IEA-Advanced Motor Fuels
ANNUAL REPORT 2021

Japan

Technology Collaboration Programme
by iea

Japan

Drivers and Policies

The Government of Japan formulates the Strategic Energy Plan to show the direction of Japan's energy policy under the Basic Act on Energy Policy, which was enacted in June 2002 for the purpose of ensuring the steady implementation of energy policy.

On October 22, 2021, the Cabinet approved the Sixth Strategic Energy Plan for submission to the Diet,[1] which 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; and (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 order to decarbonize the transportation sector, Japan will promote reduction of CO_2 emissions through the production, use, and disposal of automobiles; improvement of energy efficiency in the logistics sector; and the decarbonization of fuel itself.[2,3]

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, electrification targets were set as follows[4]:

- Aim for electrified vehicles to account for 20-30% of new light vehicles sales by 2030, and 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.

Advanced Motor Fuels Statistics

Figure 1 shows the energy sources used in the transportation sector in Japan.[5] Oil related energy accounts for 97.8% 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 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 5,278 FCVs.

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 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
3 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
4 https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/pdf/05_automobile.pdf
5 Energy White Paper 2021, Agency for Natural Resources and Energy, June 2021 (in Japanese)

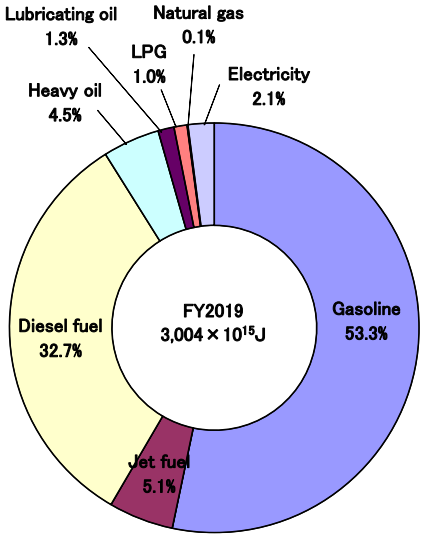

Fig. 1. Energy Sources Used in the Transportation Sector in Japan in 2019

Table 1. Current Penetration of Environmentally Friendly Vehicles Owned in Japan

Vehicle Type	Methanol[6,7]	CNG[5,6]	Hybrid[8]	EV[7]	FCV[7]	Vehicle Registration[9]
Passenger vehicles	2	11	9,711,746 (PHV:151,241)	123,706	5,170	39,185,711
Light, mid, and heavy-duty trucks	1	4,874	58,115	1,871	NA	5,948,364
Buses	0	172			NA	219,660
Special vehicles	2	1,529			NA	1,628,799
Small vehicles	1	1,816	1,896,381	4,532	NA	31,454,086
Total	6	8,402	11,666,242	130,109	5,170	78,436,620

Research and Demonstration Focus

Hydrogen

"Green Growth Strategy Through Achieving Carbon Neutrality in 2050" was updated June 18, 2021.[8] 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.

6 Automobile Inspection and Registration Information Association, as of March 2021 (in Japanese), https://www.airia.or.jp/publish/file/r5c6pv000000wkqt-att/r5c6pv000000wkr8.pdf

7 Japan Light Motor Vehicle and Motorcycle Association, as of March 2021 (in Japanese), https://www.keikenkyo.or.jp/information/attached/0000028680.pdf

8 Next Generation Vehicle Promotion Center (NeV), as of March 2021 (in Japanese), http://www.cev-pc.or.jp/tokei/hanbai.html

9 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

Hydrogen stations for fuel cell vehicles were operating in 157 locations nationwide as of January 2022.[10]

In response to such actions, the NEDO HySTRA pilot project involving the marine transportation and unloading of liquid hydrogen produced in Australia to Japan was initiated in May 2021 as part of the activities of the CO_2-free Hydrogen Energy Supply-chain Technology Research Association.[11]

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).[12]

In other news, Toyota Motor Corporation entered the 24-hour endurance race in May 2021 with a vehicle equipped with a 3-cylinder, 6-liter engine using hydrogen as a fuel, completing all 358 laps.[13]

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.[14] The introduction to the market of this heavy-duty CNG truck 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 FY 2022.[15] The LNG trucks have a running range of more than 1,000 km and CO_2 emissions from the LNG trucks are reduced by about 10%, compared to the latest diesel trucks.

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 2020 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).[16] According to trade statistics, approximately 54,000 tons of ethanol were imported (mainly from Brazil) in 2020 as raw material for ETBE (equivalent to roughly 124,000 kL of ETBE).[17]

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 in the 2030s, and achieve independent commercialization by 2040 by intensively developing and demonstrating technologies for such synthetic fuels over the next 10 years.[8]

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

[10] Next Generation Vehicle Promotion Center (in Japanese), http://www.cev-pc.or.jp/suiso_station/index.html
[11] CO_2-free Hydrogen Energy Supply-chain Technology Research Association, https://www.hystra.or.jp/en/project/
[12] Mitsubishi Heavy Industries Ltd. (in Japanese), https://www.mhi.com/jp/news/210121.html
[13] Toyota Times News (in Japanese), https://toyotatimes.jp/insidetoyota/137.html
[14] Isuzu Motors Limited (in Japanese), http://www.isuzu.co.jp/product/giga/cng/
[15] Isuzu Motors Limited (in Japanese), https://www.isuzu.co.jp/newsroom/details/20211028_01.html
[16] Japan Biofuels Supply LLP (in Japanese), http://www.jbsl.jp/effort/index.html
[17] Japan Alcohol Association (in Japanese), http://www.alcohol.jp/statis/import.pdf

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
- Green Growth Strategy Through Achieving Carbon Neutrality in 2050, https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/index.html

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 industry in the world. AMF TCP activities facilitate an international network on advanced motor fuels.