Japan

Drivers and Policies

Fossil fuel plays a central role as a source of energy in Japan. The country's domestic sources of fossil fuel are limited, however, making it dependent on imports.

In 2002, Japan enacted the Basic Act of Energy Policy to ensure the steady implementation of energy policy. The primary goal of the energy policy is to ensure a stable supply ("Energy Security") and to realize a low-cost energy supply by enhancing its efficiency ("Economic Efficiency") on the premise of "Safety." It is also important to maximize efforts to pursue environment suitability ("Environment").

In terms of primary energy, Japan's new Strategic Energy Plan, approved in 2014, discusses the use of nuclear power and the need to ensure safety, improve the efficiency of electricity generation, expand the use of liquefied natural gas (LNG) and liquefied petroleum gas (LPG), and emphasize reducing the cost of renewable energy.

In 2015, the Ministry of the Environment and the Ministry of Economy, Trade and Industry (METI) presented a government proposal that sets a target for reducing the level of greenhouse gases in 2030 "by 26% compared to the level in 2013."

In the transportation sector, in order to improve the energy efficiency of automobile transportation, Japan will, for example, increase the ratio of next-generation vehicles (e.g., hybrid vehicles, electric vehicles [EVs], plug-in hybrid vehicles [PHEVs], fuel cell vehicles [FCVs], clean diesel vehicles, and compressed natural gas [CNG] vehicles) to all new vehicles to 50% to 70% by 2030.

Now that biofuels, electricity, natural gas, LPG, and hydrogen are available as energy sources, an environment is being created in which consumers' vehicle choice promotes competition not only for fossil fuels, but also for a wider variety of energy sources.

In spreading and expanding the introduction of next-generation vehicles, research and development and infrastructure building are indispensable. Thus, the Government of Japan and the private sector will collaborate to disseminate infrastructure for next-generation vehicles.

Advanced Motor Fuels Statistics

Figure 1 shows the energy sources used in the transportation sector in Japan in 2016 [1]. Oil-related energy accounts for 97.9% of total usage. The market for alternative fuels is minimal in Japan as is the number of alternative fuel vehicles (Table 1). Methanol, CNG, hybrid, EVs, and FCVs currently constitute environmentally friendly vehicles. The number of hybrid vehicles is rather large, owing to the number of passenger hybrid vehicles. CNG vehicles currently account for the largest number of vehicles in the low-emission truck category. The penetration of FCVs in the market has expanded; Japan has 2,449 FCVs.

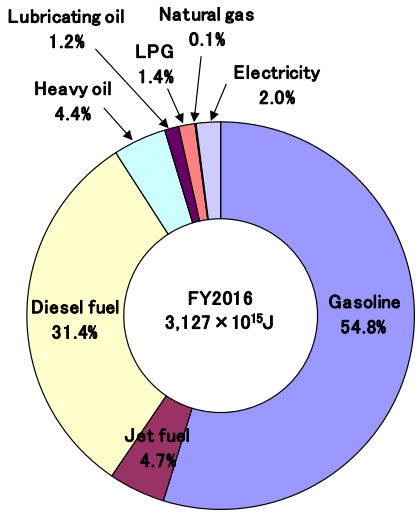

Fig. 1 Energy Sources Used in the Transportation Sector in Japan in 2016

Table 1 Current Penetration of Low-Emission Vehicles in Japan

Vehicle Type	Methanol [2]	CNG [3]	Hybrid [4]	EV [4]	FCV [5]	Vehicle Registration [6]
Passenger vehicles	0	1,603	7,409,635 (PHV:103,211)	91,357	2,440	39,585,729
Light, mid, and heavy-duty trucks	576	6,200	26,244	1,514	0	5,882,863
		20,291				
Buses	0	1,582			8	233,288
Special vehicles	0	4,056			1	1,585,018
Small vehicles	0	10,927	771,579	10,698	0	30,963,808
Total	576	44,659	7,041,358	103,569	2,449	78,250,706

Research and Demonstration Focus

Hydrogen

In 2016, *The Strategic Roadmap for Hydrogen and Fuel Cells* (revised) [7] was released. It includes new goals and specific explanations of the new efforts to be undertaken. The revised version of the roadmap stipulates the following:

1. Future price targets for household fuel cells;
2. Targets for the dissemination of FCVs: in total, about 40,000 vehicles by 2020, about 200,000 vehicles by 2025, and about 800,000 vehicles by 2030;
3. Targets for the construction of hydrogen stations: about 160 stations by 2020 and about 320 stations by 2025;
4. Clarification of descriptions concerning hydrogen power generation; and
5. The technical and economic challenges concerning the utilization of hydrogen generated using renewable energy.

In 2017, the Ministerial Council on Renewable Energy, Hydrogen and Related Issues held its second meeting and agreed on a basic hydrogen strategy to accomplish a world-leading, hydrogen-based society [8]. The strategy includes the use of hydrogen for transportation such as fuel cell (FC) buses, FC trucks, and FC ships. In April 2018, hydrogen stations for FCVs operated in 100 locations nationwide [9].

Natural Gas

Approximately half of the natural gas vehicles (NGVs) in Japan are commercial vehicles such as trucks, buses, or garbage trucks. Of the trucks, the majority are light- to medium-duty vehicles designed for short- or medium-distance transportation. In this context, Isuzu Motors Limited announced the Giga CNG in December 2015 [10]. The introduction of this heavy-duty CNG truck to the market is expected to increase the use of NGVs for long-distance transportation.

In fiscal year (FY) 2016, the Japanese Ministry of Environment subsidized a 3-year project for developing and demonstrating heavy-duty LNG trucks, with a running range of more than 1,000 km and an optimum LNG filling station that can also supply CNG. Carbon dioxide emissions from heavy-duty LNG trucks will be reduced by about 10% for the latest diesel trucks. Isuzu Motors Limited, Shell Japan Limited, and the Organization for the Promotion of Low Emission Vehicles (LEVO) have been driving this project since its inception. On June 1, 2018, Japan launched its first LNG

refueling station in Osaka and started road demonstrations of its first two heavy-duty LNG trucks. In addition, in September 2018, an L-CNG filling station that supplied CNG from LNG at the Keihin Truck Terminal in Japan was converted to an L+CNG filling station, which could also supply LNG to heavy-duty trucks. Thus, LNG stations for heavy-duty vehicles were set in Osaka and Tokyo.

Bioethanol

Since 2011, the Ministry of Environment in Okinawa Prefecture has promoted the use of biofuels (e.g., E3 gasoline); however, in FY 2016, the project terminated because of no clear idea for a commercialization [11]. In Miyakojima City, the supply of E3 gasoline was terminated in April 2016 [12]. The sale of bio-gasoline blended with ethyl-tertiary-butyl ether (ETBE) continues to the target of 500,000 kiloliters (kL) (crude oil equivalent) of bioethanol in 2017, based on the Act on Sophisticated Methods of Energy Supply Structures [13]. In 2016, sales of this blended gasoline reached a total 441,000 kL [14].

Methanol/Dimethyl Ether (DME)

The standardization of fuel supply systems (excluding the on-board fuel tank) and refueling port for DME vehicles is making progress. The International Organization for Standardization (ISO) established a working group (ISO/TC22/SC41/WG8) and has been holding meetings regularly since its first international meeting in 2016. The Society of Automotive Engineers of Japan established a subcommittee for DME under the Environment Technical Committee in 2017 to address these issues. International meetings were held in Vancouver, Canada, in February 2017, and in Ostuni, Italy, in November 2017. Japan proposed the addition of the pressure equalizing refueling port to the standard.

Outlook

In July 2018, the Japanese government approved the Strategic Energy Plan (the fifth plan) [15], which forms the basis for Japan's energy policies. This plan strengthens further efforts toward the realization of the energy mix in 2030 and sets forth the challenge for energy conversion and decarbonization in 2050 with new energy options.

References

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