Petroleum Industry in Japan 2025

Petroleum Association of Japan Fuel+

Preface

This brochure, *Petroleum Industry in Japan*, has been issued annually 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 petroleum 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 (revised in December 2022), 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 2025

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

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

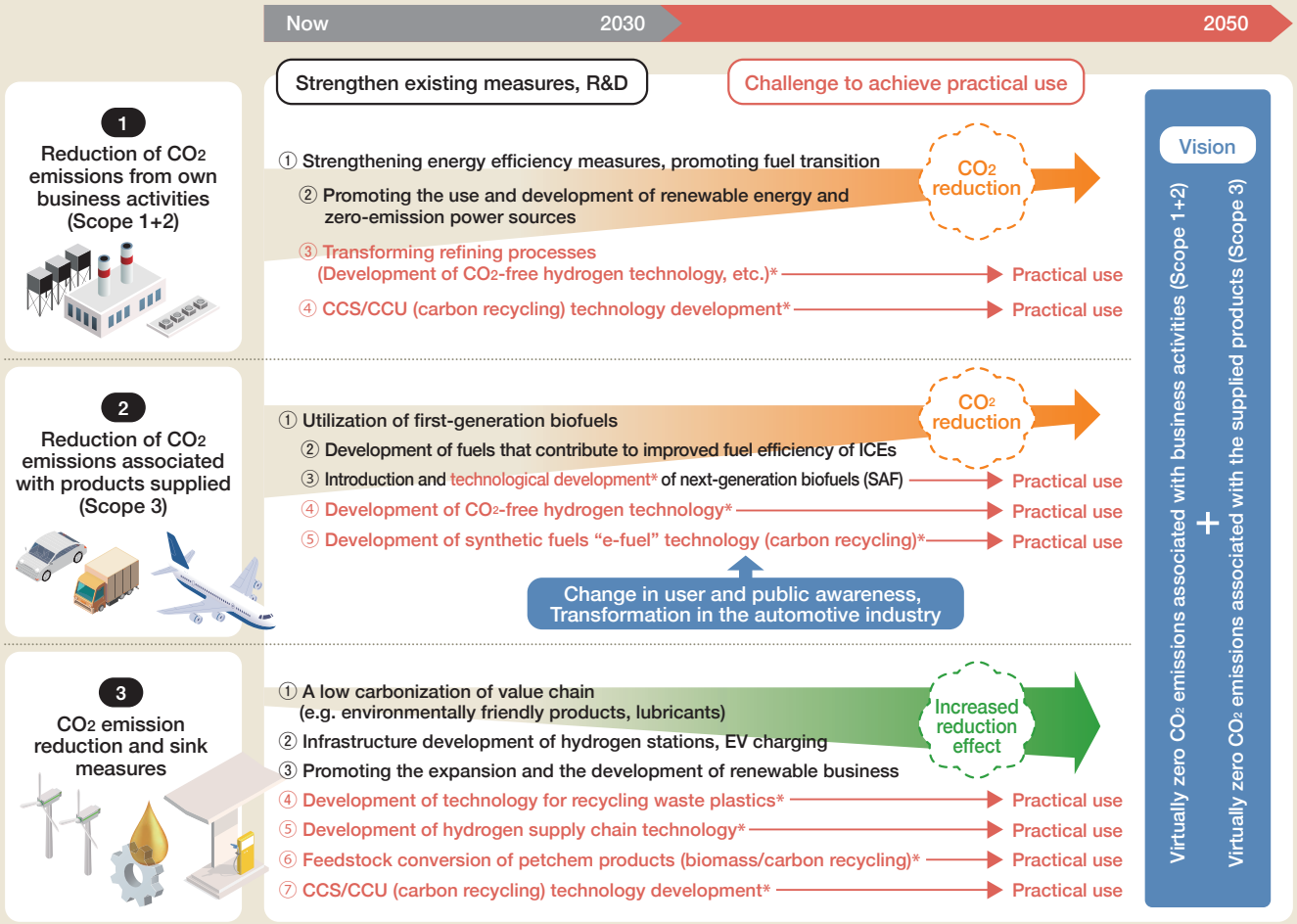
In October 2020, the Japanese government declared that Japan would realize "Carbon Neutrality by 2050." In response to this, the Petroleum Association of Japan (PAJ) renewed its "Long-term Low Carbon Vision for the Petroleum Industry" in 2019, and newly formulated the "Petroleum Industry's Vision toward 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_2 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_2 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_2-free hydrogen, and the carbon recycle (CCS and CCU), and subsequently put them into societal implementation by 2050.

In addition, as measures for CO_2 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



Scope 1: Direct greenhouse gas emissions by businesses themselves (Fuel combustion, Industrial process)
Scope 2: Indirect emissions from the use of externally supplied energy, e.g. electricity, thermal or steam, etc..
Scope 3: Indirect emissions in the supply chain outside of Scope 1,2 (Emissions of others)

*Innovative technology
Practical use includes e.g. global deployment

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.

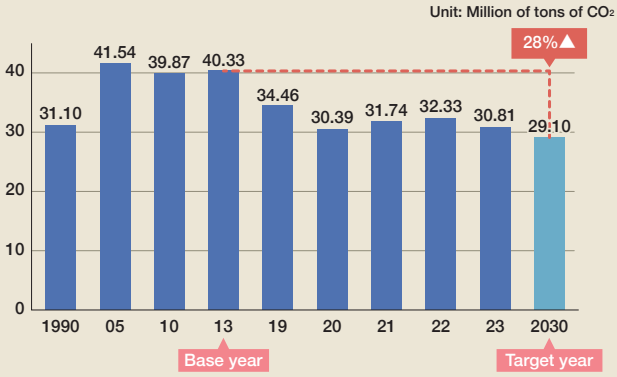
These efforts were followed in 2010 by the formulation of the "Petroleum Industry's Action Plan for a Low Carbon Society," announcing the goal to "achieve an energy saving volume of 530,000 kℓ of crude oil equivalents (volume from energy saving measures) at refineries by the end of FY2020 through energy 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 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_2 emissions, in order for its numerical targets to conform with the national targets.

At present, the target is "to realize total volume of CO_2 emissions of 29.10 million tons for 2030 (28% reduction compared with FY2013). Total volume of CO_2 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%).

Fig.1-2 Volume of CO_2 Emissions at Refineries



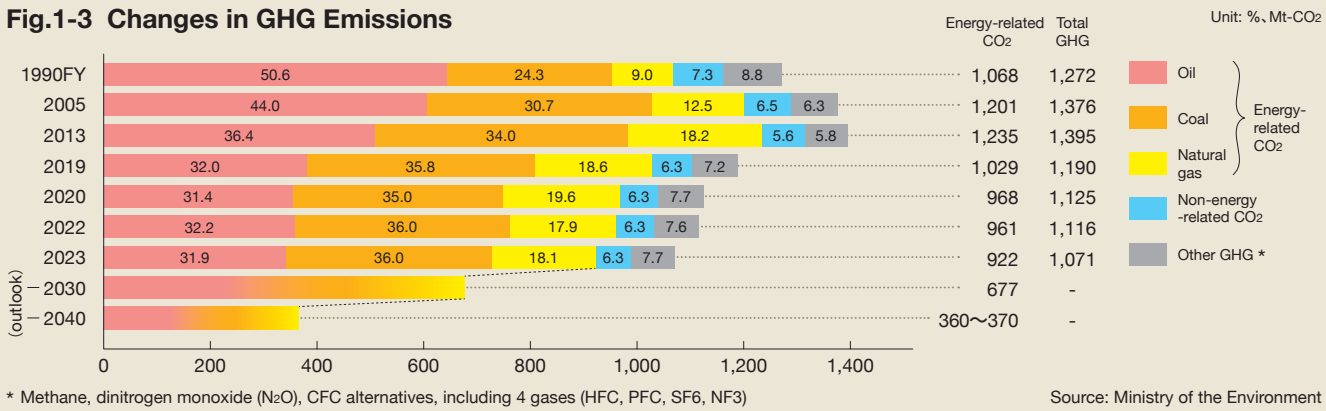
* Actual results based on electricity emissions factor afer reflecting carbon credits

Source: PAJ

3. Changes in GHG emissions

The quantity of greenhouse gas (GHG) emissions in Japan was approximately 1,071 million tons of CO_2 (actual FY2023 figures of CO_2 equivalent), with energy related CO_2 accounting for over 90 percent of these CO_2 emissions. Energy related CO_2 emissions for FY2023 was 922 million tons, which was a decrease of 4.1% YOY, and a 25% decrease compared to the most recent peak in FY2013. While CO_2 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.

Fig.1-3 Changes in GHG Emissions



* Methane, dinitrogen monoxide (N_2O), CFC alternatives, including 4 gases (HFC, PFC, SF6, NF3)

Source: Ministry of the Environment

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_2. 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_2 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.

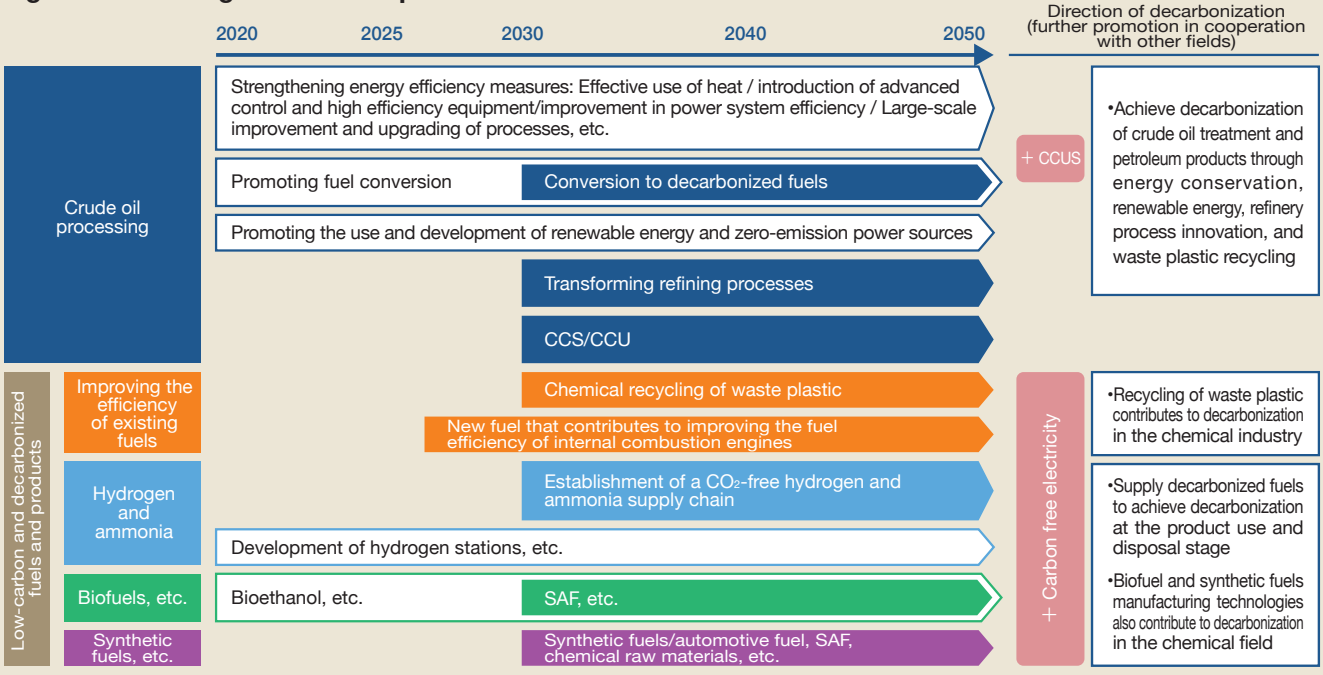
Oil companies are also establishing plans that conform to the roadmap and raising funds that utilize transition financing, with the aim of transforming their business portfolio, and engaging in efforts to realize carbon neutrality.

Fig.1-4 Direction toward CN in Roadmap for Oil Sector

Source of emissions	Crude oil processing	Product combustion
Overview	Emissions from use of heat during petroleum refining, and electric power self-generation, etc.	Emissions from combustion of petroleum products produced by the petroleum industry
Percentage of emissions*	Approx. 4%	Approx. 93%
Path of technologies towards CN	• Strengthening energy efficiency measures • Promoting fuel conversion • Conversion to decarbonized fuels • Use renewable energy and zero emission power sources • Reform of the refining process • CCS・CCU etc.	• Improve and increase efficiency of existing fuels (recycling of waste plastic / development of fuels that contribute to improved fuel efficiency of ICEs) • Conversion to low-carbon and decarbonized fuels (hydrogen and ammonia / biofuels /SAF / synthetic fuels, etc.)

* Proportion accounted for by CO_2 emitted from oil (emissions related to transportation, extraction, etc., are excluded from this Roadmap)
Source: Based on "Roadmap for Transition Finance in Oil Sector," METI

Fig.1-5 Technological Road Map in Oil Sector



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

5. Utilization of Biofuels

As biofuels (fuels derived from biomass) can be produced from renewable materials, such as agricultural crops and trees, the quantity of CO_2 emissions generated when they are combusted is not counted, and are considered to be a form of energy that is effective as a global warming measure. In April 2005, implementation targets for biofuels used in transportation were set at 500,000 kℓ of crude oil equivalents at the Kyoto Protocol Target Achievement Plan and approved at a Cabinet meeting.

Based on a request from 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 with gasoline as ETBE in FY2010." After the test marketing of bio-gasoline (gasoline containing ETBE, ethyl-tertiary-butyl-ether derived from bio-ethanol) in FY2007 and FY2008, introduction of ETBE was begun.

With regard to the "Criteria for Use of Non-fossil Energy Sources" (First Ministerial Notice) in the Law Concerning Sophisticated Methods of Energy Supply Structures, which was established in November 2010, it was stipulated that 820,000 kℓ of bio-ethanol, which is equivalent to 500,000 kℓ of crude equivalents, would be blended with gasoline for use as automobile fuel in FY2017, with the introduction target volume for each fiscal year set in stages. The petroleum industry has been steadily achieving this target using the bio-ETBE method.

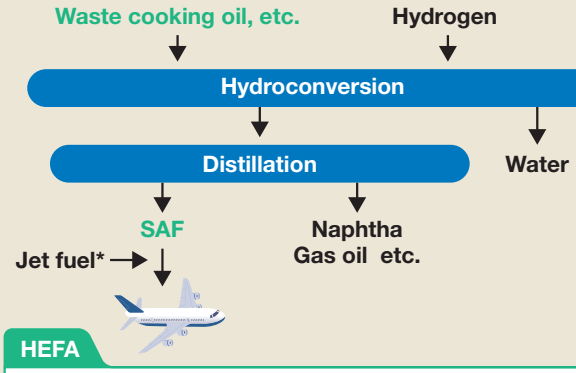
The "Technical Review Committee for the Utilization of Biofuels in Japan" was established in December 2017, in order to compile the basic approach for the formulation of criteria for FY2018 and beyond. Regarding the issues of the complete dependence on imports, relatively high raw material cost, and in consideration of competition with food, the committee indicated its stance that the period for the next criteria would be a "transitional period," in which the building of a system for the full-scale introduction of cost-effective, eco-efficient bio-ethanol (domestic production and next generation) should be the government's top priority from the perspective of the 3E (Energy security, Environmental concern and Efficient supply).

It was stipulated in the 7th SEP, which was decided at a meeting of the Cabinet in February 2025, that efforts would be made to begin supplying gasoline that was equivalent to E10 by FY2030 and raise the target of gasoline equivalent to E20 from FY2040.

6. Introduction of Sustainable Aviation Fuel (SAF)

With regard to jet fuel, in December 2021, the Ministry of Land, Infrastructure, Transport and Tourism set a goal of "replacing 10% of jet fuel used by Japanese airlines with sustainable aviation fuel (SAF) by 2030." In the petroleum industry, as well, initiatives are underway to build a system capable of stable production of SAF domestically, with the aim of realizing the 2030 goal. Operations began at a SAF mass production plant in April 2025 to provide a supply of domestically produced SAF to passenger planes. This is done by processing waste cooking oil into jet fuel by using a HEFA-based* manufacturing technology. Moreover, the SAF manufacturing technology is a method that also converts AtJ (Alcohol to Jet), a sugar source, into ethanol, etc. for producing fuel.

Fig.1-6 SAF production process through HEFA (Overview)



* In accordance with international standards, it is possible for SAF to be a blend of 50% conventional jet fuel

* HEFA: Hydro processed Esters and Fatty Acids

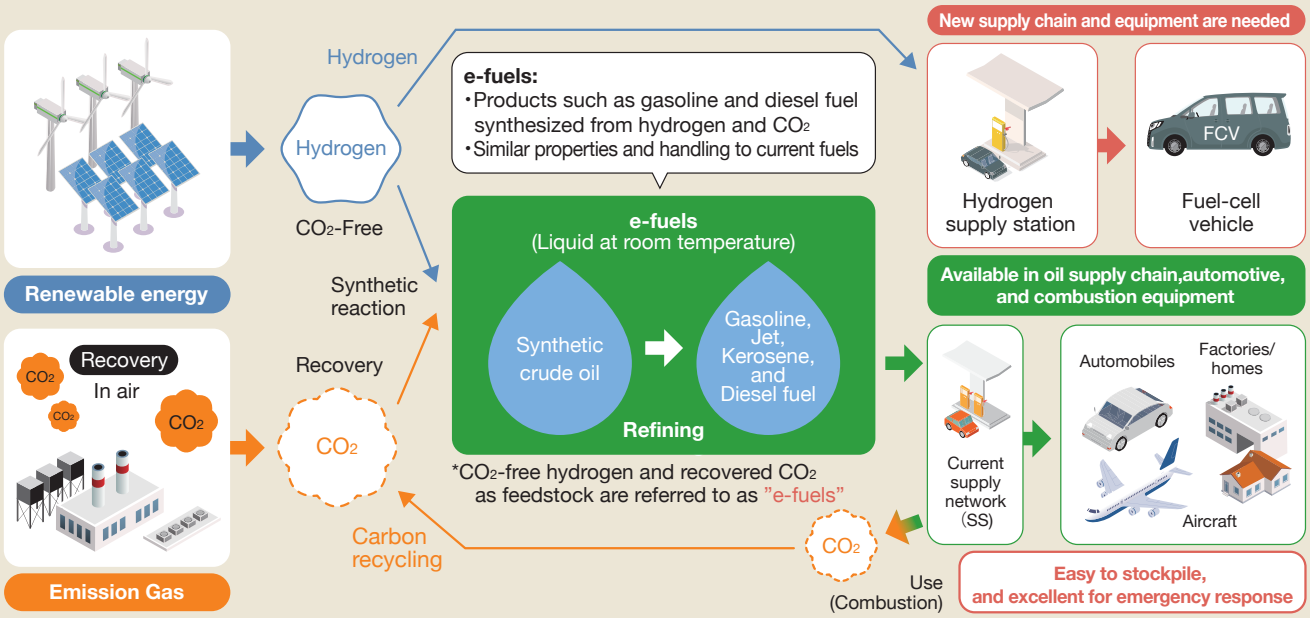
7. Key Features of Synthetic Fuels

Synthetic fuels (e-fuels) is a fuel made by combining CO_2 and hydrogen. It is a clean fuel that can be used without increasing atmospheric CO_2 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.

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_2-free hydrogen and recovered CO_2.

Fig.1-7 Key Features of Synthetic Fuels (e-fuels)

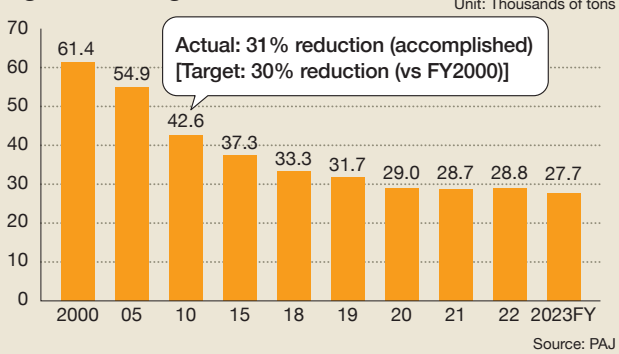


8. Controlling VOC (Volatile Organic Compounds) Emissions

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 FY2023 totaled 27,700 tons, a 55% reduction compared with FY2000.

Fig.1-8 Changes in VOC Emissions



Chapter 2

Security and Resilience Measures in the Japanese Petroleum Industry

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

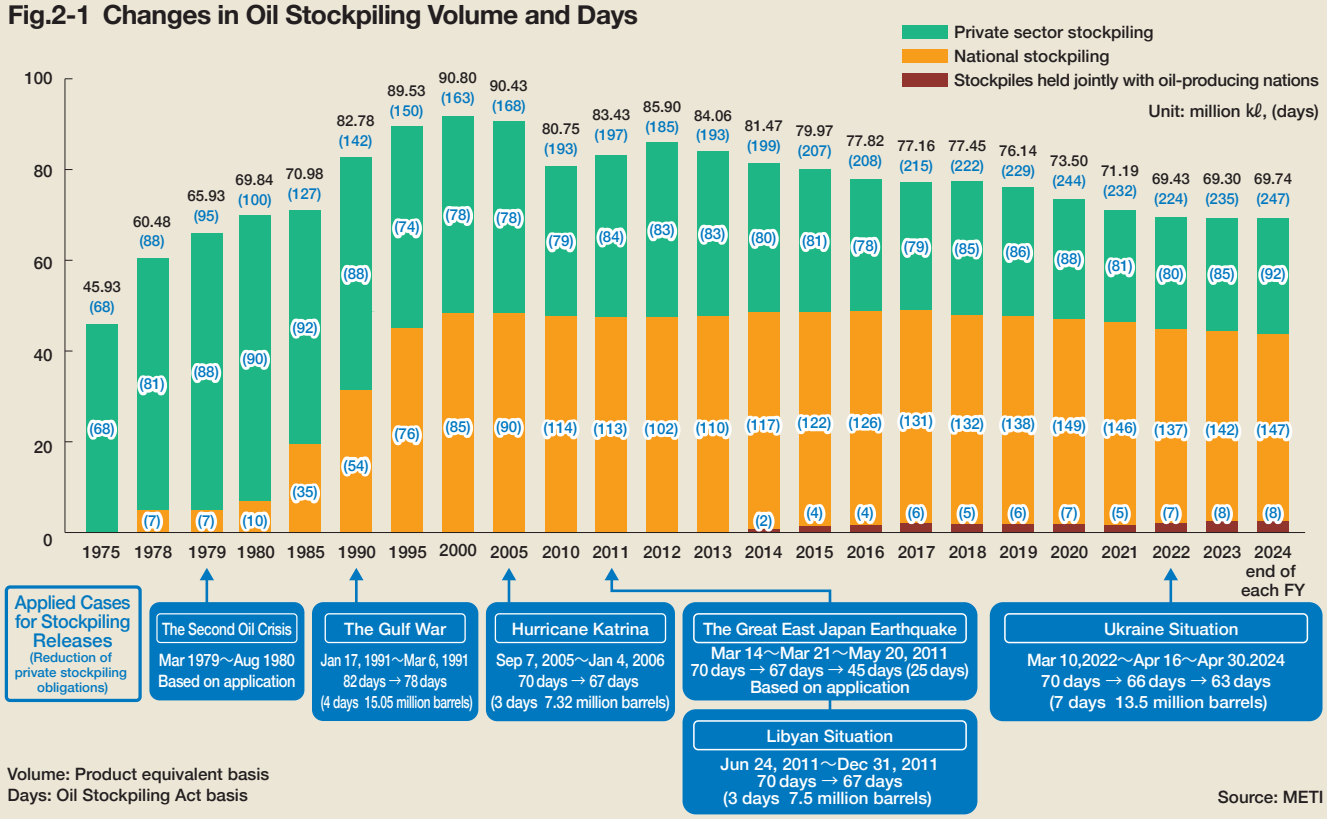
② Clarification of the provisions concerning a release order of government oil stockpiles by the Minister of Economy, Trade and Industry (METI)

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

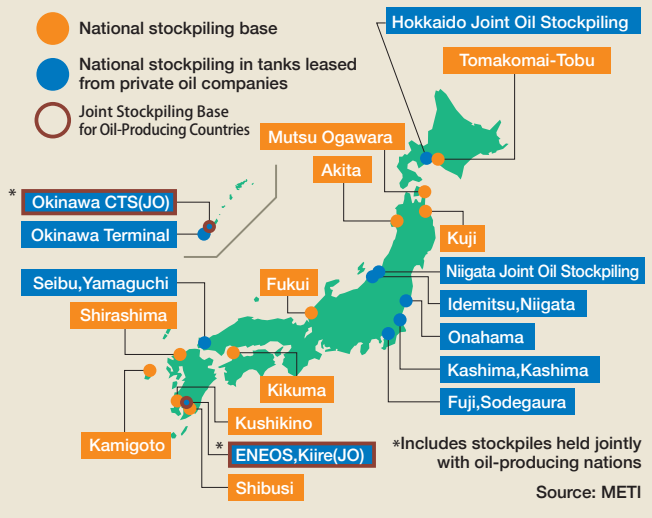


Fig.2-3 Current Status of Oil Stockpiling in Japan (as of Apr 2025)

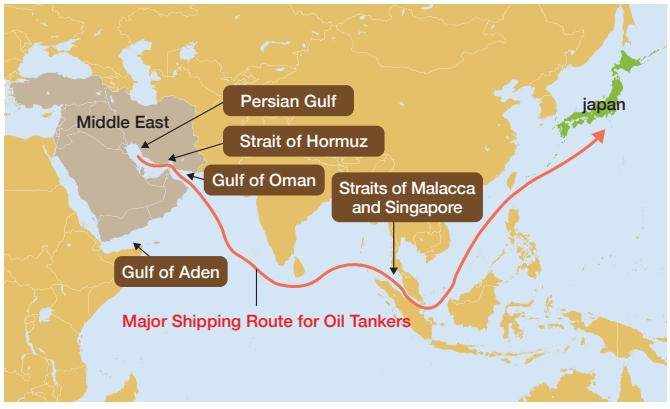
	Private sector stockpiling	National stockpiling	Stockpiles held jointly with oil-producing nations
Stockpiling Target	70 days of domestic demand	90days of net import	(Half can be counted as part of the national stockpile)
Stockpiling Quantity	95 days 26.60 million kℓ	147 days 41.25 million kℓ	9 days 2.64 million kℓ
Composition	Crude oil : 43% Oil products: 57%	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	National oil stockpiling bases (crude oil only) Private sector tanks (leased) at refineries and oil terminals, etc.	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)	①Prompt supply to distribution markets as a large part of stockpiles are held at refineries and oil terminals ②Flexible release of stockpiles depending on crude procurement status and seasonal demand fluctuation	①Strong psychological effect on the market when the government announces its decision to release its stockpiling to increase oil supply in the market ②Crude oil has to be transported from the stockpile sites to refineries ③Oil products are stockpiled in private tanks at refineries, etc., and can be supplied promptly	①Private 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 ②Crude oil has to be transported from the stockpile sites to refineries
Cases of Stockpile Release (Reduction)	①2nd Oil Crisis (Mar 1979~Aug 1980) ②Gulf Crisis (Jan~Mar 1991) ③Hurricane Katrina aftermath (Sep 2005~Jan 2006) ④The Great East Japan Earthquake (Mar~May 2011) ⑤Libyan situation (Jun~Dec 2011) ⑥Ukraine situation (Mar 2022~Apr 2024)	①Ukraine 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 securing supply inventory at the time of the Great East Japan Earthquake

- ○ Strengthened production system of refineries that were in operation (expansion of capabilities and raising operation rate)
- ○ Secured inventory by reducing private-sector oil stockpiling (25 days ≒10.5 million kℓ)
- ○ Carried out emergency import of petroleum products and halted exports (increase supply domestically)
- ○ Transshipped (coastal tankers) petroleum products from western Japan and Hokkaido to disaster-stricken areas
- ○ Tank trucks from western Japan were deployed to the disaster-stricken areas (temporary deployment of approx. 300 vehicles)
- ○ Implemented cooperation system at all companies in the disaster-stricken areas (joint use of oil terminals)
- ○ PR activities, such as providing information about the operation of SS at the disaster-stricken areas, etc., to reduce psychological anxiety of consumers in disaster-stricken areas

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.

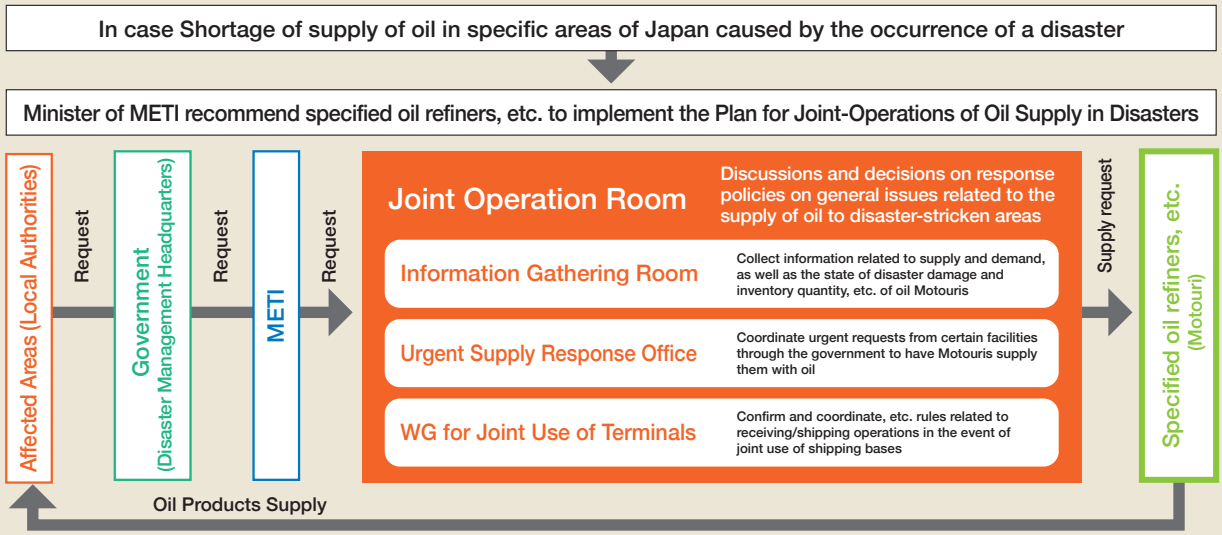
As preliminary preparation for responding quickly and smoothly to urgent requests for supply from areas affected by a disaster in the future, PAJ has been implementing initiatives since 2012 to share in advance necessary information about fuel supply with key facilities designated by prefectures, etc. 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.

Fig.2-6 Outline of the Plan for Joint-Operations of Oil Supply in Disasters



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, and the new system went into effect from December 2023.

Chapter 3

Energy Policies and Taxes Related to the Japanese Petroleum Industry

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 on 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).

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

Jul '62	Enactment of Petroleum Industry Law	
Dec '73	Enforcement of two laws for emergency responses	
Apr '76	Enactment of Petroleum Reserve Law	
May '77	Enactment of Gasoline Retail Business Law	
Jan '86	Enactment of Provisional Measures Law on Importation of Specific Refined Petroleum Products (Fuel Import Restriction Law)	
Jul '87	Automatic Approval for Installation of Product Upgrading Facilities	1st Phase Deregulation
Mar '89	Abolition of Guidance on Gasoline Production Quota	
Oct '89	Abolition of Guidance on Kerosene Inventory Build-up for Winter	
Mar '90	Abolition of Guidance on SS Construction (Scrap-and-Build Rule) and on Transfer of SS Brand between Primary Distributors	
Sep '91	Flexible Approval for Installations of Crude Processing Facilities	
Mar '92	Abolition of Guidance on Crude Processing (Throughput)	
Mar '93	Abolition of Tariff-quota System (TQ) for Heavy Fuels	
Mar '96	Repeal of Fuel Import Restriction Law (Import liberalization of fuel products)	2nd Phase Deregulation
Apr '96	Enactment of Act on Quality Control of Gasoline and Other Fuels by revising Gasoline Retail Business Law	
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	
Dec '01	Repeal of Petroleum Industry Law	

Jan '02	Enactment of New Oil Stockpiling Act
Feb '09	Partial Revision of Act on Quality Control of Gasoline and Other Fuels (Registration and Quality Assurance Obligation of Processors)
Aug '09	Act on the Promotion of Use of Non-fossil Energy Sources and Effective Use of Fossil Energy
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)
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)
Feb '11	Mandatory measures for prevention of leakage from SS underground tanks
Nov '12	Amendment of Oil Stockpiling Act
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)
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)
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)
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)
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 '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)
Dec '24	Notification of Criteria for Judgement by Oil Refiner Concerning the Efficient Utilization of Crude Oil, etc. in accordance with the Act on Sophisticated Methods of Energy Supply Structures (Raise vacuum-residue processing rate to about 8.0% by FY2028)

(NB): In addition to what is described in the chart shown above, there are other laws related to oil security, including four security laws
(Fire Service Act, High Pressure Gas Safety Act, Industrial Safety and Health Act, Act on the Prevention of Disaster in Petroleum Industrial Complexes and Other Petroleum Facilities)

2. Petroleum Industry Reorganization Movements

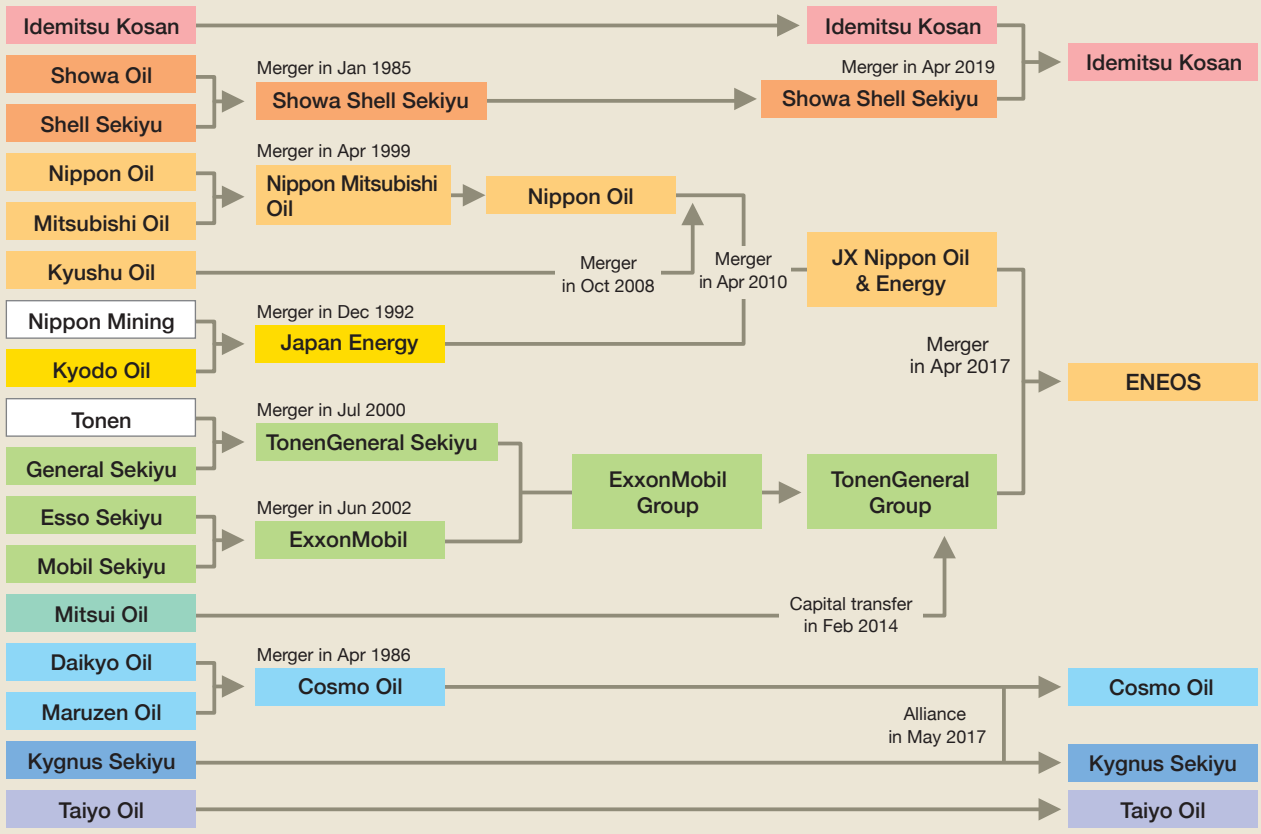
In view of the flow of global realignment of Western oil majors and fierce competition in the domestic oil market after the abolition of the Fuel Import Restriction Law, the movement toward reorganization of domestic oil refiners and primary oil distributors (Motouri) became increasingly active. In the 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*1 and TonenGeneral Sekiyu merged to form ENEOS*2. 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.

Fig.3-2 Reorganization Trends of Primary Distributors (Motouri) in Japan



3. Revisions to the Strategic Energy Plan

The Basic Act on Energy Policy, enacted in June 2002, set forth 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 stipulated the formulation of the Strategic Energy Plan (SEP), which laid out the basic direction of energy policies.

In the 4th SEP, formulated in April 2014 taking into account 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. Moreover, the importance of petroleum was recognized anew as energy that is resistant to crisis and positioned as a "last resort" energy source in times of disaster.

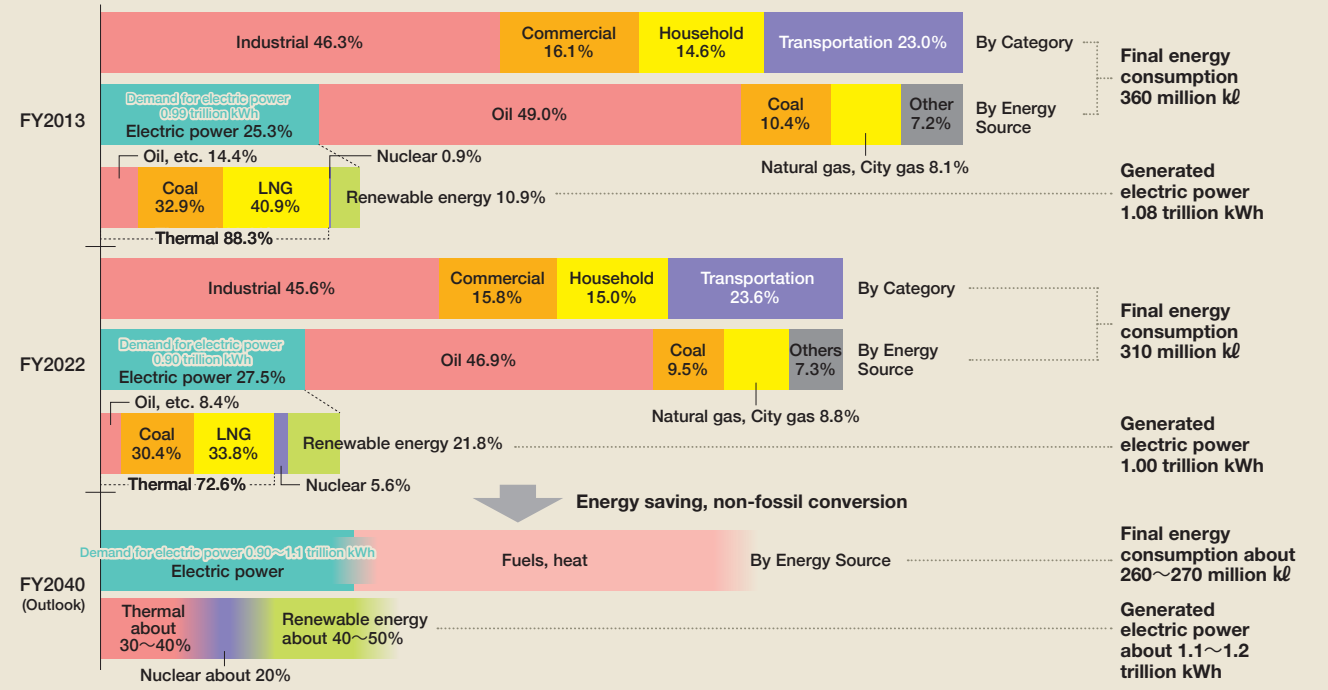
Following the adoption of the Paris Accord at COP21 (December 2015), the 5th SEP (July 2018), which was formulated with an eye toward 2050, positioned fossil fuel as "the staple until the transition to decarbonization is realized" for moving toward 2050, while maintaining the framework of the 4th SEP.

The 6th SEP (October 2021), which was formulated taking the government's decarbonization declaration into consideration, set forth a policy for securing without interruption a stable supply of necessary natural resources and fuel, while carrying forward the smooth transition to decarbonization.

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, a Cabinet meeting in February 2025 approved the latest Strategic Energy Plan, which conform to the policies of the GX2040 Vision and the greenhouse gas reduction targets for FY2040 as stipulated in the Global Warming Countermeasures Plan. In the 7th SEP, it was stated that the direction of the plan would be to support the societal implementation of next-generation fuels with the aim of realizing decarbonization, while continuing to focus on the simultaneous achievement of "S+3E" as the basic stance of the energy policy.

Amidst the decline in demand for petroleum, a policy that cites the importance of efforts for maintaining refineries and ensuring flexibility of the supply chain, and maintaining oil stockpiling levels while ensuring necessary oil refining capability domestically, has been presented to advance a realistic transition while ensuring a stable supply.

Fig.3-3 Outlook of Energy Demand in FY2040



(NB): Demand for electric power is calculated by subtracting transmission and distribution loss and on-site power consumption from the quantity of electric power generated

Source: Based on "The 7th Strategic Energy Plan" (February 2025)

4. Sophistication of Energy Supply Structure

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. 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.

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.

In May 2022, the segment stating "promotion of use of non-fossil energy sources" in the purpose of the Sophisticated Methods Act was revised to "environmentally friendly use of energy sources" (while maintaining effective use of fossil energy materials). Based on this revision, initiatives for reducing CO_2 emissions in the refining process were newly added to the evaluation indicators for the Fourth Ministerial Notice, in addition to improvements made to the residual oil processing capabilities that were 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.

Fig.3-4 Overview of Current Judgment Criteria (Fourth Ministerial Notice)

○ Relevant period
- FY2024 ～ FY2028

○ Purpose
- Raise VR(*1) processing rate
- Reduce environmental burden of refining operation

○ Definition
- VR processing rate = (VR oil throughput of specified residue oil processing units) / (Crude oil processing volume)

○ Specified residual oil processing units
- FCC (Fluid Catalytic Cracking Unit)
- RFCC (Residue Fluid Catalytic Cracking Unit)
- H–Oil (Residue Hydroconversion Unit)
- Residue Oil Pyrolysis Unit (Coker, etc.)
- Heavy Oil Direct Desulfurization Unit (DDS)

○ Targets for FY2028
- Raise VR processing rate to about 8.0%
- Further reduce CO_2 emissions intensity by 1% or more (*2)

○ Response by oil refiners
- Increase proportion of crude oil processing quantity accounted for by VR oil throughput fed to specified residue oil processing units

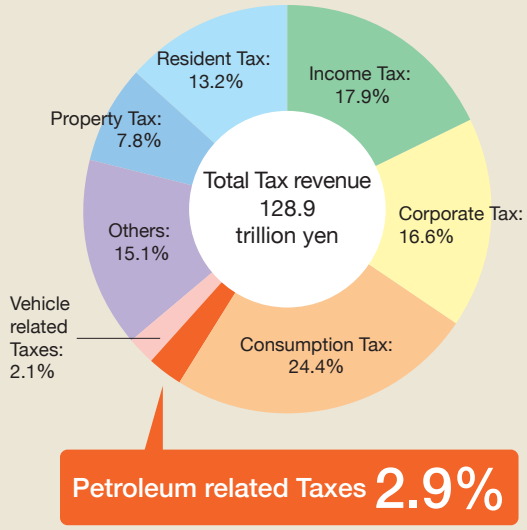
*1 VR: Vacuum Residue (true boiling point of 565°C or higher)
*2 The improvement target of the CO_2 emission intensity is supplementary

5. Various Petroleum-related Taxes

Various taxes are levied on petroleum in multiple stages. First, customs duties and a petroleum and coal tax are levied on crude oil and petroleum products at the import stage (taxes are currently not levied on crude oil). In 1978, a petroleum and coal tax was established as a petroleum tax to be a financial resource for promoting stockpiling and development of oil. In 2003, the petroleum tax was renamed the petroleum and coal tax when coal was added as a subject for taxation in order to equalize the tax burden between fuels, and a new tax rate was established for each fuel. Furthermore, starting from 2012, the tax rate was raised due to a special tax for global warming countermeasures.

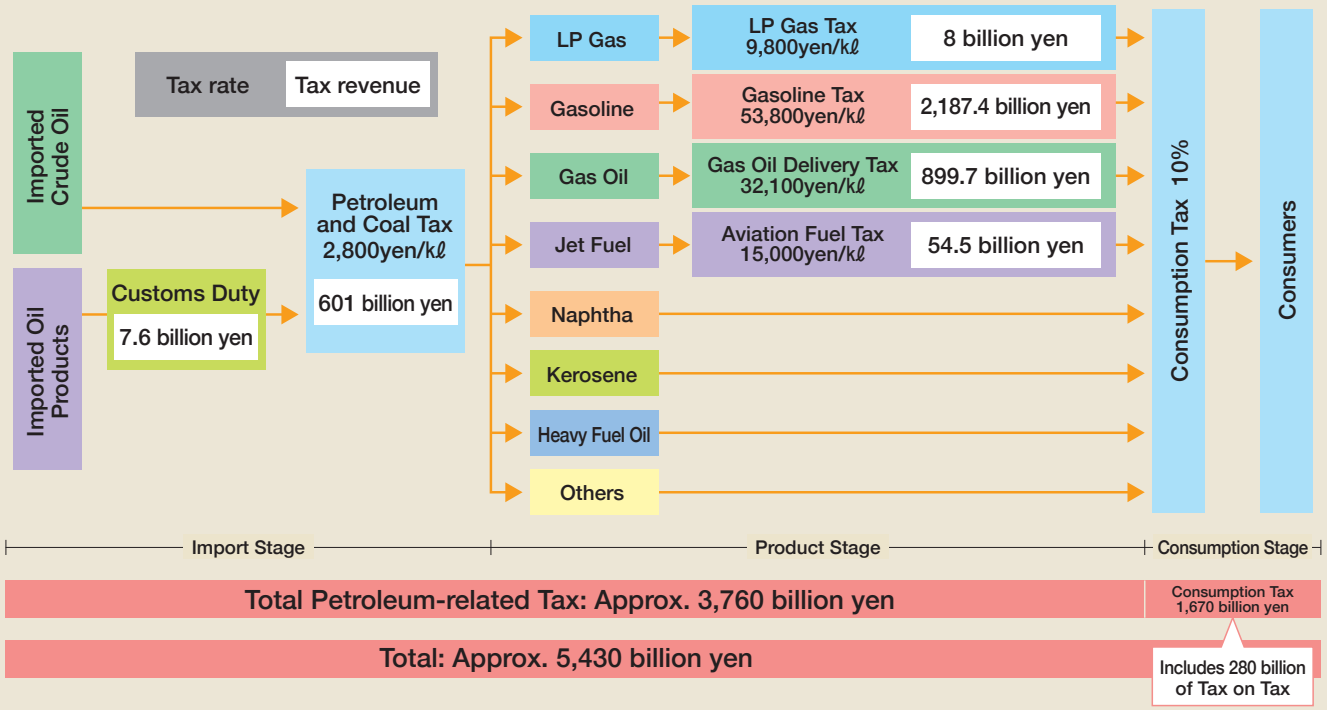
Moreover, individual indirect taxes, such as a gasoline tax (gasoline tax and local gasoline tax), gas oil delivery tax, aviation fuel tax, and LPG tax (tax applied only to LPG used for automobiles) are levied on each product. These various petroleum-related taxes amount to about 3,760 billion yen (based on the initial budget for FY2025), accounting for approximately 2.9% of the total national and local tax revenue. If the consumption tax of approximately 1,670 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 5,430 billion yen.

Fig.3-5 Proportion of tax revenue accounted for by petroleum-related taxes (initial budget for FY2025)



Source: Ministry of Finance, PAJ

Fig.3-6 Multiple Types and Stages of Taxation of Petroleum-related Taxes (initial budget for FY2025)



Source: Ministry of Finance, PAJ

6. Origins of Various Taxes and Changes in Tax Rates

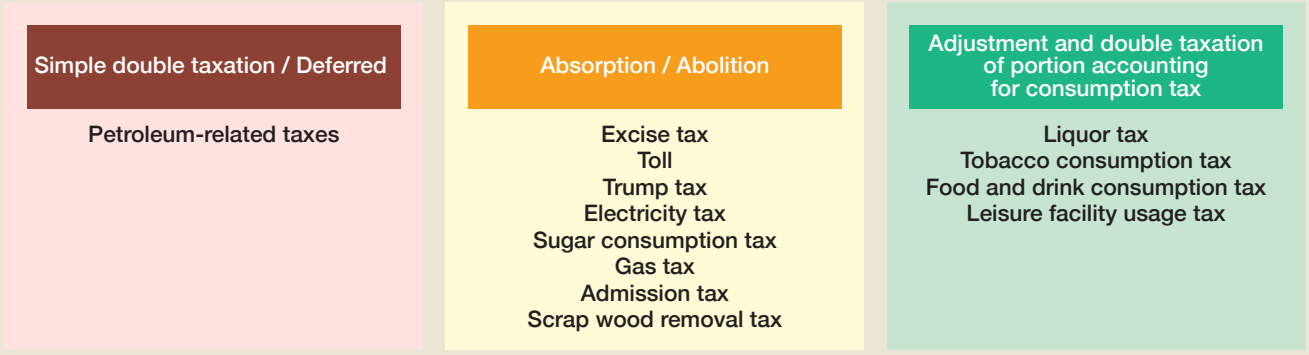
In 1949, the gasoline tax, which had been abolished before the war, was revived to respond to insufficient postwar financial resources, etc. In 1954, the entire amount of the gasoline tax was designated as road specific revenue source for road construction, together with the local road tax (current, local gasoline tax) established the following year, to be allocated to road maintenance and improvement. In addition, the gas oil delivery tax (local tax) was introduced in 1956 as a road specific revenue source 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 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 on numerous occasions to secure the financial resources needed for road construction and maintenance.

In 1989, when the consumption tax was introduced, measures to adjust existing individual indirect taxes (abolished by being absorbed by the consumption tax, reduced by the portion of the duplicated consumption tax) were implemented, so that the tax burden on consumers would not be increased. However, the petroleum tax was neither abolished nor reduced on the grounds that gasoline tax and gas oil delivery tax were used as a road specific revenue source (simple double taxation and deferred), with the consumption tax portion being simply added to the sales price of fuel, which included the gasoline tax and gas oil delivery tax.

Although the road specific revenue sources system was abolished in 2009 (becoming a general revenue source), no specific adjustment measures were taken with regard to the consumption tax and gasoline tax and gas oil delivery tax (the local road tax was renamed the local gasoline tax). Furthermore, in April 2010, the provisional tax rates were abolished, and it was stipulated that the existing provisional tax level should be maintained for the time being.

A bill to abolish the old provisional tax rate for the gasoline tax was passed in November 2025, and the gasoline tax was reduced from 53,800 yen/kℓ to 28,700 yen/kℓ, effective December 31, 2025. The old provisional tax rate for the gas oil delivery tax rate is scheduled to be abolished on April 1, 2026, so that the gas oil delivery tax will be reduced from 32,100 yen/kℓ to 15,000 yen/kℓ.

Fig.3-7 Status of Adjustment to Existing Indirect Tax at the Time of Implementation of Consumption Tax



1. Supply and Demand of Energy

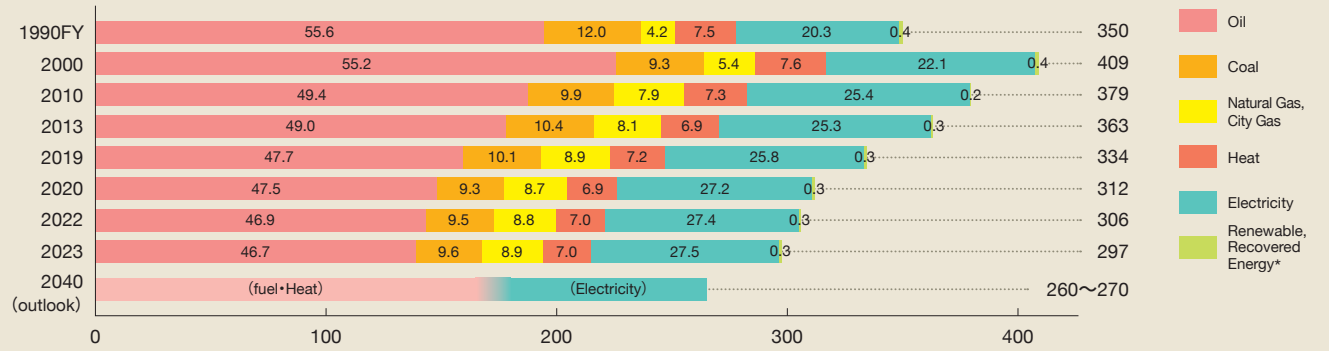
Final domestic energy consumption in FY2023 was 297 million kℓ Crude Oil Equivalent (COE), a 2.7% decrease year-over-year (YOY). Broken down by energy source, petroleum consumption was 139 million kℓ COE, a decrease of 3.0% YOY.

Domestic primary energy supply was 454 million kl COE, decrease of 4.0% YOY. Of this amount, petroleum supply was 162 million kl COE, a decrease of 5.2% YOY, with its share of the total energy supply being 35.7%, a slight decline compared with the previous fiscal year.

The amount of electric power generated was 988 billion kWh, a decrease of 1.4% YOY. The proportion of the power supply configuration accounted for by oil-fired thermal power generation was 7.4%, a YOY decrease.

Fig.4-1 Changes in Final Energy Consumption

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

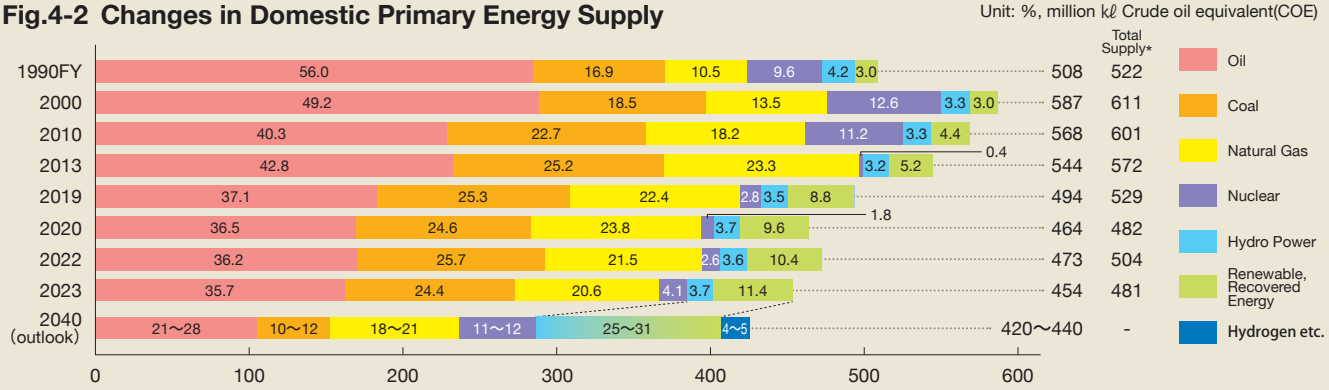


* Effective recovery use of wasted energy

Source: METI

Fig.4-2 Changes in Domestic Primary Energy Supply

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

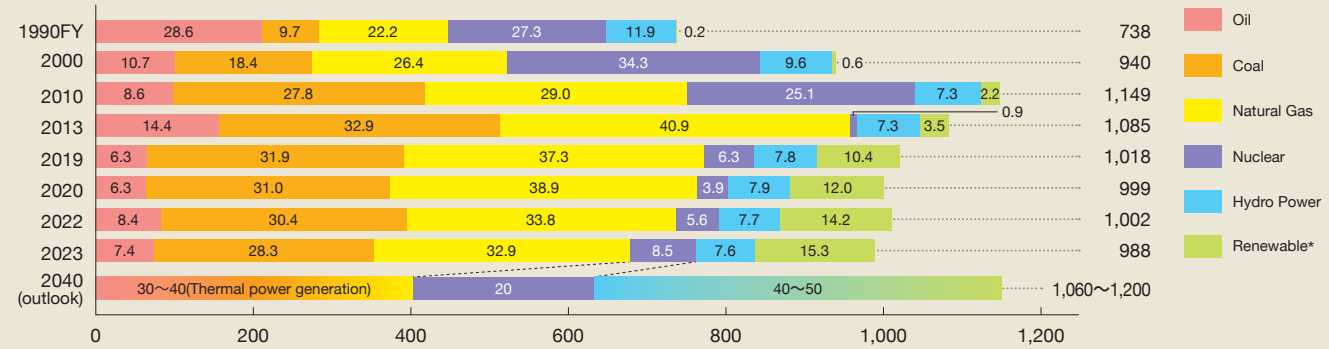


*Primary Domestic Energy Supply is total supply minus exports and changes in inventories

Source: METI

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

Unit: %, billion kWh



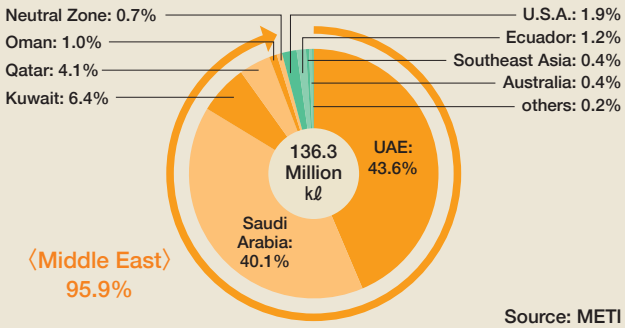
* Solar, Wind, Geothermal and Biomass

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

2. Crude Oil Imports

Japan imported 136.3 million kℓ of crude oil in FY2024, a decrease of 5.9% YOY. The crude oil import volume by region showed that Middle Eastern oil producing countries accounted for 95.9%. The countries from which Japan imported crude oil, shown in order of volume, were the United Arab Emirates (43.6% of total imports), Saudi Arabia (40.1%), Kuwait (6.4%), and Qatar (4.1%). The top two countries accounted for more than 80% and the four countries accounted for more than 90% of Japan's total crude oil imports.

Fig.4-4 Crude Oil Imports by Country (FY2024)



Source: METI

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.

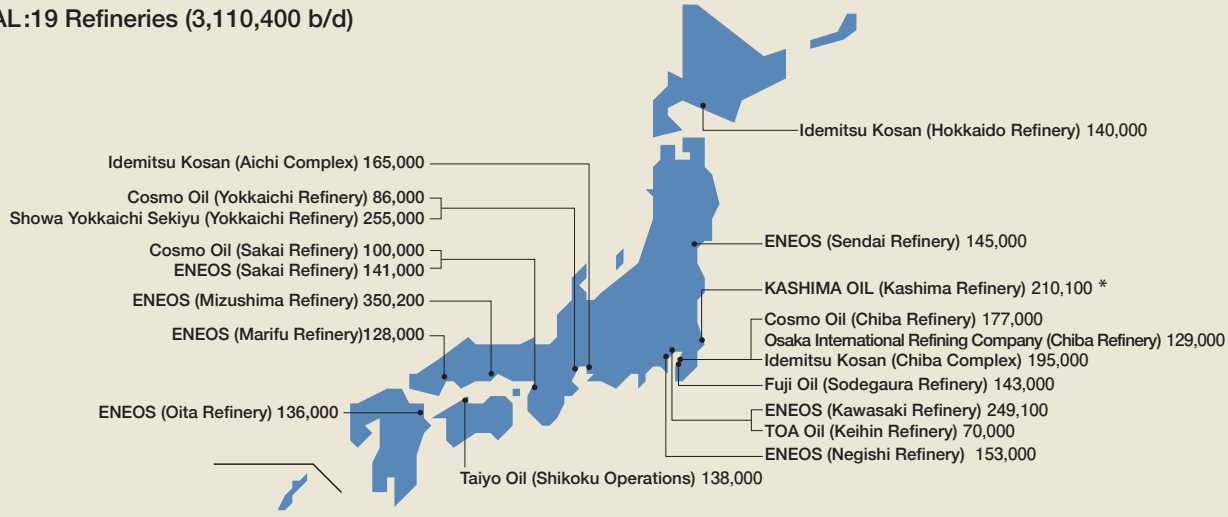
As the domestic crude oil output in Japan in FY2024 was 381 thousand kℓ, which represents only 0.3% or the equivalent of about one day's worth of the 135 million kℓ of Japan's crude oil processing volume, almost all of Japan's crude oil is imported from overseas. Consequently, all of Japan's refineries are located in coastal areas. As of the end of March 2025, 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.

Fig.4-5 Location of Refineries and Crude Oil Processing Capacity (March, 2025)

unit : b/d

TOTAL:19 Refineries (3,110,400 b/d)



* KASHIMA OIL (Kashima Refinery) include the capacity of condensate splitter

Source: PAJ

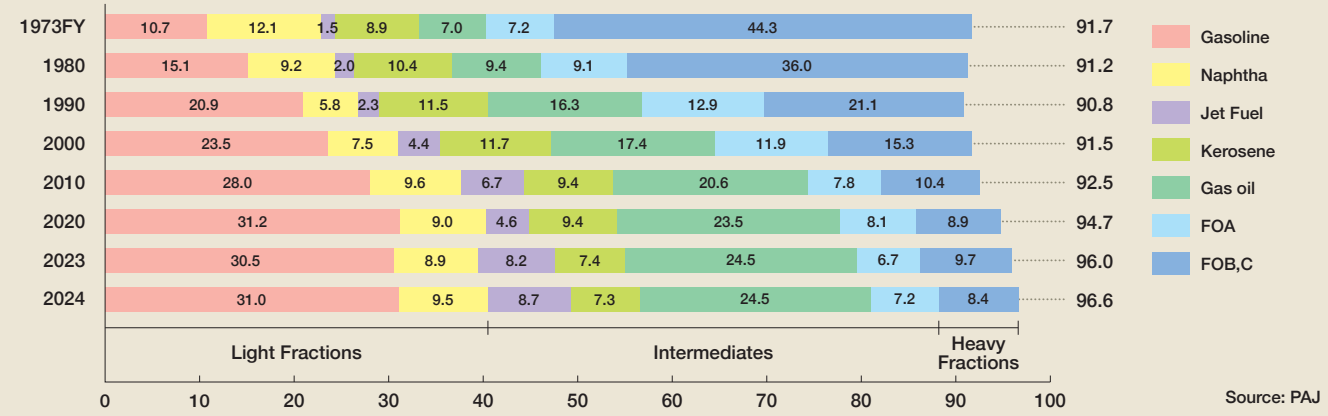
4. Production of Petroleum Products

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 FY2024 was 132 million kℓ, a decrease of 6.1% YOY. The production yields were about 41% for the light fractions, about 48% for four intermediate products, and about 8% for heavy fractions, with the total production of fuel oil amounting to approximately 97%.

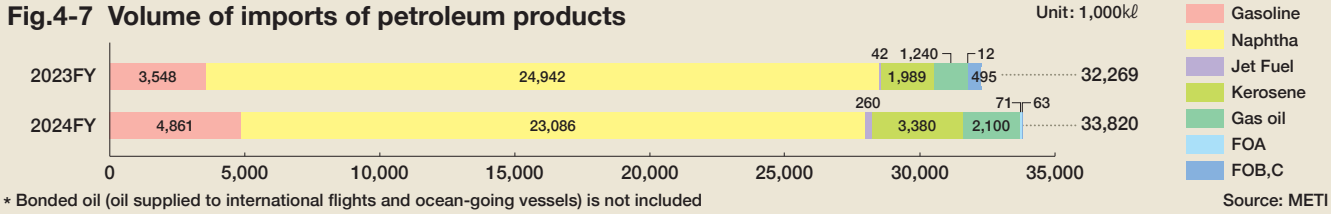
Fig.4-6 Changes in Petroleum Products Yield



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.

Fig.4-7 Volume of imports of petroleum products

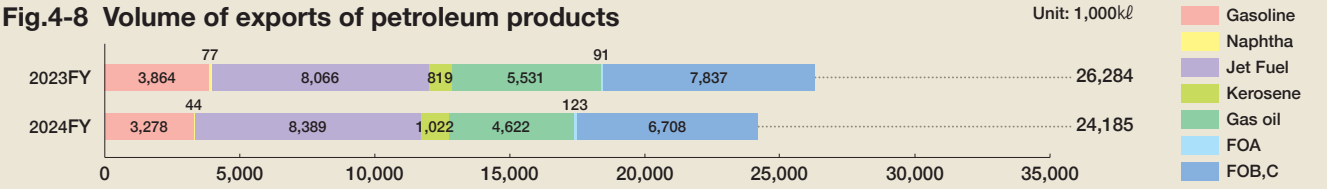


* Bonded oil (oil supplied to international flights and ocean-going vessels) is not included

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.

Fig.4-8 Volume of exports of petroleum products



* Bonded oil (oil supplied to international flights and ocean-going vessels) is included

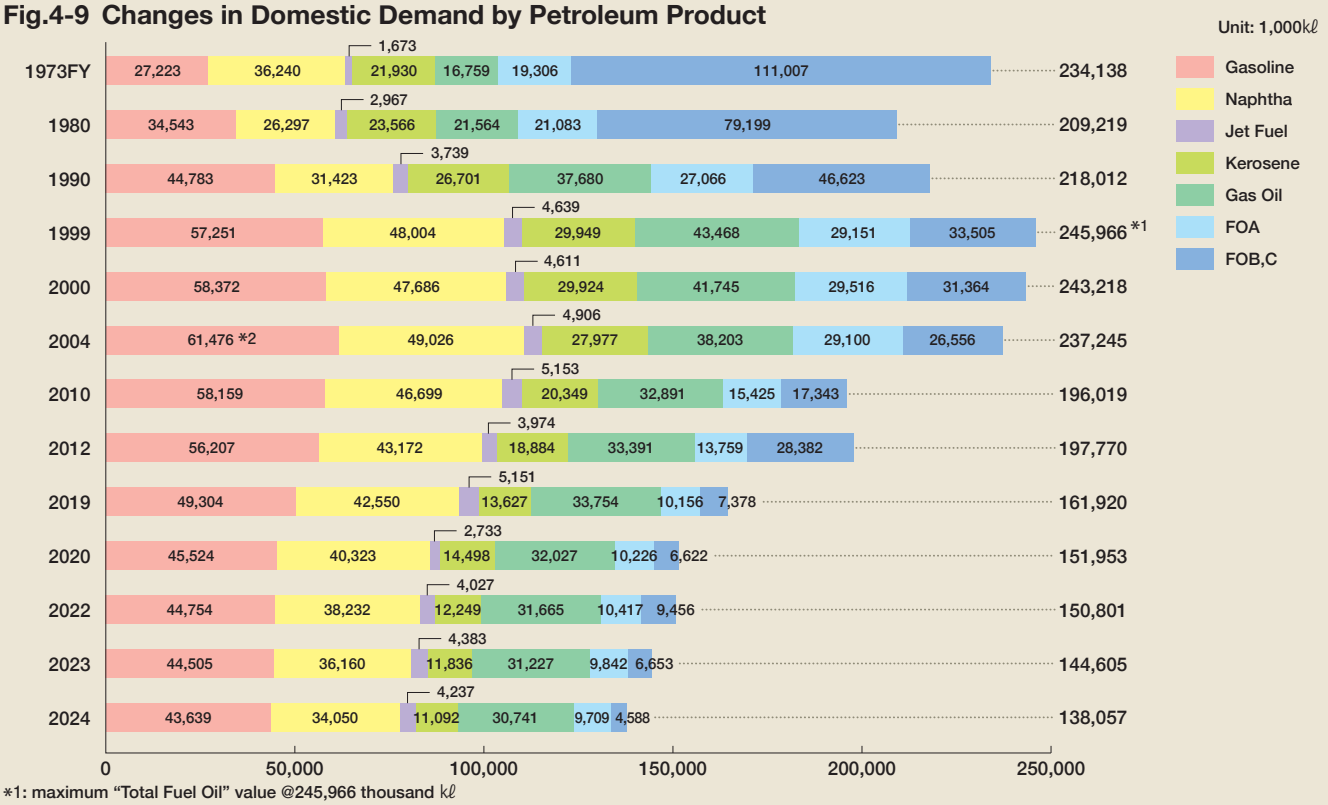
Source: METI

7. Demand for Petroleum Products

Of the total demand for oil in FY2024, fuel oil incurred a decrease of 4.5% YOY to 138.1 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 44% from its peak in FY1999 and is expected to continue to decrease going forward.

Fig.4-9 Changes in Domestic Demand by Petroleum Product



*1: maximum “Total Fuel Oil” value @245,966 thousand kℓ
*2: maximum “Gasoline” value @61,476 thousand kℓ

Source: METI

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.

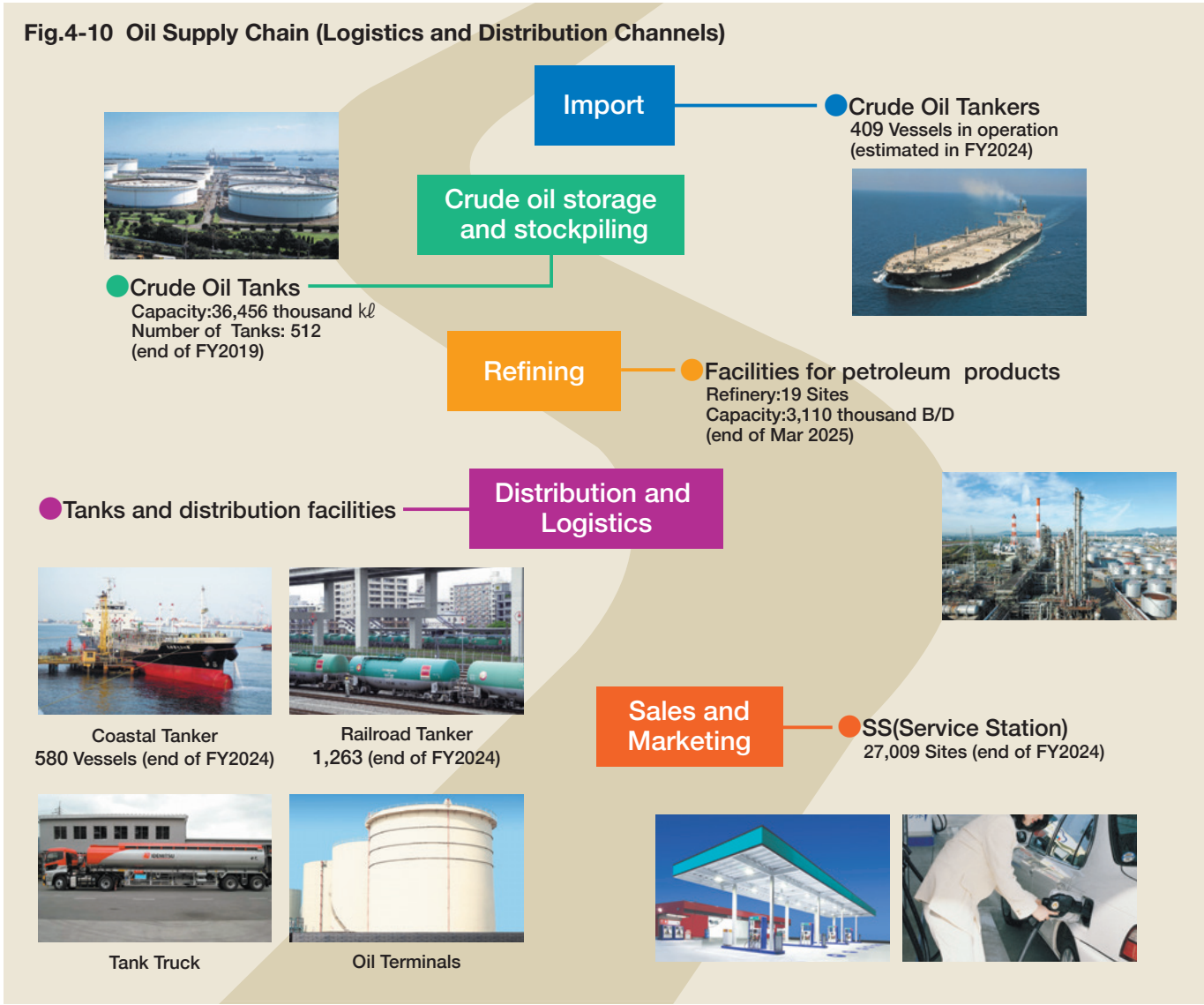
A coastal tanker is used for marine transportation between seaside districts in order to transship oil from a refinery to an oil terminal, or delivering oil directly from a refinery or an oil terminal to users. This method is excellent for large-volume and long-distance transportation. The amount transported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

Fig.4-10 Oil Supply Chain (Logistics and Distribution Channels)



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

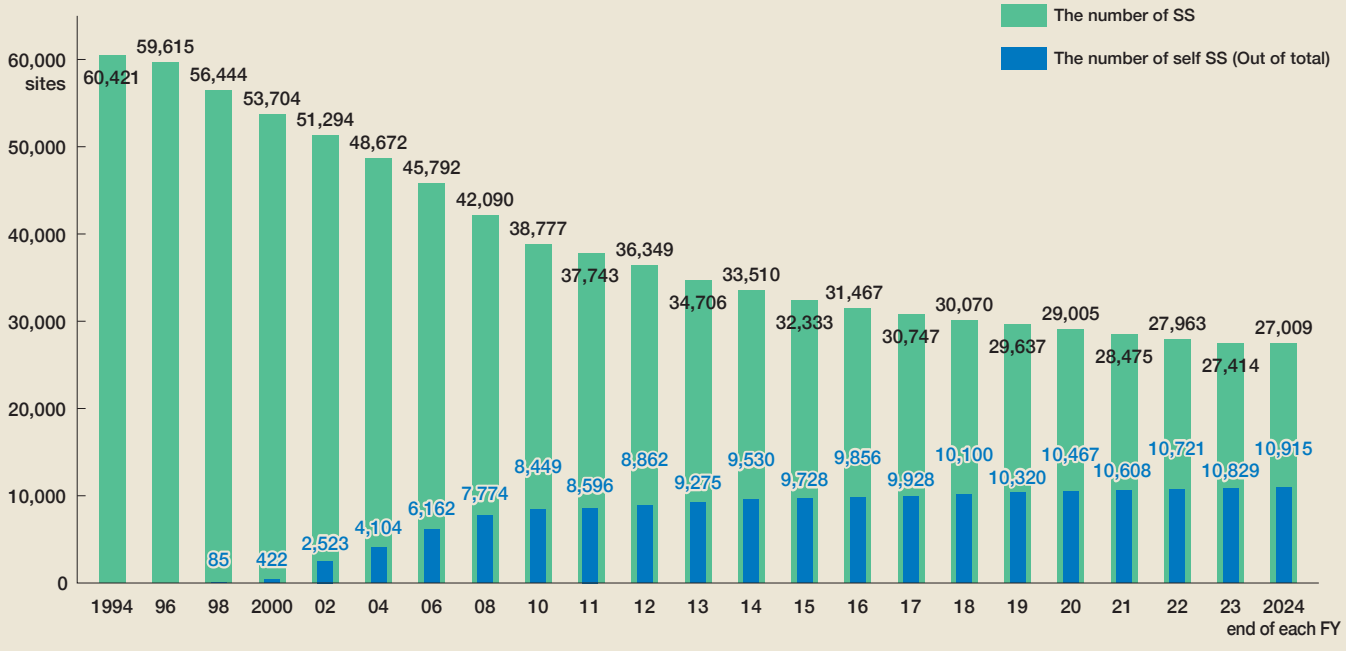
Domestic gasoline sales volume is showing a downward trend due to structural factors, such as population decline and improved fuel efficiency of vehicles. Moreover, an increase in next-generation vehicles, such as electric vehicles (EV), plug-in hybrid vehicles (PHV), and fuel cell vehicles (FCV), are 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 27,009 at the end of March 2025. 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 372 municipalities at the end of March 2024, an increase of 14 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 February 2025, there were 14,260 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 10,915 as of the end of March 2025, 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)



Source: METI, Oil Information Center.

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, distributers, 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	
Items	Specification
Lead	Non-detectable
Sulfur content	0.001mass% max.
MTBE	7 vol% max.
Benzene	1 vol% max.
Kerosene	4 vol% max.
Methanol	Non-detectable
Washed gum	5 mg/100ml max.
Color	Orange
Oxgen content*1	1.3 mass% max.
Ethanol*1	3.0 vol% max.

Diesel Fuel	
Items	Specification
Sulfur content	0.001 mass% max.
Cetane index	45 min.
Distillation, T90%	360°C max
Triglyceride	0.01 mass% max.
FAME*2	0.1 mass% max.

Kerosene	
Items	Specification
Sulfur content	0.008 mass% max.
Flash point	40°C min.
Color,Saybolt	+25 min.

Heavy Oil	
Items	Specification
Sulfur content*3	0.5 mass% max.
Inorganic acid	Non-detectable

*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

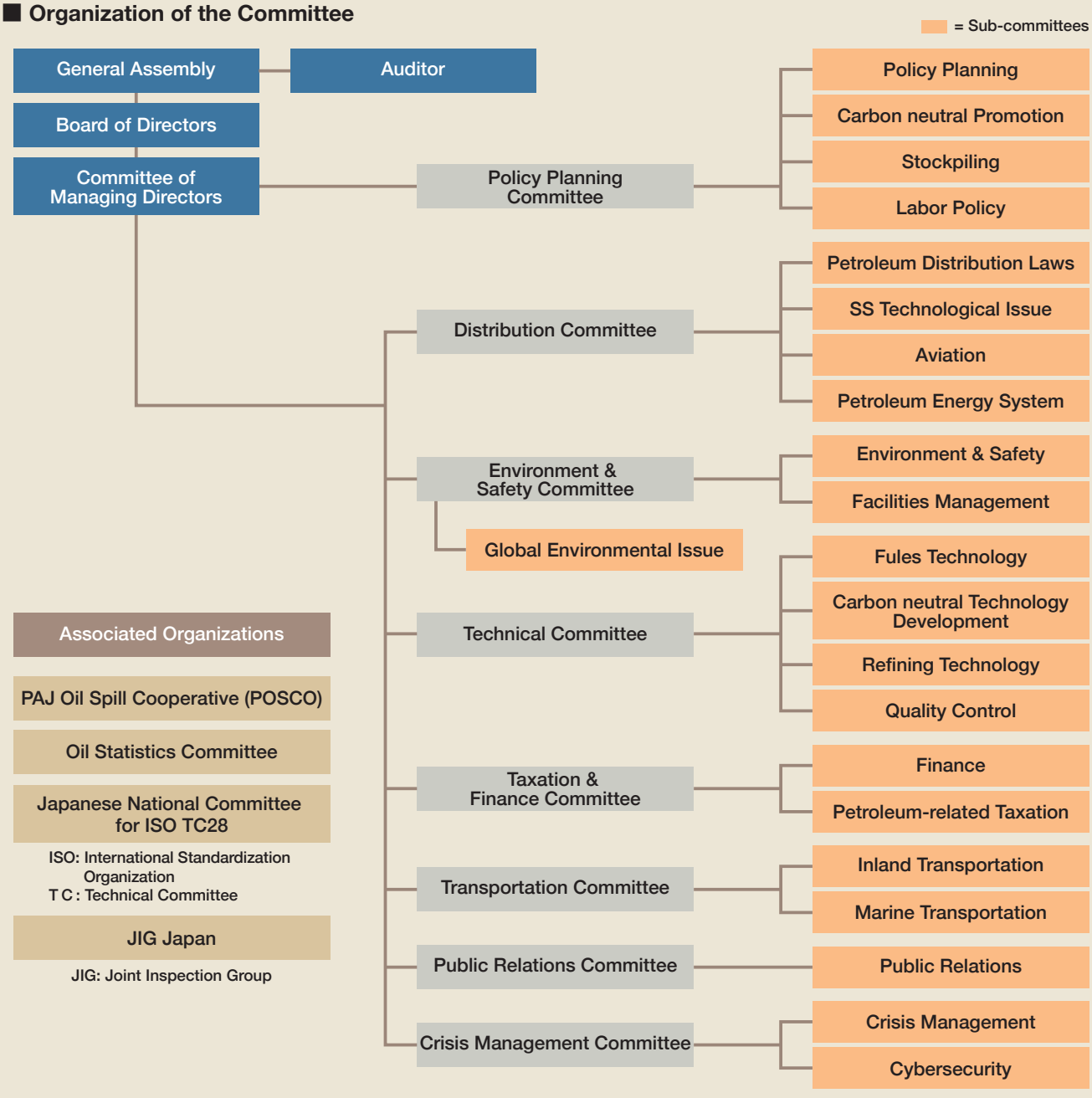
Appendix Activities of Petroleum Association of Japan(PAJ)

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

■ Organization of the Committee



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