Petroleum Industry in Japan 2022

Petroleum Association of Japan

Preface

This brochure, *Petroleum Industry in Japan*, issued bi-annually, aims at providing consumers and other stakeholders with the up-to-date information on the Japanese petroleum industry and the industry's initiatives.

Although the new coronavirus, COVID-19, is still showing no sign of ending, the petroleum industry continues 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 movements to combat climate change, the Japanese government is also declared in October 2020 to aim at a goal of the "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 various initiatives to contribute to the realization of a carbon neutral society.

This brochure is revised from time to time to provide the various movements surrounding the petroleum industry in a concise and easy-to-read manner.

We hope this brochure will help to give you a sound understanding of oil and the petroleum industry in Japan.

December 2022

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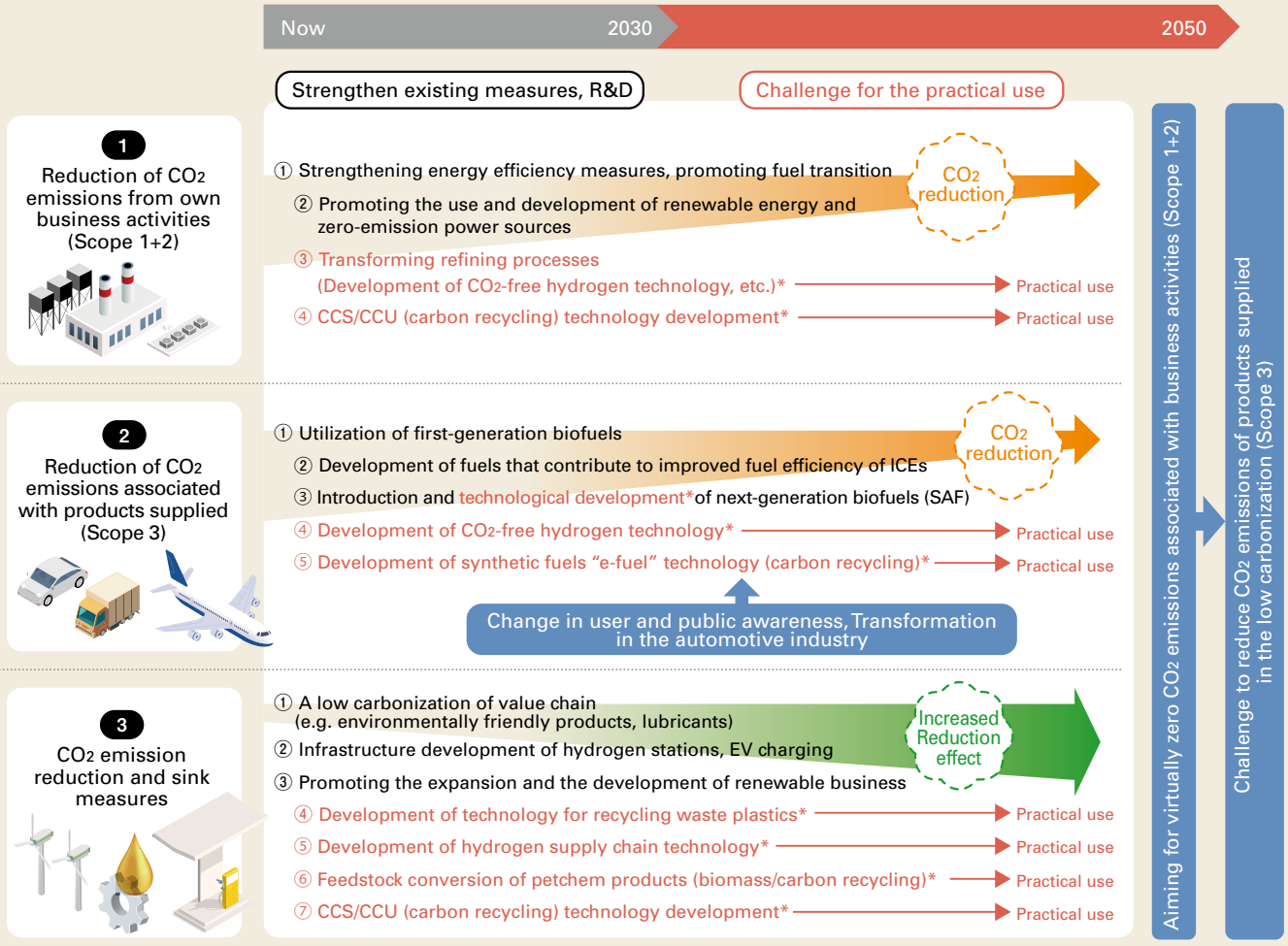
1. A vision for Carbon Neutrality in Japanese Petroleum Industry

In October 2020, the Japanese government declared that Japan would realize "Carbon Neutrality by 2050." In response to this, Petroleum Association of Japan (PAJ) renewed its "Long-term Low Carbon Vision for the Petroleum Industry" in 2019, and formulated "A vision for Carbon Neutrality in Japaness Petroleum Industry" in March 2021.

The greatest challenge of this vision aims to achieve virtually zero CO_2 emissions (carbon neutrality) associated with business activities (Scope 1+2). To achieve this challenge, in addition to strengthening existing measures such as promoting energy conservation as well as the use and development of renewable energy, the petroleum industry as a whole will take on the challenge of "innovative technology development" by 2030, including reform of the refining process through technological developments such as the use of CO_2-free hydrogen, and CCS(Carbon dioxide Capture and Storage) & CCU (Carbon dioxide Capture and Utilization, carbon recycle). After that, the industry will continue to take on the challenge of putting it into societal implementation toward 2050.

The industry will also challenge to reduce CO_2 emissions associated with products supplied in the low carbonization (Scope3) by means of the development and practical application of innovative technologies such as synthetic fuels.

Fig:1-1 ■ A vision for Carbon Neutrality in Japanese Petroleum Industry



Scope1: Direct greenhouse gas emissions by businesses themselves(Fuel combustion, Industrial process)
Scope2: Indirect emissions from the use of externally supplied energy, e.g. electricity, thermal or steam, etc..
Scope3: Indirect emissions in the supply chain outside of Scope 1,2 (Emissions of others)

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

In addition, as measures for CO_2 emission reduction and sinks, the development of infrastructure such as hydrogen fueling stations and EV charging stations, the expansion of renewable energy business, the development of waste plastic recycling technology, and the conversion of raw materials for petrochemical products to next-generation biomass will contribute to the realization of carbon neutrality in society as a whole.

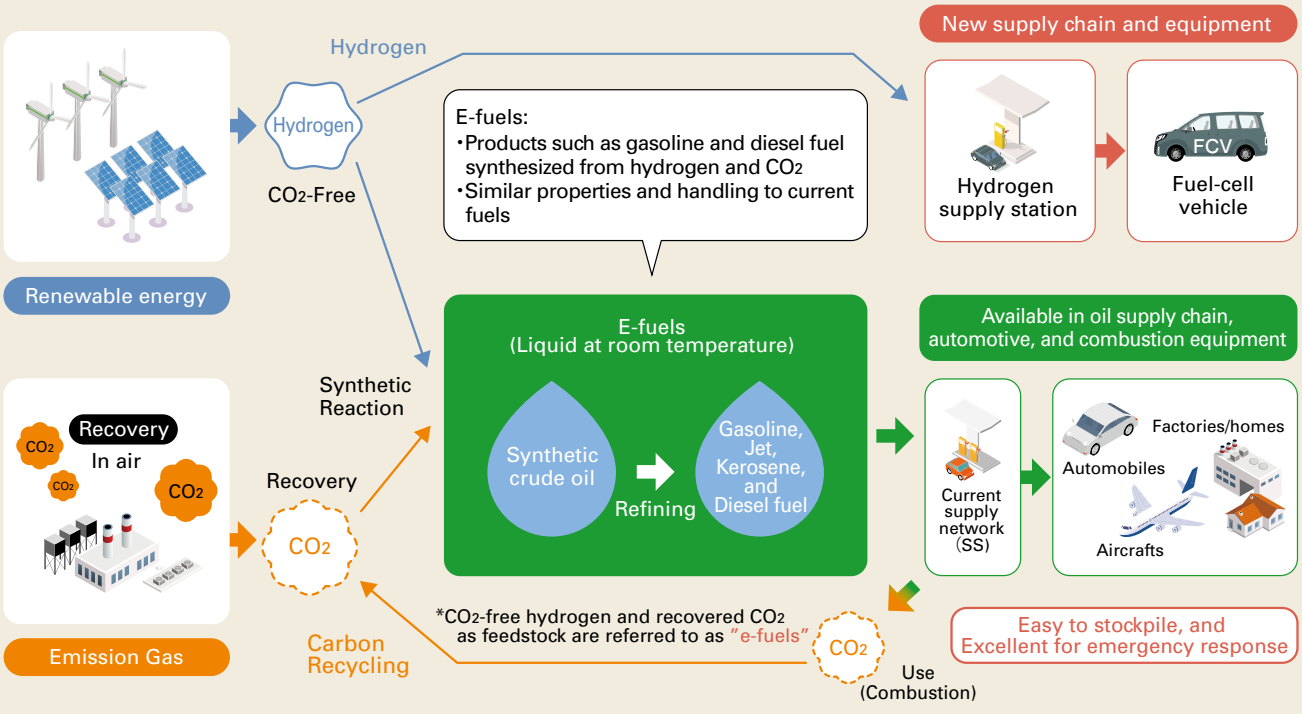
Current oil refineries in Japan refine crude oil, which is primarily a fossil fuel, as a feedstock to produce petroleum products such as gasoline, other fuels and raw materials for chemical products. The refineries of the future toward 2050 will be transformed into bases that produce "carbon-neutral fuels and chemical products", using the fruits of "innovative technology development" such as CO_2-free hydrogen, recovered CO_2, next-generation biomass, and waste plastics as feedstock, while utilizing existing facilities and modifying the necessary refining processes.

2. Synthetic Fuels

Synthetic fuel (e-fuel) is a fuel made by synthesizing 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. E-fuel, a liquid at room temperature, has high energy density and are excellent in terms of portability and ease of handling.

E-fuels also being developed with the aim of having the similar properties as existing gasoline and diesel fuel. For this reason, e-fuel has the advantage that they can be used not only as a stand-alone e-fuel, but also blended with existing gasoline or diesel fuel to be used for vehicles and combustion equipment with conventional internal combustion engines (ICEs), and its supply infrastructure (tank trucks, service stations, etc.) can also be used for the existing oil supply chain . In other words, even in the "transition period" toward carbon neutrality, e-fuel has excellent characteristics in that they can be supplied stably while suppressing the increase in the burden on the public.

Fig:1-2 ■ Future Synthetic Fuels(e-Fuels) Scope



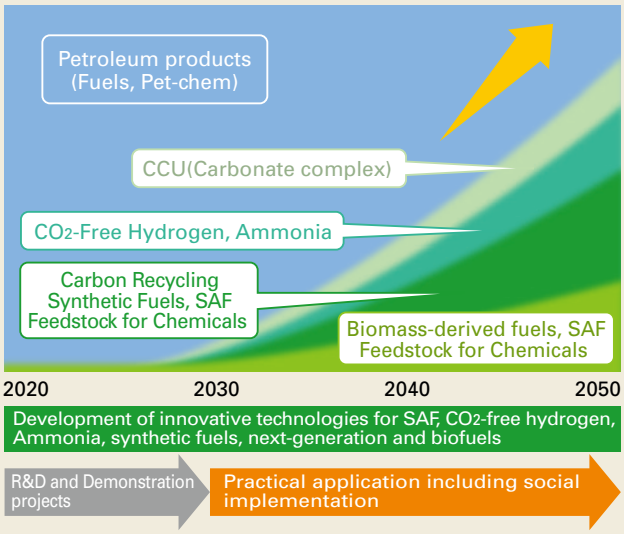
3. Decarbonization of Products toward Carbon Neutrality

Petroleum products, which currently account for the majority of fuels and chemical feedstocks, will shift to "carbon neutral products", such as e-fuel, CO_2-free hydrogen, and biomass-derived fuels, toward 2050 through the practical application and societal implementation of innovative technologies.

During the transition period for shifting to new energy sources, there is an extremely difficult issue of how to ensure a stable supply of both old and new energy sources.

The petroleum industry will proactively address issues such as climate change, while ensuring a stable supply of petroleum products into the future. Through these efforts, the industry will contribute to realize a carbon neutrality for society as a whole and to supply society with "sustainable energy" that will play an active role in building a "sustainable society".

Fig:1-3 ■ Image Figure for Petroleum Products Toward Carbon Neutrality



4. Roadmap for "Transition Finance" in Oil Sector

In order to achieve carbon neutrality, the Ministry of Economy, Trade and Industry (METI) has formulated a sectoral roadmap for "transition finance" to decarbonization, based on its view that it is important to promote financing for transition efforts to steadily move toward decarbonization in industries that emit large amount 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 oil companies' strategies and initiatives. 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 in March 2021.

To achieve net zero CO_2 emission 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 decarbonizing technologies such as CCS and CCU, 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 a stable supply of oil is a major premise for proceeding with the transition, and financial institutions requires each company to take this point into consideration when developing its transition strategy and also when determining the eligibility for founding.

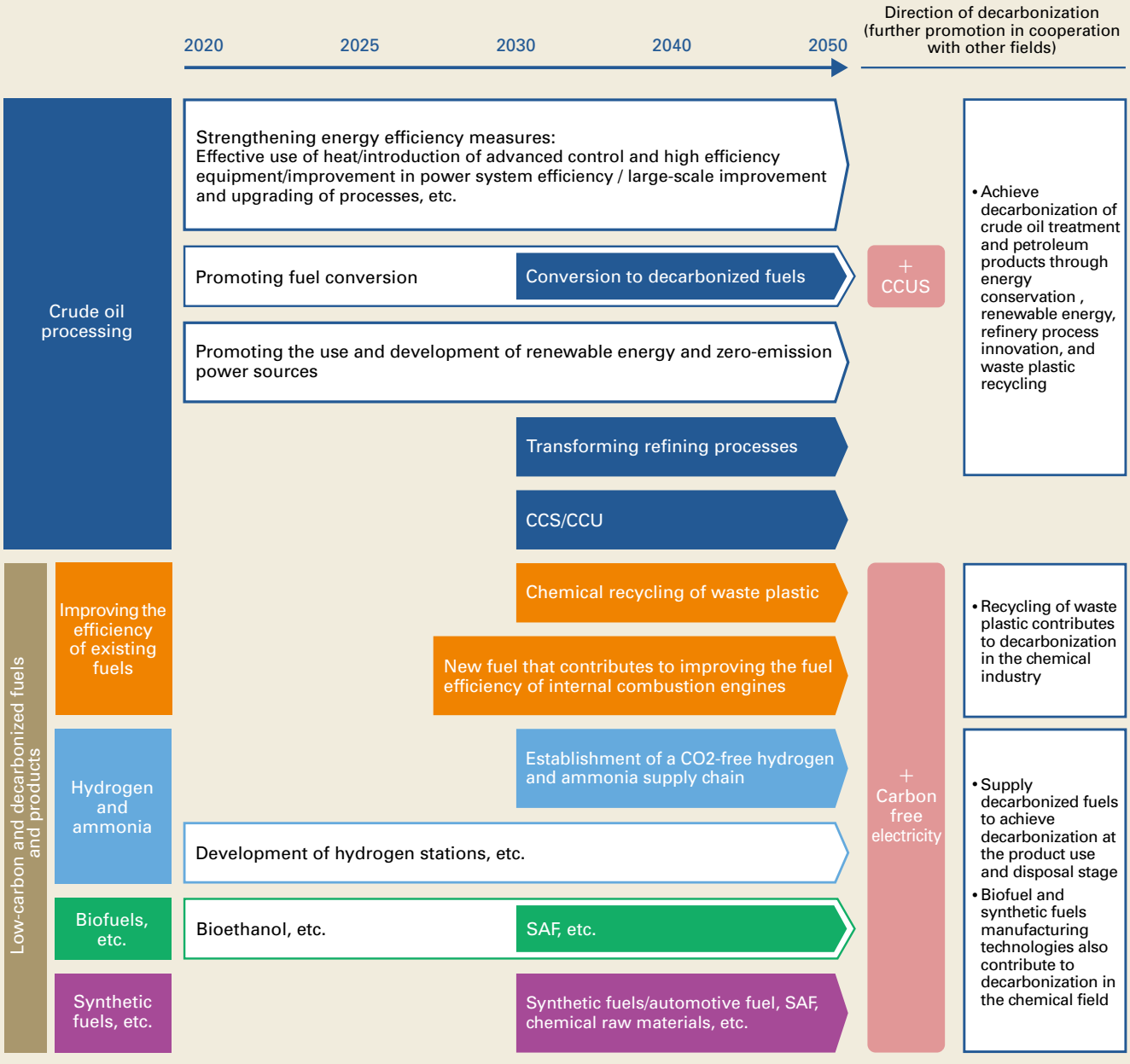
Recently, oil companies are now beginning to raise funds through transition financing, and the petroleum industry is working to realize its vision of becoming carbon neutrality while utilizing such funds as well.

Fig:1-4 ■ Image Figure for Petroleum Products Toward Carbon Neutrality

Major sources of emissions	Crude oil processing	Product combustion
Overview	Use of heat during petroleum refining, and emissions from electricity selfgeneration	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)

*Others and Emissions from transportation and mining are not covered under this roadmap
Source: Roadmap for "Transition Finance" in Oil Sector, Feb., 2022, METI

Fig:1-5 ■ Technology Pathways to Decarbonization, Technical Roadmap in Oil Sector



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

5. Utilization of Biomass Fuels

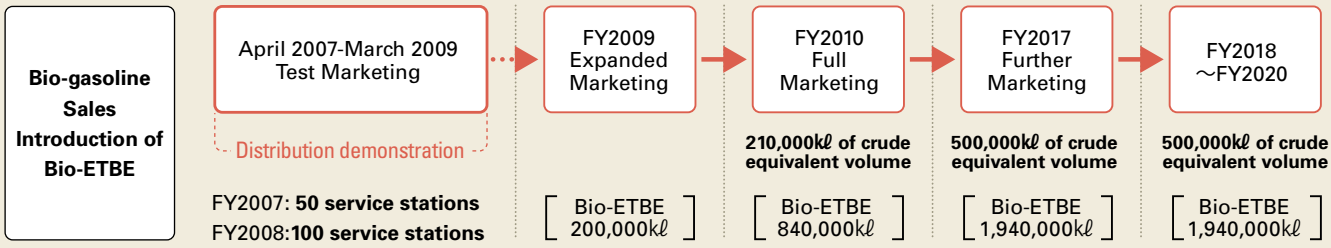
Biomass fuels can be produced from renewable materials such as agricultural crops and trees, and they are considered to be an energy effective against global warming due to its carbon-neutral effect, in which the amount of CO_2 emitted during combustion won't be counted. In Japan the implementation target amount of biomass fuels for transportation use was set to 500,000kℓ of crude oil equivalent set in the Kyoto Protocol Target Achievement Plan (April 2005).

In January 2006, based on the request of the Agency of Natural Resources and Energy, the petroleum industry announced a target plan to blend bio-ETBE produced from 360,000kℓ of bio-ethanol (210,000kℓ of crude oil equivalent) with gasoline in fiscal year (FY) 2010, aiming to cooperate in the achievement of the government plan. After the test marketing of bio-gasoline (containing bio-ETBE, Ethyl-Tertiary-Butyl-Ether) during FY2007 and FY2008, the petroleum industry introduced 200,000kℓ of bio-ETBE blended gasoline in FY2009, a year before the full-scale introduction in FY2010.

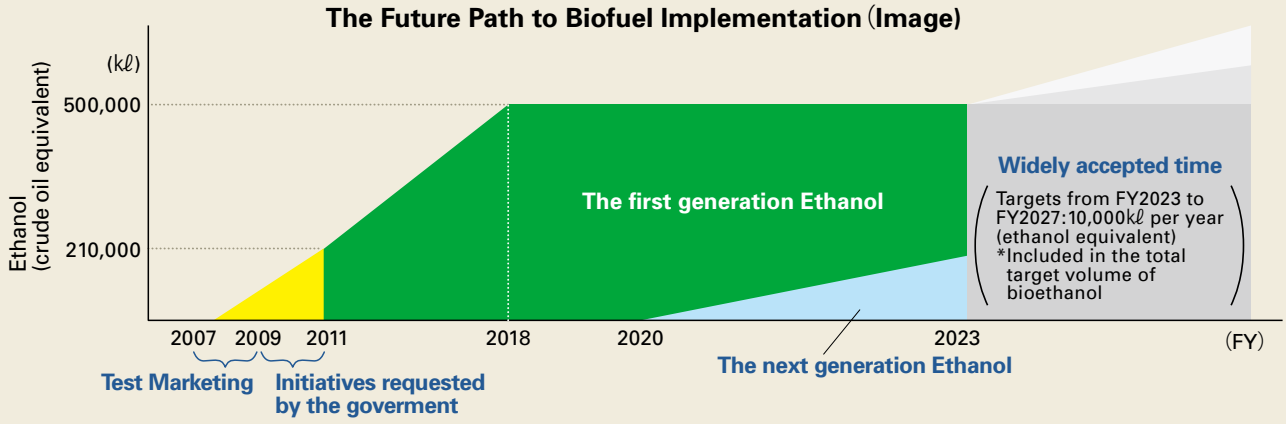
Furthermore, according to the "Criteria for Use of Non-fossil Energy Sources", indicated in November 2010, under the Law Concerning Sophisticated Methods of Energy Supply Structures specified that about 820,000kℓ of bio-ethanol (500,000kℓ of crude equivalent volume) is blended directly with gasoline or in the form of bio-ETBE for automobile fuels in FY2017, and each year's target volume was set in phases. The member companies of PAJ have steadily achieved this target with 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 the criteria for FY2018 and beyond. In consideration of the issues of almost all dependence on import, relatively high raw material cost and competition with food, the committee has 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 the cost-effective and eco-efficient bio-ethanol (domestic

Fig:1-6 ■ Biofuel Initiatives in the Petroleum Industry (Bio-Gasolin, Bio-ETBE)



The Future Path to Biofuel Implementation (Image)



Source: Based on The 2'nd Technical Review Committee for the Utilization of Biofuels in Japan, Jan. 26, 2018, METI

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, the annual target volume of 500,000kℓ of crude oil equivalent is maintained for five years until FY2022.

After that, the criteria for the utilization for the next generation bio-ethanol*, enforced on April 1, 2020, established the annual target of 10,000kℓ (ethanol equivalent) for petroleum refiners for the five years from FY2023 to FY2027, which is included in the overall target of 500,000kℓ of bio-ethanol (crude oil equivalent). Furthermore, the amount of bio-jet fuels, equivalent to ethanol in terms of calorific value, after April 1, 2023 can be considered to be part of the target amount of bio-ethanol.

* The next generation bio-ethanol: While the first generation bio-ethanol is produced from food based raw materials, the next generation bio-ethanol is produced from non-food raw materials such as cellulose from plants and trees, and algae.

6. Efforts to Global Warming Issues

PAJ formulated the "Voluntary Action Plan for Global Environmental Conservation by the Petroleum Industry" in February 1997 to respond to Keidanren's* initiative, and set a target to be achieved by FY2012 for the improvement of "unit energy consumption at oil refineries" as the energy saving indicator at refineries. The target level of the unit energy consumption at oil refineries was set at a 13% improvement from the FY1990 level on the annual average of the FY2008-2012 period, but the result was exceeded the target by 15% due to the efforts of each company through advanced heat recovery and efficiency improvement and optimization of refining facilities.

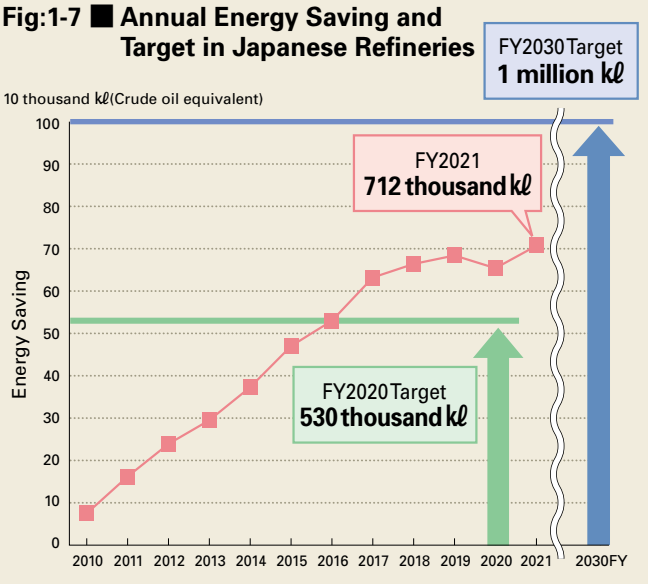
In line with the basic policy of the "Commitment to a Low-Carbon Society" announced by Keidanren to succeed its "Voluntary Action Plan", PAJ issued the "Commitment to a Low-Carbon Society for the Petroleum Industry" in March 2010. In this commitment, the new target was set to achieve an energy saving volume of 530 thousand kiloliters (kℓ) (crude oil equivalent) at refineries in FY2020 by means of energy conservation measures after FY2010, in comparison with a business-as-usual (BAU) case of no energy conservation measures after FY2010, and PAJ promotes further improvement in energy saving. As a result, the energy saving in FY2020 was 654 thousand kℓ of crude oil equivalent, which is 123% of the target achievement rate compared to FY 2010, and 712 thousand kℓ in FY2021.

In response to Keidanren's call, PAJ issued "Petroleum Industry's Action Plan for a Low Carbon Society–Phase II" in March 2015 to set a target after FY2020, taking into consideration the ongoing plan. The Phase II plan aims "to achieve one million kℓ of energy saving at refineries in FY2030 on a crude equivalent basis compared to the FY2010 level".

In October 2020, the Japanese government declared that Japan would realize "Carbon Neutrality by 2050 in Japan." In response to Keidanren's initiative, PAJ revised its "Action Plan for a Low Carbon Society" to the "Carbon Neutral Action Plan for the Petroleum Industry" in September 2021. The latest action plan stipulates the following two policies: The first one is to achieve energy savings equivalent to one million kℓ of crude oil equivalent through promoting the introduction of BAT (Best Available Technology) in refineries toward FY2030, and the second one is to proactively take on the challenge of realizing Carbon Neutrality by 2050, the development of innovative technologies such as CO_2-free hydrogen, synthetic fuels, and CCU (carbon recycling) as well as societal implementation of those technologies.

* Keidanren : Japan Business Federation

Fig:1-7 ■ Annual Energy Saving and Target in Japanese Refineries

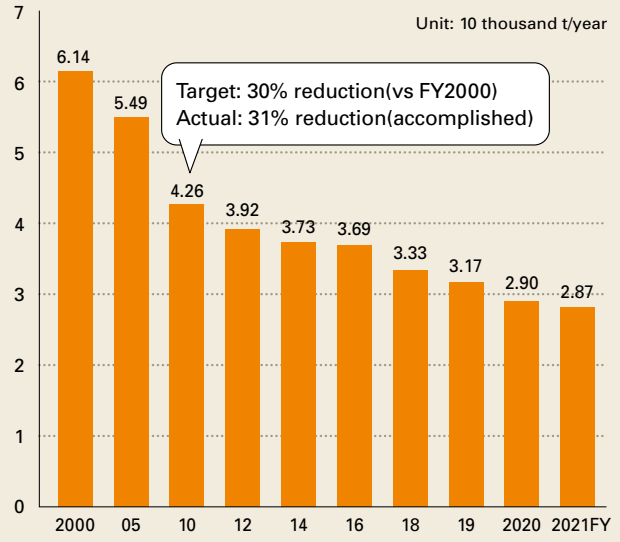


7. Volatile Organic Compounds (VOC) Reduction Measures

VOC are known to change into suspended particulate matter (SPM) or photochemical oxidants when released into the atmosphere. Fuel storage tanks and their loading facilities are the main sources of VOC emissions from refineries. For this reason, crude oil and gasoline at refineries and oil terminals are stored in tanks with a sealed type floating or inner-floating roof to contain VOC emissions. In addition, hydrocarbon vapor recovery units are installed at fuel loading facilities for railroad tankers and tank trucks.

PAJ has been making efforts to control VOC emissions under its Voluntary Action Plan, which set a target of a 30% reduction in FY2010 versus the base year of FY2000, and is confirming the results periodically. The reduction target was achieved in FY2010 with a 31% reduction. The follow up effort was continued and the FY2021 result was a 53% reduction versus the base year of 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 on 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, replacing the Gasoline Retail Business Law, to maintain the world's highest level of gasoline, kerosene and diesel fuel quality. The new law specified the existing quality standards as compulsory ones from both environmental and safety viewpoints, and obliged the 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 satisfying the standard quality requirements.

At first, the compulsory standards were specified on 8 items for gasoline quality, and on 3 items for both diesel fuel and kerosene quality. The Fuel Quality Control Act has been amended since then, as various new importers entered the market, new regulatory items were added as a result of problems that were not initially envisioned and also the emergence of new eco-friendly fuels. As an example, several fires involving vehicles using the imported high concentration of alcohol-blended fuel (more than 50% of content is alcohol) were reported. To ensure consumers' safety, the sale of such alcohol blended fuel as a general gasoline vehicles' use was banned effective August 2003 and amended the Fuel Quality Control Act to include the upper limit of alcohol-to-gasoline blending as a maximum of 3% of volume for ethanol and 1.3 % in weight for oxygenate. Furthermore, as a part of furnishing the usage environment of bio-diesel fuels, that are recently used for a global warming countermeasure, effective March 2007, mandatory standards for FAME (Fatty Acid Methyl Ester), Tri-glyceride and four other materials were added to diesel fuel quality requirements in order to allow blending of bio-diesel components in diesel fuel. The additional requirements include an upper limit for blending in diesel fuel. In February 2009, a registration system and quality assurance system was established for new entrants in the business for blending ethanol and ETBE with gasoline.

Fig:1-9 ■ The Fuel Quality Control Act-Compulsory Standard(as of Apr. 2022)

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℃ max
Triglyceride	0.01 mass% max.
FAME*2	0.1 mass% max.

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

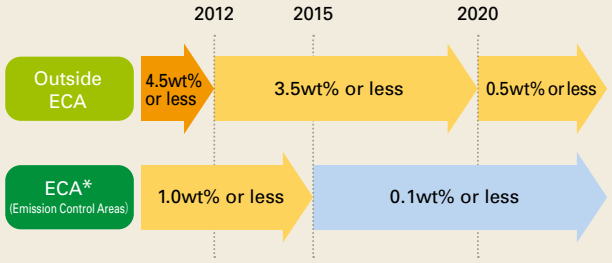
Heavy Fuel Oil	
Items	Specification
Sulfur content*3	0.5 mass% max.
Inorganic acid	Non-detectable

*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)

9. Low Sulfur in Marine Fuels

Emission of air pollutants from ships (Sulphur Oxides: SOx, Particulate Matter: PM, etc.) are regulated by the International Convention for the Prevention of Pollution from Ships (MARPOL), which is deliberated and adopted by the International Maritime Organization (IMO). Under the 2008 treaty amendments, the sulfur content of marine fuels used outside the Emission Control Areas (ECA) has been restricted to 3.5% m/m (mass by mass) or less from January 2012 and to 0.5% m/m or less from January 2020.

Fig:1-10 ■ IMO Regulation of Sulfur Content in Marine Fuel



*The Baltic Sea area, the North Sea area, the North American area (covering designated coastal areas off the United States and Canada) and the United States Caribbean Sea area (around Puerto Rico and the United States Virgin Islands).

Chapter 2 Security and Resilience Measures of the Petroleum Industry

1. Japan's Oil Stockpiling System

In response to OECD recommendation in 1962, which obliged member countries to hold oil stockpiling level at a 60-day equivalent to the nation's oil demand, the Energy Committee under the Industrial Structure Council made a proposal in December 1963 for the necessity of oil stockpiling. At the outbreak of the third Middle East War in 1967, Japan's oil dependency reached 65% of the primary energy supply. With a rapid rise in risk awareness in Japan, the oil stockpiling system in Japan virtually started from fiscal year (FY) 1972.

The first oil crisis, occurred in 1973, caused 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 reinforced oil stockpiling system 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, such measures by the government were legislated as (1) setting the stockpiling target, (2) putting an obligation on refiners, marketers (distributors) and importers of petroleum to hold oil stockpiling at least above the level of their basic obligation volumes, and (3) lowering 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 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, 10 national oil stockpiling bases were constructed across the country. In accordance with the expansion of government stockpiling, the private-sector stockpiling was reduced by 4 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 stockpile level was changed from quantity-based to days-based, and it was decided to secure its amount equivalent to about 90 days of net crude oil imports and one-half of the 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 new Oil Stockpiling Act. In order to ensure fulfillment of oil stockpiling obligations as well as strengthen the foundations for emergency responses, the following provisions were amended in the new act:

① Notification requirements for business commencement of oil refiners, distributors and retailers; clarification of registration requirements for oil importers

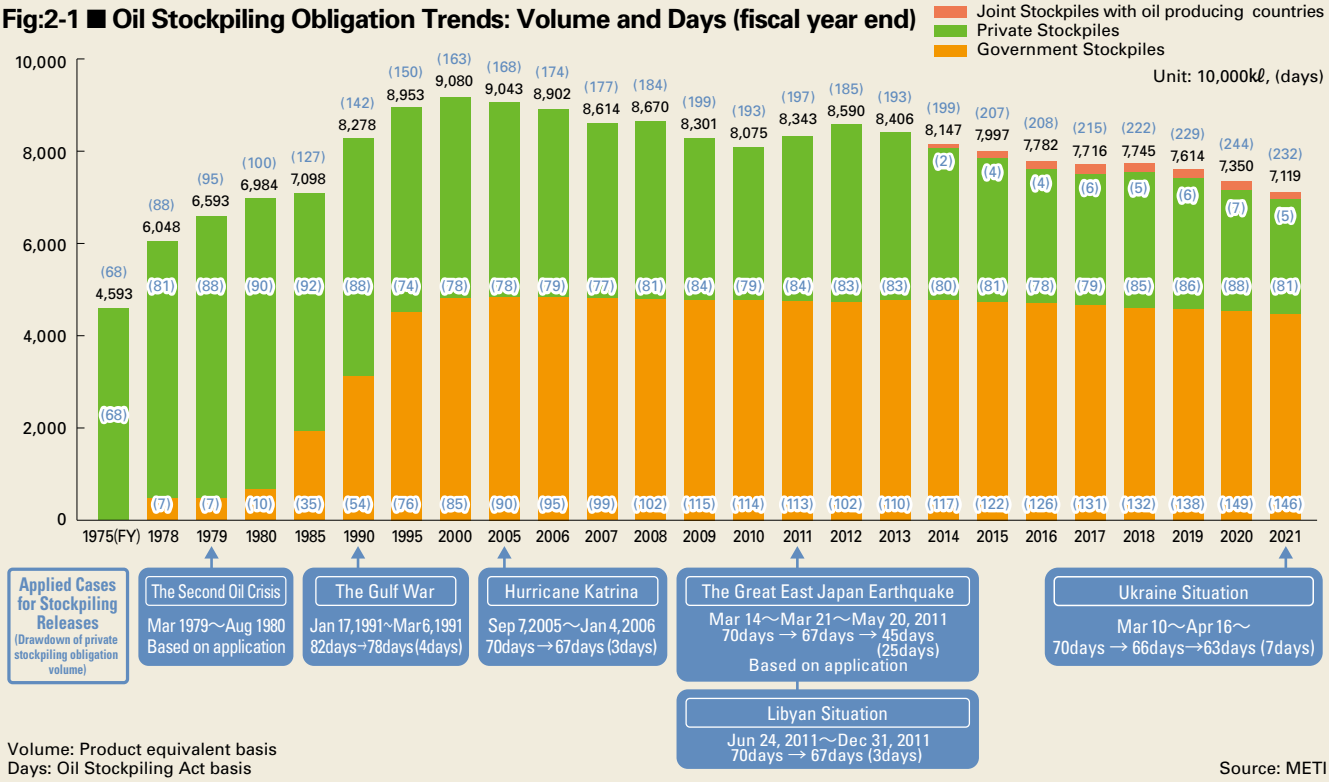
② Clarification of the provisions concerning a release order of the government oil stockpiles by the minister of the Ministry of Economy, Trade and Industry (METI)

③ Recommendation to increase the crude oil processing volumes above planned volumes

Subsequently, the government oil product stockpiling 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, the Japanese government initiated a joint stockpiling project with oil-producing countries. The project scheme is that oil-producing countries can reserve their crude oils in Japan and use them commercially under normal circumstances;however, in an emergency Japanese oil companies can receive preferentially crude oil supply from their reserves under the project agreement. Such joint crude oil stockpiles in Japan were started with Abu Dhabi National Oil Company (ADNOC) in 2009 and Saudi Arabia's state-owned oil company (Saudi Aramco) in 2011.

Fig:2-1 ■ Oil Stockpiling Obligation Trends: 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

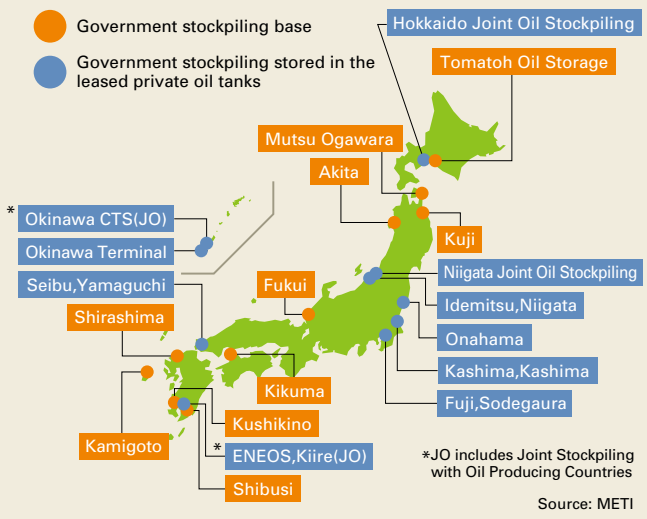
Under the IEA's cooperative emergency response measures (a mechanism in which IEA member countries coordinate to release their oil stockpiles), measures to draw down the private sector oil stockpiling obligation volume may be taken.

When the Gulf Crisis broke out in 1990, in accordance with the IEA's decision, the private-sector stockpiling obligation volume was lowered from January to March 1991 as part of the international coordination system. In addition, in August 2005, when Hurricane Katrina damaged oil production and refining infrastructure in the U.S. Gulf of Mexico, 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 Libya, an OPEC member, 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 of 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 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 the government stockpiles.

Fig:2-2 ■ Location of Government Stockpiling



Source: METI

Fig:2-3 ■ Current Status of Oil Stockpiling in Japan (as of Apr 2022)

	Private Stockpiling	Government Stockpiling	Joint Stockpiling with Oil Producing Countries
Stockpile Days	88 days	145 days	4 days
Stockpiling Volume	26.9 million kℓ	44.5 million kℓ	1.3 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: ①Tanks of national stockpiling bases ②Tanks 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	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 transport from the private oil terminals to the refineries by tanker
Cases of Stockpile Release	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 on March 11, 2011, while the supply of electricity and city gas was stopped, oil, which excels in handling, storage and transportability, played a significant role as the most independent and distributed source of energy supply. Oil was effectively used as fuel for hospitals' emergency power generation, 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. Among nine refineries located in the Kanto and Tohoku regions, six refineries halted production (equivalent to about 30% of Japan's total refining capacity). Oil terminals on the northern Pacific coast

were also unable to carry out product shipment although there were adequate inventories. Because of the paralyzed social infrastructure such as harbor facilities and roads, together with logistic obstacles, supply of petroleum products could not be secured temporarily in some regions.

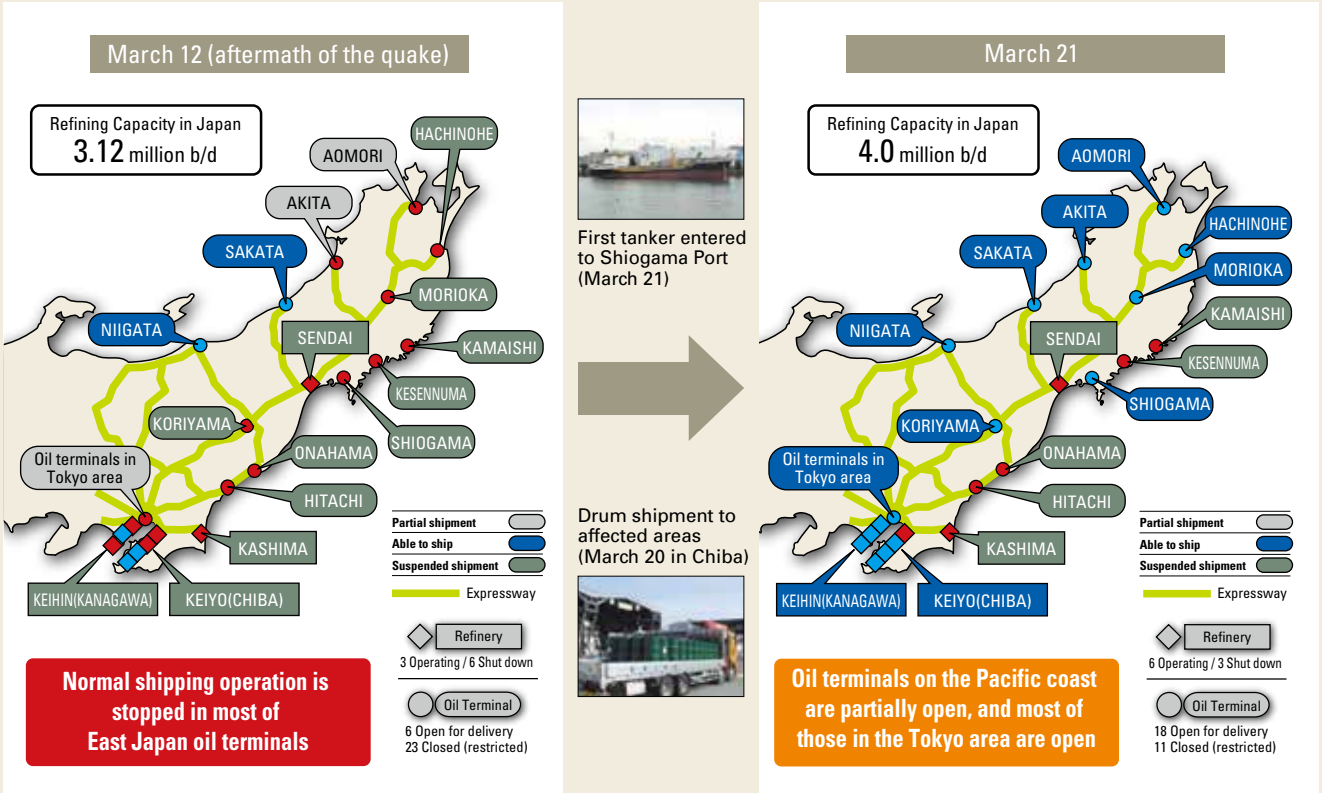
The government received about 5,000 requests for various emergency relief supplies from the disaster areas, of which about 1,400, or 30 percent, were for petroleum fuels. Furthermore, the Petroleum Association of Japan (PAJ) set up an operation center to cope with urgent support requests from the Prime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

By the collaboration with the prefectural government and the Ministry of Land, Infrastructure, Transport and Tourism, two oil terminals in Shiogama (Miyagi Prefecture), which have large-scale facilities, resumed shipping their remaining products on March 17 (6 days after the disaster), and started receiving fuel products from coastal tankers on March 21. In the absence of an institutional framework by laws and agreements, five Motouris established a cooperative framework to jointly utilize the facilities of two Motouris in Shiogama. PAJ member companies built various cooperation systems beyond their business boundaries.

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

Operating Situation of Refineries and Oil Terminals in Tohoku and Kanto Areas



4. Disaster Response through the Petroleum Reserve Law Amendments

At the time of the Great East Japan Earthquake in March 2011, the petroleum industry made its utmost efforts to stably supply 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 disorders arising from a shortage of petroleum products, and made the following proposal to fulfill a stable oil supply at a time of disaster:

1. The government's reserve of petroleum products should be built up as a last resort of oil supply when the 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. For securing logistics, a system to directly supply petroleum products to critical sites such as evacuation centers and hospitals should be launched by organizing a cooperative structure between oil storage management companies and transportation companies to enhance prompt and assured deliveries.

In November 2012, the Oil Stockpiling Act has been amended to make it possible to release of the government crude oil reserves at the time of a domestic oil supply shortage in a certain area due to a disaster, in addition to oil supply shortage from overseas. On the other hand, the government petroleum product stockpiling is now composed of four types of oil, i.e. gasoline, diesel fuel and heavy fuel oil A, in addition to the aforementioned kerosene. Moreover, based on the amended act, in the event of a large-scale domestic disaster that causes a shortage of oil supply to a particular region, oil refiners and Motouris have 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 have 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 other companies' shipping terminals when a company's own shipping facilities is no longer available due to damage or other reasons. In the event of a major disaster, METI Minister can recommend that refiners and Motouris to 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.

5. Information Sharing with Local Governments

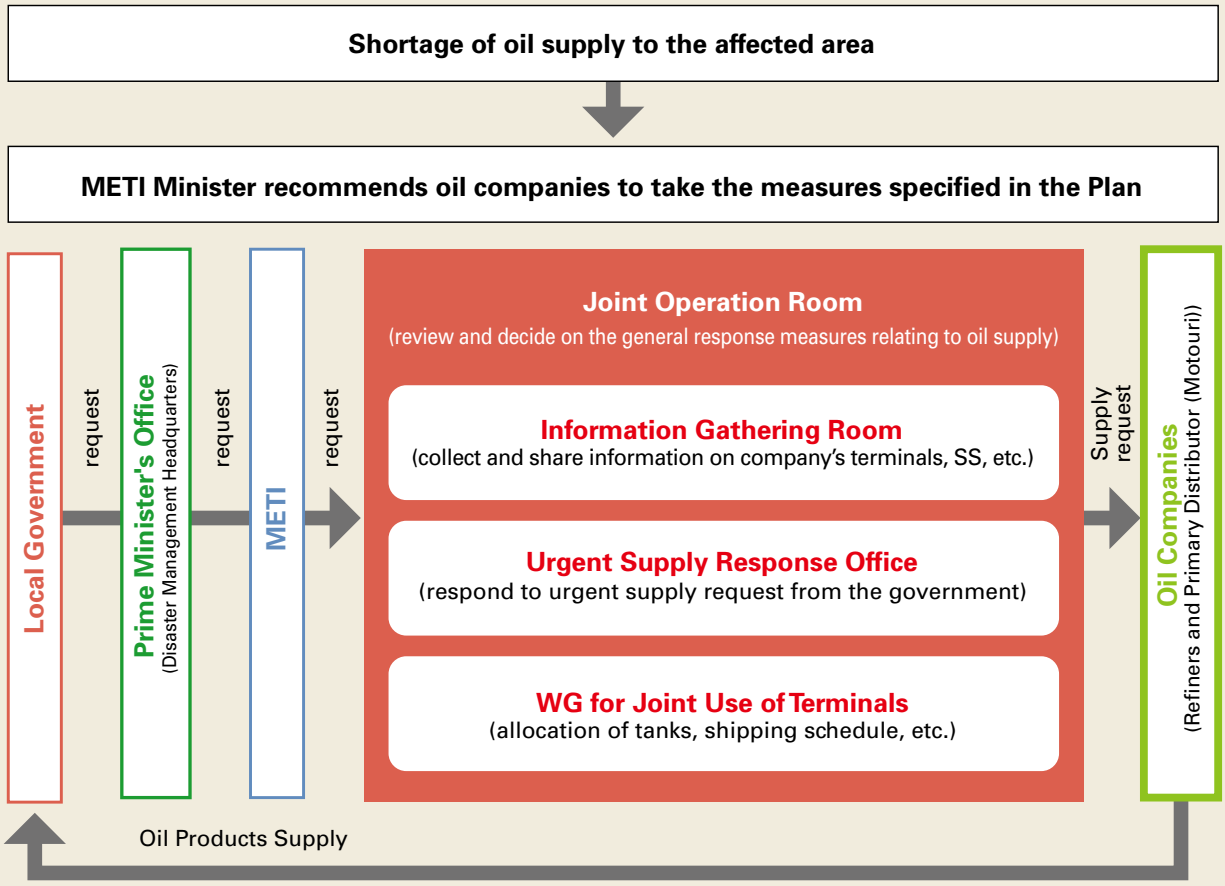
In the Great East Japan Earthquake, each Motouri responded to emergency supply requests, via the central government or local governments, for fuels to critical institutions such as hospitals. However, due to incorrect or inadequate information from the requesters about the fuel kind and receiving equipment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

As a preliminary preparation for responding quickly and smoothly to urgent supply requests from the affected areas in the event of a disaster, PAJ has been working on gathering necessary information beforehand on fuel supply to key institutions which are designated by local governments and authorities since 2012.

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

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

Fig:2-5 ■ Oil Supply Coordination Plan in Disaster



6. Response of the Petroleum Industry at the Time of Kumamoto Earthquake

The Kumamoto Earthquake on April 16, 2016 was the first disaster in which the "Oil Supply Coordination Plan in Disasters" under the Oil Stockpiling Act was activated.

In line with this plan, PAJ held the joint operation room meetings every day from the day of the disaster until April 21 to share information on shipping facilities of each oil refinery and Motouri. In addition, considering the government's response policy measures, PAJ discussed and made decisions on how to respond to the situation as the oil industry.

Specifically, on the day of the disaster, PAJ confirmed with the member companies that there was no major damage to their shipping terminals and distribution channels in the region. The member companies decided to reinforce their shipping capabilities to ensure oil supplies 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 near the affected areas, aiming at early restoring operations at SS that had to be restricted or suspended. Furthermore, as a countermeasure against wide-area power outage in Aso area, PAJ responded to the urgent request from the electric power company to supply diesel fuel, as a power generation fuel for a high-voltage generator truck. With 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 to maintain and strengthen the supply chain for ensuring a stable supply of fuels to end consumers even at the time of a 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 reinforcing the seismic retrofitting works at shipping terminals, waterproofing works for electrical equipment, and installation of emergency power supplies. At the current 21 refineries in Japan, various works to meet earthquake-resistant and liquefaction standards that exceed the requirements of existing laws and regulations have been taken. In addition, as there were many urgent requests for small-lot drum deliveries to a site where a tank truck could not unload fuels, drum filling facilities were maintained and expanded. At service stations (SS), disaster response measures were initiated to install a back-up power source, to put hand-driven pumps in place, to store emergency use materials and to prepare for providing SS as temporary evacuation sites.

On the system side, considering that it took a long time for each oil company to collect information from its shipping bases in the affected area after the earthquake, such countermeasures to strengthen communication methods as deploying satellite phones have been taken. Besides, PAJ established a system to consolidate information from its member companies (Motouris) in an emergency occasion. In this regard, PAJ issued in December 2013 the guideline of the Business Continuity Plans (BCP) for oil supply, and each Motouri has individually formulated its own BCP in accordance with the guideline.

The petroleum industry has been taking measures to strengthen oil supply infrastructure such as refineries and oil terminals in preparation for earthquakes and tsunamis (seismic sea wave). From FY2021, the industry will further strengthen its disaster response capabilities against heavy rains and typhoons that have been frequent in recent years.

8. Safety Measures in Oil Refineries

Facility layouts at oil refineries are planned so that legally mandate safe distances are kept not only between the petroleum processing and storage sites and the nearby residential areas, but also between the facilities 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. Refineries strive to detect abnormalities that lead to accidents at an early stage by conducting periodic overhaul inspections as well as shutdown, on-stream, daily and special inspections of refining facilities and storage takes. Also, in order to minimize damage in the event of an abnormality, an emergency shutdown system has been installed and an initial fire extinguishing system is in place. In the event of an accident such as a fire or oil spill, "In-company Disaster Prevention Organizations" and "Joint Disaster-prevention Organizations", consisting of regularly trained disaster prevention personnel, are formed to ensure that the company can respond appropriately and quickly. These organizations are equipped with large chemical fire engines, elevated water spraying vehicles, foam liquid carriers, oil booms, oil recovery equipment and vessels.

PAJ formulated its "Voluntary Action Plan on Industrial Security" in August 2013. The plan is reviewed annually and the necessary 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 which invests limited resources in effective safety measures in accordance with 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 Basic System for Industrial Safety" under the Industrial Structure Council's "Sectional Committee on Security and Consumer Product Safety" in February 2021 and began examining safety regulation systems such as the High Pressure Gas Safety Act.

As a result of the deliberations, the subcommittee finalized that the following system changes should be taken in order 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 can independently execute a high level of safety while utilizing technology" to shift to a self-management type of safety, instead of uniform individual and prior regulations, under appropriate auditing and supervision by the government, and (2) To re-examine the procedures and inspections in a way that is appropriate and to take measures for legal amendment (to create new institutional measures by promoting smart industrial safety in mind). The final summary of these institutional changes as "Efforts toward Immediate Institutionalization and Main Issues for the Future in the Industrial Safety Field" was approved by the Subcommittee in December 2021.

The High Pressure Gas Safety Act was revised in June 2022, and the subordinate ordinances are scheduled to be prepared before the enforcement of the act by the end of March 2024.

Chapter 3 Energy Policies Related to the Japanese Petroleum Industry

1. Transition of Petroleum-related Regulations

Regulations of the petroleum industry had been enforced by giving the highest priority to the concept of securing a stable supply under the Petroleum Industry Law, which was enacted in July 1962 as a fundamental law. 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 since then. Consequently, a broad range of regulations, including administrative guidance, on petroleum imports, refining, manufacturing, and marketing were in effect.

However, in line with advances in globalization of the Japanese economic society, petroleum-related regulatory reforms have been taken in stages, and along with the assurance of stable supply, the realization of efficient supply based on market principles became the goal of petroleum policy. With the repeal of two laws, i.e., 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 has been liberalized, except for regulations regarding stockpiling (the Oil Stockpiling Act) and fuel qualities (the Act on the Quality Control of Gasoline and Other Fuels).

Thereafter, against the backdrop of liberalization and decreasing oil demand, the rationalization of facilities, etc. has progressed.

Fig:3-1 ■ Petroleum Industry Regulatory Reform History in Japan

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)	
Apr '96	Enactment of Act on Quality Control of Gasoline and Other Fuels by revising Gasoline Retail Business Law	2nd Phase Deregulation
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	Enforcement of Law Concerning Sophisticated Methods of Energy Supply Structures	
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 the Law Concerning Sophisticated Methods of Energy Supply Structures (Compatibility of Effective Use of Fossil Energy and Environmentally Friendly Use of Energy Sources)	

2. The Strategic Energy Plan

"The Basic Act on Energy Policy", enacted in June 2002, illustrates the following three basic principles of energy policy (the "3E"): "Energy security through stable energy supply", "Environmental suitability", and "Efficient supply using market mechanisms." The basic act also stipulates to formulate the "Strategic Energy Plan" (SEP), to map out the basic direction of the nation's energy policy and to review it roughly every three years.

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

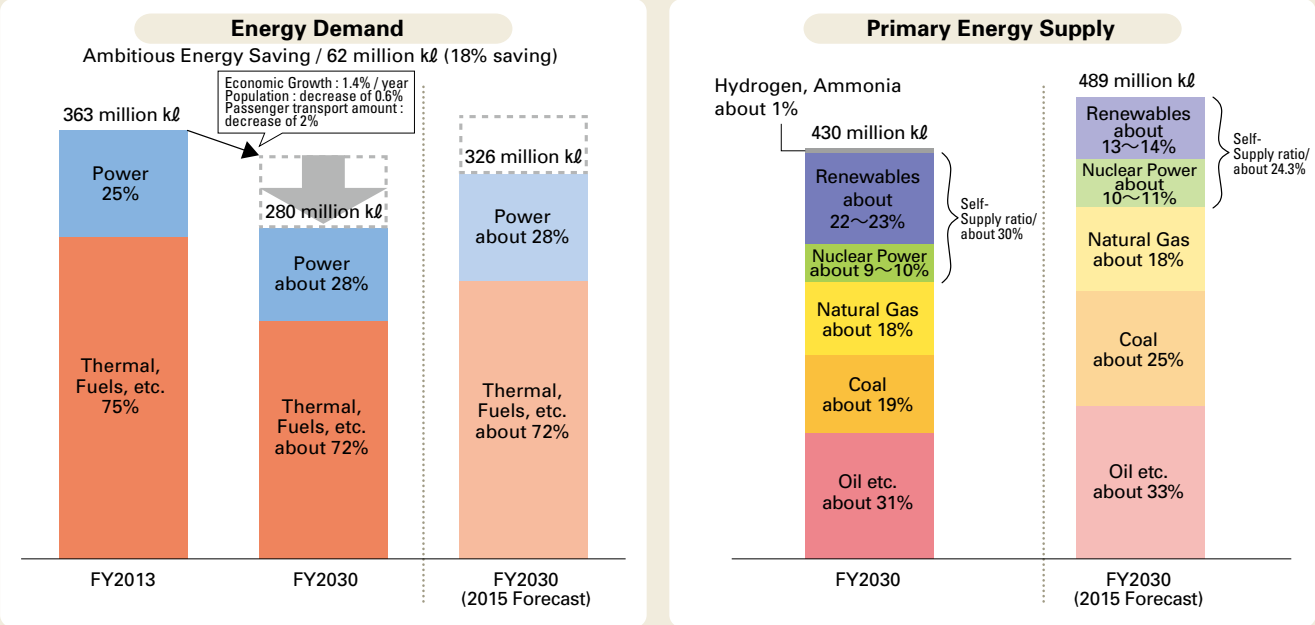
The 6th SEP, which was approved at the Cabinet meeting in October 2021, continues to focus on the simultaneous achievement of "S+3E" as the basic perspective of energy policy. It also emphasizes that petroleum is regarded as a) the "last resort" of energy supply in times of disaster, because of its advantages such as portability, easy storage, and mobility of being able to supply fuels to the affected areas immediately after disasters, and also b) an "essential energy source for people's life and economic activities" with a wide range of fuel and material applications, that contributes to energy supply not only in normal times but also in emergency occasions.

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 still estimated to account for more than 30% of the primary energy supply.

The 6th SEP also states the importance of ensuring a resilient oil supply system that can respond not only in ordinary times but also in a time of emergency toward 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 is also mentioned.

Fig:3-2 ■ Outlook of Energy Supply and Demand toward 2030 Unit: %, million kiloliters (kℓ) Crude oil equivalent(COE)



Source : METI

3. Law Concerning Sophisticated Methods of Energy Supply Structure

In July 2009, the conventional 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 Energy Supply Law) 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 effective use of fossil energy resources.

Specifically, "the notification of the criteria for judgment concerning the promotion of the effective utilization of crude oil for petroleum refiner" was given in July 2010 (The first Ministerial Notice on the Sophisticated Energy Supply Law), aiming to raise the facilities installation ratio of Japan's heavy oils cracking units (about 10% in 2010) to about 13% by FY2013. Each petroleum refiner made effort to raise the installation ratio of heavy oils cracking units by (1) the reduction of crude distillation units and (2) new or additional installation of heavy oils cracking units. Consequently, the average facilities installation ratio of Japan's heavy oils cracking units improved to around 13% at the end of March 2014. The second Ministerial Notice on the Sophisticated Energy Supply Law was notified to oil refiners in July 2014. With the new notification, the definition on the conventional facilities installation ratio was revised to include that of residual oil processing units, which adds heavy oils direct desulfurization units, fluid catalytic cracking units and solvent de-asphalting units to the conventional heavy oils cracking units. The target percentage of the new facilities installation ratio raised to 50% (about 45% at the time of FY2014) by the end of March 2017. Each oil refiner was obliged to attain the target ratio for its facility improvement. As a means of achieving the target, the accommodation of refining capacities through collaboration between refineries and business restructuring was permitted. Besides, 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 the facility optimization. Consequently, the average facilities installation ratio of residual oil processing units was 50.5% at the end of March 2017.

In May 2017, the Natural Resources and Fuels Subcommittee under 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 capacity utilization ratio, collaboration among refineries, capacity expansion, etc. and to achieve further utilization of heavy oil cracking capacity". Then, the third Ministerial Notice on the Sophisticated Energy Supply Law was notified in October 2017. Oil refining companies are obliged to achieve an increase of their vacuum-residue (VR) oil cracking rate in accordance with their actual performance rates. 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 remains unchanged. Based on this, the fourth Ministerial Notice regarding measures for FY2022 onwards was notified with consideration 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. Movements toward the Petroleum Industry Reorganization

In view of the 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 active. In the wake of the merger of Nippon Oil and Mitsubishi Oil in April 1999, unprecedentedly large-scale and rapid market reorganization has occurred since then.

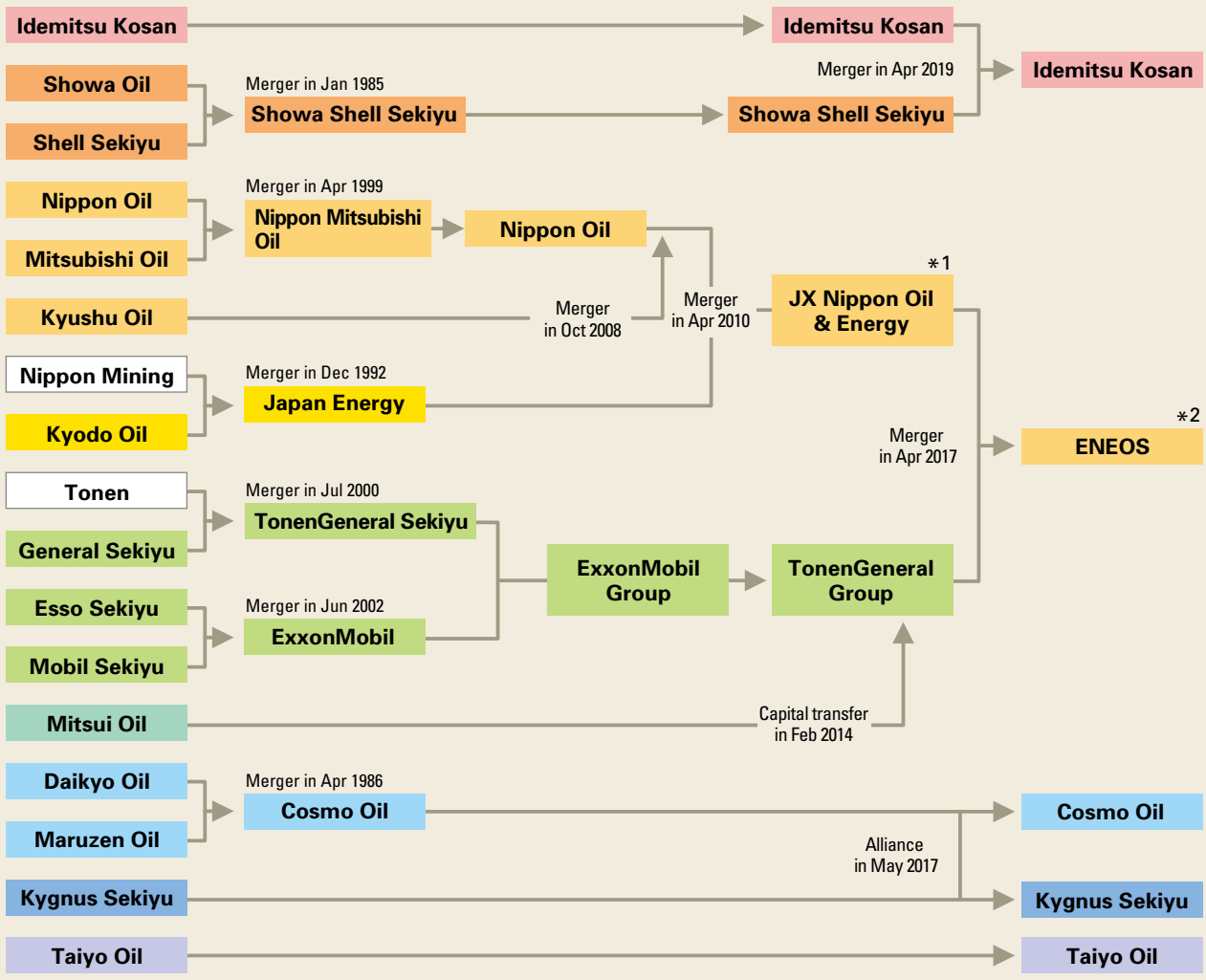
In June 2002 Esso Sekiyu, Mobil Sekiyu and other

affiliated companies were integrated into newly established ExxonMobil Yugen Kaisha. In 2008, to cope with soaring crude oil prices and fierce competition in the overall energy market, Nippon Oil merged with Kyushu Oil in October 2008. Furthermore, in July 2010 JX Nippon Oil & Energy was established as a result of the management integration between Nippon Oil and Japan Energy, which had concluded a wide-ranging business tie-up agreement from upstream operations to refining and distribution operations, fuel cell business, and technology development. The industry's management efforts toward further rationalization and efficiency improvement were conducted. Then in June 2012, ExxonMobil Japan Group changed its domestic capital ties in Japan to transform itself into the TonenGeneral Group, headed by TonenGeneral Sekiyu.

After that, business alliances and business integrations have progressed 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 have merged to form ENEOS*2, which accounts for 55% of the domestic refining capacity. Furthermore, the management integration between 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 of Oil Companies in Japan (as of Jul 2022)



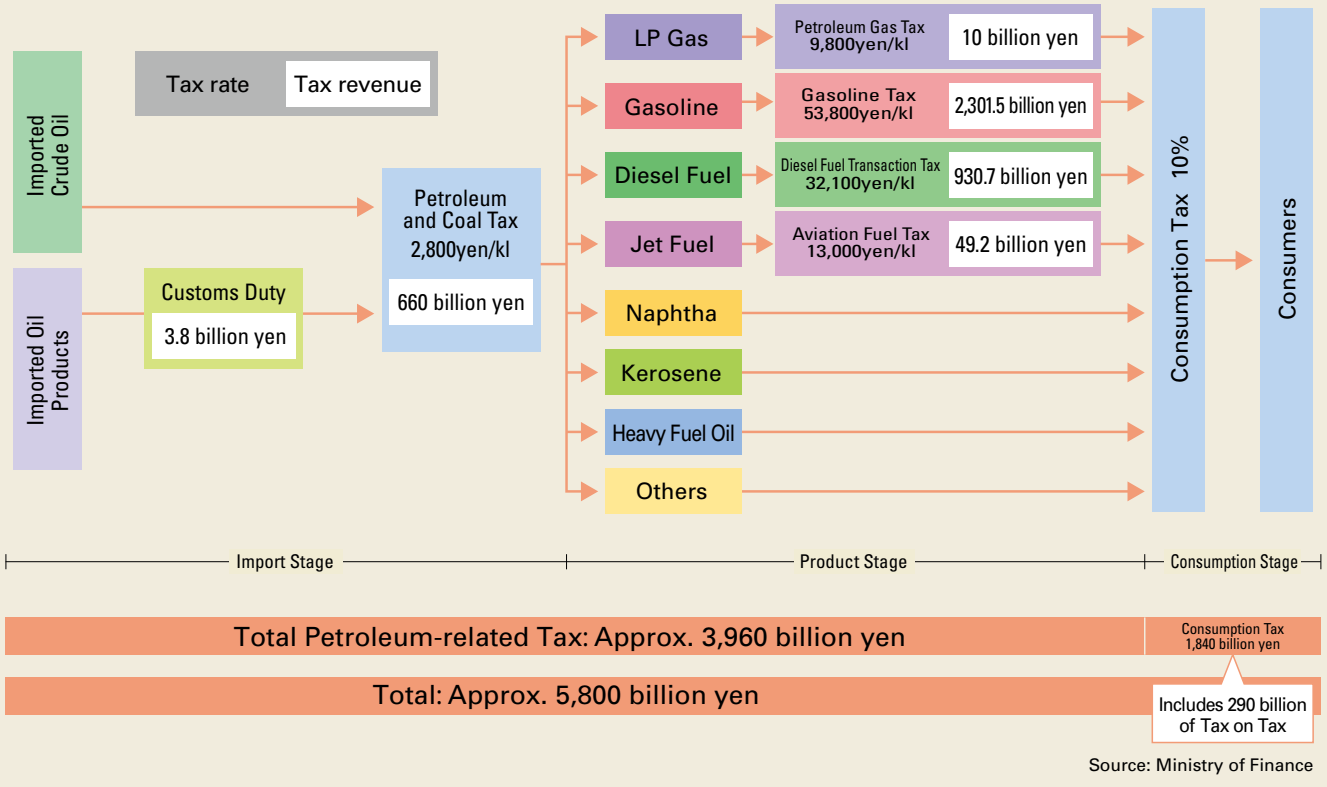
5. Various Petroleum-related Taxes

Various taxes are levied on oil in multiple stages. Currently, customs duty is imposed on imported petroleum products, and petroleum and coal tax is levied on imported crude oil and petroleum products at the import stage. When refined products are delivered to consumers, individual indirect taxes such as gasoline tax, diesel fuel transaction tax, aviation fuel tax, and oil and petroleum gas tax (taxed only for automobiles) are levied on the respective products. These petroleum-related taxes amounts to about 3,960 billion yen, which accounts for approximately 3.5% of tax revenue, which is the sum of national and local taxes. If the consumption tax of about 1,840 billion yen (for the sales amount of petroleum products that contain petroleum tax amounts) is added to these petroleum-related taxes, the total tax on oil amounts to about 5,800 billion yen. The basic tax rates of gasoline tax and diesel fuel transaction tax are 28,700 yen/kℓ and 15,000 yen/kℓ, respectively; however, the provisional tax rates of 53,800 yen/kℓ and 32,100 yen/kℓ, respectively, have been applied for the time being.

Fig:3-4 ■ Tax Rate of Gasoline and Diesel Fuel Transaction Tax

		Basic Tax Rate	Provisional Tax Rate
Gasoline Tax	Gasoline Tax	24,300yen/kℓ	48,600yen/kℓ
	Local Gasoline Tax	4,400yen/kℓ	5,200yen/kℓ
	Total	**28,700yen /kℓ**	**53,800yen /kℓ**
Diesel Fuel Transaction Tax		**15,000yen /kℓ**	**32,100yen /kℓ**

Fig:3-5 ■ Multiple & Multi-stage Imposition of Petroleum-related Taxes (FY2022 Budget)



Source: Ministry of Finance

6. Origins of Petroleum Taxation and Changes in Tax Rates

In 1949, gasoline tax, which had existed before the war, was reinstated to secure general postwar financial resources needed for general use. Gasoline tax was designated as the specific revenue source for road construction (hereinafter referred to as the road specific revenue source) in 1954, 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, diesel fuel transaction tax was introduced in 1956 as a local tax and the specific revenue source for road construction in order to balance the tax burden between gasoline and diesel fuel. Later, in 1974, in response to the need to secure further revenue sources for road construction, the provisional tax rate of gasoline tax and local road tax were added to the gasoline tax, and in 1976 the provisional tax rate was also applied to the diesel fuel transaction tax. 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 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 absorbing into consumption tax, or reduced the duplicative consumption tax portion while maintaining the double taxation) were taken, in order not to increase the tax burden on consumers. However, the petroleum tax burden was neither abolished nor reduced on the grounds that those taxes are used as the road specific revenue source. Therefore, the consumption tax portion was added to fuels' sales prices in which petroleum taxes are included as simple double taxation. In 2009, though the road specific revenue source system was abolished and incorporated into a general revenue source, no specific adjustment measures have been taken for taxation on consumption tax and petroleum taxes (local road tax was renamed local gasoline tax). The provisional tax rates were abolished in April 2010, but the existing provisional tax level are maintained for the time being.

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

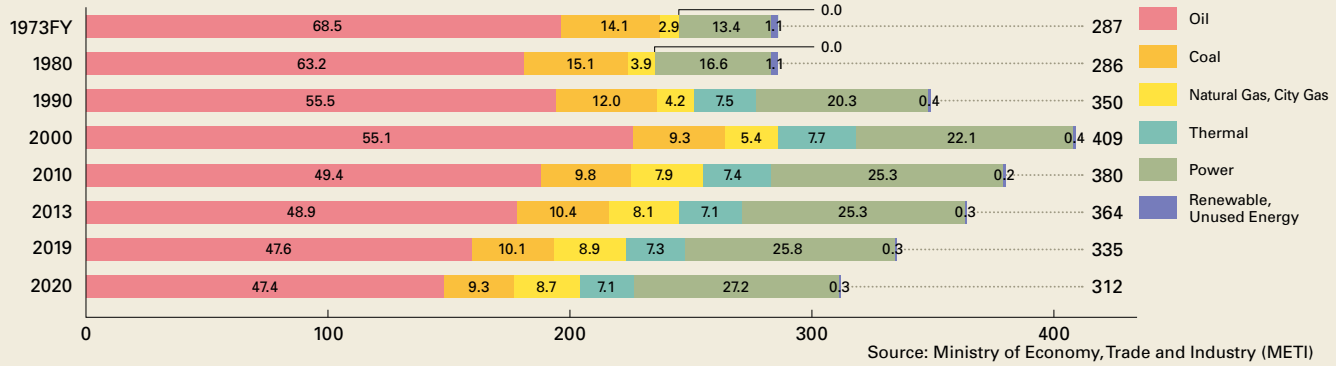
1. Primary Energy Supply and Demand in Japan

According to the Comprehensive Energy Statistics compiled by the Ministry of Economy, Trade and Industry (METI) in April 2022, final energy consumption for FY2020 in Japan was 12,082 PJ (Peta-jour), Crude oil equivalent (COE): 312 million kiloliters(kℓ), a decrease of 6.7% year-over–year (YOY). In detail, petroleum consumption was 5,730 PJ (COE: 148 million kℓ), a decrease of 7.1% YOY.Power consumption was 3,289 PJ (COE: 85 million kℓ), a decrease of 1.5%YOY.

Furthermore, total domestic supply of primary energy in FY2020 was 17,965 PJ (COE: 464 million kℓ), a decrease of 6.1%YOY. Among them, petroleum supply (including LPG, same applies below) was 6,543 PJ (COE: 169 million kℓ), a decrease of 7.9%YOY. The share in total energy supply compared to the previous year, petroleum decreased from 37.1% to 36.4%, and coal and nuclear power decreased, while natural gas increased.

Fig:4-1 ■ Final Energy Consumption Trends

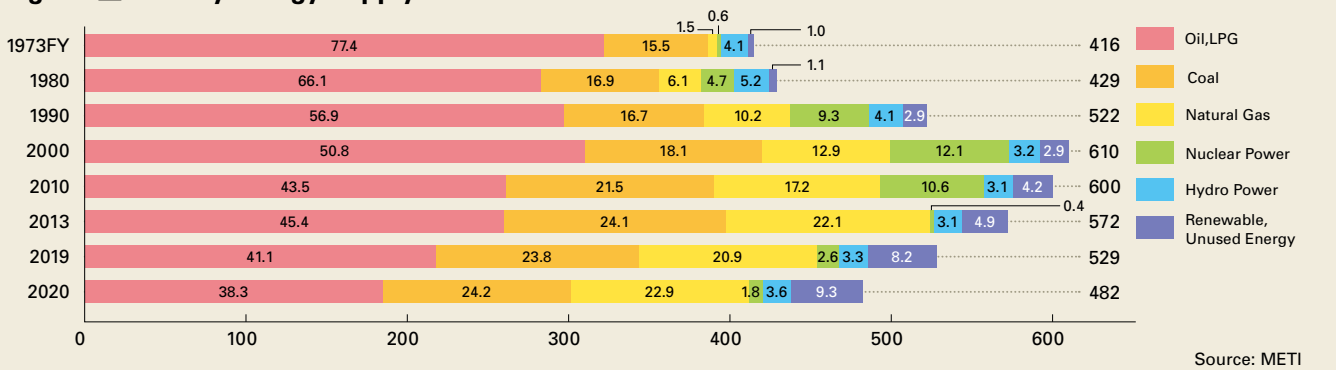
Unit: %, million kiloliters (kℓ) Crude oil equivalent(COE)



Source: Ministry of Economy, Trade and Industry (METI)

Fig:4-2 ■ Primary Energy Supply Trends

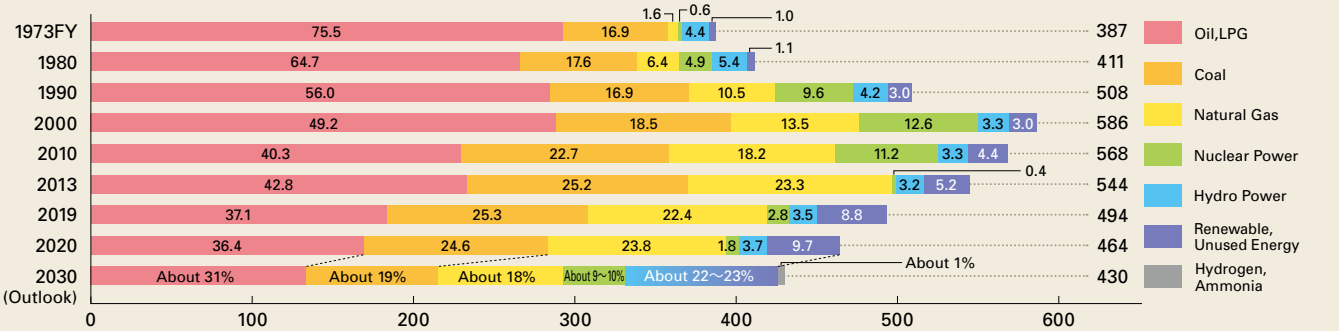
Unit: %, million kiloliters (kℓ) Crude oil equivalent(COE)



Source: METI

Fig:4-3 ■ Primary Domestic Energy Supply Trends

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



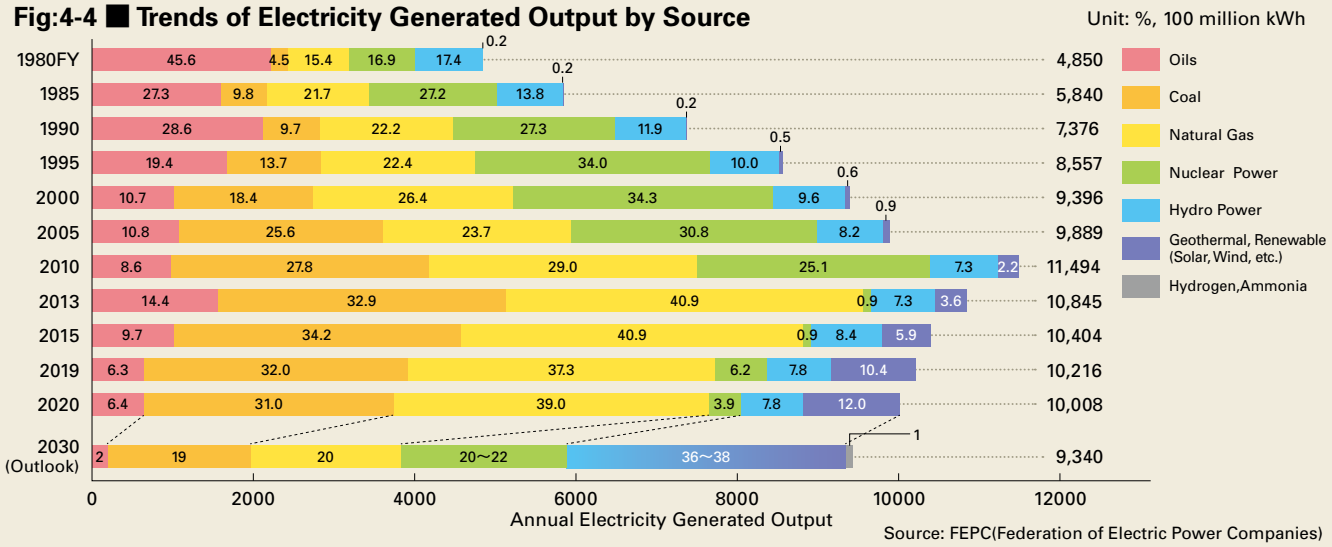
*Primary Domestic Energy Supply is total supply minus exports and changes in inventories

Source: METI

2. Power Supply Configuration

The ratio of oil-fired thermal power generation in power supply configuration in FY2020 increased slightly to 6.4% from 6.3% in the previous year. After the Great East Japan Earthquake, thermal power generation such as by oil has been compensating for the shutdown of nuclear power generation. While the ratios 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 ■ Trends of Electricity Generated Output by Source

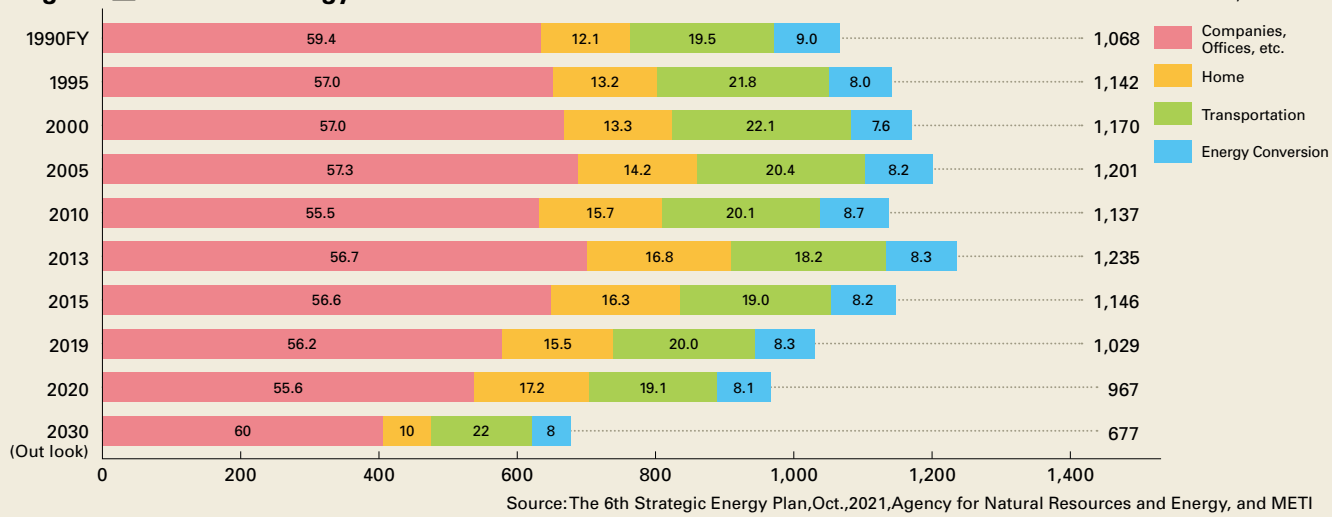


Source: FEPC(Federation of Electric Power Companies)

3. Energy-related CO_2 Emissions

Energy-derived CO_2 emissions in FY2020 decreased for the seventh consecutive year to about 967million tons, a decrease of 5.9% year-over–year (YOY). Compared to the most recent peak in FY2013, it decreased by 21.7%. CO_2 emissions increased for four consecutive years from 2010 to 2013 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 due to the decrease in energy demand, the spread of renewable energy, and low-carbon power generation due to the restart of a part of nuclear power plants.

Fig:4-5 ■ Trends of Energy-Derived CO_2 Emissions

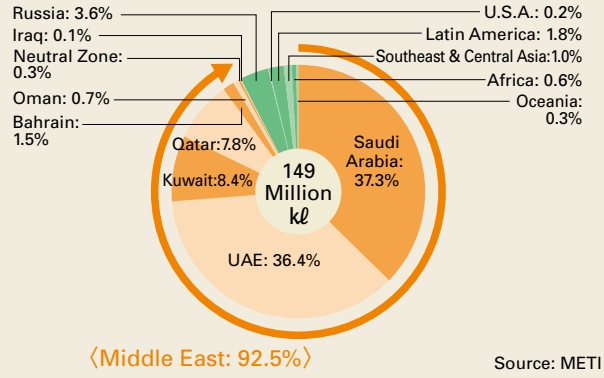


Source: The 6th Strategic Energy Plan,Oct.,2021,Agency for Natural Resources and Energy, and METI

4. Crude Oil Import

Japan has imported crude oil of 149 million kℓ in FY2021, an increase of 9.1% YOY. The crude import volume by region showed that Middle Eastern oil producing countries accounted for 92.5%. Major countries in terms of crude oil import volume are Saudi Arabia (37.3% of total import volume), the United Arab Emirates (UAE, 36.4%), and Kuwait (8.4%). The top two countries accounted for more than 70% of Japan's total crude import volume.

Fig:4-6 ■ Crude Oil Import According to The Country in 2021FY



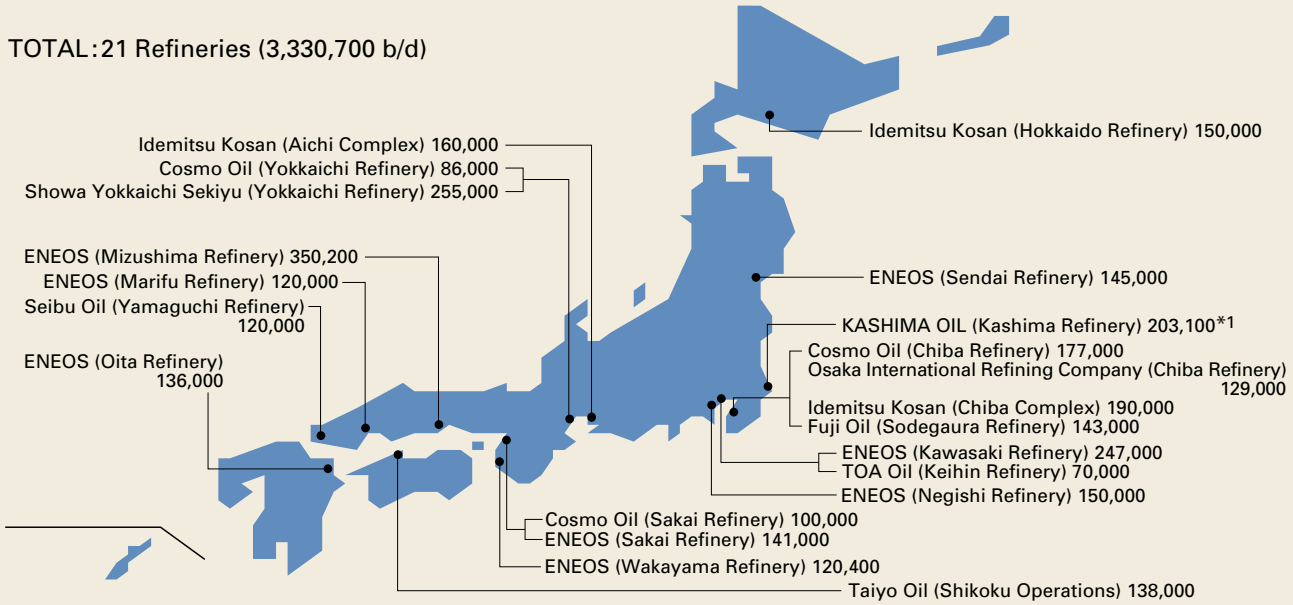
Source: METI

5. Petroleum Supply System in Japan

There are two methods for covering domestic petroleum product demand: One method is to import petroleum products and the other is to import crude oil and refine it to produce petroleum products locally. The latter method, i.e., crude oil importation and domestic refining, so called the "Domestic Petroleum Refining System", has been adopted in Japan. This method has various advantages such as being able to reduce procurement costs by importing a massive amount of crude oil with large scale tankers, to flexibly change production volume of each petroleum product in line with the domestic demand structure, to adjust product qualities which meet domestic environmental standards, to have superiority in responding to emergencies, etc.

Japan, therefore, imports almost all crude oil, for FY2021, the domestic yield of crude oil was a mere 470 thousand kℓ, equivalent to 0.3%, or one day, of the 147 million kℓ of Japan's crude processing volume. All 21 refineries in Japan are located in coastal areas as of the end of March 2022. As the domestic petroleum products demand continues to decline, the number of refineries and crude oil processing capacity are also on a downward trend.

Fig:4-7 ■ Location of Refineries and Crude Distillation Capacity in Japan (as of end-October 2022) unit: b/d



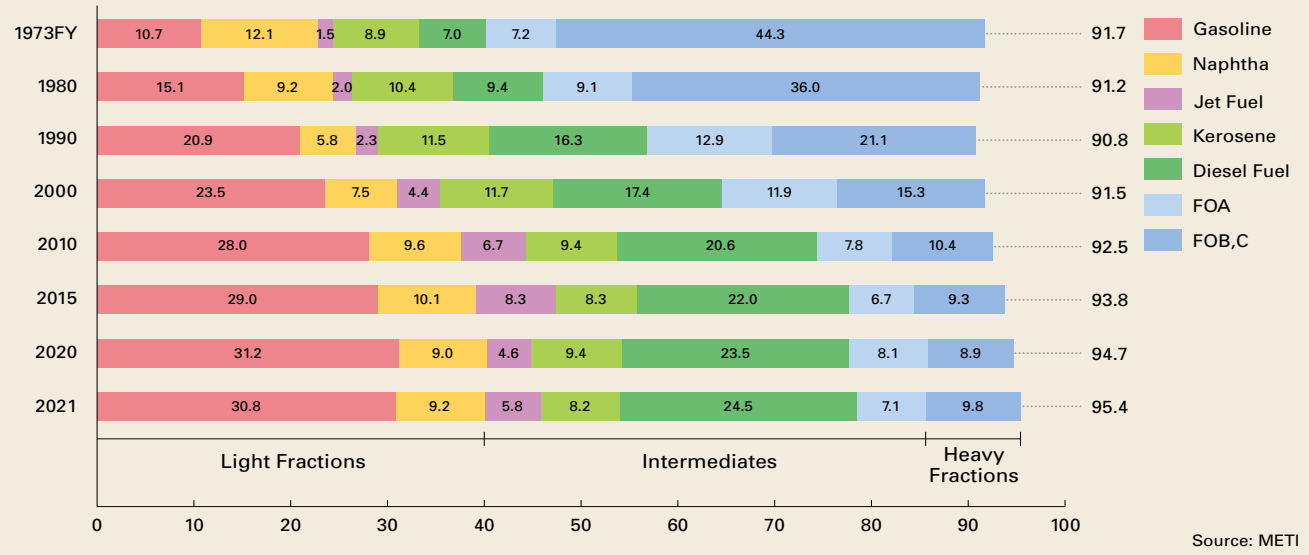
*1 KASHIMA OIL (Kashima Refinery) include the capacity of condensate splitter

6. Refining for Petroleum Products

Petroleum products have the characteristic to produce multiple products such as gasoline, kerosene, diesel fuel, and heavy fuel oil are simultaneously produced (co-products) from crude oil at a fixed rate. Therefore, it is difficult to produce only a specific product from crude oil. On the other hand, in terms of demand, recently the proportion of so-called "white oil" such as gasoline, kerosene, and diesel fuel is increasing. For this reason, lighter crude oils are selected and a secondary process that cracks or reforms heavy fuel oil etc. into gasoline component is applied as a method to deal with such demand changes. Fuel oil production in FY2021 was 142 million kℓ, an increase of 6.4% YOY. The petroleum product yields are about 40% for the light fractions (gasoline and naphtha), about 46% for the intermediate four products (kerosene, jet fuel, diesel fuel and heavy fuel oil A (FOA), and about 10% for the heavy fuel oil B (FOB) and heavy fuel oil C (FOC).

Fig:4-8 ■ Trends in Fuel Oil Yield from FY1973 to 2021FY

Unit: %

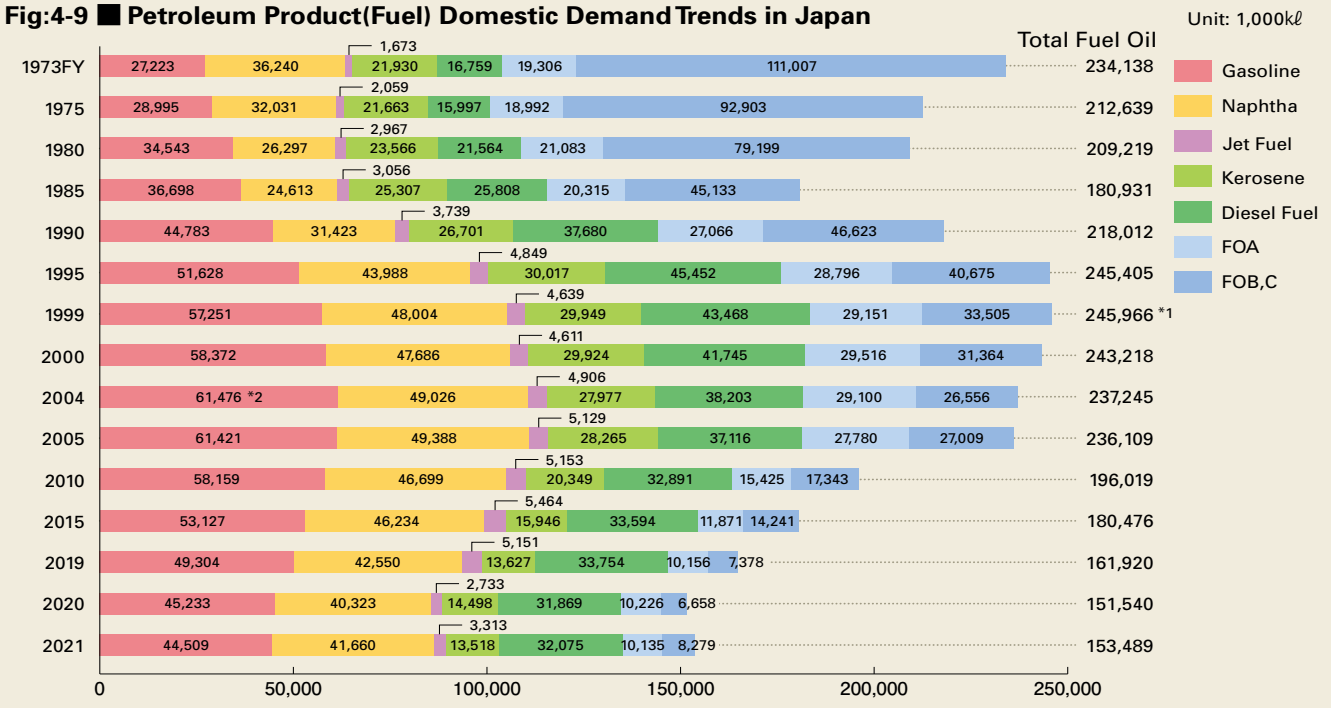


Source: METI

7. Demand for Petroleum Products

The total petroleum products demand for fuel oil in FY2021 was 153million kℓ, an increase of 1.0% YOY. Compared to FY1999 when the demand peaked, it decreased by 38% 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. gasoline, kerosene, and fuel oil A decreased by 2.2%, 6.8%, and 0.9%, respectively, while naphtha, jet fuel oil, diesel fuel, and Fuel Oil B and C increased by 3.3%, 21.2%, 0.2%, and 25.0% YOY respectively.

Fig:4-9 ■ Petroleum Product(Fuel) Domestic Demand Trends in Japan



*1 : maximum "Total Fuel Oil" value in the past 46 years @245,966 thousand kℓ
*2 : maximum "Gasoline" value in the past 46 years @61,476 thousand kℓ

Source: METI

8. Import of the Petroleum Products

Naphtha imports have been outstandingly large every year in terms of petroleum product imports, and about 70% of domestic demand was covered by imported products in FY2021. For Japan, which adopts the "Domestic Petroleum Refining System", petroleum product import plays a supplemental role, with the exception of naphtha, for which Japanese petrochemical companies import their own naphtha as a petrochemical feedstock.

Incidentally, jet fuel and heavy fuel oils are imported to refuel international aircraft and ocean-going vessels that are not supplied to the domestic market are not included in the import volume of these products.

9. Export of the Petroleum Products

As for the export quantity by fuel product in FY2021, heavy fuel oils (FOB & FOC), diesel fuel, and Jet Fuel were ranked in descending order. Jet fuel exports about 1.7 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 export. Similarly, when FOC produced in Japan is supplied to ocean-going vessels, its volume is considered as an export, and these exports account for about 70% of the FOC exports. In addition, diesel fuel produced in Japan has a sulfur content of 10 ppm or less, and its exports to Australia, where a strict sulfur content regulation is taken, has been to about one-third of Japan's total diesel fuel exports in FY2021. While domestic demand has been declining, gasoline and other fuels have also being exported, depending on the trends in overseas markets.

10. Petroleum Logistics in Japan

Petroleum products are delivered to consumers from refinery via oil terminals and service stations (SS). Depending on the location of the delivery destination, the handling volume, such methods as the transportation distance, etc., coastal tankers, tank trucks, and railroad tankers are used in Japan.

A coastal tanker is used for marine transportation between sea-side districts and also for transshipping oil from a refinery to an oil terminal or delivering oil directly from a refinery or an oil terminal to heavy consumers. It is excellent in large-volume and long distance transportation. The amount of transportation is about 1,000 to 7,000kℓ per tanker.

Railway transportation is used to transship oil from sea-side refineries to oil depots in inland areas by trains made up of special freight wagons called railroad tankers. The amount of transportation is about 60kℓ per railroad tanker and about 1,200kℓ per train.

A tank truck is used to deliver oil from refineries and oil depots to SS and consumers. The amount of transportation per vehicle is about 20kℓ, which is smaller than coastal tankers and railroad tankers, but the tank truck transportation has excellent characteristics in terms of mobility and flexibility.

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

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

Crude oil storage and stockpiling

● Crude Oil Tank
Capacity : 36.456million kℓ
Number of Tanks: 512
(end of FY2019)

Import

● Crude Oil Tanker
482 Vessels in operation
(estimated in FY2021)

Refining

● Facilities for the petroleum products
Refinery : 21 Site
Capacity : 3.46 million B/D
(end of FY2021)

Products storage and stockpiling

● Tanks and distribution facility
Oil Terminals: Capacity; 13.450million kℓ
Number of Tanks: 3,075
(end of FY2019)
Coastal Tanker : 524 Vessels (end of FY2021)
Railroad Tanker : 1,352 (end of FY2021)
Tank Truck : 6,515 (end of FY2017)

● Tanks for petroleum products (including semi-finished)
Capacity : 32.119 million kℓ
Number of Tanks: 2,392
(end of FY2019)

Distribution and Logistics

Sales and Marketing

● SS(Service Station)
28,475 Sites (end of FY2021)

11. Business Climate Changes Surrounding Service Stations(SS)

Domestic gasoline sales volume shows a downward trend due to structural factors such as population decline and vehicles' fuel efficiency improvement. Besides, an increase in New Generation Vehicles such as Electric Vehicles (EV), Plug-in Hybrid Vehicles (PHV) and Fuel Cell Vehicles (FCV) is expected in the future.

With fierce market competition due to declining petroleum fuel demand and heavy burden of measures against accidental oil spills from underground tanks (UGT), the number of SS has peaked at 60,421 at the end of March 1995, and has continued to decline to 28,475 at the end of March 2022.

The Agency for Natural Resources and Energy (ANRE) under METI surveyed the number of "SS depopulated areas" where three or less SSs in a single municipality, and there were 343 municipalities at the end of March 2021, an increase of 11 from the end of the previous fiscal year.

PAJ and petroleum companies established the "SS Depopulated Area Countermeasures Council" together with the government and related organizations in March 2015. The council not only provide SS operators with identification of issues on SS operations and equipment, and examined tactics for such solutions, but also disseminate information to local governments that are striving to relieve concerns about supply instability, deliberate deregulation, establish a consultation desk and coordinate for the implementation of measures. Based on the results of these studies, the "Handbook on Countermeasures for SS Depopulated Areas"was compiled in May 2016. In addition, ANRE established the "Study Group on SS Depopulated Areas" to continue to study countermeasures for SS depopulated areas in December 2022, and a revised edition of the handbook was published in June 2022.

On the other hand, in April 1998, a manned self-service SS, where a qualified SS attendant could watch car drivers' refueling operations, was introduced. Since then, the number of self-service SS increased to 10,608 at the end of March 2022, because it makes it possible to operate more efficiently than full-service SS. This accounted for about 37% of the total SS.

To cope with such changes, it has become an urgent issue to strengthen value-added sales and improve management efficiency at SS. As measures to create new additional services at SS, setting up stores in other industries such as convenience stores at SS sites and handling car leases are promoted.

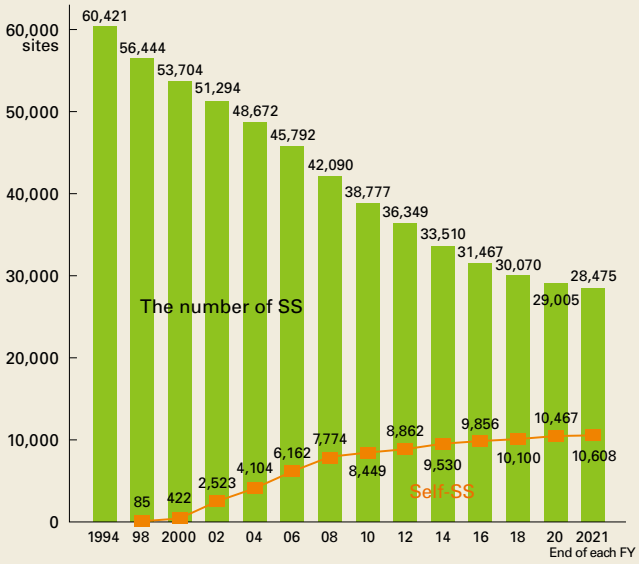
In addition, for efficiency improvement and diversified operations at SS, it has become possible from April 2020 to conduct outdoor sales of goods at SS and refueling permits at self-SS by using tablet devices.

Fig:4-11■ Trends in Number of SS Depopulated Municipalities

End of FY	0 SS	1 SS	2 SS	3 SS	Total municipality
2012	7	60	81	109	257
2013	8	63	81	113	265
2014	10	66	96	111	283
2015	11	71	100	106	288
2016	12	75	101	114	302
2017	10	79	103	120	312
2018	9	83	104	129	325
2019	10	82	107	133	332
2020	10	86	109	138	343
2021	10	89	112	137	348

Source: METI

Fig:4-12 ■ Changes in SS and Self-SS by Year



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, and
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. Undertaking governmental subsidy programs such as the "Major Oil Spill Response Program", including international conferences
5. Enhancing communication and understanding among member companies

II. Main Activities and Projects in FY2022

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 statistics 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 visions 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) Strengthening the dissemination of information on the industry's effort to enhance security and resilience
   (3) Provide opinions on oil and energy policy based on the premise of S+3E
5. Relating activities
   (1) Support the business of the Japan National Committee for the World Petroleum Council
   (2) Deal with labor policy issues concerning the petroleum industry

■ Executives

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

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

Vice-President
Takeshi SAITO
Representative Director
President
ENEOS Corporation

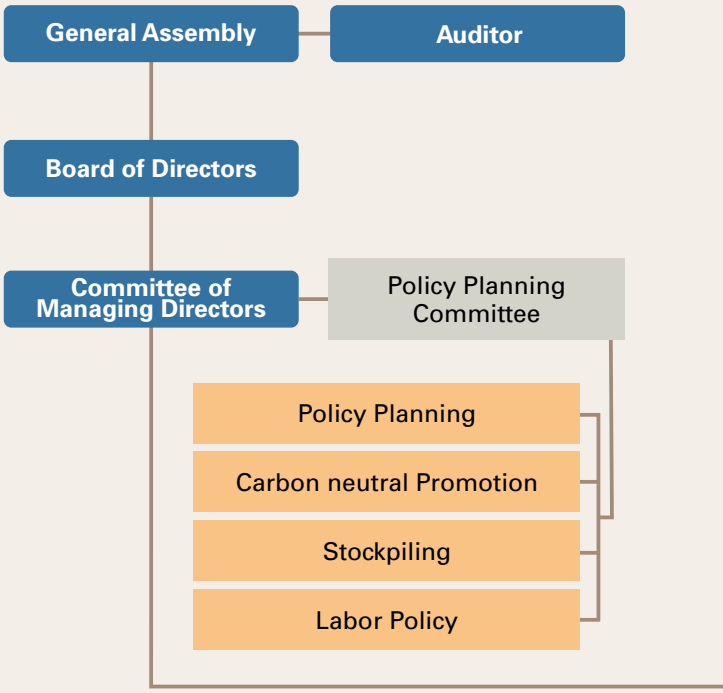
Senior Managing Director
Shinya OKUDA

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



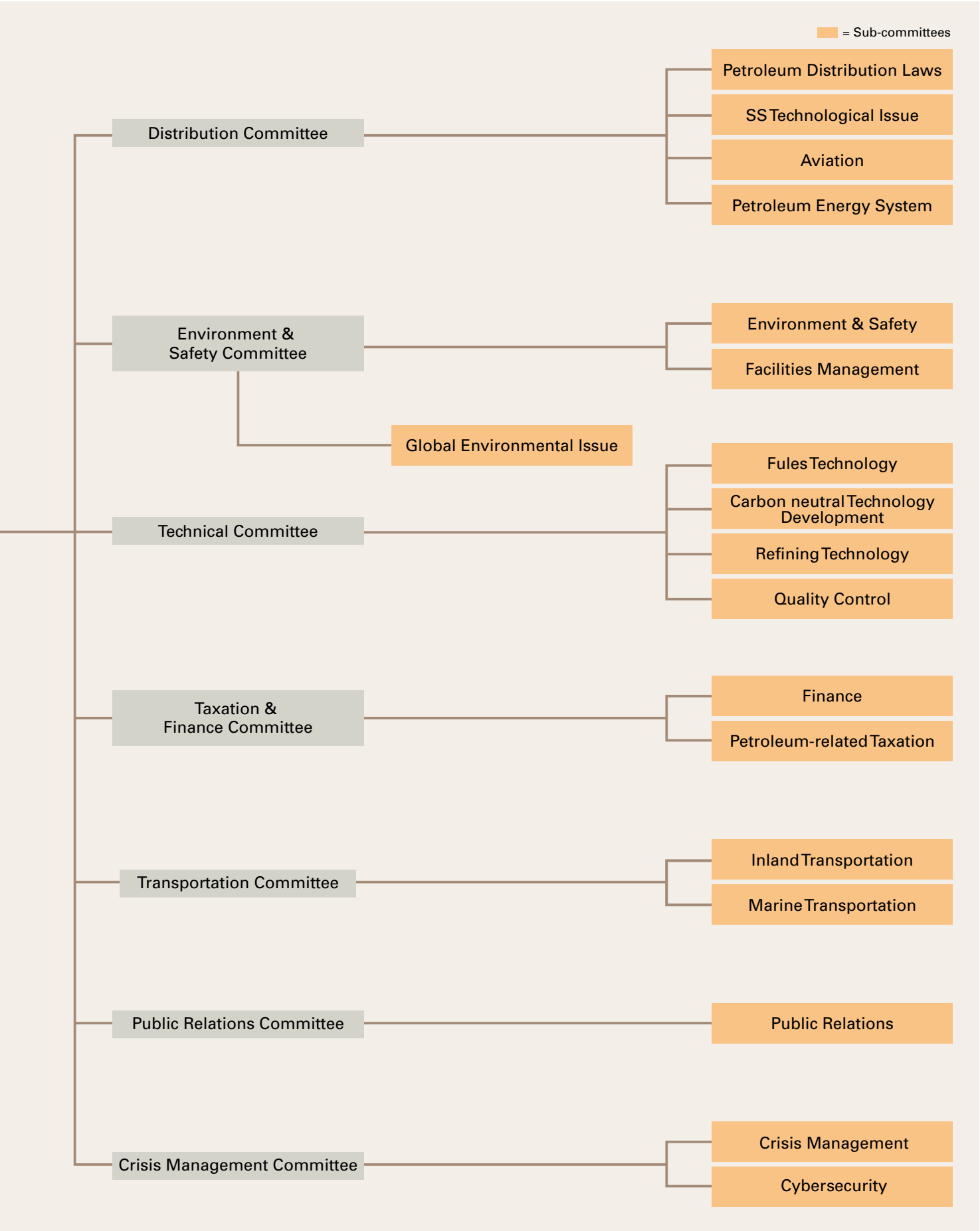
Associated Organizations

Oil Statistics Committee
- Refining
- Marketing

PAJ Oil Spill Cooperative (POSCO)

Japanese National Committee for ISO TC28
ISO: International Standardization Organization
TC: Technical Committee

JIG Japan
JIG: Joint Inspection Group


= Sub-committees
Distribution Committee
Petroleum Distribution Laws
SS Technological Issue
Aviation
Petroleum Energy System
Environment & Safety Committee
Environment & Safety
Facilities Management
Global Environmental Issue
Technical Committee
Fules Technology
Carbon neutral Technology Development
Refining Technology
Quality Control
Taxation & Finance Committee
Finance
Petroleum-related Taxation
Transportation Committee
Inland Transportation
Marine Transportation
Public Relations Committee
Public Relations
Crisis Management Committee
Crisis Management
Cybersecurity

Petroleum Association of Japan

Fuel+

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