

IEA-Advanced Motor Fuels ANNUAL REPORT 2023

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. An energy policy approach to achieving carbon neutrality by 2050, as announced in October 2020. The proposed approach has a greenhouse gas (GHG) emission reduction target of 46% in fiscal year (FY) 2030 (from baseline FY 2013 levels) and continues Japan's strenuous efforts to meet its lofty goal of cutting its emission by 50%, as announced in April 2021.
2. Initiatives to ensure a stable energy 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 acting 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, calling 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 representatives of these fields with action plans from the viewpoints of both industrial and energy policies. Japan upholds an ambitious goal while demonstrating realistic pathways to meet that goal wherever possible. A 2-trillion-yen Green Innovation Fund has been established to encourage companies to take on ambitious challenges.⁴ In December 2023, to simultaneously achieve the three goals of decarbonization, economic growth, and a stable energy supply through GX (green transformation), the Government of Japan compiled "Sector-specific Investment Strategies" for 10 years in the prioritized fields as an effort to improve companies' predictability and strongly encourage companies to invest in GX.⁵

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.^{6,7}

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

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 METI (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 METI, 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 METI, August 31, 2021, "Budget (Green Innovation Fund)," https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/pdf/1_budget.pdf.

⁵ METI, December 22, 2023, "Sector-specific Investment Strategies" Compiled as Effort for Specifying Investment Promotion Measures for the Realization of GX," https://www.meti.go.jp/english/press/2023/1222_002.html.

⁶ 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.

⁷ 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.

For commercial vehicles, the following electrification targets were set:⁸

- Electrified vehicles account for 20–30% of new light vehicle sales by 2030, with electrified vehicles and decarbonized fuel vehicles to account for 100% by 2040.
- An advanced introduction of 5,000 heavy vehicles in the 2020s and 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.⁹ 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 vehicles, compressed natural gas (CNG) vehicles, hybrid and plug-in hybrid vehicles (HEVs and PHVs), electric vehicles (EVs), and fuel cell vehicles (FCVs) currently constitute the environmentally friendly vehicle options in Japan.

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 7,473 FCVs.

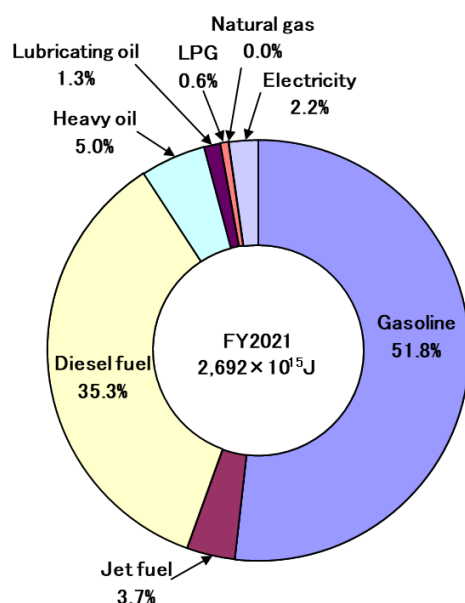


Figure 1. Energy Sources Used in the Transportation Sector in Japan, 2021

Table 1. Penetration of Environmentally Friendly Vehicles Owned in Japan, March 2023

Vehicle Type	Methanol ^{14,15}	CNG ^{14,15}	Hybrid ¹⁴	PHV ¹⁴	EV ¹⁴	FCV ¹⁴	Vehicle Registration ¹⁶
Passenger vehicles	2	7	11,447,604	207,578	162,389	7,310	38,882,417
Light, mid, and heavy-duty trucks	1	3,478	86,021	3	2,070	11	5,956,671
Buses	0	92	1,399	1	252	133	212,180
Special vehicles	1	1,064	13,733	281	342	19	1,647,775
Small vehicles	1	1,186	1	2	30	NA	31,308,530
Total	5	5,827	11,548,758	207,865	165,083	7,473	78,007,573

⁸ METI, “Automobile/battery industries,”

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

⁹ Agency for Natural Resources and Energy, June 6, 2023, “Cabinet Decision Made on the FY2022 Annual Report on Energy (Japan’s Energy White Paper 2023),” https://www.meti.go.jp/english/press/2023/0606_003.html.

Research and Demonstration Focus

Hydrogen

In 2017, Japan formulated the world's first national hydrogen strategy, the Basic Hydrogen Strategy. Under this strategy, Japan achieved several accomplishments: commercialization of the world's first FCVs, increased utilization of fuel cells by households, and a world-class number of related patents. In this context, Japan's efforts to transition into a hydrogen-based society are moving from the technology development phase to the commercial phase.

In June 2023, the Basic Hydrogen Strategy was revised¹⁰ to include two new basic pillars: the "Hydrogen Industry Strategy" — a policy for strengthening the industrial competitiveness of hydrogen — and the "Hydrogen Safety Strategy" — a policy for the safe use of hydrogen. This revised strategy will be reviewed within a 5-year period.

With regard to the use of hydrogen in mobility, Japan is providing support for the spread of fuel cell vehicles and the development of hydrogen stations. 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 given their range limitations. In the future, the spread of FCVs and the systematic development of hydrogen refueling stations will be accelerated. In particular, the cumulative number of fuel cell trucks on the road is expected to be up to 15 million by 2050, at a value of 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 FCVs including fuel cell buses and trucks. Nationwide as of December 2023, hydrogen stations for FCVs operated in 161 locations.¹¹

In response to Japan's hydrogen strategy, the New Energy and Industrial Technology Development (NEDO) CO₂-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA) pilot project (the marine transportation and unloading of liquid hydrogen produced in Australia and delivered to Japan) was initiated in May 2021.¹² The world's first liquefied hydrogen carrier, the Suiso Frontier, departed Victoria, Australia, on January 28, 2022, marking a significant milestone for the 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, Victoria, to Kobe, Japan.

To establish a safer and more efficient cargo-handling operation, on March 4, 2023, HySTRA successfully conducted a handling demonstration test using the world's first rigid-type loading arm system (LAS) for ship-to-shore transfer of liquefied hydrogen. The new rigid-type LAS, installed at the "Hy touch Kobe," offers a more compact design compared with existing hose-type LASs, which is advantageous to increase the size of the system in the near future.

Because hydrogen engines can leverage well-established internal combustion engine (ICE) technologies, they have a high potential for commercialization at lower cost. Toyota has installed the hydrogen engine in a commercial light-duty vehicle (HiAce) to conduct on-road feasibility testing by fleet operators on public roads in Australia.¹³

Natural Gas

Approximately 80% 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 released a CNG heavy-duty truck in December 2015¹⁴ and a heavy-duty LNG truck in

¹⁰ The Ministerial Council on Renewable Energy, Hydrogen and Related Issues, June 6, 2023, "Basic Hydrogen Strategy," https://www.meti.go.jp/shingikai/enecho/shoene_shinene/suiso_seisaku/pdf/20230606_5.pdf.

¹¹ Next Generation Vehicle Promotion Center (in Japanese), http://www.cev-pc.or.jp/suiso_station/index.html

¹² HySTRA (CO₂-free Hydrogen Energy Supply-chain Technology Research Association), "Hydrogen Supply Chain: Hydrogen Energy Supply Chain Pilot Project between Australia and Japan," <https://www.hystra.or.jp/en/project/>.

¹³ Toyota, November 11, 2023, "Evolution of Hydrogen Technology and Taking on New Challenges in Australia," <https://global.toyota/en/newsroom/corporate/40081554.html>

¹⁴ Isuzu Motors Limited (in Japanese), <https://www.isuzu.co.jp/product/cng/giga.html>.

October 2021.¹⁵ Mitsubishi Corporation and Air Water Inc. have jointly developed Japan's first compact LNG filling facility for LNG-powered trucks. They launched trial operations of the facility and LNG trucks in Hokkaido under the Ministry of the Environment's Low Carbon Technology R&D Program on November 18, 2022.¹⁶ This project uses LNG mixed with liquified bio methane (LBM) refined from livestock manure-based biogas, which is expected to be a carbon-negative fuel.

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 2022 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).¹⁷ According to trade statistics, approximately 57,825 kL of ethanol were imported (mainly from Brazil) in FY 2022 as raw material for ETBE (equivalent to roughly 127,900 kL of ETBE).¹⁸

E-fuel

In order to achieve a cost lower than the price of gasoline for synthetic fuels in 2050, Japan will work on commercialization of synthetic fuels. In addition to improving the efficiency of existing technologies (reverse shift reaction plus Fischer Tropsch [FT] synthesis process) and designing and developing production facilities, innovative new technologies and processes (e.g., co-electrolysis, direct-FT) will be developed as part of 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.¹⁹

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 to enable commercialization of synthetic fuels through public-private partnership.²⁰

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 sustainable aviation fuel (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.²¹

Outlook

In a "Green Growth Strategy towards 2050 Carbon Neutrality," Japan will promote the electrification of automobiles and take comprehensive measures to achieve 100% electrified vehicles (EVs, FCVs, HEVs and PHVs) 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 zero emissions through the production, use, and disposal of automobiles in 2050.

Additional Information Sources

- METI, "[Overview of Japan's Green Growth Strategy Through Achieving Carbon Neutrality in 2050](#)," January 2021.

¹⁵ Isuzu Motors Limited (in Japanese), https://www.isuzu.co.jp/newsroom/details/20211028_01.html.

¹⁶ Mitsubishi Corporation, "Introduction of Trial Operations of Compact LNG Filling Facilities for LNG Trucks in Hokkaido," <https://www.mitsubishicorp.com/jp/en/bg/natural-gas-group/topics/lng-filling-facilities/>.

¹⁷ Japan Biofuels Supply LLP, <https://www.jbsl.jp/english/objective/>

¹⁸ Japan Alcohol Association (in Japanese), <http://www.alcohol.jp/statis/import.pdf>

¹⁹ 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

²⁰ METI, "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

²¹ <https://actforsky.jp/>

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.