the environment for the use of biodiesel that are being used recently as a countermeasure for a global warming, mandatory standards for FAME (fatty acid methyl ester), triglyceride and four other materials were added to diesel fuel quality requirements, effective March 2007.

In February 2009, a registration system and quality assurance system were established for new entrants in the business of blending ethanol, ETBE, etc., with gasoline.

Fig.4-12 The Fuel Quality Control Act-Compulsory Standard

Gasoline		Diesel Fuel		Kerosene		Heavy Oil	
Items	Specification	Items	Specification	Items	Specification	Items	Specification
Lead	Non-detectable	Sulfur content	0.001 mass% max.	Sulfur content	0.008 mass% max.	Sulfur content*3	0.5 mass% max.
Sulfur content	0.001mass% max.	Cetane index	45 min.	Flash point	40°C min.	Inorganic acid	Non-detectable
MTBE	7 vol% max.	Distillation, T90%	360°C max	Color,Saybolt	+25 min.		
Benzene	1 vol% max.			Triglyceride	0.01 mass% max.		
Kerosene	4 vol% max.	FAME*2	0.1 mass% max.				
Methanol	Non-detectable						
Washed gum	5 mg/100ml max.						
Color	Orange						
Oxygen content*1	1.3 mass% max.						
Ethanol*1	3.0 vol% max.						

\*1 For an automobile that received registration by the Road Vehicle Act or its vehicle number is specified by law as a vehicle compatible with E10, gasoline specifications for both oxygen and ethanol are relaxed to 3.7 mass% and 10 vol% max, respectively.

\*2 This specification is applicable to diesel fuels without blending of FAME (Fatty Acid Methyl Ester). Compulsory standards allow FAME upper blending limit of 5.0 mass%. In such a case, additional standards include:

- Methanol: 0.01 mass% max. • Acid value: 0.13 mgKOH/g max. • Formic acid + Acetic acid + Propionic acid: 0.003 mass% max.
- Acid stability: 65 min. or more (or keep the increase in acid value to 0.12 mgKCH/g or lower by means of a prescribed testing method)

\*3 3.5 mass % max. (In case the vessel is installed with sulfur oxide removal systems)

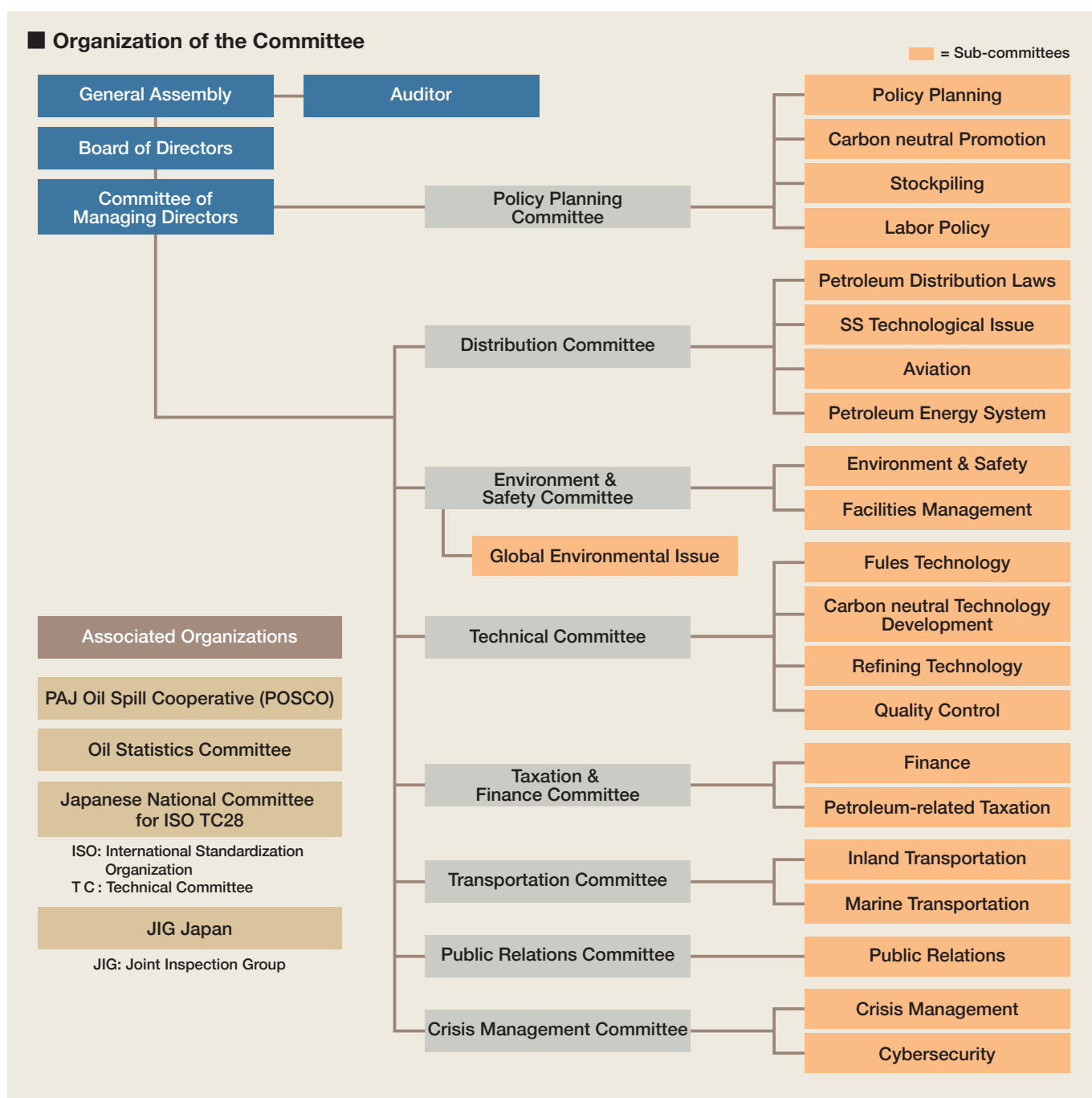
Source: METI

# Appendix Activities of Petroleum Association of Japan(PAJ)

The Petroleum Association of Japan (PAJ) was established in November 1955 as a private-sector, non-profit industry association made up of domestic petroleum refiners and primary distributors. At present, PAJ consists of ten member companies. PAJ is aiming to achieve the healthy development of the petroleum industry and contribute to the sustainable development of the national economy, primarily through the activities described below.

\* "Petroleum" referred to above includes new fuels, such as e-fuels, hydrogen, and CCUS, that have realized low carbonization or decarbonization through technology related to carbon neutrality.

1. Disseminating information and conducting PR related to petroleum
2. Expressing opinions related to the petroleum industry
3. Carrying out research and study, and statistics activities related to petroleum
4. Carrying out research and study activities on the effects of petroleum on climate change issues and on carbon neutrality
5. Undertaking government-subsidized programs, such as the "Major Oil Spill Response Program"
6. Improving communication among member companies to cultivate a sense of community
7. In addition, carrying out programs that lead to achieving the objectives of PAJ





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