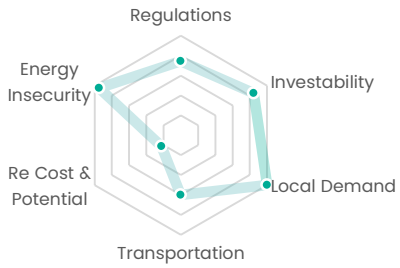
Japan

Index rank # 11

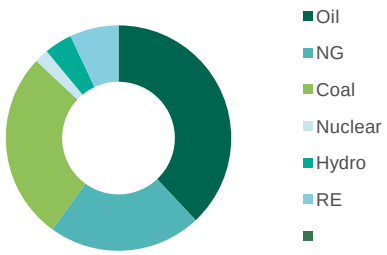
Aggregate score (out of 5) 3.5

GDP - USD (trn):	5.1
GDP per capita - USD:	40,113
Land area ('000 km2):	365
Population density (per km²):	347
Grid emissions factor (gCO²/kWh):	492

Hydrogen Drivers Matrix



Primary Energy Mix



3.7 Regulatory commitment
- Committed to net zero by 2050
- >USD4bn targeted H2 funding
- Ineffective carbon tax of USD3/tonCO2 on fossil fuel use

3.0 Transportation
- Leads the world in hydrogen shipping technology and infrastructure investments

4.2 "Investability"
- Rated A+ by S&P
- 29th in WB Ease of Doing Business
- Power infrastructure investments led by domestic firms

1.1 RE cost and potential
- Very high LCOEs, yet the fourth largest solar market globally
- Large offshore wind potential, but mostly floating

5.0 Local demand potential
- 3rd largest steel manufacturer
- 6th largest oil refiner
- 6th highest container port traffic

4.7 Energy insecurity
- 93% of energy supply is imported
- High import cost and supplier diversification strong H2 drivers

Developing supply chains to import hydrogen, export technology

In 2017, Japan was the first country in the world to publish a national hydrogen strategy. Japan is the world's fifth largest consumer of energy but imports more than 90% of its total energy supply, including most of its oil, from the Middle East. At the same time, having created the world's fourth largest solar market through sky-high FiTs, Japan has shown clear willingness to put money behind its clean energy independence, which lends confidence to the domestic production target of 300kt hydrogen by 2030 (vs. EU's 10mt). Cost of solar in Japan today is c.USD0.10/kWh (June 2021 auctions), c. ten times higher than in Saudi Arabia.

Japan today has hydrogen demand of 2mtpa and intends to boost this to 3m tons by 2030, and 20m by 2050. Any meaningful hydrogen supply will therefore need to be sourced from abroad. Reflecting this, Japan's hydrogen plan centres around building international hydrogen transportation networks both technologically and politically. There are strong R&D efforts ongoing on green ammonia as an energy vector for power, which are likely to lead to the first international green hydrogen supply chains. Hydrogen is also a business opportunity for Japan to monetise its leadership in hydrogen technologies, particularly in fuel cells, turbines and gas shipping.

USD3.4bn funding

JPY370bn (USD3.4bn) from Japan's JPY2trn Green Innovation Fund will be allocated over the next decade for hydrogen development—USD2.7bn to develop a hydrogen supply chain and drive demand, and USD630m to scale up green hydrogen projects.

Spearheading hydrogen shipping

Japanese companies are leading in hydrogen shipping technologies. Kawasaki unveiled the world's first liquefied hydrogen carrier in May this year with 90-ton capacity and is working on a 11,000-ton second generation prototype[1]. In January this year, it completed the 180-ton Kobe LH2 Terminal, the world's first liquefied hydrogen receiving terminal. First shipments are expected in spring 2022.

Japanese-Australian H2 road

Japanese and Australian companies have initiated numerous joint ventures in the developing blue/green hydrogen trade lane between the two countries. Iwatani, Japan's largest hydrogen supplier, and Australian state electricity company Stanwell are leading a feasibility study for export of up to 3GW of green hydrogen from Central Queensland (FID expected 2022, first shipments 2026). Sumitomo and Rio Tinto plan to start construction of a pilot 300ktpa plant in Queensland in 2022.

International partnerships

In 2021, INPEX, JERA and JOGMEC agreed with ADNOC (UAE) to explore the commercial potential of a clean ammonia export from the UAE. Last September, the world's first blue ammonia shipment left Saudi Arabia for Japan. A Dutch-Japanese hydrogen development partnership has also been signed.

hydrogen investability index

Cranmore Partners energy estate.

[1] Pilot tanker (Suiso) capacity at 1,250 m3; next generation at 160,000m3, tonnage estimated here using hydrogen density of 71kg/m3 assuming full compression