

IEA-Advanced Motor Fuels ANNUAL REPORT 2022

Japan



Japan

Drivers and Policies

On October 22, 2021, the Cabinet approved the Sixth Strategic Energy Plan for submission to the Diet.¹ The Plan includes two key themes:

1. Showing the approach to an energy policy of achieving carbon neutrality by 2050 announced October 2020, with the GHG emission reduction target of greenhouse gas emissions by 46% in FY 2030 from its FY 2013 levels, while continuing strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%, as announced in April 2021.
2. Presenting initiatives to ensure stable supply and reduce energy costs based on the major premise of ensuring safety, in order to solve challenges facing Japan's energy supply and demand structure while taking action against climate change.

In accordance with the Sixth Strategic Energy Plan, the Diet passed the “Bill for the Act of Partial Revision of the Act on the Rationalization etc. of Energy Use and Other Acts in Order to Establish Stable Energy Supply and Demand Structure” on May 13, 2022. In addition, the Act on the Rationalization of Energy Use (e.g., improving energy consumption per unit) was expanded to include non-fossil energy. It calls for specific operators to develop medium- to long-term plans to transition to non-fossil fuel energy.²

In June 2021 the Ministry of Economy, Trade and Industry (METI), in collaboration with other ministries and agencies, formulated the “Green Growth Strategy through Achieving Carbon Neutrality in 2050.”³ The strategy specifies 14 promising fields that are expected to grow, and provides them with action plans from the viewpoints of both industrial and energy policies. Japan upholds an ambitious goal while showing realistic pathways toward it wherever possible. A 2 trillion-yen Green Innovation Fund has been established to encourage companies to take on ambitious challenges.⁴

To decarbonize the transportation sector, Japan will promote the reduction of CO₂ emissions through the production, use, and disposal of automobiles; the improvement of energy efficiency in the logistics sector; and the decarbonization of fuel itself.^{5, 6}

For passenger cars, comprehensive measures such as expanding the introduction of electrified vehicles and infrastructures, and reinforcing technologies related to electrified vehicles such as batteries, supply chain, and value chain will be taken to achieve 100% electrified vehicle sales by 2035.

As for commercial vehicles, the following electrification targets were set:⁷

- Aim for electrified vehicles to account for 20-30% of new light vehicle sales by 2030, with electrified vehicles and decarbonized fuel vehicles to account for 100% by 2040.
- Aim for an advanced introduction of 5,000 heavy vehicles in the 2020s and set a target by 2030 for 2040 electrified vehicle penetration.

¹ Agency for Natural Resources and Energy, “Cabinet Decision on the Sixth Strategic Energy Plan,” https://www.meti.go.jp/english/press/2021/1022_002.html

² Ministry of Economy, Trade and Industry, March 1, 2022, “Cabinet Decision on the Bill for the Act of Partial Revision of the Act on the Rationalization etc. of Energy Use and Other Acts in Order to Establish Stable Energy Supply and Demand Structure,” https://www.meti.go.jp/english/press/2022/0301_004.html

³ Ministry of Economy, Trade and Industry, June 12, 2022, “Green Growth Strategy Through Achieving Carbon Neutrality in 2050,” https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/index.html

⁴ https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/pdf/1_budget.pdf

⁵ Agency for Natural Resources and Energy, October 2021, “Outline of Strategic Energy Plan,” https://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/6th_outline.pdf

⁶ Agency for Natural Resources and Energy, October 2021 (in Japanese), “Strategic Energy Plan,” https://www.enecho.meti.go.jp/category/others/basic_plan/pdf/20211022_01.pdf

⁷ https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/pdf/05_automobile.pdf

Advanced Motor Fuels Statistics

Figure 1 shows the energy sources used in the transportation sector in Japan.⁸ Oil-related energy accounts for 97.7% of total usage. The market for alternative fuels is very small in Japan, as is the number of alternative fuel vehicles owned (Table 1). Methanol, CNG, hybrid, EVs, and FCVs currently constitute the environmentally friendly vehicles.

The number of hybrid vehicles is rather large, owing to the number of passenger hybrid vehicles. CNG and hybrid 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 6,981 FCVs.

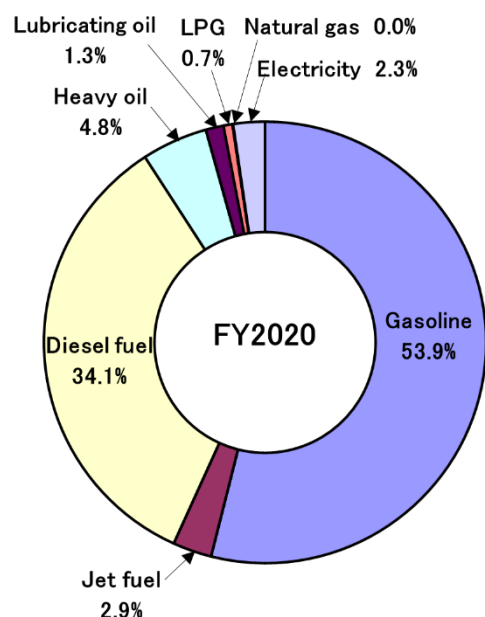


Fig. 1. Energy Sources Used in the Transportation Sector in Japan, 2020

Table 1. Penetration of Environmentally Friendly Vehicles Owned in Japan, March 2022

Vehicle Type	Methanol ^{9,10}	CNG ^{9,10}	Hybrid ¹¹	EV ¹¹	FCV ¹¹	Vehicle Registration ¹²
Passenger vehicles	2	8	HV:10,630,750 PHV: 174,231*	138,325	6,981	39,017,038
Light-, mid-, and heavy-duty trucks	1	3,928	73,211	1,877	NA	5,938,350
Buses	0	119			NA	216,416
Special vehicles	1	1,272			NA	1,633,622
Small vehicles	1	1,447	2,322,201**	21,161	NA	31,308,530
Total	5	6,774	13,200,393	161,363	6,981	78,113,956

*PHVs are not included in the number of HV.

**The sales number of HEV small vehicles for the last 10 years, including the current fiscal year, is shown because there is no publicly available information on the number of HEV small vehicles owned.

⁸ Energy White Paper 2022, Agency for Natural Resources and Energy, June 2022 (in Japanese)

⁹ Automobile Inspection and Registration Information Association, as of March 2022 (in Japanese), https://www.airia.or.jp/publish/file/r5c6pv0000010qt2-att/05_teikougai.pdf

¹⁰ Japan Light Motor Vehicle and Motorcycle Association, as of March 2022 (in Japanese), <https://www.keikenkyo.or.jp/information/attached/0000042686.pdf>

¹¹ Next Generation Vehicle Promotion Center (NeV), as of March 2022 (in Japanese), <http://www.cev-pc.or.jp/tokei/hoyuudaisu.html>

¹² Automobile Inspection and Registration Information Association, as of March 2022 (in Japanese), <https://www.airia.or.jp/publish/file/r5c6pv000000z01x-att/r5c6pv000000z02c.pdf>

Research and Demonstration Focus

Hydrogen

With regard to the use of hydrogen in mobility, support is being provided for the spread of fuel cell vehicles and the development of hydrogen stations. In addition, commercial vehicles such as trucks are one of the areas where hydrogen utilization is expected in the transportation field; trucks need to transport goods daily over long distances, which is difficult for EVs to apply. In the future, the spread of fuel cell vehicles and the systematic development of hydrogen refueling stations will be accelerated. In particular, the cumulative number of fuel cell trucks installed is expected to be up to 15 million units by 2050, amounting to approximately USD 2.7 trillion. In terms of refueling infrastructure, approximately 1,000 hydrogen stations will be installed in optimal locations by 2030, in anticipation of the widespread use of fuel cell vehicles, fuel cell buses, and fuel cell trucks.

Nationwide as of December 2022, hydrogen stations for fuel cell vehicles operated in 164 locations.¹³

In response to such actions, the NEDO HySTRA pilot project (the marine transportation and unloading of liquid hydrogen produced in Australia and delivered to Japan) was initiated in May 2021 as part of the activities of the CO₂-free Hydrogen Energy Supply-chain Technology Research Association.¹⁴ The world's first liquefied hydrogen carrier, the Suiso Frontier, departed Victoria, Australia, on January 28, 2022, marking a significant milestone of the Hydrogen Energy Supply Chain Pilot Project. Built by Kawasaki Heavy Industries Ltd, the Suiso Frontier enables the safe transport of liquefied hydrogen in large quantities from the Port of Hastings, VIC, to Kobe, Japan. For the pilot project, 99.999% pure hydrogen has been produced from Latrobe Valley coal and biomass via gasification, trucked to Hastings, cooled to -253 degrees C, and subsequently liquified to less than 800 times its gaseous volume to create highly valuable liquefied hydrogen.

Hydrogen engines can leverage well-established internal combustion engine technologies. Therefore, they are seen as having high potential for commercialization at lower cost. Activity in the Japanese industrial sector in 2020 featured the announcement of joint research on a single-cylinder hydrogen engine with a 5-liter stroke volume aimed at large engines conducted by Mitsubishi Heavy Industries Engine & Turbocharger (MHIET) of the Mitsubishi Heavy Industries Group and the National Institute of Advanced Industrial Science and Technology (AIST).¹⁵

Natural Gas

Approximately 79% of the natural gas vehicles (NGVs) in Japan are commercial vehicles, such as trucks, buses, or special vehicles (mainly 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, a heavy-duty truck fueled by compressed natural gas, in December 2015.¹⁶ The introduction of this vehicle is expected to increase the use of NGVs for long-distance transportation. Aiming to further extend the running range, Isuzu Motors Limited released heavy-duty LNG trucks in October 2021, with a running range of more than 1,000 km; the CO₂ emissions from these trucks are reduced by about 10%, compared to the latest diesel trucks.¹⁷

Biofuel

With respect to initiatives aiming to encourage the use of biofuels in Japan, sales of gasoline blended with ethyl tert-butyl ether (ETBE) in FY 2021 again achieved the target defined in the Act on Sophisticated Methods of Energy Supply Structures (500,000 kL (crude oil equivalent) of bioethanol and 1.94 million kL of bio-ETBE each year).¹⁸ According to trade statistics, approximately 67,000 kL of ethanol were imported (mainly from Brazil) in FY 2021 as raw material for ETBE (equivalent to roughly 148,200 kL of ETBE).¹⁹

¹³ Next Generation Vehicle Promotion Center (in Japanese), http://www.cev-pc.or.jp/suiso_station/index.html

¹⁴ CO₂-free Hydrogen Energy Supply-chain Technology Research Association, <https://www.hystra.or.jp/en/project/>

¹⁵ Mitsubishi Heavy Industries Ltd. (in Japanese), <https://www.mhi.com/jp/news/210121.html>

¹⁶ Isuzu Motors Limited (in Japanese), <https://www.isuzu.co.jp/product/cng/giga.html>

¹⁷ Isuzu Motors Limited (in Japanese), https://www.isuzu.co.jp/newsroom/details/20211028_01.html

¹⁸ Japan Biofuels Supply LLP, <https://www.jbsl.jp/english/objective/>

¹⁹ Japan Alcohol Association (in Japanese), <http://www.alcohol.jp/statis/import.pdf>

Six private companies established “Research Association of Biomass Innovation for Next Generation Automobile Fuels” on July 20, 2022. This association promotes technological research on the use of biomass as well as the efficient production of bioethanol fuel for automobiles through the optimized circulation of hydrogen, oxygen, and CO₂ during production to achieve a carbon-neutral society.²⁰

E-fuel

In order to achieve a cost lower than the price of gasoline for synthetic fuels in 2050, the commercialization of synthetic fuels will be worked out. In addition to improving the efficiency of existing technologies (reverse shift reaction plus FT synthesis process) and designing and developing production facilities, innovative new technologies and processes (e.g., co-electrolysis, Direct-FT) will be developed in order to establish an integrated production process for synthetic fuels. The Green Growth Strategy aims to establish high-efficiency and large-scale production technology by 2030, expand the introduction and reduce costs during the 2030s, and achieve independent commercialization by 2040 by intensively developing and demonstrating technologies for such synthetic fuels over the next 10 years.²¹

METI launched the “Public-private sector council to promote the introduction of synthetic fuels (e-fuel)” on September 16, 2022, and the “Public-private sector council for methanation promotion” on June 28, 2021, to address issues such as technology and price in order to commercialize synthetic fuels through public-private partnership.²²

On March 2, 2022, 16 companies, including airlines and plant construction companies, announced the launch of “ACT FOR SKY,” an organization that will transcend industry boundaries with the aim of domestically producing SAF, an alternative fuel for aircraft. The organization will research stable procurement of used cooking oil and other raw materials and methods to produce it at reduced cost.²³

Outlook

In a “Green Growth Strategy towards 2050 Carbon Neutrality,” the electrification of automobiles will be promoted. Comprehensive measures will be taken to achieve 100% electrified vehicles (electric vehicles, fuel cell vehicles, plug-in hybrid vehicles, hybrid vehicles) in new passenger car sales by the mid-2030s at the latest. Furthermore, through efforts to neutralize energy such as e-fuel, Japan aims to achieve net emission through the production, use, and disposal of automobiles in 2050.

Additional Information Sources

- The Ministry of Economy, Trade and Industry, Overview of Japan’s Green Growth Strategy Through Achieving Carbon Neutrality in 2050, January 2021, https://www.meti.go.jp/english/press/2020/pdf/1225_001a.pdf

Benefits of Participation in the AMF TCP

Participation in the AMF TCP makes it possible to obtain the latest information on advanced motor fuels for stakeholders, policy makers, and industries. AMF TCP activities facilitate an international network on advanced motor fuels.

²⁰ Six Private Companies Establish “Research Association of Biomass Innovation for Next Generation Automobile Fuels,” July 20, 2022, https://global.toyota/en/newsroom/corporate/37543537.html?_ga=2.238844416.1634822074.1672032845-1414364891.1672032845

²¹ The Ministry of Economy, Trade and Industry, “Green Growth Strategy Through Achieving Carbon Neutrality in 2050,” Formulated, June 2021 https://www.meti.go.jp/english/press/2021/0618_002.html

²² Public-private sector council to promote the introduction of synthetic fuels (e-fuel), https://www.meti.go.jp/shingikai/energy_environment/e_fuel/001.html

²³ <https://actforsky.jp/>