March 2025 / Japan

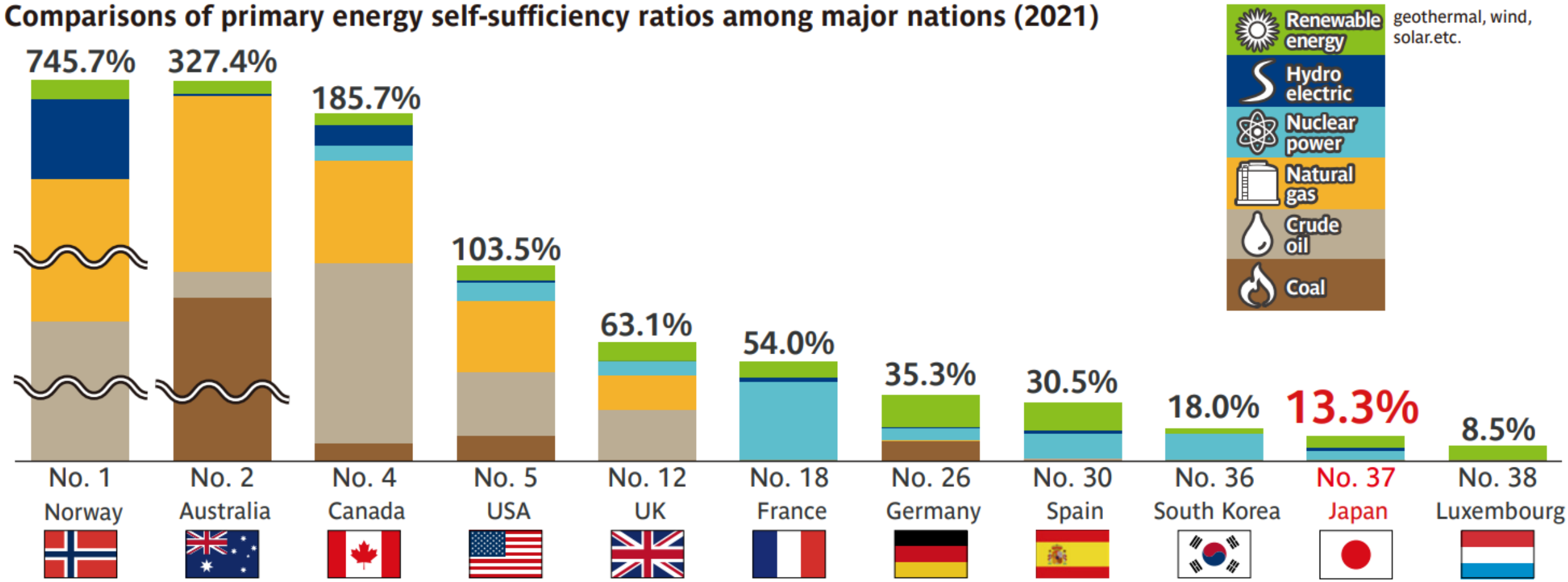
Asia-Pacific Climate Security Project (APCS)

Energy Security and Energy Transition in Japan

Climate & Energy Area / Policy Researcher
Hajime Takizawa

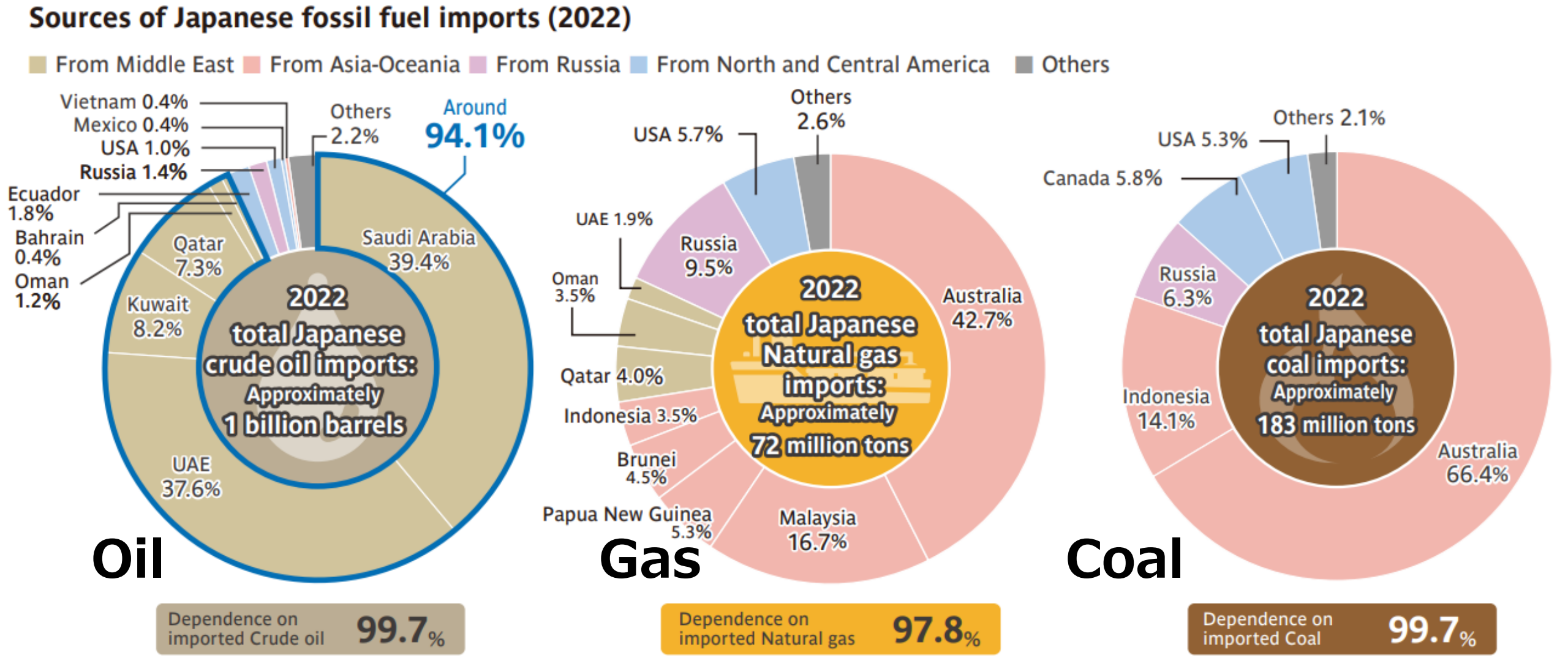
IGES
公益財団法人
地球環境戦略研究機関

Energy self-sufficiency: Japan ranks 37 out of 38 OECD countries



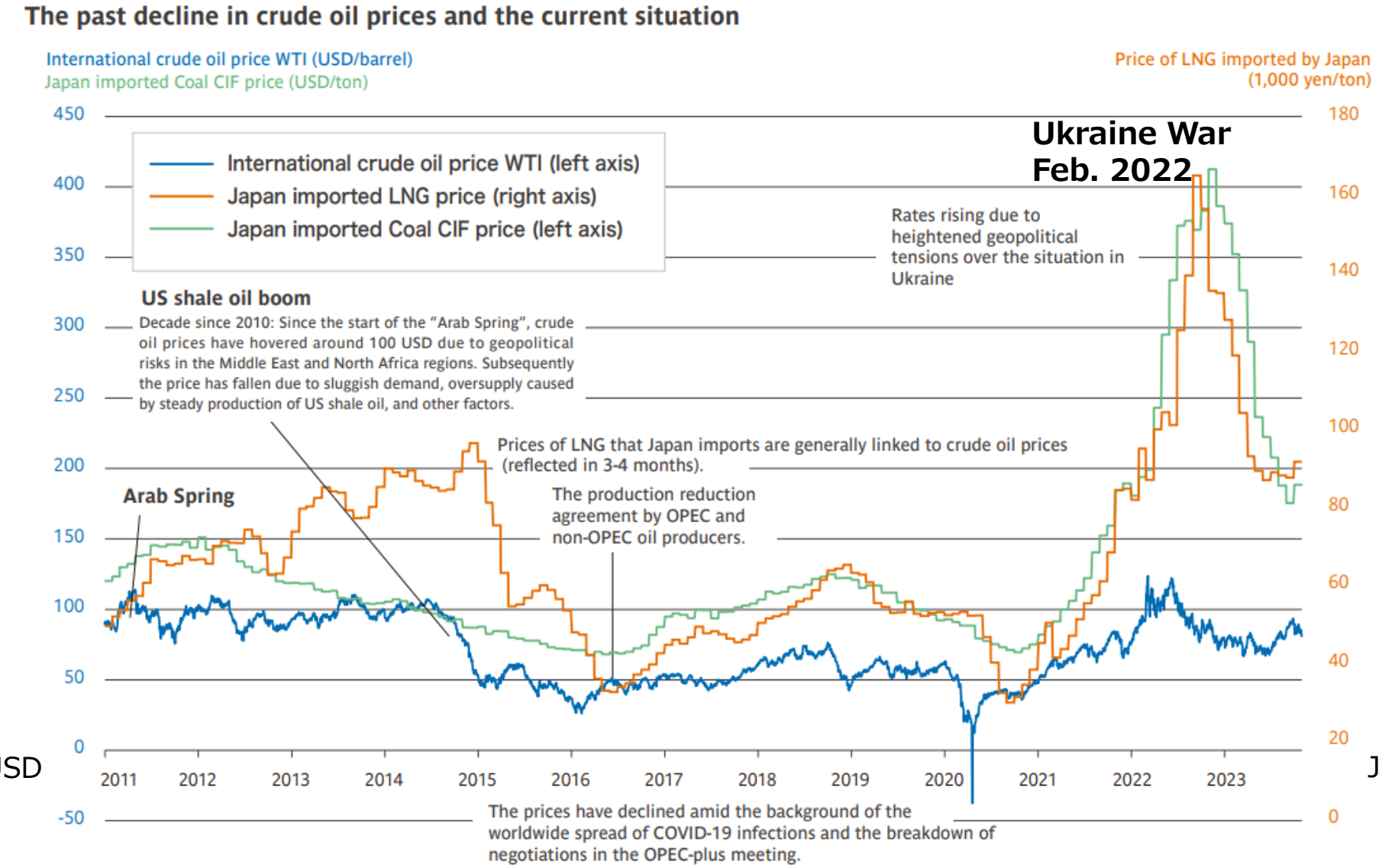
Source: Estimates for 2021 from IEA “World Energy Balances 2022”, except for data on Japan, which are confirmed values of FY2021, derived from “Comprehensive Energy Statistics of Japan”, published by the Agency for Natural Resources and Energy * The ranks in the table are those of the 38 OECD member countries.

Over 97% of Japan's fossil fuels are imported



Source: "Trade Statistics of Japan", Ministry of Finance (The degree of dependence on sources outside Japan on FY is derived from "Comprehensive Energy Statistics of Japan", published by the Agency for Natural Resources and Energy)

Soaring fossil fuel prices due to Ukraine war and weak yen



JPY**79.8**/USD
(2011)

JPY**140.5**/USD
(2023)

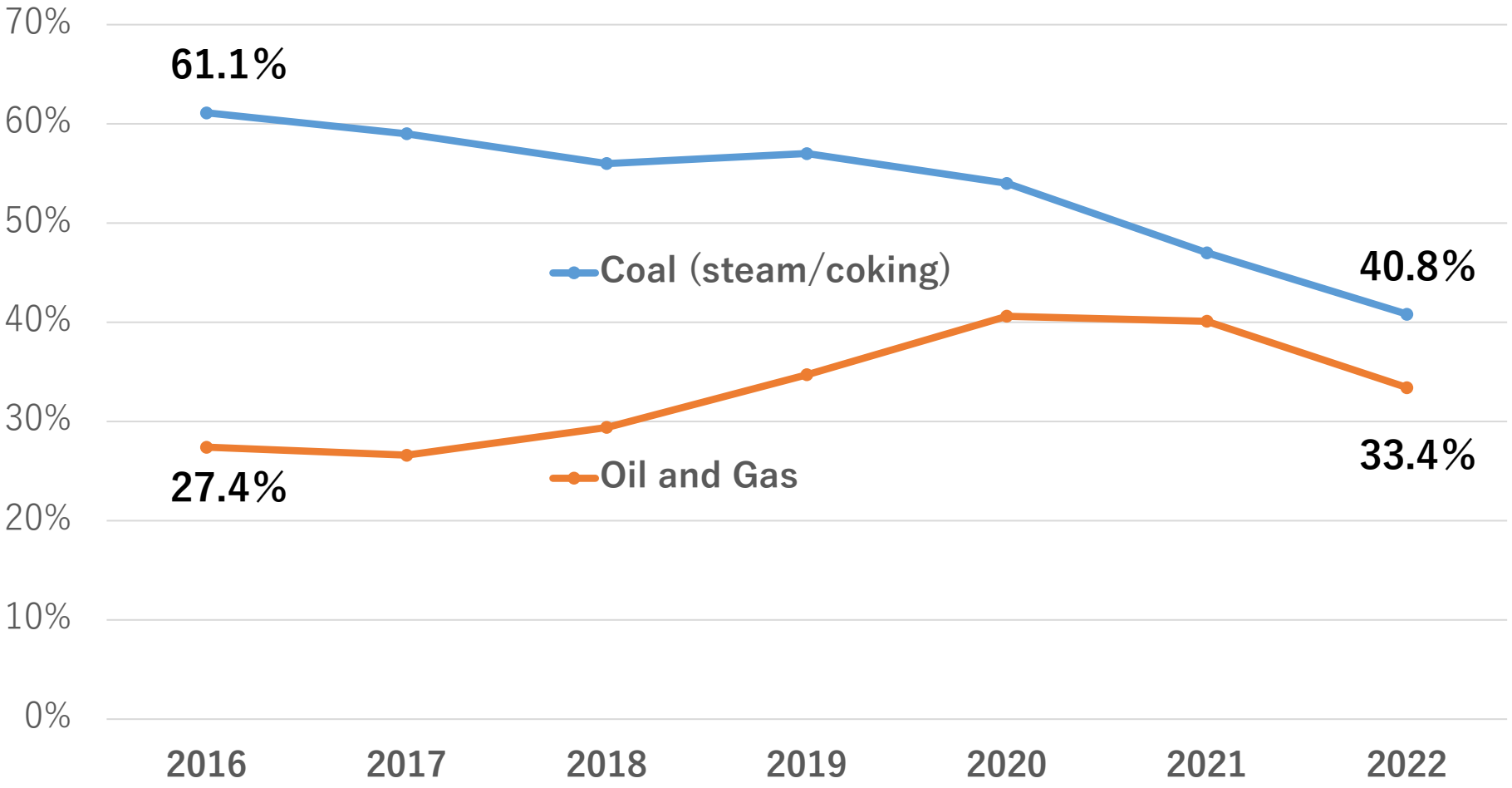
Source: Compiled by the Agency for Natural Resources and Energy based on CME Nikkei and Ministry of Finance trade statistics

Degree of energy dependence on Russia

Country	Primary energy self-sufficiency (2021)	Dependence on Russia Russia's share of imports (2020)		
		Oil	Natural gas	Coal
Japan	13% (Oil:0% gas:2% coal:0%)	1.5% (6th place)	9.5% (3rd place)	6.3% (3rd place)
Italy	23% (Oil:12% gas:4% coal:0%)	11% (4th place)	31% (1st place)	56% (1st place)
Germany	35% (Oil:3% gas:5% coal:51%)	34% (1st place)	43% (1st place)	48% (1st place)
France	54% (Oil:1% gas:0% coal:0%)	0%	27% (2nd place)	29% (2nd place)
UK	61% (Oil:75% gas:43% coal:12%)	11% (3rd place)	5% (4th place)	36% (1st place)
US	104% (Oil:96% gas:113% coal:110%)	1%	0%	0%
Canada	186% (Oil:288% gas:138% coal:235%)	0%	0%	0%

Source: White Paper 2023, Ministry of Economy, Trade and Industry

Japan's independent development ratios



Independent development ratio

The share of the offtake amount under the control of Japanese enterprises (including domestic production)

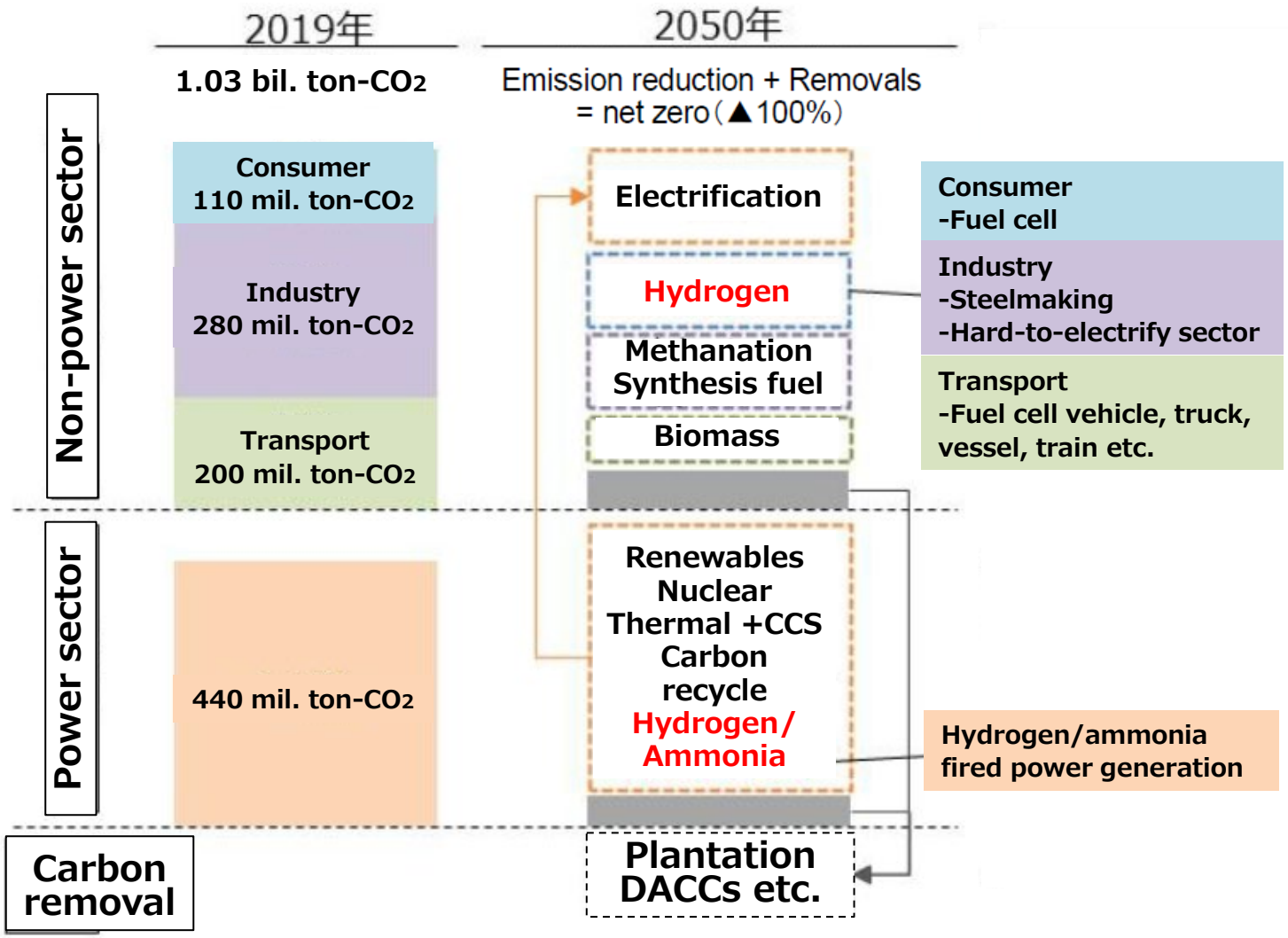
7th Strategic Energy Plan

Target	2030	2040
Coal	-	60%
Oil & Gas	More than 50%	More than 60%

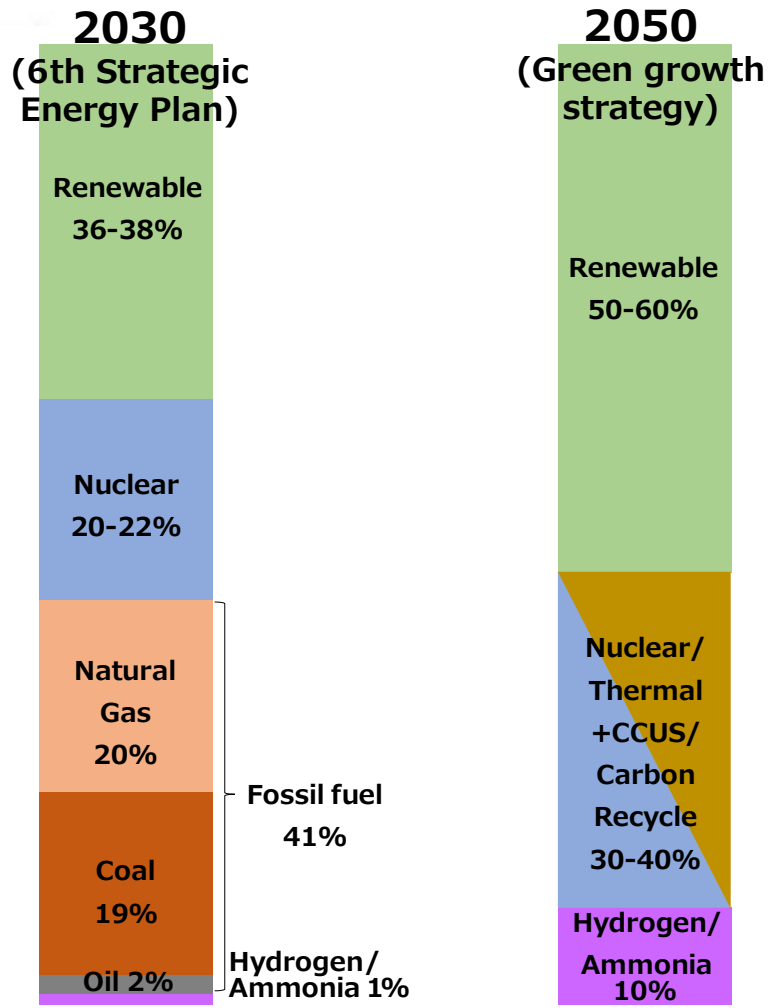
Source: Compiled by author based on White Paper 2024 and the 7th Strategic Energy Plan, Ministry of Economy, Trade and Industry

Japan's climate policy - 2050 net zero and decarbonization

CO2 emissions

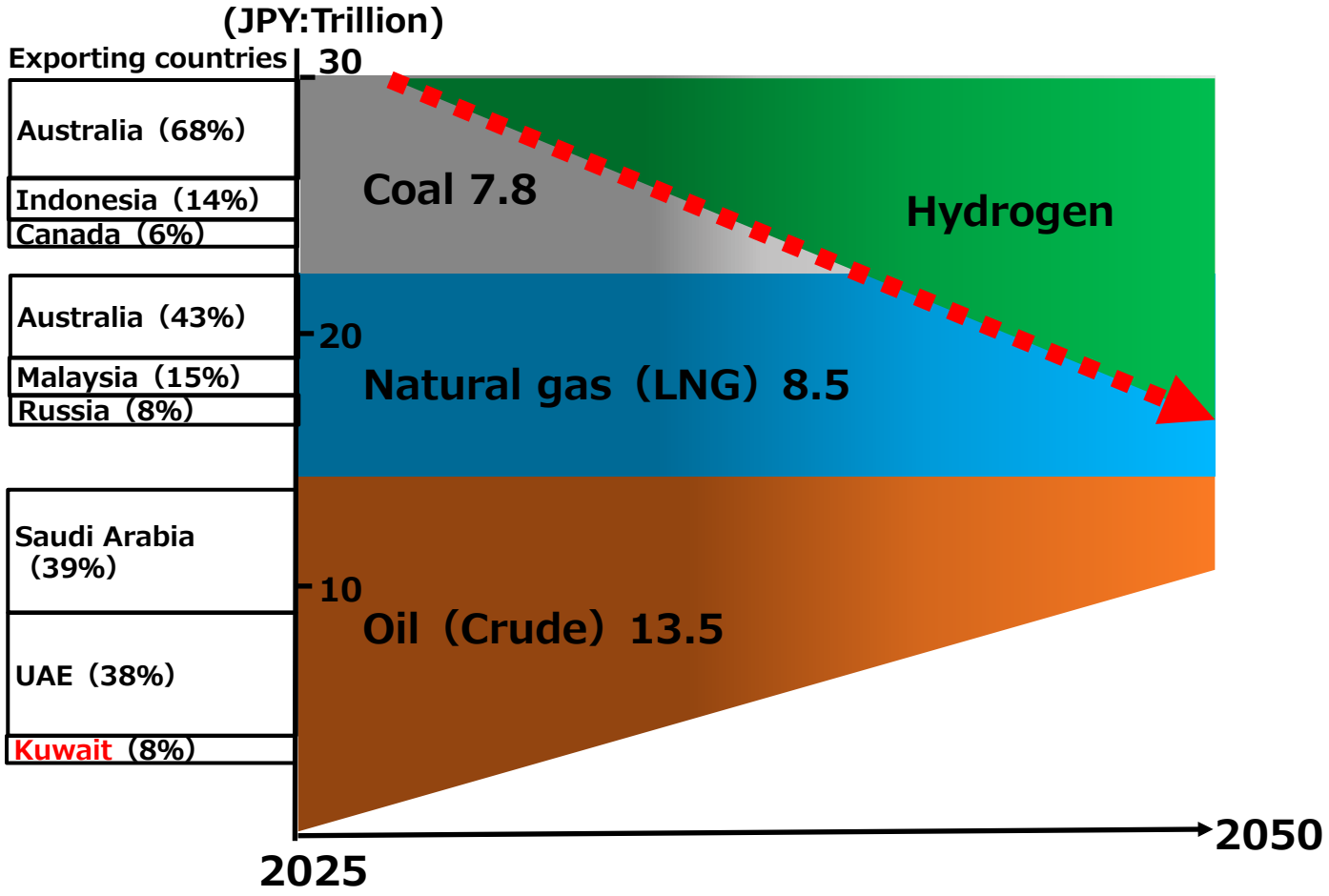


Power generation mix

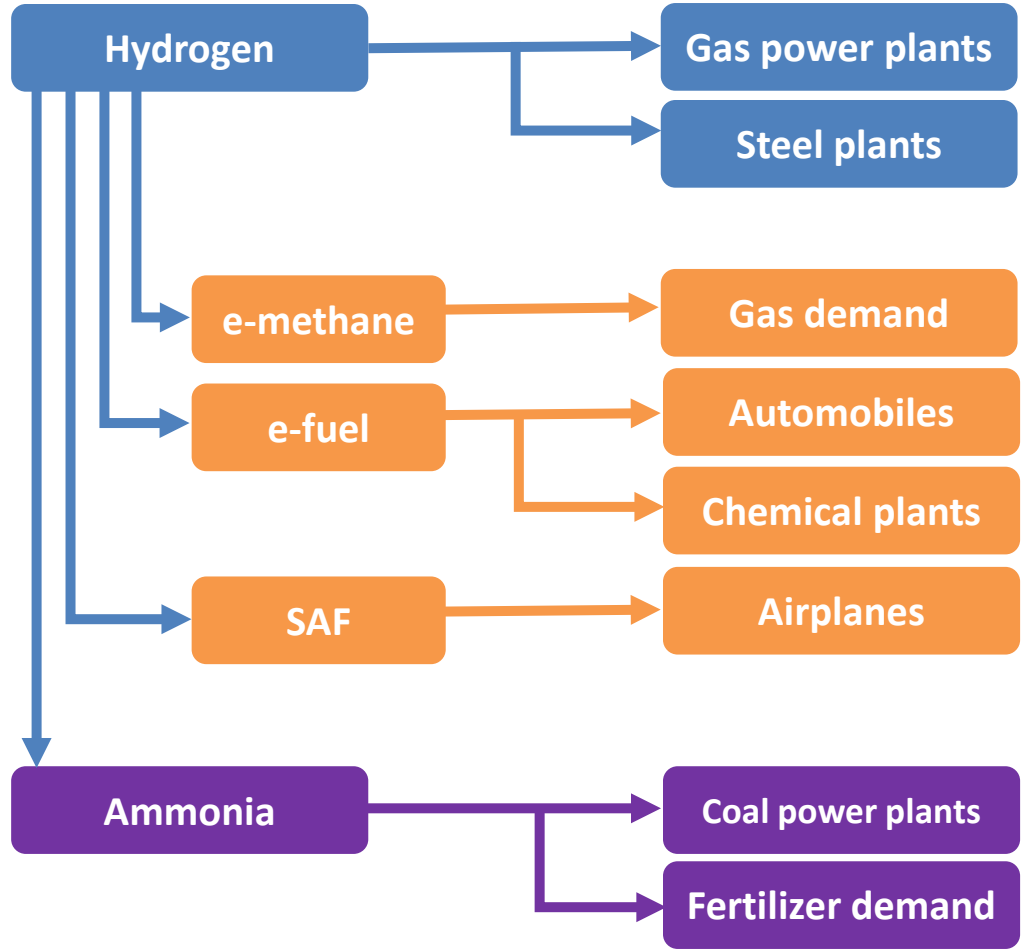


Source: Report for the Hydrogen Safety Strategy (Ministry of Economy, Trade and Industry, Dec. 2022)

Japan’s annual imports of fossil fuels



Applications of Hydrogen in various industries

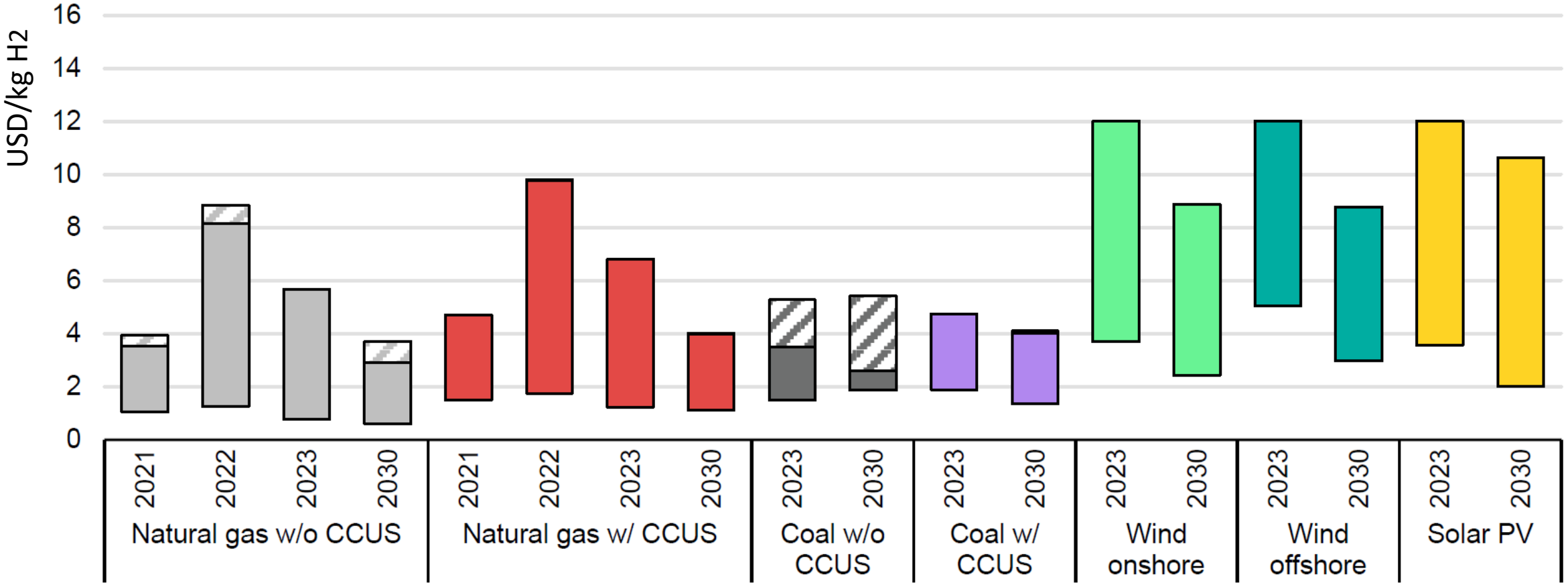


Domestic fuel reserve stock

Fuel	LNG	Coal	Oil	Uranium
Stock days	20 days	29 days	200 days	2.9 years

Source: Compiled by author based on Trade Statistics, Ministry of Finance and Studies on achieving carbon neutrality by 2050, Ministry of Economy, Trade and Industry

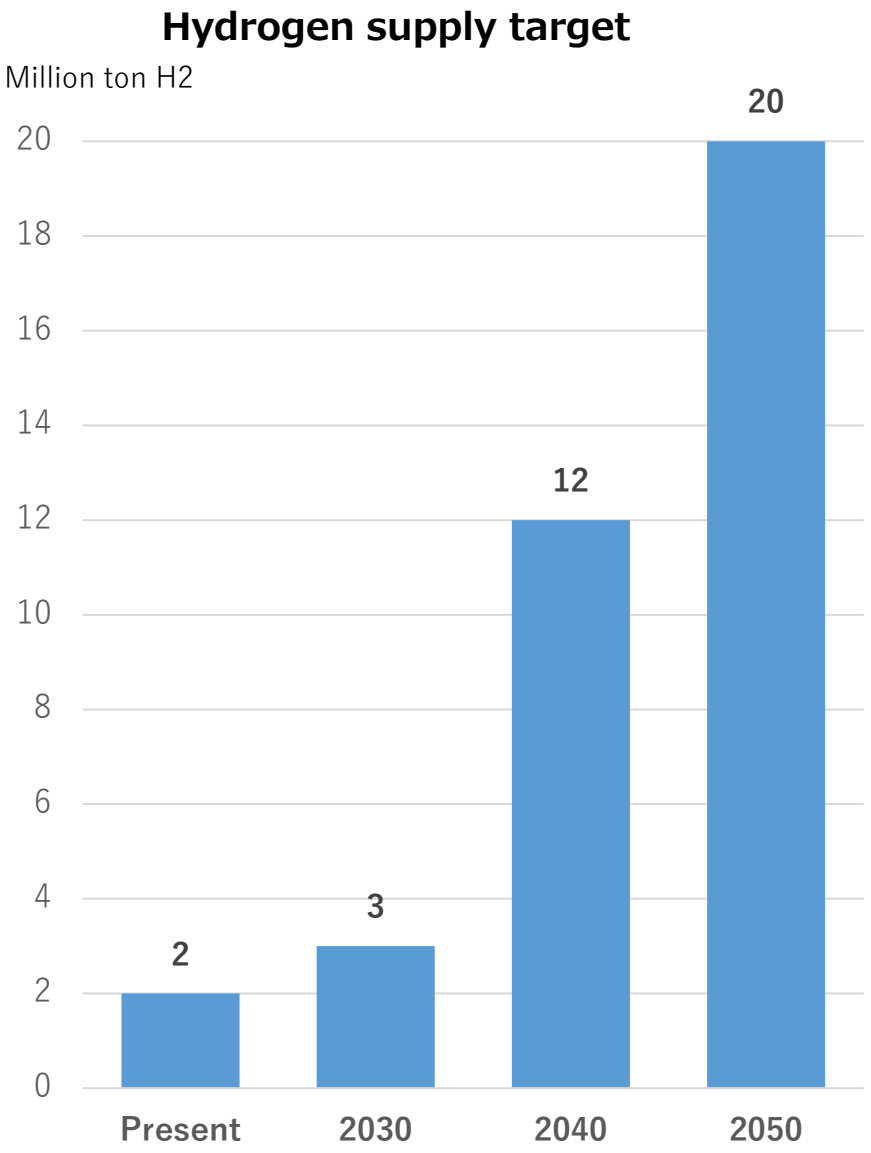
Hydrogen production cost by pathway, 2023, and in the Net Zero Emissions by 2050 Scenario, 2030

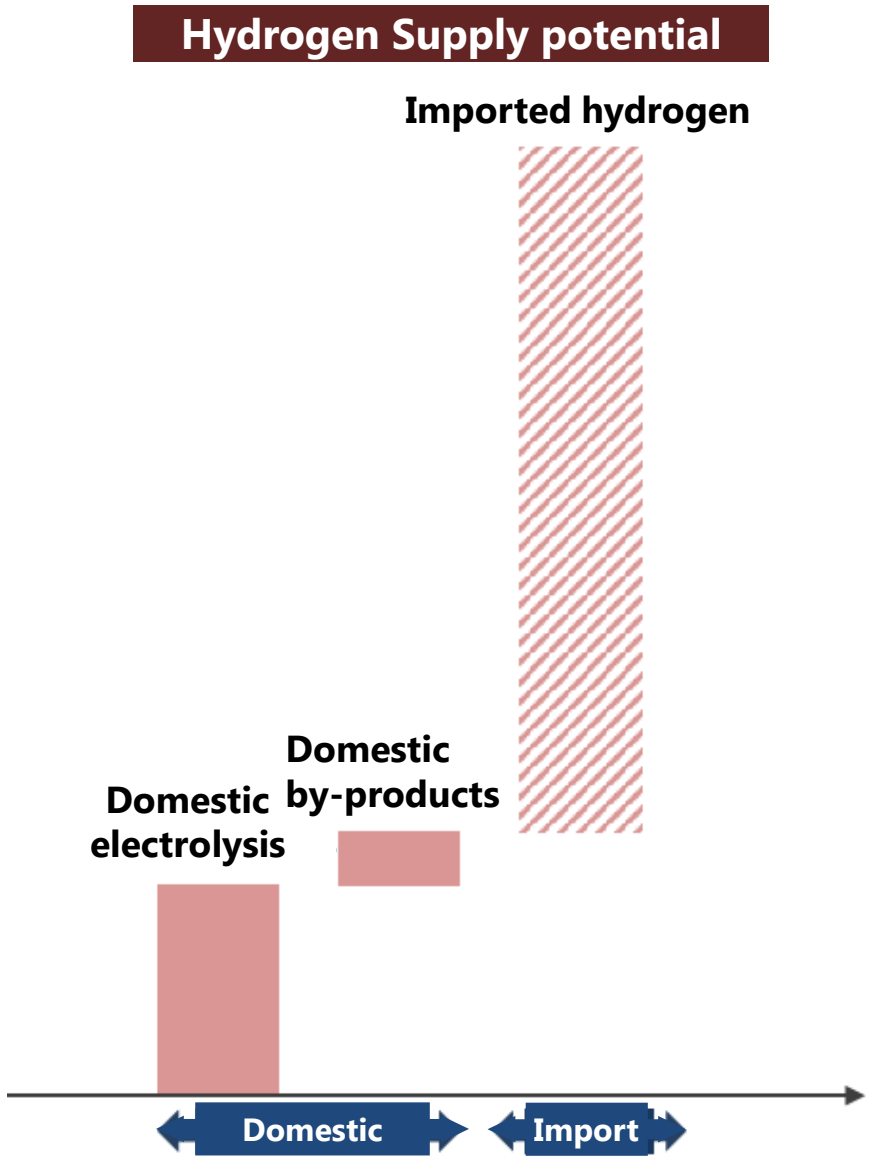


Notes: CCUS = carbon capture, utilisation and storage; w/ = with; w/o = without. Cost ranges reflect regional differences in fossil fuel prices, renewable costs, CO2 prices, technology CAPEX and OPEX as well as cost of capital. Natural gas price is USD 5-21/MBtu for 2021, USD 6-51/MBtu for 2022, USD 3-35/Mbtu for 2023 and USD 1-15/MBtu for 2030 NZE. Coal price is USD 9-270/t for 2023 and USD 1-120/t for the NZE Scenario in 2030. The levelised production cost of solar PV electricity is USD 20-120/MWh for 2023, USD 14-90/MWh for the NZE Scenario in 2030, with capacity factor of 12-35%. Onshore wind electricity levelised production cost is USD 23-110/MWh for 2023, USD 22-100/MWh for the NZE Scenario in 2030, with a capacity factor of 15-53%. The offshore wind electricity levelised production cost is USD 55-230/MWh for 2023, USD 36-145/MWh for the NZE in 2030, with a capacity factor of 32-67%. Electrolyser CAPEX is USD 950/kW for the NZE Scenario in 2030 and includes the electrolyser system, its balance of plant and EPC, installation cost and contingencies; electrolyser capacity factor assumed to be the same as the renewable power plant. The cost of capital is 6-20%. The dashed area represents the CO2 price impact, based on USD 15-140/t CO2 for the NZE Scenario. Renewable-based hydrogen production costs are capped at USD 12/kg H2. Water cost is not included. Other techno-economic assumptions are included in the Annex.

Sources: IEA Global Hydrogen Review 2024

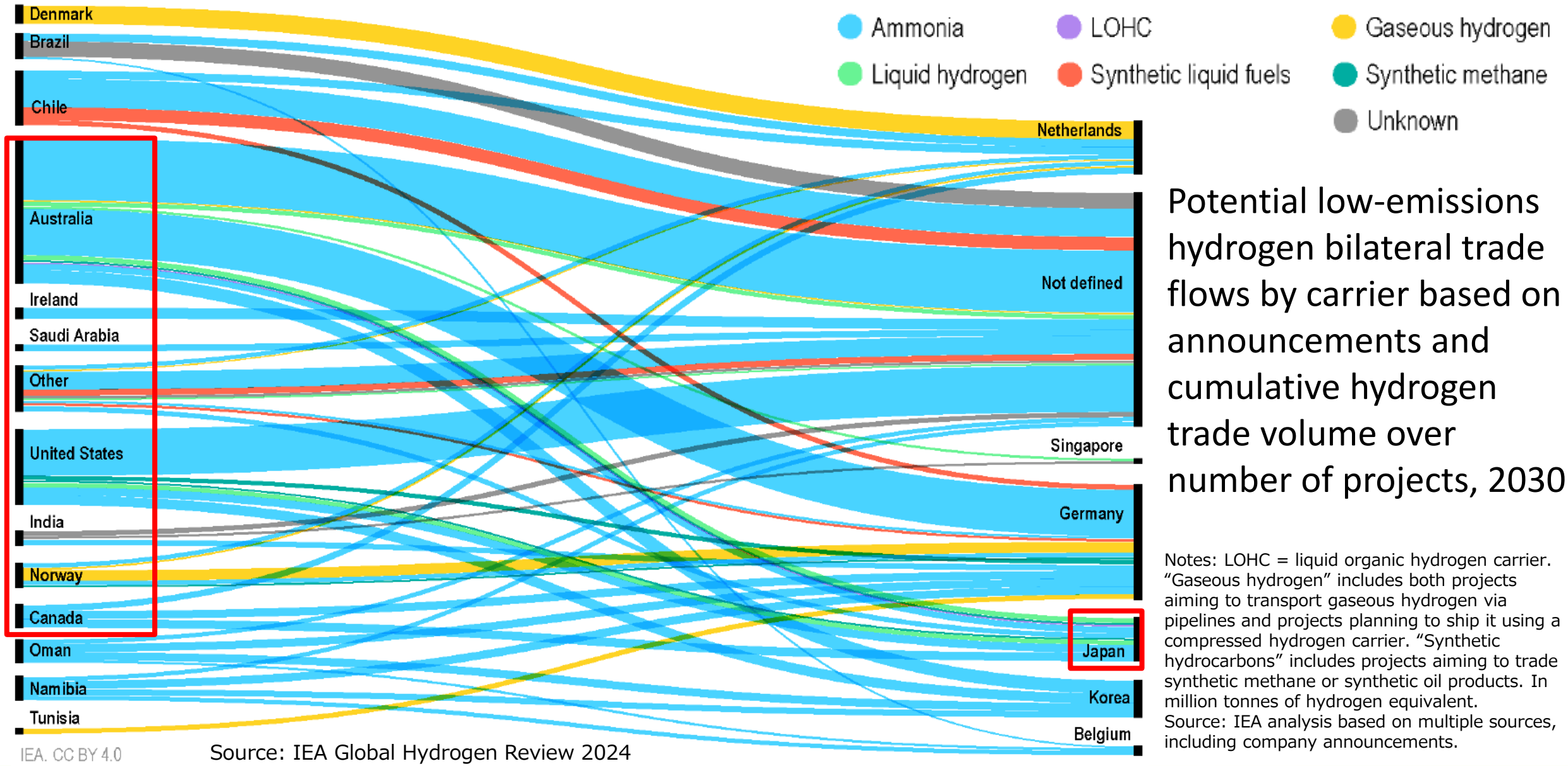
Japan’s hydrogen will mainly come from abroad





Source: Basic Hydrogen Strategy and Studies on achieving carbon neutrality by 2050, Ministry of Economy, Trade and Industry

Countries Exporting Hydrogen to Japan

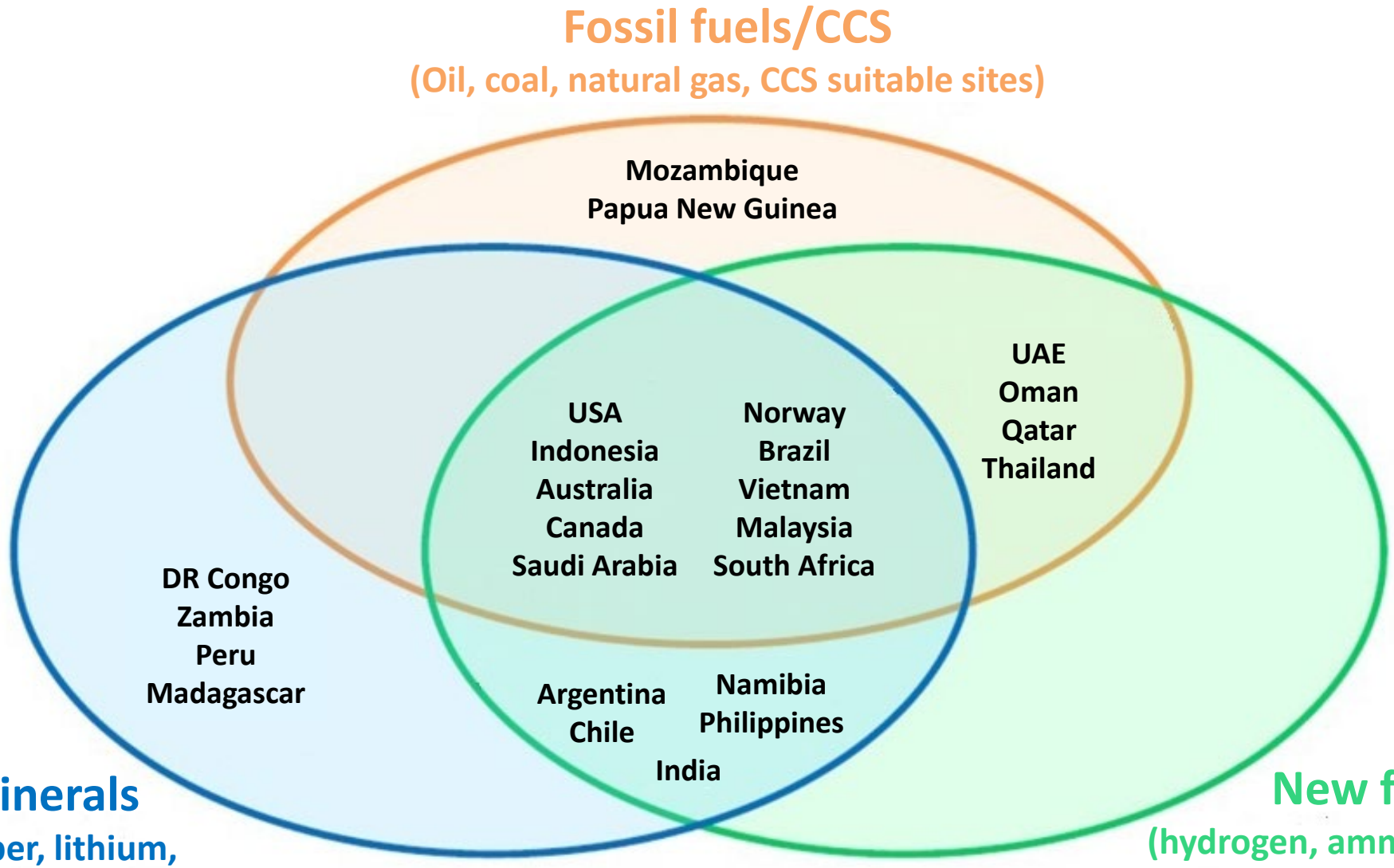


Potential low-emissions hydrogen bilateral trade flows by carrier based on announcements and cumulative hydrogen trade volume over number of projects, 2030

Notes: LOHC = liquid organic hydrogen carrier. "Gaseous hydrogen" includes both projects aiming to transport gaseous hydrogen via pipelines and projects planning to ship it using a compressed hydrogen carrier. "Synthetic hydrocarbons" includes projects aiming to trade synthetic methane or synthetic oil products. In million tonnes of hydrogen equivalent.
Source: IEA analysis based on multiple sources, including company announcements.

Source: IEA Global Hydrogen Review 2024

For energy diplomacy, 25 target countries are divided into five categories



Source: A guideline for resource diplomacy with an eye on GX, Ministry of Economy, Trade and Industry, 2023

Approach of Japan's energy diplomacy

	Five categories	Characteristics	25 target countries	Approach
1	Comprehensive partner	Excess capacity for exporting various natural resources	USA, Australia, Canada, Norway	• Sharing advanced knowledge and technical collaboration on new fuels • Establishing market rules and supply chains
2	Traditional stable supplier	A traditional stable supplier to Japan	UAE, Oman, Qatar, Saudi Arabia, Chile	• Continuous securing of conventional energy • Energy transition extends existing relationships into new fuels
3	Improving investment environment	High potential for natural resources	DR Congo, Zambia, Namibia, PNG, Peru, Madagascar, Mozambique	• Building investment infrastructure • Coordinated investment and financing for the upstream
4	Regional partner	Close in distance to Japan and strong existing business relationship	Indonesia, Thailand, Philippines, Vietnam, Malaysia	• Asia Zero Emission Community/Asia Energy Translon Initiative • Cooperation in times of emergency
5	Emerging superpower	Huge growth opportunities and demand are expected	Argentina, India, Brazil, South Africa	• Developing a market due to strong domestic demand • Future supply of new fuels to Japan

Source: A guideline for resource diplomacy with an eye on GX, Ministry of Economy, Trade and Industry, 2023

Summary

1. With its scarce energy resources, Japan relies almost entirely on imports for fossil fuels.
2. Decarbonised society will transition away from fossil fuels to low-carbon hydrogen.
3. In a hydrogen-based society, Japan's hydrogen supply will rely on foreign imports.
4. Japan will develop its energy diplomacy not only with traditional exporters of fossil fuels, but also with exporters of new fuels and rare-earth minerals.