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# Hydrogen update and outlook in Japan 2022

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## 1. Introduction

With support from the Japanese government, efforts are well underway to establish a hydrogen economy in Japan. There has been consistent development of the infrastructure necessary to support a hydrogen economy, as shown by the following:

- In March 2020, construction of the world's largest-class renewable energy-powered hydrogen production plant, the 10 megawatt-class Fukushima Hydrogen Energy Research Field was completed.
- On 20 January 2022, the Suiso Frontier, the world's first liquefied hydrogen carrier, arrived at Victoria, Australia as part of a demonstration of the transport of liquefied hydrogen from Australia to a modified port terminal in Kobe, Japan.
- Japan boasts the greatest number of hydrogen fuel stations for road vehicles of any country, with approximately 160 as of June 2021, and has pledged to increase that number to 1,000 by 2030.
- Work is underway to demonstrate that Japan's extensive liquid natural gas infrastructure, which currently accounts for 37% of Japan's energy mix, can be co-used with, and fully converted to, liquid hydrogen or ammonia, lowering barriers for the full-scale introduction of hydrogen and ammonia into Japan's energy mix.

Further, from a supply perspective, Japanese corporations continue to actively pursue opportunities to develop low-carbon hydrogen production facilities overseas, most notably in Canada, Australia and New Zealand. Given Japan's ambition of achieving a leading hydrogen economy, it is expected that these hydrogen infrastructure and supply initiatives will continue through 2022.

## 2. Recent policy developments regarding hydrogen

Hydrogen is a central pillar of Japan's pledge to achieve carbon neutrality by 2050. In April 2021, further to Japan's 2050 carbon neutrality pledge, the then prime minister, Yoshihide Suga, announced a commitment to achieve a 46% reduction in greenhouse gas emissions by fiscal year 2030 compared with fiscal year 2013 levels. In pursuit of this goal, on 22 October 2021 the cabinet of the current prime minister, Fumio Kishida, approved Japan's Sixth Strategic Energy Plan, which memorialised the 2050 carbon neutrality pledge, and for the first time included targets for energy produced from hydrogen and/or ammonia sources at 1% of Japan's total power generation by fiscal year 2030. The Kishida administration has positioned the promotion of clean

energy as a core driver for economic growth, and Japan's draft budget for fiscal year 2022 has earmarked around 100 billion Japanese yen for the introduction of renewable energies and clean energy vehicles, and the acceleration of research and development for the practical uses of hydrogen and ammonia and their integration into the economy.

The Japanese government has bolstered these policy efforts with a 2 trillion Japanese yen green innovation fund, which was established by the Ministry of Economy, Trade and Industry (METI) in March 2021. The green innovation fund has already committed billions of yen to fund projects related to hydrogen, such as demonstrations of "green" water electrolysis plants for hydrogen production, the creation of global standards for water electrolysis equipment, demonstrations of methylcyclohexane (MCH)[i] and liquid hydrogen supply chains, and testing of co-firing hydrogen in gas turbines.

In addition, on 30 November 2021, METI, together with Japan's Clean Fuel Ammonia Association, announced the establishment of a task force that will coordinate internationally and with the International Organization for Standardization for the establishment of global standards regarding ammonia, to be announced in the second half of 2022. METI has further announced plans to set safety standards for ammonia and hydrogen-fired power generation facilities by September 2022.

While a great deal of attention has been given to hydrogen as an energy source for the production of electricity, the potential utility of hydrogen is far broader. Japan's Strategic Road Map for Hydrogen and Fuel Cells, released on 12 March 2019, notes other applications for hydrogen, such as for transport (ie, hydrogen fuel cells or hydrogen combustion engines), and for industrial processes such as oil and steel refineries, for which low-carbon hydrogen can replace the by-product hydrogen that is currently utilised to heat boilers or in other processes.

## 3. Hydrogen policy and rules

While Japan pushes forward with the development of a hydrogen infrastructure, supply chain, and other hydrogen technologies, in order for Japan to realise a hydrogen economy, a number of actions must be taken. While Japan has cast a wide net by funding research and demonstrations for transporting and storing hydrogen in various forms such as MCH, ammonia and liquid hydrogen, Japan has yet to settle on a preferred form. The industry may be cautious about making large investments in infrastructure until there is a clearer picture as to what form of hydrogen that infrastructure should be built for.

In addition, Japan has yet to adopt a national certification standard for the carbon footprint or "colour" of hydrogen. In this respect Japan lags behind other regions and countries such as the European Union and Australia, where guarantee-of-origin (GO) schemes with respect to the carbon properties of the production and/or transport of hydrogen have been, or are being, introduced. Such GO schemes are viewed as important steps toward facilitating a global hydrogen economy as they allow parties to "decouple" physical hydrogen from its carbon properties, and enable corporations to meet their commitments with respect to carbon footprint reduction targets.

Although not a national system, in 2019, Aichi Prefecture (home of Toyota Motor Corporation) introduced its own scheme for certifying hydrogen as "low-carbon", meaning hydrogen produced from solar power, wind power, hydropower, geothermal, biomass and other renewable natural resources excluding those produced from carbon resources (eg, oil, natural gas and coal). Hydrogen that is produced using renewable energy, or for which carbon emissions are offset using either Japan's Green Energy Certificates[ii] or J-Credits,[iii] can apply

for and receive a low-carbon hydrogen certificate from the governor of Aichi Prefecture in accordance with the following process:

- the applicant prepares a plan on how to produce the hydrogen with a low-carbon process, typically electrolysis using renewable energy, and submits the plan to the governor of Aichi Prefecture;
- the examination committee, consisting of a professor and officials of Aichi Prefecture as well as the Chubu bureau of METI, will examine the production plan submitted by the applicant;
- if approved, the operator (previously, the applicant) will produce the hydrogen in accordance with the production process so approved;
- the operator will report to the governor the record of production of hydrogen annually after the year for which the production plan was approved;
- the same examination committee as listed above will examine such record of production of hydrogen submitted by the operator; and
- if approved, a "low-carbon" hydrogen certificate will be issued to the operator in the name of the governor of Aichi Prefecture.

The "low-carbon" hydrogen certificate can be made public by either the governor or the operator itself.[iv]

However, because the Aichi low-carbon hydrogen certificates are not tradeable, and because it is a regional rather than national scheme, there is limited economic utility in the certificates themselves outside of helping companies meet their sustainability commitments. The Japanese government may look to the Aichi scheme as a reference point for future efforts to adopt a national certification or GO scheme, although, given current efforts toward a global certification scheme for ammonia, the Japanese government may instead pursue a similar approach for hydrogen and work with partners overseas to establish a global GO standard for hydrogen.

## 4. Comment

Supported by the ongoing efforts of the Japanese government to meet greenhouse gas reduction targets by 2030, it is expected that investments in technologies related to the production, storage, transport and use of hydrogen will continue to accelerate. Further, technological advances, as well as the downward trend for renewable energy costs, will lead to cost reductions for low-carbon hydrogen, which, coupled with efforts by the Japanese government to establish international standards for both hydrogen and ammonia, will fuel growth for the hydrogen economy in Japan in 2022 and beyond.

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[i] MCH is produced from toluene and hydrogen, and can be stored and transported in a liquid state at ambient temperatures and pressures.

[ii] Green energy certificates are a private certification scheme introduced in 2000 by the Japan Natural Energy Company Ltd. Electricity customers can purchase renewable electricity by paying a premium price in exchange for green energy certificates.

[iii] J-Credits are a scheme started by METI in 2013 under which the Japanese government certifies as credits the amount of greenhouse gas emissions reduced through efforts to introduce energy-saving devices and utilise renewable energy as well as the amount of such emissions removed through efforts such as appropriate forest management.

[iv] There are currently five approved low-carbon hydrogen certificates published on the Aichi Prefecture website.