Petroleum Industry

in Japan 2023

Petroleum Association of Japan

Preface

This brochure, *Petroleum Industry in Japan*, has been continuously issued by the Petroleum Association of Japan 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.

The new coronavirus Covid-19, which has had a tremendous impact on the economy and society, underwent a change in May of this year in how it is positioned in the Infectious Disease Law and the steady recovery of economic activities. Amidst these circumstances, the petroleum industry continued to work to ensure a stable supply of petroleum products by thoroughly implementing measures to prevent the spread of infection in the supply chain.

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, the Petroleum Association of Japan (PAJ) formulated its "Vision for Carbon Neutrality in the Petroleum Industry" 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 of oil and the petroleum industry in Japan.

December 2023

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

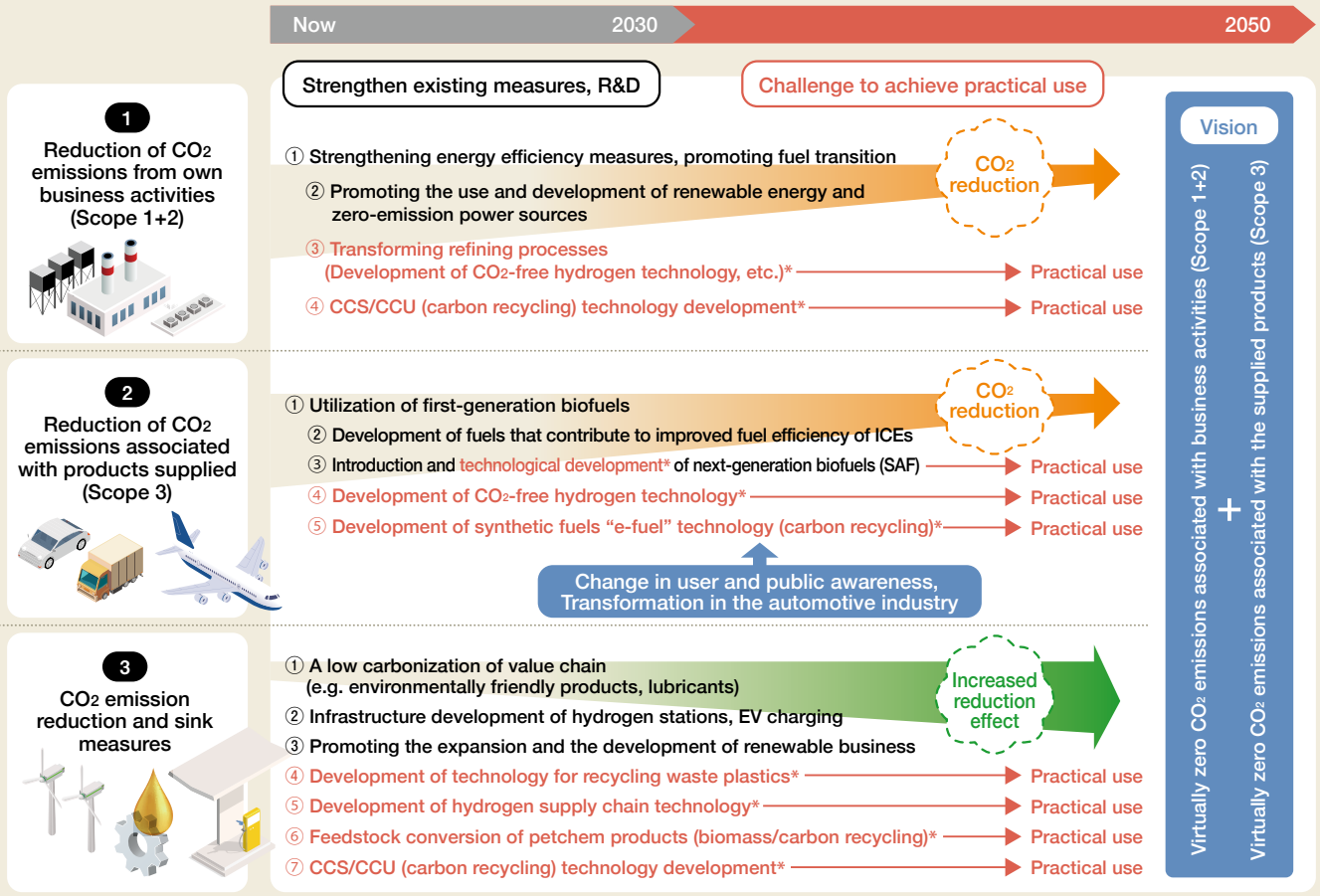
In October 2020, the Japanese government declared that Japan would realize "Carbon Neutrality by 2050." In response to this, the Petroleum Association of Japan (PAJ) renewed its "Long-term Low Carbon Vision for the Petroleum Industry" in 2019, and newly formulated the "Petroleum Industry's Vision toward 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

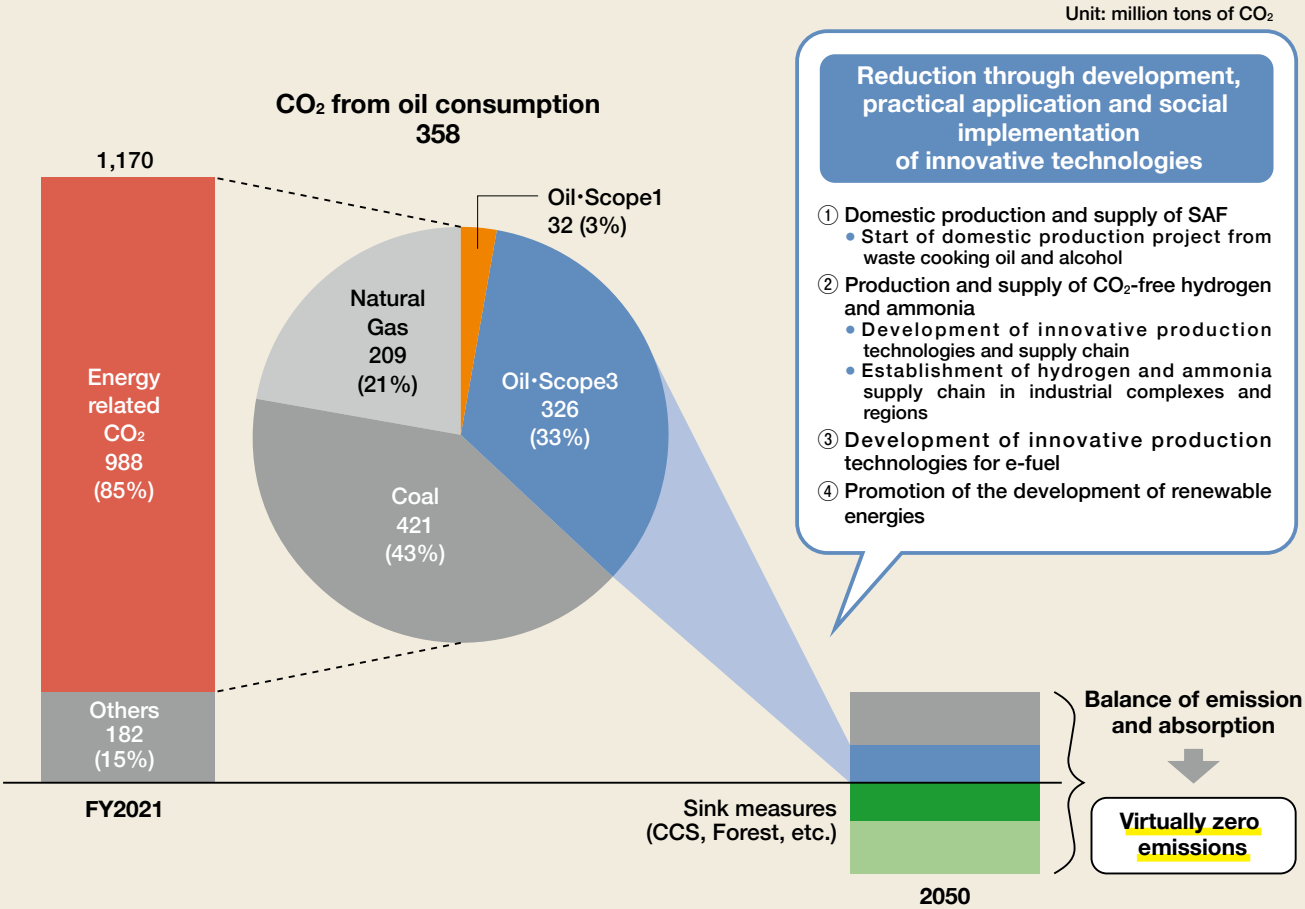
2. Images of the Challenge Towards Carbon Neutrality

The quantity of greenhouse gases emissions in Japan (actual FY2021 figures) was approximately 1.2 billion tons (CO_2 equivalent) in total, with energy-derived CO_2 accounting for about 1 billion tons, of which around 1/3 was the result of the consumption of petroleum. Of the CO_2 emissions from the consumption of petroleum, emissions from refineries (Scope 1) accounted for about 3 million tons, and the majority of the emissions came from petroleum consumed by the supplied petroleum products (Scope 3), so the reduction of these emissions is of great importance.

Heading towards 2050, the petroleum industry intends to take on the challenge of reducing CO_2 emissions associated with supplied petroleum products (Scope 3) to virtually zero through the development and commercialization of such innovative technologies as SAF, CO_2-free hydrogen, ammonia, and synthetic fuel (e-fuel), as well as promoting the development of recyclable energies and other measures.

The challenge of reducing Scope 3 CO_2 emissions to virtually zero is extremely ambitious and difficult to achieve. Nevertheless, every oil company will contribute to the realization of carbon neutrality in society as a whole by making proactive efforts in the research, development, and societal implementation of carbon neutral technologies, as well as continue their activities for a stable supply of energy demanded by consumers.

Fig.1-2 Images of the Challenge Towards Carbon Neutrality



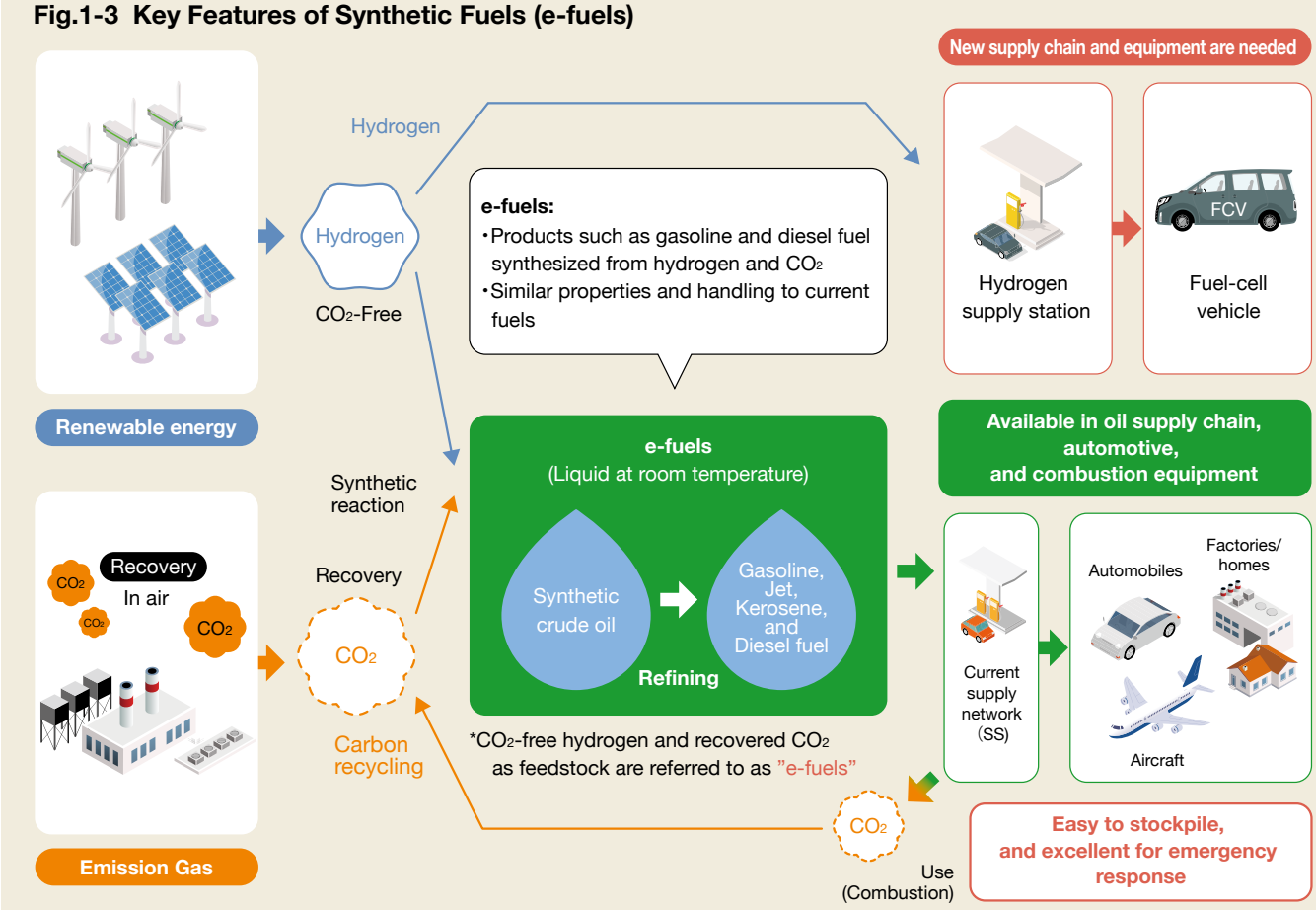
*1 2021 emissions and breakdown are calculated from the Ministry of Environment and the Greenhouse Gas Inventory Office emissions by fuel type (Domestic emissions)
Scope3 for oil are calculated from the emissions of crude oil and petroleum products minus refinery's CO_2 emissions (oil portion)
*2 Scope1 emissions for oil are the CO_2 emissions of refineries minus CO_2 emissions from purchased electricity, etc.

3. 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.

Fig.1-3 Key Features of Synthetic Fuels (e-fuels)



4. 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_2 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.

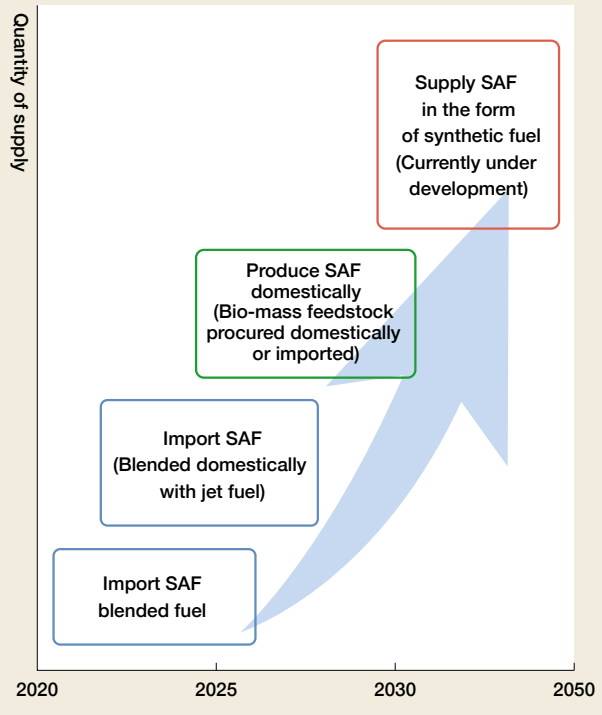
Furthermore, it was stipulated in the "Criteria for Use of Non-fossil Energy Sources" in the Law Concerning Sophisticated Methods of Energy Supply Structures in November 2010 that approximately 820,000 kℓ of bio-ethanol (500,000 kℓ of crude equivalents) should be blended directly with gasoline or in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

Moreover, 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 achieve this goal by 2030, including the start of imports of SAF during 2023, with the aim of starting production and supply of SAF in Japan from 2025.

Fig.1-4 Image of expansion of SAF supply system



* SAF-blended fuel: SAF blended with conventional jet fuel (can be used as is as fuel)

5. 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.

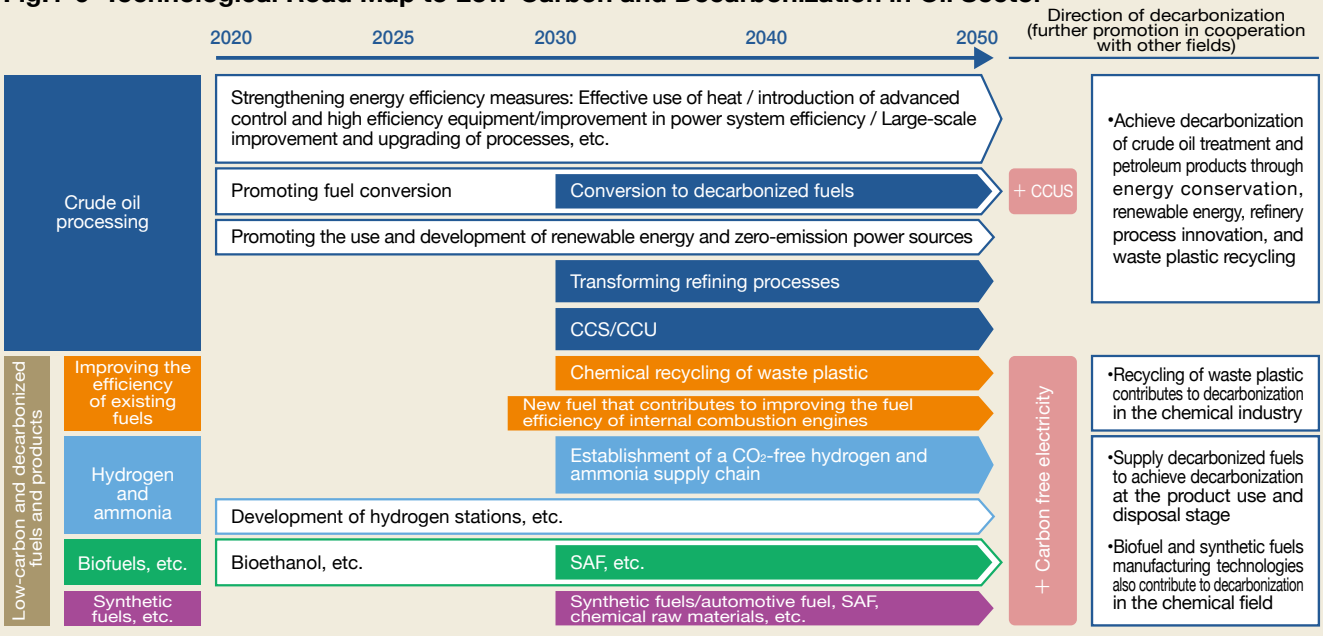
Recently, oil companies have begun to raise funds through transition financing, and the petroleum industry is working to realize its vision of carbon neutrality while also utilizing such funds.

Fig.1-5 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	• Energy conservation and higher efficiency • Conversion to low-carbon and decarbonized fuels • Introduction of CO_2 capture, etc.	• Conversion to low-carbon and decarbonized fuels (Hydrogen and ammonia/Biofuel/ Synthetic fuels/Low-carbon fuel)

*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.1-6 Technological Road Map to Low-Carbon and Decarbonization in Oil Sector



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

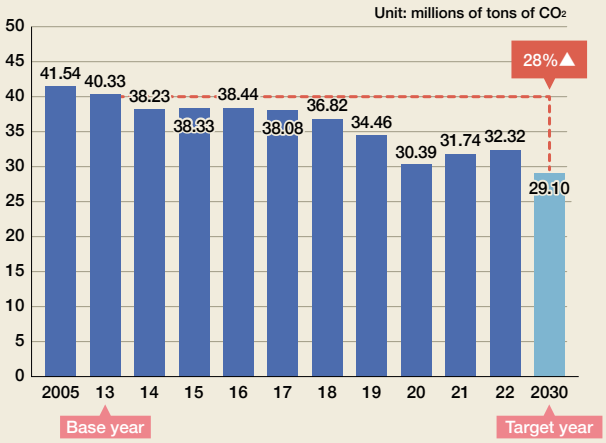
6. History of Initiatives for Global Warming Issues

In response to calls by Keidanren, PAJ drew up its voluntary action plan and engaged in efforts to save energy at oil refineries. In line with Keidanren's basic policy, PAJ formulated the "Petroleum Industry's Action Plan for a Low Carbon Society" in March 2010, and announced its goal of achieving an energy saving volume of 530,000 kℓ (crude oil equivalent) at refineries in FY2020 by means of energy saving initiatives enacted from FY2010 onward. As a result, this goal was realized as of FY2016, when an energy saving volume of 551,000 kℓ was achieved.

With regard to initiatives for FY2020 and beyond, PAJ, in response to Keidanren's call, formulated "Petroleum Industry's Action Plan for a Low Carbon Society – Phase II" in March 2015, and stated "the achievement of energy saving of one million kℓ of crude oil equivalents at refineries in FY2030 compared to the FY2009 level, by means of energy saving initiatives enacted from FY2010 onward" as its goal, which took into consideration the continuity of the existing initiatives. As a result, the energy saving in FY2021 was 712,000 kℓ, which was a target achievement rate of 71.2%.

In October 2020, the Japanese government declared that Japan would realize "Carbon Neutrality by 2050." In response to a call by Keidanren, which had learned of this declaration, PAJ revised its "Action Plan for a Low Carbon Society" to the "Carbon Neutral Action Plan for the Petroleum Industry" in September 2021. Furthermore, in July 2023, the numerical targets for the energy saving volume for FY2030 was shifted from being expressed in terms of crude oil equivalent to being expressed in terms of the total volume of CO_2 emissions, in order to conform with the national government's targets, so "the total volume CO_2 emissions will be 29.1 million tons (a reduction of 28% compared with FY2013)." Consequently, in line with the shift in the abovementioned target, the total volume of CO_2 emissions for FY2022 was 32.32 million tons (a reduction of 19.9% compared with FY2013, with 71.3% of the target being achieved.

Fig.1-7 Volume of CO_2 Emissions at Refineries



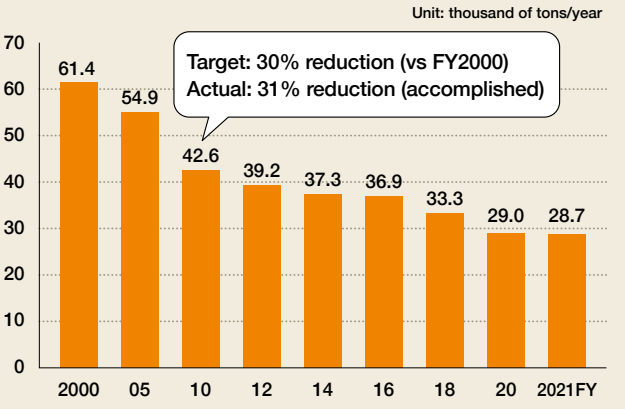
* Volumes of CO_2 emissions are actual results based on electricity emissions factor afer reflecting carbon credits

7. 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 FY2021 totaled 28,700 tons, a 53% reduction compared with FY2000.

Fig.1-8 Annual Trend of VOC Emissions



Source: VOC emission control voluntary action plan (PAJ)

8. 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), tri-glyceride 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.1-9 The Fuel Quality Control Act-Compulsory Standard (as of Apr. 2023)

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 international 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: 0.12 mgKOH/g max.

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

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

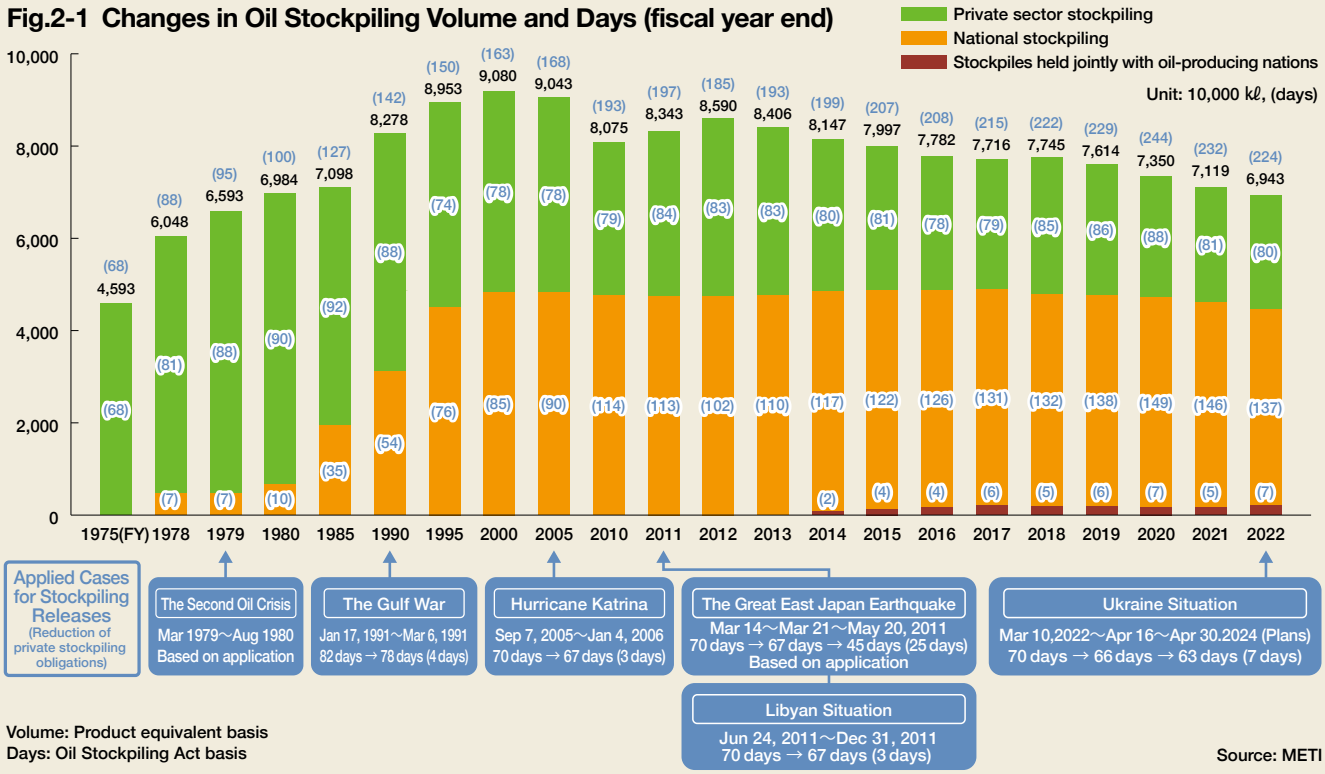
② Clarification of the provisions concerning a release order of government oil stockpiles by the Minister of Economy, Trade and Industry (METI)

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. (After the Great East Japan Earthquake, the Oil Stockpiling Act was amended in 2012 to expand the product stockpiling to four fuel products, i.e., gasoline, diesel fuel, and heavy fuel oil A, in addition to 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 International (KPI) in 2020.

Fig.2-1 Changes in Oil Stockpiling Volume and Days (fiscal year end)



Volume: Product equivalent basis
Days: Oil Stockpiling Act basis

Source: METI

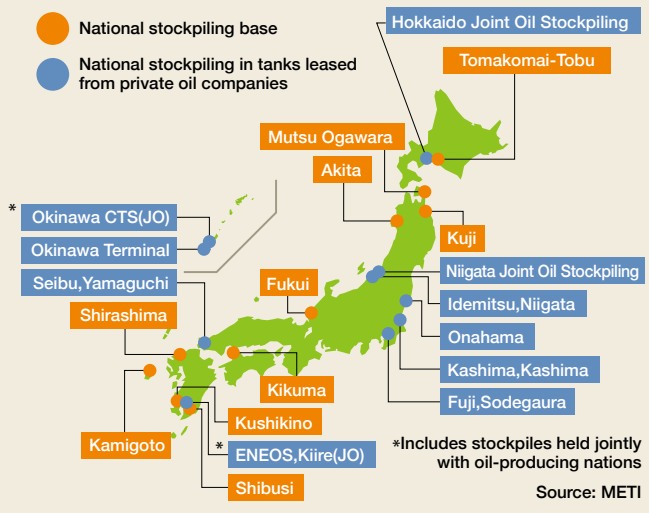
2. Release of Oil Reserves in an Emergency

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



Source: METI

Fig.2-3 Current Status of Oil Stockpiling in Japan (as of Apr 2023)

	Private sector stockpiling	National stockpiling	Stockpiles held jointly with oil-producing nations
Stockpile Days	86 days	138 days	7 days
Stockpiling Volume	26.7 million kℓ	42.6 million kℓ	2.1 million kℓ
Obligation Days	70 days of domestic demand	90days of net import together with one-half of the joint stockpiling of oil-producing countries	---
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	Crude oil: ① Tanks of national stockpiling bases ② Tanks borrowed from private sector Oil products: Private sector tanks in refineries and oil terminals	Private sector tanks contracted by oil-producing countries
Composition	Crude oil : 50% Oil products: 50%	Crude oil : 97% Oil products: 3%	Crude oil:100%
Administrative Body	Oil refiners and importers (It is, however, possible for the joint stockpiling companies to act for such management)	①10 national stockpiling bases (2/3 of government reserve) ②Private oil companies (1/3 of government reserve): (Management on consignment)	Private oil companies (Management on consignment)
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, oil depots, etc., and can be supplied promptly	①Private oil tanks are leased to national oil companies of oil-producing countries with government support. 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 ②Oil need to transported from the private oil terminals to the refineries by tanker
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~)	①Ukraine situation (Apr 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. The Great East Japan Earthquake: Experiences and Lessons Learned

In the aftermath of the Great East Japan Earthquake of March 11, 2011, while the supply of electricity and city gas was stopped, oil, which features excellent handling, storage, and portability, played a significant role as the most independent and distributed disaster-resistant source of energy. Oil was effectively used 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.

Through the efforts of the prefectural government, the Ministry of Land, Infrastructure, Transport and Tourism, and other agencies, the oil terminal in Shiogama (Miyagi Prefecture), which is a large-scale facility located in the disaster-stricken area, resumed shipping its stocks on March 17 (6 days after the disaster), and started receiving fuel products from coastal tankers on March 21. At the time, when an institutional framework based on laws and agreements did not yet exist, various cooperative systems were built that went beyond the boundaries of companies, such as the joint use by five Motouris of the facilities of two companies that had recovered quickly from the disaster.

Fig.2-4 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

4. Information Sharing with Local Authorities

In the Great East Japan Earthquake, each Motouri responded to emergency supply requests from the central government or local governments for fuel for critical institutions such as hospitals. However, due to incorrect or inadequate information from those making the requests about the kind of fuel or equipment, such as tank inlet specifications, some delivery problems occurred.

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 working since 2012 on sharing necessary information about fuel supply to key institutions designated by local governments and authorities.

To date, PAJ has concluded the Memorandum of Understanding for information sharing with 46 prefectures, governmental organizations, and designated public institutions.

* In 2008, PAJ and the Tokyo Metropolitan Government concluded the "Agreement on the Stable Supply of Petroleum Fuels in the Event of a Large-scale Disaster," which is currently being implemented.

5. Disaster Response through the Oil Stockpiling Act Amendments

At the time of the Great East Japan Earthquake in March 2011, the petroleum industry made every effort to provide a stable supply of oil products at all stages, from refining to distribution. Taking into account the lessons learned from the great earthquake, the petroleum industry has advocated the formulation of an agile and flexible stockpiling system to control disorder arising from a shortage of petroleum products, and made the following proposal to provide a stable supply of oil in times of disaster:

1. The government's reserve of petroleum products should be built up to be a last resort of oil supply when normal product distribution is interrupted;

2. Such government product reserves should be kept at refineries, etc. as an operating inventory to secure mobility and quality maintenance (a unified public and private storage method);

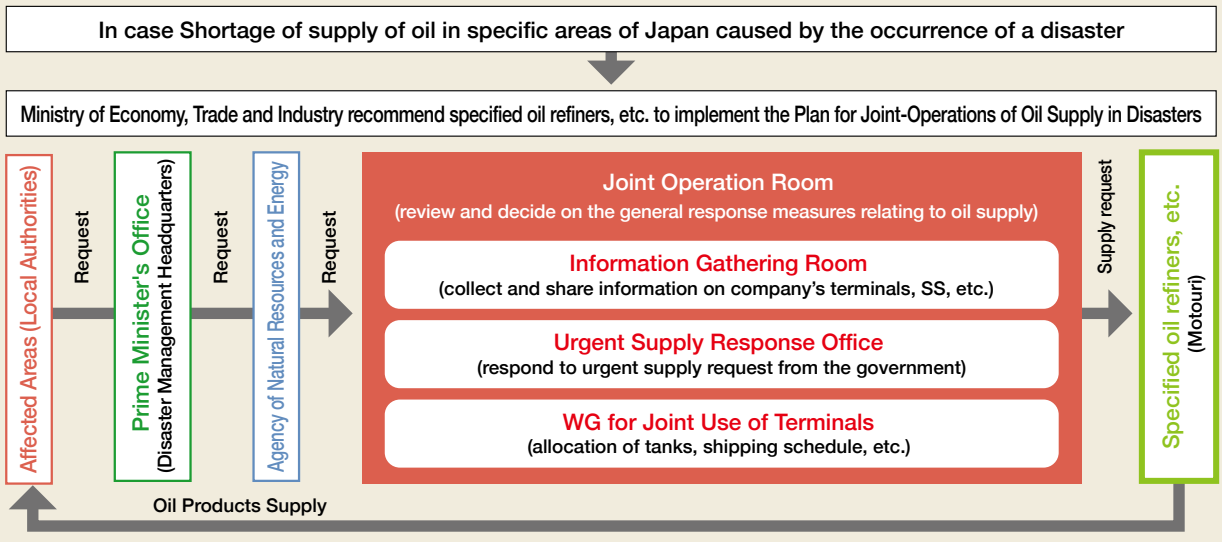
3. To secure logistics, a system to directly supply petroleum products to critical facilities, such as evacuation centers and hospitals, should be built by organizing a cooperative structure between oil storage management companies and transportation companies to enhance prompt and assure deliveries.

In November 2012, the Oil Stockpiling Act was amended to make it possible to release government crude oil reserves not only at the time of a domestic oil supply shortage in certain areas due to a disaster, but also when there is an oil supply shortage from overseas.

On the other hand, the kinds of petroleum products subject to the government petroleum product stockpiling became gasoline, diesel fuel and heavy fuel oil A, in addition to kerosene, which had been stockpiled from the very beginning. Moreover, based on the amended 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" for each of the 10 regions nationwide to ensure a stable supply in such region, and submitted it to METI. The plan calls for the establishment of a joint operation room to serve as a command center for the industry 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 other companies when one's own shipping facility is no longer available due to damage or other reasons. In the event of a major disaster, METI can recommend that refiners and Motouris take the measures specified in the plan.

PAJ has been conducting the training stipulated in the plan every year to enhance the proficiency level of disaster response capabilities and to study and develop countermeasures for the various issues learned from the training sessions.

Fig.2-5 Outline of the Plan for Joint-Operations of Oil Supply in Disasters



6. 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.

7. Resiliency Measures for the Oil Supply Infrastructure

Taking into account the lessons learned from the Great East Japan Earthquake, it was revealed that a major challenge for the petroleum industry is maintaining and strengthening the supply chain to ensure a stable supply of fuel to end consumers, even in times of disaster. The industry has been strengthening its emergency response capabilities in terms of both facilities and systems.

In terms of facilities, the industry has been carrying out seismic retrofitting construction at shipping terminals, waterproofing work on electrical equipment, and installing emergency power supplies. At the all refineries currently operating in Japan, various works have been 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 the shipping bases in the disaster-stricken area and each oil company to exchange information after the earthquake, a system was built to consolidate information at PAJ from each oil company 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.

The petroleum industry has been carrying out measures to strengthen the oil supply infrastructure, including refineries and oil terminals, in preparation for earthquakes and tsunamis (seismic sea wave). The industry formulated a plan to further strengthen from FY2021 its disaster response capabilities against heavy rains and typhoons that have been frequent in recent years.

8. 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.

9. Enhancement of Smart Industrial Safety

Taking the environmental changes surrounding industry safety into account, METI established the Subcommittee on the Basic System for Industrial Security in February 2021, under the Committee for Security and Consumer Products Safety of the Industrial Structure Council, and began deliberations on re-examining safety regulation systems, such as the High Pressure Gas Safety Act.

As a result of the deliberations, the subcommittee finalized the following system changes, which should be undertaken not to lower the level of safety, but rather to sustainably improve the safety level through the use of technology: (1) To allow “business operators that are able to independently execute a high level of safety while utilizing technology” to shift to a self-management type of safety, instead of uniform individual and ex-ante regulations, under appropriate auditing and supervision by the government, and (2) To amend the law (to create new institutional measures that have the promotion of smart industrial safety in mind), in order to take steps to reexamine the procedures and inspections so they take the form that corresponds to the above. The final summary of these institutional changes was approved by the Subcommittee as "Efforts toward Immediate Institutionalization and Main Issues for the Future in the Industrial Safety Field,” in December 2021.

The High Pressure Gas Safety Act was revised in June 2022, with the revised Act going into effect in 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 Act on the Quality Control of Gasoline and Other Fuels).

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 (1st Phase Deregulation)	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 ofFossil Energy and Environmentally Friendly Use of Energy Sources)
Apr '96 (2nd Phase Deregulation)	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. 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 2002 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.

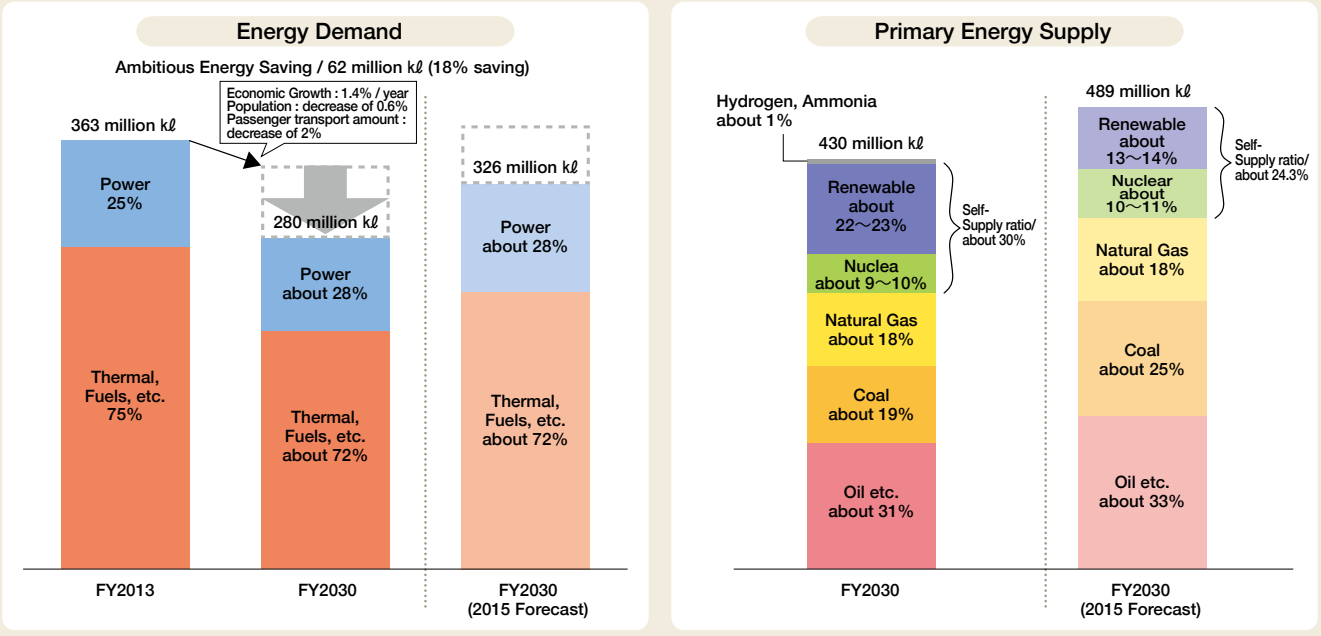
In conjunction with the formulation of the 6th SEP, the Energy Supply and Demand Outlook was revised to reflect the raising of the greenhouse gas reduction target in FY2030 (46% reduction versus FY2013).

According to the new supply and demand outlook, the share of oil in the primary energy supply in FY2030 will be about 31%, a decrease from around 33% in the previous Long-term Energy Supply and Demand Outlook formulated in July 2015. However, it is estimated that it will still account for more than 30% of the primary energy supply.

The 6th SEP also stressed the importance of ensuring an oil supply system that can respond not only in ordinary times but also in times of an emergency with an eye to 2030. The plan also calls for the need to further strengthen the supply network to cope with disasters, maintain the stockpiling levels, improve productivity, and strengthen competitiveness. The need to decarbonize refineries through energy conservation and CO_2-free hydrogen was also mentioned.

Fig.3-2 Outlook of Energy Supply and Demand Toward 2030

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



Source : METI

3. Making Advances in 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 the Law Concerning Sophisticated Methods of Energy Supply Structures (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 the Sophisticated Energy Supply Law) 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 March 2014, 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. The Second Ministerial Notice on the Sophisticated Energy Supply Law was presented to oil refiners in July 2014. The purpose of this law was to define the facilities installation rate, a target indicator, to be residual oil processing unit installation rate (about 45% as of FY2014), which is the conventional heavy oil cracking units with the addition of heavy oil direct desulfurization units, fluid catalytic cracking units, and solvent deasphalting units, with the target percentage of the new facilities installation rate being raised to 50% by the end of March 2017. Each oil refiner was obliged to attain the facility improvement that was in line with its facilities installation rate. As a means of achieving the target, some flexibility regarding refining capacities through collaboration between refineries and business restructuring was permitted. Moreover, each oil refiner was requested to make a periodic report to METI on the progress status of its concrete program to achieve this target, together with its business restructuring plan as a base for facility optimization. Consequently, the facilities installation rate of residual oil processing units reached an average of 50.5% at the end of March 2017.

In May 2017, the Natural Resources and Fuels Subcommittee of the Petroleum Council’s Advisory Committee for Natural Resources and Energy presented the basic direction “to promote the effective utilization of heavy oil cracking units through improvement of the capacity utilization rate, collaboration among refineries, capacity expansion, etc., thereby achieving further utilization of heavy oil cracking capacity." Then, the Third Ministerial Notice on the Sophisticated Energy Supply Law was 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 efforts by each refiner, the VR processing rate in FY2021 was 8.1%.

In May 2022, taking the 6th SEP into account, the purpose of the Sophisticated Energy Supply Law was revised from "promoting the use of non-fossil energy sources" to "environmentally friendly use of energy sources"; however, the effective use of fossil energy feedstocks remained unchanged. Based on this, for the Fourth Ministerial Notice regarding measures for FY2022 onwards, consideration is underway in order to promote new initiatives that contribute to CO_2 emission reduction in the refining process, while maintaining the concept of the Third Ministerial Notice. (As of July 2022)

4. Petroleum Industry Reorganization Movements

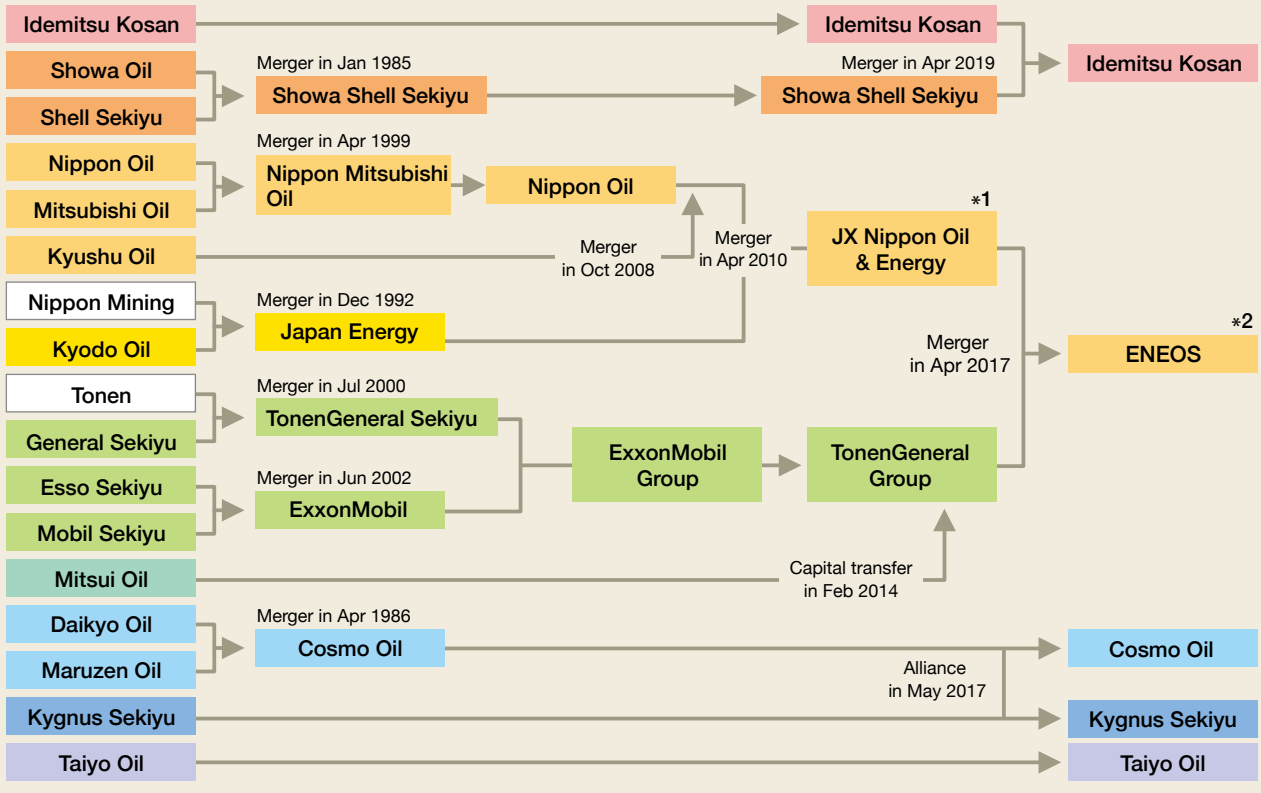
In view of the flow of global realignment of Western oil majors and fierce competition in the domestic oil market after the abolition of the Fuel Import Restriction Law, the movement toward reorganization of domestic oil refiners and primary oil distributors (Motouri) became increasingly active. In the 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.3-3 Reorganization Trends of Primary Distributors (Motouri) in Japan



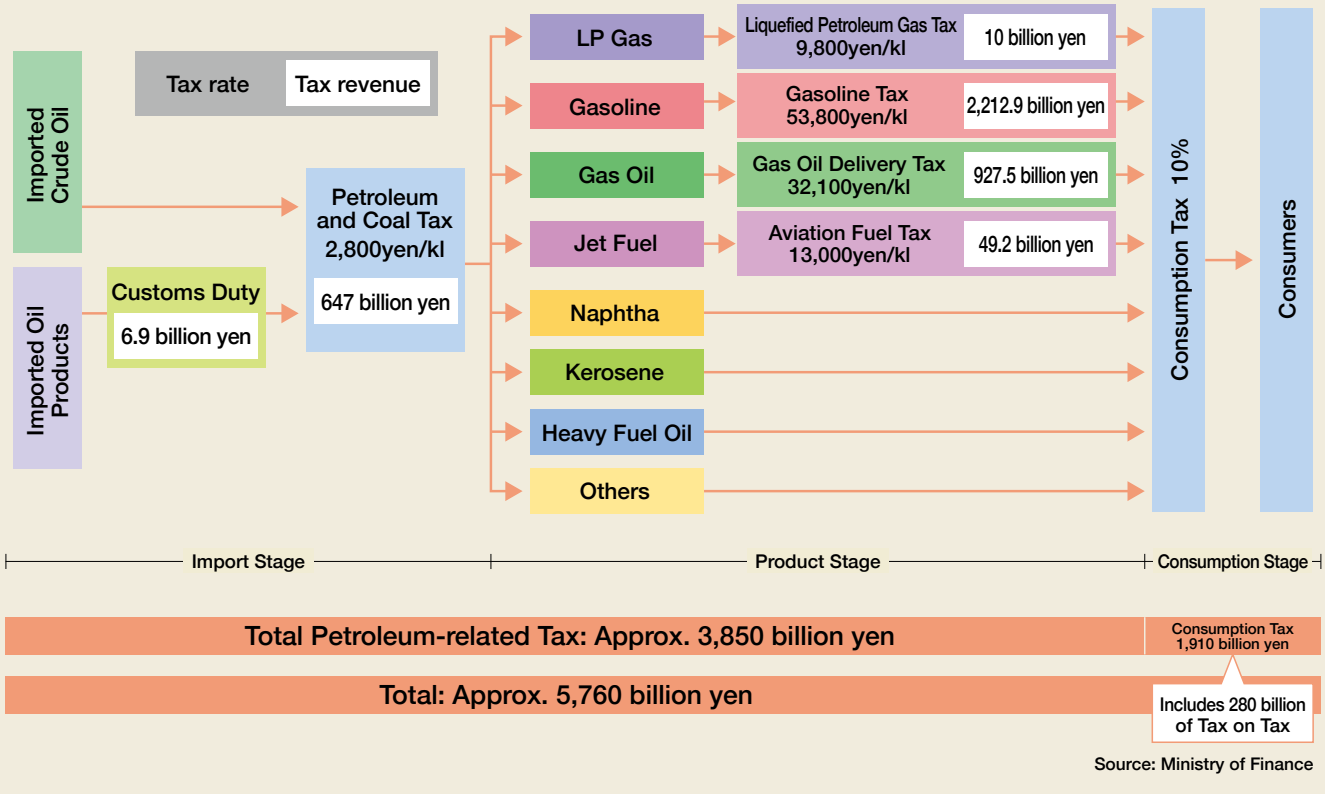
5. Various Petroleum-related Taxes

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. 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 petroleum and gas used for automobiles) are levied. These various petroleum-related taxes amount to about 3,850 billion yen, which accounts for approximately 3.3% of the total national and local tax revenue. If the consumption tax of approximately 1,910 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 5,760 billion yen. 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.

Fig.3-4 Tax Rate of Gasoline and Gas Oil Delivery Tax

		Basic Tax Rate	Special Provisions for Tax Rate
Gasoline Tax	Gasoline Tax Local Gasoline Tax	24,300 yen/kℓ 4,400 yen/kℓ	48,600 yen/kℓ 5,200 yen/kℓ
	Total	28,700 yen/kℓ	53,800 yen/kℓ
Gas Oil Delivery Tax		15,000 yen/kℓ	32,100 yen/kℓ

Fig.3-5 Multiple Types and Stages of Taxation of Petroleum-related Taxes (initial FY2023 budget)



Source: Ministry of Finance

6. Origins of Petroleum Taxation and Changes in Tax Rates

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.

The petroleum and coal tax started as the petroleum tax in 1978 to secure financial resources for promoting the stockpiling and development of oil. In 2003, in addition to coal being added as a taxable fuel (and the petroleum tax was renamed the petroleum and coal tax) in order to balance the tax burden among fuels, new tax rates were also established for each fuel. Furthermore, a tax rate corresponding to the amount of CO_2 emissions was added in October 2012 as a special taxation for global warming countermeasures, and as a transitional measure, the tax rate was increased in three stages until April 2016.

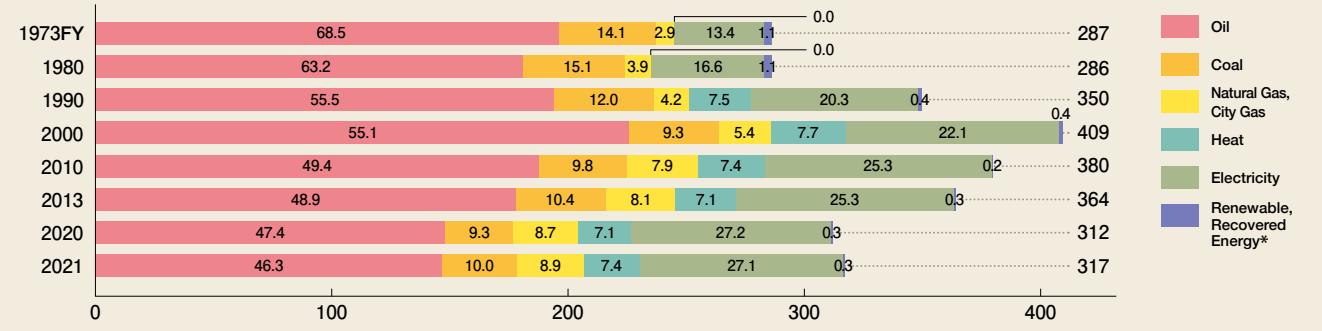
1. Results of Supply and Demand of Energy

Final energy consumption in Japan for FY2021 was 12,276 PJ, Crude Oil Equivalent (COE): 317.05 million kℓ, an increase of 1.6% year-over-year (YOY). Broken down by energy source, petroleum consumption was 5,683 PJ (COE: 147 million kℓ), a decrease of 0.9% YOY, and electric power consumption was 3,325 PJ (COE: 86 million kℓ), an increase of 1.1% YOY.

Supply of primary energy domestically was 18,760 PJ (COE: 482 million kℓ), an increase of 4.1% YOY. Of this amount, petroleum supply (including LPG) was 6,720 PJ (COE: 174 million kℓ), an increase of 2.9% YOY. Its share of the total energy supply compared to the previous year decreased from 36.4% to 36.0% YOY.

Fig.4-1 Changes in Final Energy Consumption

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

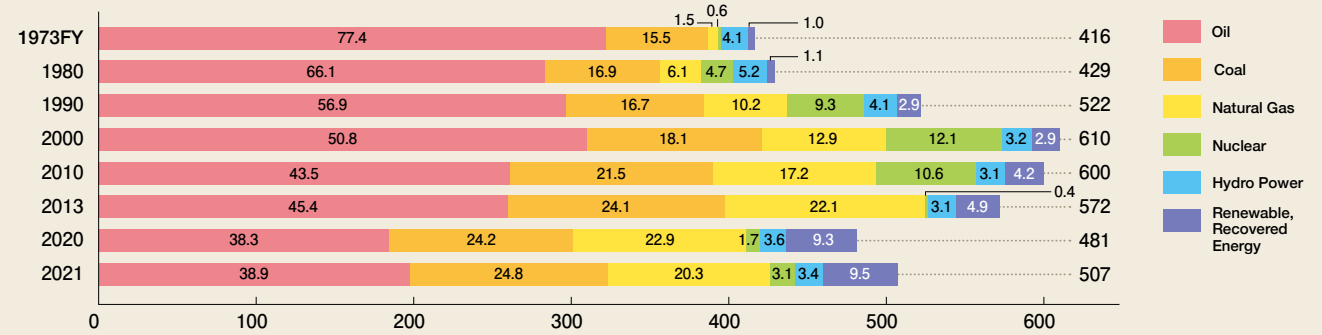


∗ Effective recovery use of wasted energy

Source: METI

Fig.4-2 Changes in Total Primary Energy Supply

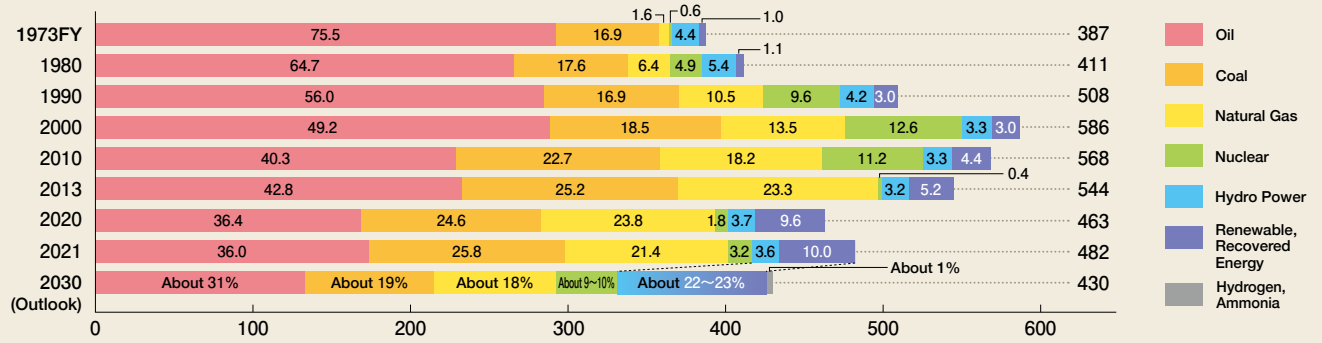
Unit: %, million kiloliters (kℓ) Crude oil equivalent(COE)



Source: METI

Fig.4-3 Changes in Domestic Primary Energy Supply

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



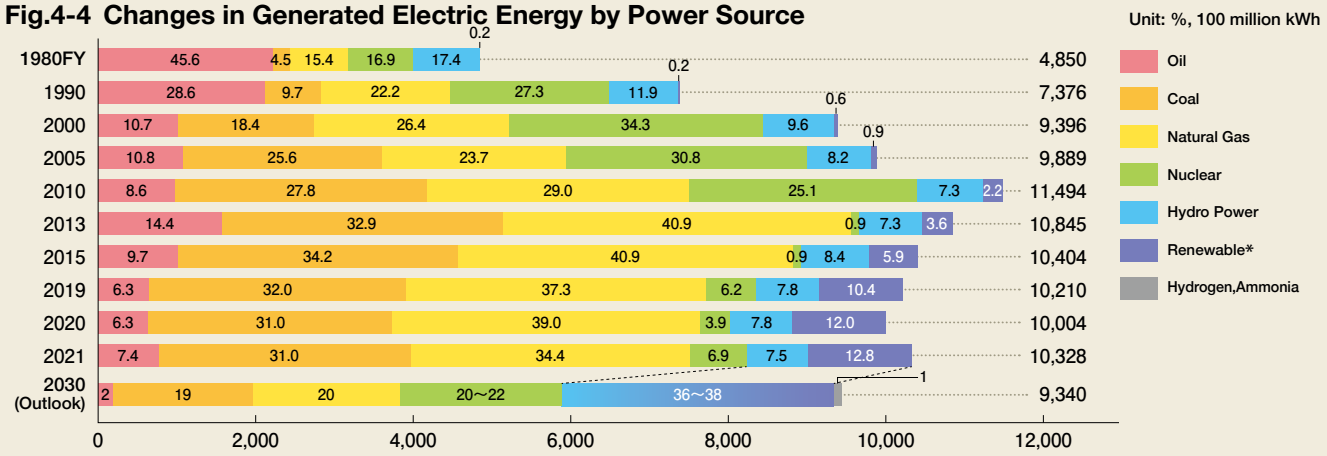
*Primary Domestic Energy Supply is total supply minus exports and changes in inventories

Source: METI

2. Makeup of Electric Power

The rate of oil-fired thermal power generation in the power supply configuration in FY2021 (confirmed report) increased to 7.4% from 6.3% in the previous fiscal year. After the Great East Japan Earthquake, thermal power generation by means of oil and other sources compensated for the amount that had been generated by nuclear power prior to its shutdown. While the ratio of LNG- and coal-fired power generation were maintained, that of oil-fired thermal power has fallen below 10% again since FY2010, and has been on a downward trend since then.

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



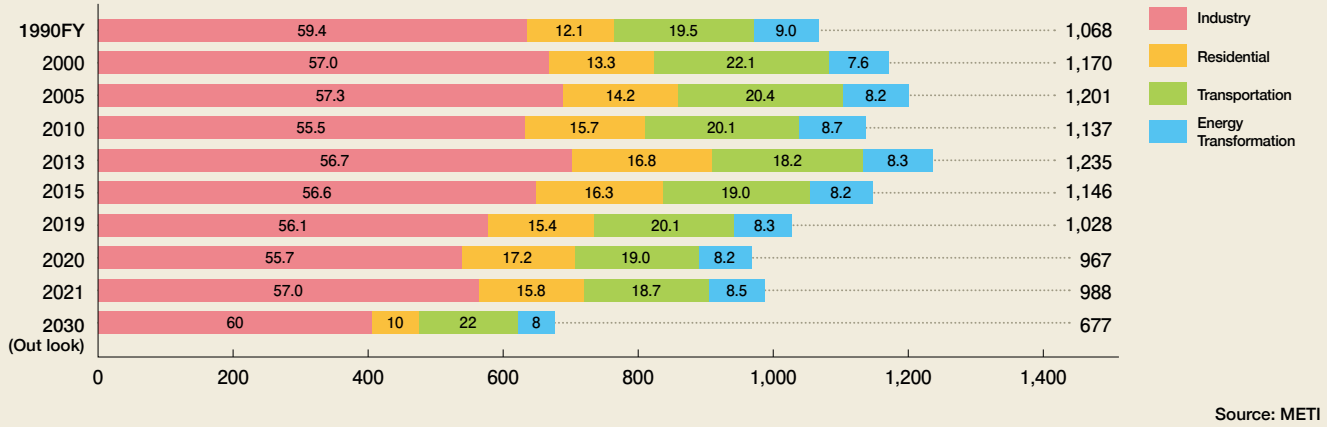
* Solar, Wind, Geothermal and Biomass

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

3. CO_2 Emissions from Energy

Due to the effects of the economic recovery after the Covid-19 pandemic, CO_2 emissions from energy consumption increased in FY2021 (confirmed report) for the first time in eight years, reaching 988 million tons, an increase of 2.1% year-on-year (YOY). It was a 20.0% decrease compared to the most recent peak in FY2013. CO_2 emissions increased for four consecutive years from FY2010 to FY2013 due to the shutdown of nuclear power plants, etc. after the Great East Japan Earthquake. However, since then, emissions have been on a download trend because of the decrease in energy demand, and low-carbon power generation due to the spread of renewable energy and the restart of some nuclear power plants.

Fig.4-5 Changes in CO_2 Emissions from Energy

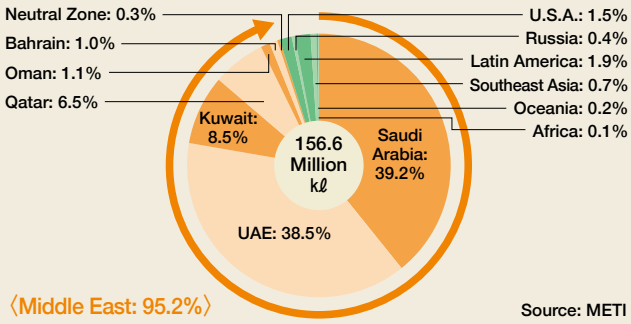


Source: METI

4. Crude Oil Imports

Japan imported 156.6 million kℓ of crude oil in FY2022, an increase of 5.1% YOY. The crude import volume by region showed that Middle Eastern oil producing countries accounted for 95.2%. The countries from which Japan imported crude oil, shown in order of volume, were Saudi Arabia (39.2% of total imports), the United Arab Emirates (38.5%), and Kuwait (8.5%). The top two countries accounted for more than three-quarters of Japan's total crude oil imports.

Fig.4-6 Crude Oil Imports by Country (FY2022)



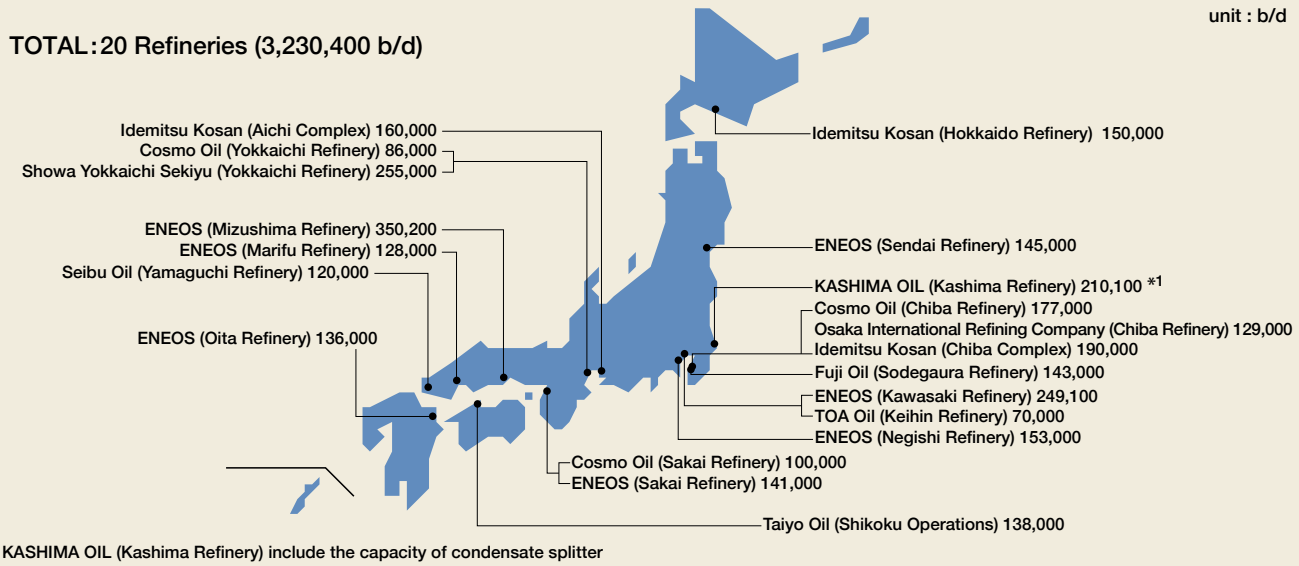
Source: METI

5. 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 FY2022 was 410,000 kℓ, which represents only 0.3% or the equivalent of about one day's worth of the 156 million kℓ of Japan's crude oil processing capacity, almost all of Japan's crude oil is imported from overseas. Because of this, all of Japan's 20 refineries (with a crude oil processing capacity of 3,230 thousand barrels per day) are located in coastal areas, as of the end of October 2023. 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.4-7 Location of Refineries and Crude Oil Processing Capacity (as of end October 2023)



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

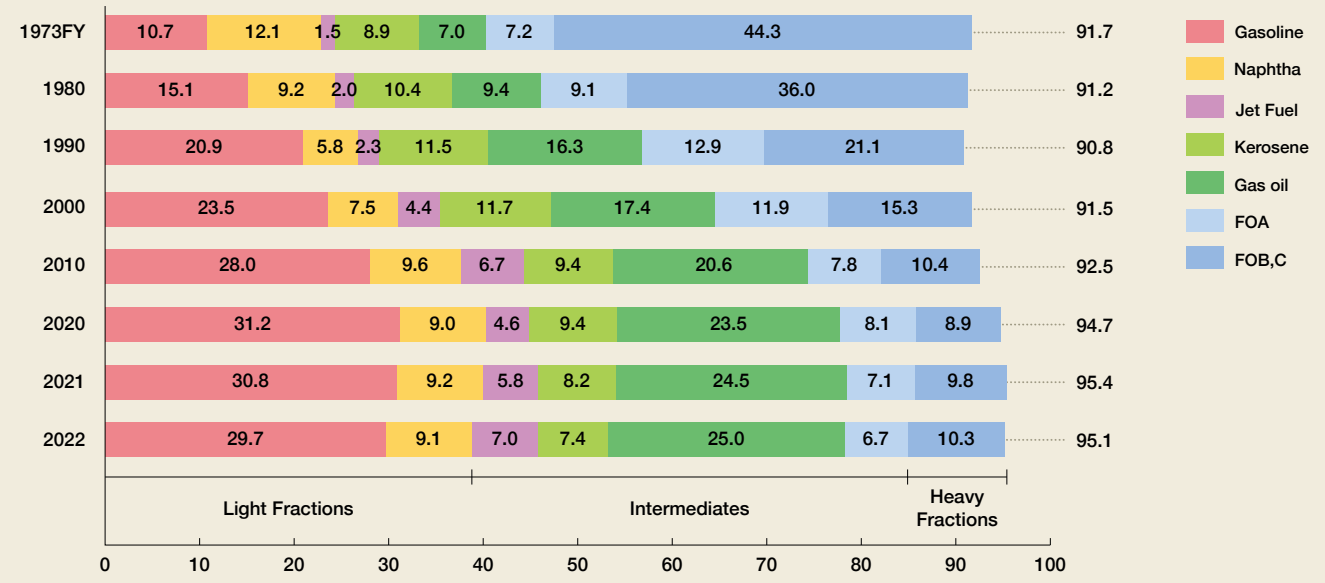
6. Production of Petroleum Products

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.) simultaneously from crude oil in certain proportions (yield), and it is impossible to product 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 oils and cracking heavy oil for use as the base material for gasoline, kerosene, etc. Production of main petroleum products in FY2022 was 150 million kℓ, an increase of 5.7% YOY. The production yields are about 39% for the light fractions, about 46% for four intermediate products, and about 10% for heavy fractions, with the total production amounting to approximately 95%.

Fig.4-8 Changes in Petroleum Products Yield from FY1973 to 2022FY

Unit: %



Source: PAJ

7. Import of Petroleum Products

Naphtha imports account for far and away the largest share among imported petroleum products every year; about 70% of domestic demand for petroleum products was covered by imported products in FY2022. As Japan has adopted the method of refining oil in the consumption locale, petroleum product imports play a supplemental role, with the exception of naphtha, for which Japanese petrochemical companies import their own naphtha as a petrochemical feedstock.

Furthermore, as jet fuel and heavy fuel oil, etc. that are imported for refueling international aircraft and ocean-going vessels are not supplied to the domestic market, they are not included in the volume of imported products.

8. Export of Petroleum Products

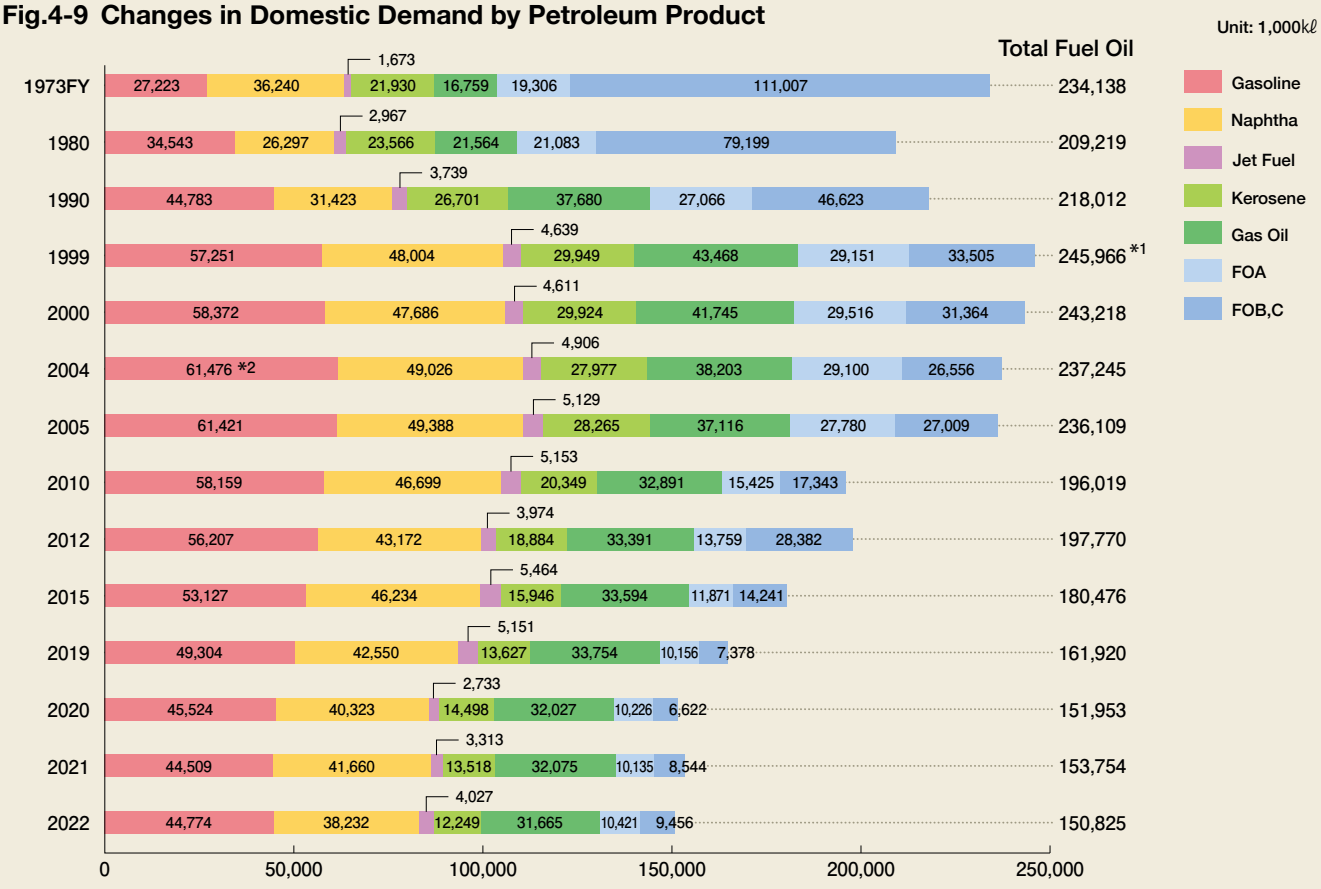
As for the quantity of exports by fuel product in FY2022, ranked in descending order are heavy fuel oil B and heavy fuel oil C (FOB and FOC), gas oil, and jet fuel. Exports of jet fuel are about 1.8 times as much as the domestic demand. This is because the volume of jet fuel that is supplied domestically to international flights (bonded exports) is considered as an export. Similarly, when heavy fuel oil produced in Japan is supplied to ocean-going vessels, this volume is considered as an export, and these exports account for about 60% of the FOB & FOC exports. In addition, gas oil produced in Japan has a sulfur content of 10 ppm or less, and a large volume of gas oil is exported to Australia, where sulfur content is strictly regulated. About 40% of Japan's total gas oil exports went to Australia in FY2022. With domestic demand declining, gasoline and other fuels are also being exported, depending on the trends in overseas markets.

9. Demand for Petroleum Products

The total petroleum products demand for fuel oil in FY2022 was 151 million kℓ, a decrease of 1.9% YOY. Compared to its peak in FY1999, demand decreased by 39% due to improvements in fuel efficiency and energy-saving measures, etc. Especially, demand decreased sharply in FY2020 due to the impact of the spread of the Covid-19 pandemic and other factors.

Naphtha, kerosene, and gas oil decreased 8.2%, 9.4%, and 1.3% YOY, respectively, while gasoline, jet fuel, heavy fuel oil A, and heavy fuel oil B and C increased 0/6%, 21.6%, 2.8%, and 10.7% YOY, respectively.

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

10. 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.

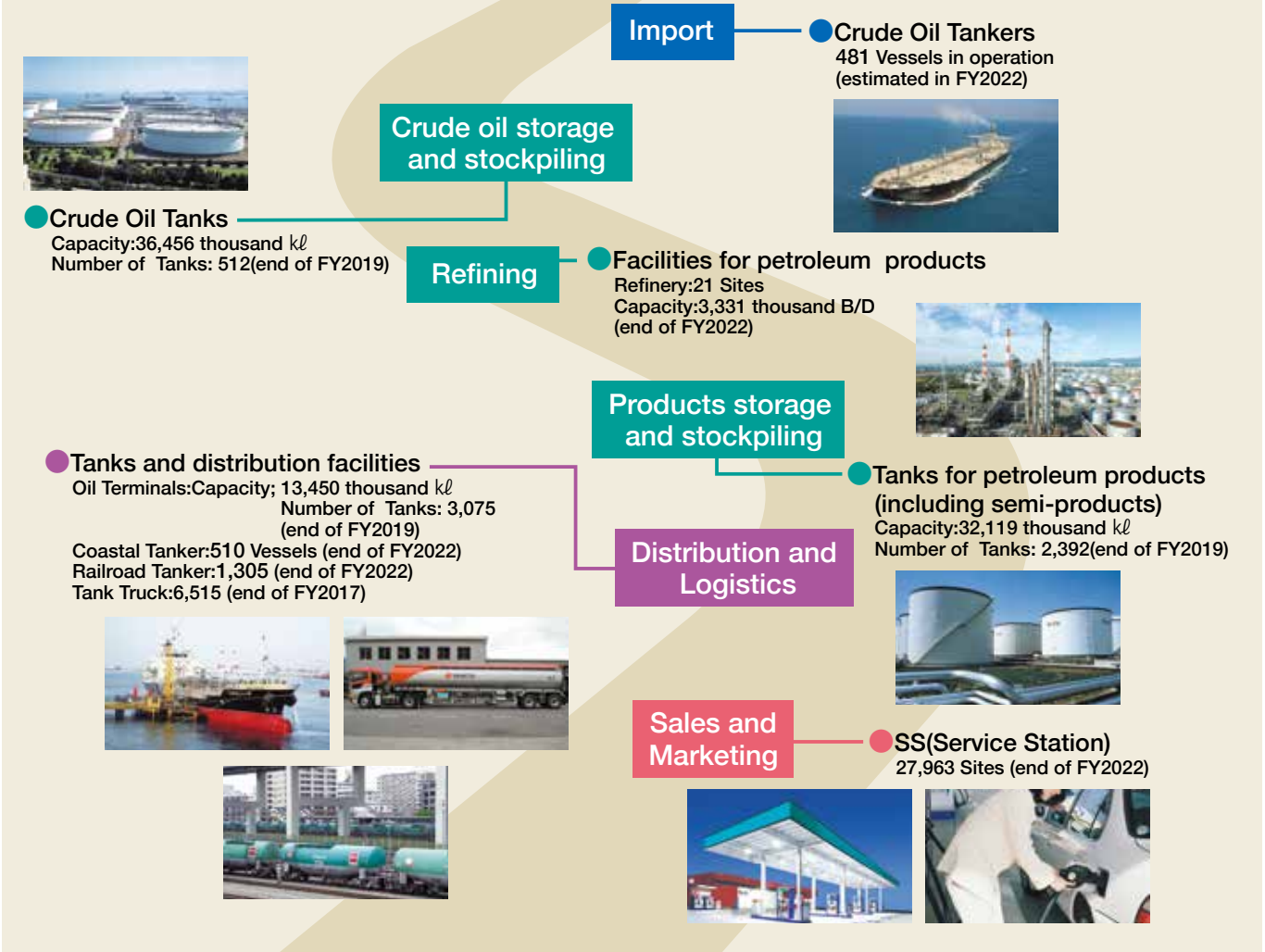
A coastal tanker is used for marine transportation between seaside districts in order to transship oil from a refinery to an oil terminal, or delivering oil directly from a refinery or an oil terminal to users. This method is excellent for large-volume and long-distance transportation. The amount transported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



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

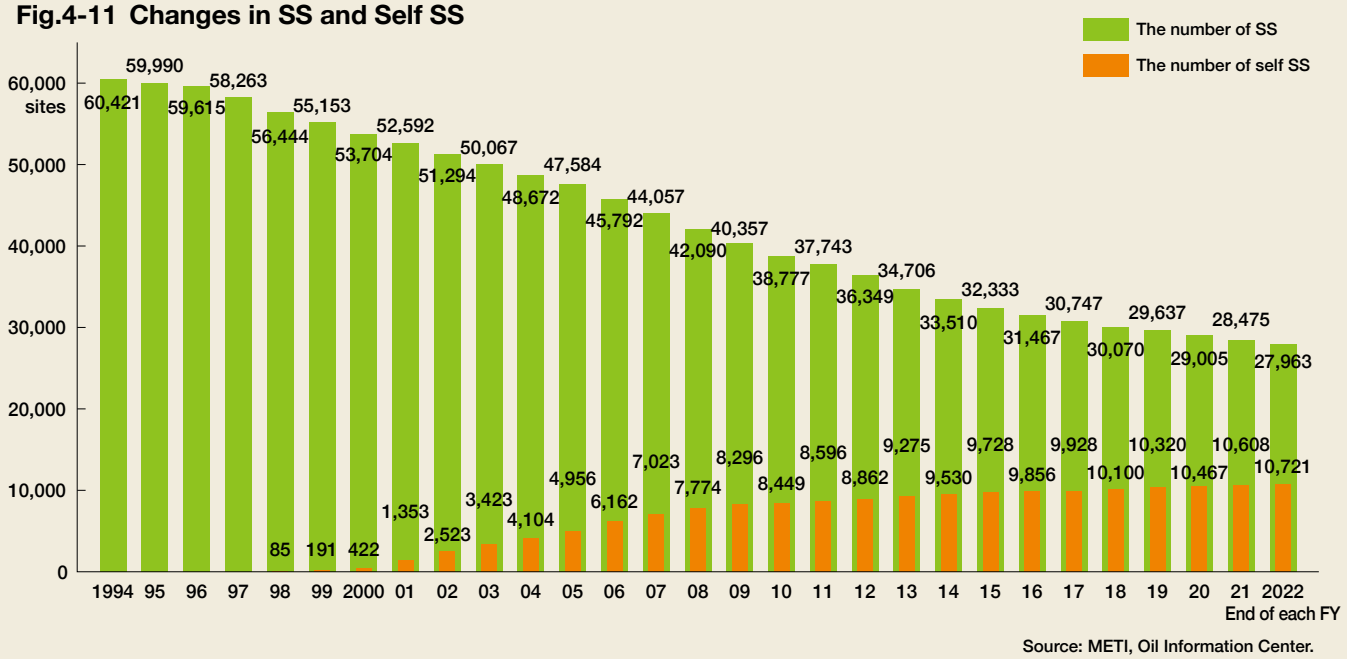
Domestic gasoline sales volume is showing a downward trend due to structural factors, such as population decline and improved fuel efficiency of vehicles. Moreover, an increase in next-generation vehicles, such as electric vehicles (EV), plug-in hybrid vehicles (PHV), and fuel cell vehicles (FCV), are 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 27,963 at the end of March 2023. 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 348 municipalities at the end of March 2022, 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 May 2023, there were 14,461 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 10,721 as of the end of March 2023, accounting for approximately 38% 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 SS and Self SS



Source: METI, Oil Information Center.

Appendix Profile of Petroleum Association of Japan (PAJ)

Petroleum Association of Japan (PAJ), incorporated in November 1955, is composed of 11 refiners and primary distributors in Japan. Its main activities are:

1. to collect the opinions of the member companies and compile proposals to be incorporated in the government petroleum policy.
2. to survey the situation of the petroleum industry.
3. to provide information relating to the petroleum industry.

I. Activities

PAJ deals with all matters concerning the refining and marketing of petroleum products. The main functions by PAJ are as follows:

1. Publishing information on important issues for the petroleum industry
2. Advocating the industry's opinions and submitting proposals to the government, business associations, the media and the general public
3. Researching and coordinating activities related to important petroleum issues and providing information on such issues
4. Researching and coordinating activities related to climate change issues related to petroleum,and carbon neutral
5. Undertaking governmental subsidy programs such as the "Major Oil Spill Response Program", including international conferences
6. Enhancing communication and understanding among member companies

II. Main Activities and Projects in FY2023

1. Improvement and reinforcement of the petroleum industry's business structure
   (1) Advocate deliberations on the new energy policy
   (2) Offer opinions to strengthen international competitiveness of the industry
   (3) Offer opinions to the deregulation of the industry and refinery safety
   (4) Appropriately handle tax revision
   (5) Offer the formation of a fair and transparent domestic petroleum market
   (6) Provide information and statistical data of the petroleum industry
2. Emergency response measures to secure stable supply of petroleum products
   (1) Strengthening efforts to secure stable supply of petroleum products during the transition period
   (2) Maintain and strengthen petroleum supply network through reviewing safety regulations on service station
   (3) Provide timely and appropriate information in emergencies
3. Environment and social responsibility
   (1) Strengthening efforts to realize carbon neutral vision in 2050
   (2) Enhance voluntary safety management action plan (Risk-based approach)
   (3) Implement PAJ Major Oil Spill Response Program
4. PR activities for better public understanding of the petroleum industry
   (1) Strengthening the dissemination of information on the industry's effort to combat climate change, including carbon neutrality
   (2) Strengthen the dissemination of information on the industry's efforts to enhance security and resilience
   (3) Provide opinions on oil and energy policy based on the premise of S+3E

■ Executives

President
Shunichi KITO
Representative Director
President and Chief Executive Officer
Idemitsu Kosan Co., Ltd.

Vice-President
Yasuhiro SUZUKI
President
Representative Director
Chief Executive Officer
Cosmo Oil Co., Ltd.

Vice-President
Tomohide MIYATA
Representative Director
Executive Vice-President
ENEOS Corporation

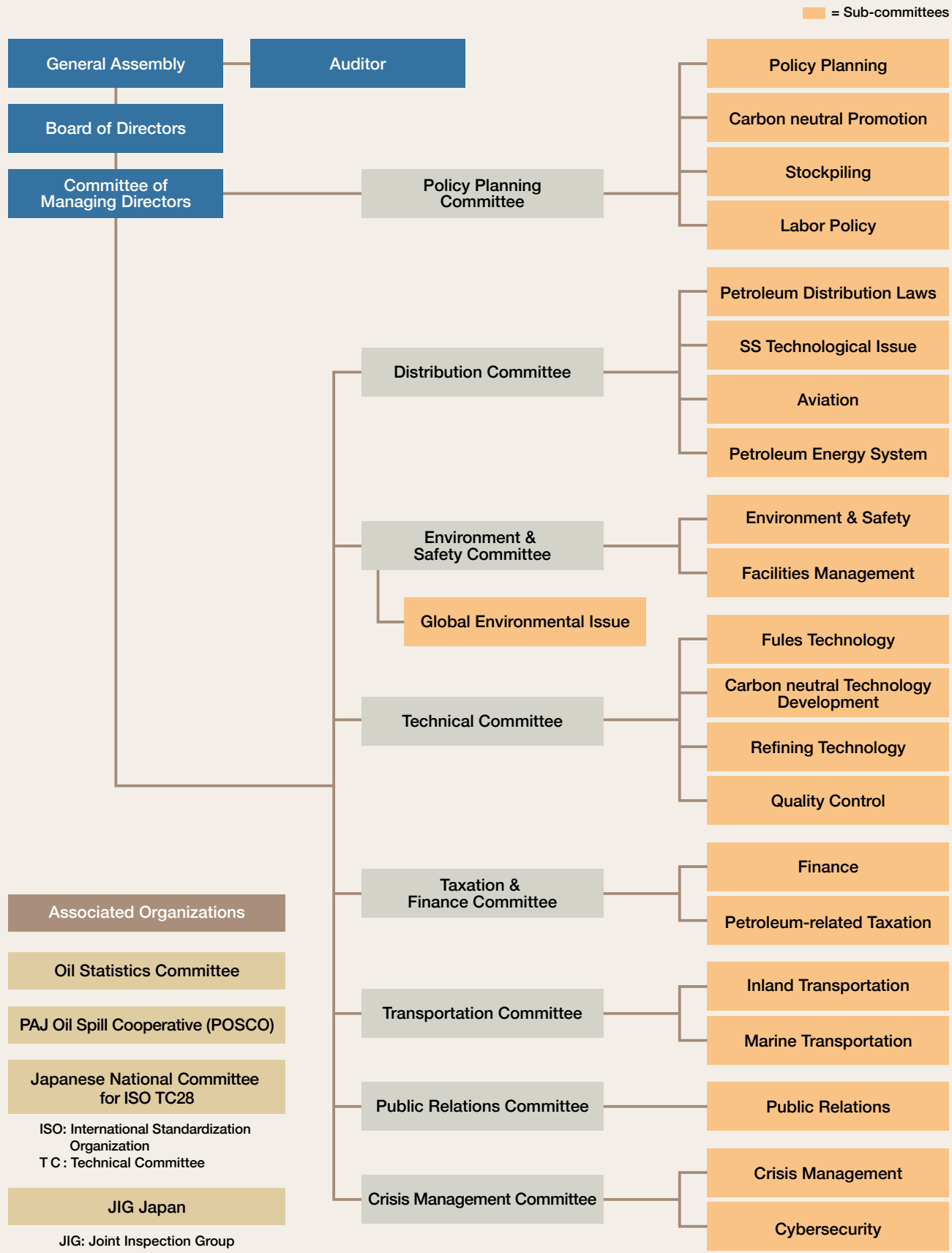
Senior Managing Director
Shinya OKUDA

Managing Director
Uichiro YOSHIMURA

PAJ Member Companies (11)

- Idemitsu Kosan Co., Ltd.
- TOA OIL CO., LTD.
- KASHIMA OIL CO., LTD.
- Taiyo Oil Company, Limited
- Fuji Oil Company, Ltd.
- Cosmo Oil Co., Ltd.
- Cosmo Oil Marketing Co., Ltd.
- ENEOS Corporation
- Kygnus Sekiyu K.K.
- SHOWA YOKKAICHI SEKIYU CO., LTD.
- Seibu Oil Co., Ltd.

■ Management and Committees



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