PRI Principles for Responsible Investment

DELIVERING NET ZERO EMISSIONS IN JAPAN

UNEP FINANCE INITIATIVE | United Nations Global Compact

An investor initiative in partnership with UNEP Finance Initiative and UN Global Compact

INTRODUCTION

There is overwhelming evidence that Japan faces severe impacts from climate change if global temperature rise exceeds 1.5°C. These impacts include increased frequency and intensity of extreme weather, sea level rise threatening cities and infrastructure, and damage to agriculture.[1] Impact assessments by the Japanese government find that a temperature rise of just 1.7°C threatens frequent flood-related disasters causing massive damage to infrastructure and economic activity, and puts staple crops like rice at risk.[2]

Investors globally and in Japan increasingly recognise the urgency and importance of acting to deliver reductions in greenhouse gas (GHG) emissions in line with the goals of the Paris Agreement. This urgency is reflected in the Government of Japan's recent announcement of an new target to achieve net zero carbon emissions by 2050, which brings Japan into line with rapidly growing list of major economies that have made similar commitments, including the EU, UK, US, and China. As more commitments are announced, investors, businesses and other stakeholders are turning their attention to the question of how the Japanese government will implement new policies in the near term to deliver on their long-term emissions reduction goals.

Based on research by Vivid Economics as part of the Inevitable Policy Response (IPR) project, and drawing on other leading sources of research, PRI has developed a roadmap of policies for Japan to deliver a net zero economy by 2050. The policy recommendations address the overall climate ambition and key sectors for decarbonisation: power, industry, road transport, and buildings. Together, these recommendations describe essential near-term actions to reach net zero by 2050 in a way that is economically, politically and technologically achievable and ultimately beneficial.

As analysis by PRI's Inevitable Policy Response (IPR) project shows, delayed, disruptive and disorderly policy response to climate change risks undermining the value of financial assets as well as increasing the difficulty of reducing emissions at the required rate. On the other hand, early and ambitious action creates certainty for markets to seize the opportunities for growth and job creation that are provided by the sustainable and low-carbon industries of the future.

The role of private finance is central. Investors need to support these efforts using the levers at their disposal: capital allocation, stewardship, and their own policy engagement activities. Many investors are supportive of urgent action by policy makers to design and implement policies that will facilitate the investment flows required to achieve net zero emissions.

[1] Intergovernmental Panel on Climate Change (IPCC) (2020), *Special Report: Global warming of 1.5°C, available at: https://www.ipcc.ch/sr15/*

[2] Ministry of the Environment, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Agriculture, Forestry and Fisheries, Ministry of Land, Infrastructure, Transport and Tourism, Japan Meteorological Agency (2018), *Climate Change in Japan and Its Impacts*, available at: https://www.env.go.jp/earth/tekiou/pamph2018_full_Eng.pdf

SUMMARY OF POLICY ASKS

Overall climate ambition

- Set out a roadmap to achieve net zero by 2050, including interim targets for 2030, and set the new targets in law. Carry out a comprehensive study on the economic and distributional impacts of the goal to achieve net zero GHG emissions by 2050, in order to inform policy decisions.
- Establish an independent expert advisory body on climate change for target setting, progress monitoring, and policy recommendations appropriate to the institutional architecture of Japan's policy making process. It should have a statutory mandate to issue recommendations to policy makers and on Government to respond to any recommendations.
- Design and implement an ambitious carbon pricing regime consistent with the net zero by 2050 climate objective. Carbon pricing should at a minimum cover power and industry, and a strategy should also assess the possibility of extending carbon pricing to transport and buildings.

Zero-carbon power

- Develop and implement a clear plan for deep decarbonisation of electricity by 2050. The plan should set targets for wind and solar PV generation for 2030 in line the 2050 goal, and schedule auctions to deliver the necessary wind and solar PV capacity.
- Review power market arrangements and remove impediments to investment and generation of low-carbon power, such as the connectable amount rules that lead to renewables curtailment.
- Ensure sufficient investment in high voltage transmission infrastructure to connect regions of high renewable generation potential with demand centres.
- Cancel all new thermal coal plant projects that are in a pre-construction phase. Carry out a comprehensive feasibility study on phasing out coal generation and set near to mid-term targets to phase out all unabated coal generation.

Industry

- Build on Japan's Basic Hydrogen Strategy and develop and implement strategies on low-carbon steel, chemicals, and cement. Strategies should set the objective of decarbonising energy intensive industry by 2050, and set out a roadmap to shift to production using electric, hydrogen, and CCS technologies to meet this goal.
- Assess the technical and economic feasibility of raising the mandatory average annual reduction in industrial energy consumption from 1% to 2%, and aim to implement a target of greater than 2%.

Road transport

- Develop and implement a policy regime to end the sales of conventional petrol and diesel cars and vans by 2035 (including non-plug-in hybrid vehicles), and achieve 100% zero emission light duty vehicles by this date.
- Building on Japan's Basic Hydrogen Strategy, develop and implement comprehensive strategy to decarbonise heavy road transport by 2050 at the latest. Set out a programme of RD&D projects to commercialise low-carbon trucks, and identify policies to drive mass-market deployment.

Buildings

- Publish a detailed plan for identifying and realising the energy savings potential in the existing buildings stock. This plan should include financial incentives for retrofitting, building on the existing subsidy scheme, and set targets to retrofit all the buildings stock by 2050.

OVERALL CLIMATE AMBITION

CURRENT ACHIEVEMENTS AND POLICIES

Japan is the World's fifth largest emitter of greenhouse gases (GHGs) at around 3% of the global total, and CO_2 accounts for over 90% of Japan's emissions. Japan's emissions have begun to decline since 2013 and in 2018 emissions were 2% below 1990 levels.[3] Japan's energy-related emissions account for 88% of its total GHG emissions, and this proportion has remained roughly the same since 1990. This emissions reduction trend falls far short of the levels required to deliver on the goals of the Paris Agreement.

Japan has recently announced a new commitment to achieve net zero emissions by 2050. On 25 December 2020, the Japanese government published a Green Growth Strategy. This provides a high-level outline of how Japanese industry expects to initiate a green transition, and can be expected to be the starting point for the development in 2021 of a more comprehensive roadmap of policies to deliver on Japan's 2050 net zero commitment.[4]

As we approach COP26 in Glasgow in November 2021, a new set of emissions reduction targets and pathways will be expected to replace Japan's existing Paris Agreement NDC, which pledges a 26% reduction by 2030 from 2013 levels, and an 80% reduction by 2050 from 1990 levels, with a goal to reach net zero early in the second half of the 21st Century. At the sub national level, as of July 2020, 177 local governments covering well over half of Japan's population, including Tokyo, Kyoto, and Yokohama, had committed to a net zero GHG emissions target by 2050.[5]

Current policies in all the sectors included in this report fall well short of levels required to reach the goals of the Paris Agreement, so a comprehensive range of new policies will need to be brought forward to achieve Japan's increased ambition to reach net zero by 2050.

Carbon pricing is a vital tool to cut carbon emissions in economically efficient ways. Japan's carbon tax, the Tax for Climate Change Mitigation, is an upstream tax on the import or extraction of fossil fuels, currently set at only US$3/$tCO_2$. The carbon tax applies to CO_2 emissions from all sectors, covering around 68% of GHG emissions in Japan.[6] Japan's current carbon price is not sufficient to meet the objectives of the Paris Agreement. The Carbon Pricing Leadership Coalition (2017) recommend a carbon price range of between US$40-US$80/tCO_2 by 2020 and US$50-US$100/tCO_2 by 2030 to ensure countries are on an emissions pathway consistent with the Paris Agreement.[7]

An emissions trading scheme (ETS) has been under consideration in Japan since 2008, with ongoing discussions but little progress.[8] The previous administration in Japan cancelled plans for an ETS in 2010 that were opposed by Keidanren, Japan's major big business federation.[9] Prime Minister Suga has now instructed that government ministries should prepare analysis and plans for a carbon pricing scheme as part of the efforts to meet the objective of carbon neutrality by 2050.

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[3] UNFCCC (2020). *Japan, 2020 Common Reporting Format (CRF) Table*. Retrieved from https://unfccc.int/documents/223782
[4] https://www.meti.go.jp/english/press/2020/1225_001.html
[5] Ministry of the Environment (2020). *2050 Zero Carbon Cities in Japan*.
[6] World Bank (2020). *Carbon Pricing Dashboard*.
[7] Carbon Pricing Leadership Coalition (2017). *Report of the High-Level Commission on Carbon Prices.*
[8] World Bank (2020). *Carbon Pricing Dashboard*.
[9] Kawakatsu, T., Lee, S. and Rudolph, S. (2017). *The Japanese carbon tax and the challenges to low-carbon policy cooperation in East Asia*.

KEY POLICY RECOMMENDATIONS

- Set out a detailed roadmap to achieve net zero by 2050, including interim targets for 2030, and set the new targets in law. Carry out a comprehensive study on the economic and distributional impacts of the goal to achieve net zero GHG emissions by 2050, in order to inform policy decisions.
- Establish an independent advisory body on climate change for target setting, progress monitoring, and policy recommendations appropriate to the institutional architecture of Japan's policy making process. There should be a clear statutory mandate for the advisory body to issue recommendations to policy makers and for Government to respond to any recommendations. The body should be composed of leading technical experts across all climate policy fields.
- Design and implement a carbon pricing regime at levels consistent with the net zero by 2050 climate objective. Carbon pricing should at a minimum cover power and industry, and a strategy should also assess the possibility of extending carbon pricing to transport and buildings.
- In the case of a carbon tax, Government should set the level of a tax to rise to US$50–US$100/tCO_2 by 2030 with further increases to 2050. In the case of an Emissions Trading System, Government should set emissions caps that decline linearly to zero by 2050, and include a mechanism to correct for any surplus allowances.
- An independent advisory body providing recommendations on climate policy can be an effective part of Japan's climate governance, accelerating the energy transition at the lowest cost. A growing number of countries (e.g. the UK, Denmark, France, New Zealand) have established independent bodies to provide recommendations to policy makers on climate policy. The UK was the first of these, when it established the Committee on Climate Change in 2008. Research shows an independent advisory body is most effective when it has a legal mandate to make recommendations and for Government to respond to those recommendations.[10]

[10] London School of Economics (2018). *The role and influence of the UK's Committee on Climate Change*.

ZERO CARBON POWER

CURRENT ACHIEVEMENTS AND POLICIES

Power contributes around 47% of Japan's energy-related CO_2 emissions. Power sector emissions totalled 510 $MtCO_2$ in 2018, a 4% increase on 2010 level.[11] Coal generation contributes 61% of Japan's CO_2 emissions from the power sector, with natural gas contributing 31%, and oil contributing the remaining 8%.[12] Although Japan has had high renewables growth in recent years, especially for solar PV, the IEA estimates that under current policy, power sector emissions in Japan will be over six times those of an emissions pathway consistent with the Paris Agreement by 2040.[13]

Renewables grew from 11% of electricity generation in 2010 to 19% in 2018. Hydro remains the largest source of renewable power in Japan, representing 8% of electricity generation in 2018; solar PV at 6%, bioenergy at 4%, and wind at 1%. Solar PV has been the main driver of new renewable deployment since 2010, contributing 75% of the growth in renewables over this period.[14]

Feed-in tariffs have been the main driver of renewable electricity growth over the last decade. Japan has run additional solar PV auctions since 2017 for utility-scale projects,[15] and has announced plans to shift in 2022 to a more market orientated approach for subsidising renewables.[16] In 2018, the Japanese government announced a target that renewables would supply 22-24% of electricity generation in 2030 as part of the Fifth Strategic Energy Plan.[17] Government will be developing the Sixth Strategic Energy Plan in 2021. Japan's Ministry of Economy, Trade and Industry (METI) has announced it plans to approve 30 offshore wind power projects in the next 10 years.[18] 92 member companies of the Japan Climate Initiative have called on the government raise the renewable energy share of the energy mix to 40-50% by 2030.[19]

Despite Japan's progress on renewables over the last decade, the country remains heavily reliant on coal power. In 2018, coal supplied 37% of Japan's electricity generation. Japan's reliance on coal power has grown in recent years, with coal-fired generation rising by 8% between 2010 and 2018 following the Government's decision to shut down all of the country's nuclear reactors in the face of the Fukushima nuclear disaster in 2011. Japan does not have a commitment or plan to phase out coal power. However, the government announced in July 2020 its intention to shut down around 100 of its 114 ageing and inefficient coal-fired power plants by 2030.[20] Japan also continues to construct new coal-fired power stations, with recent analysis finding plans for over 20 in the next five years.[21]

The Green Growth Strategy for Japan published in December 2020 proposes that a reasonable target for renewable energy would be 50-60% of total generation by 2050, and includes new offshore wind generation targets of 10GW by 2030 and 30-45GW by 2050.[22] The report states that the remainder

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[11] IEA (2019). *World Energy Outlook 2019*.
[12] Ibid.
[13] IEA (2019). *World Energy Outlook 2019*.
[14] IEA (2019). *World Energy Outlook 2019*.
[15] PV Magazine (2020). *Japan's fifth solar auction delivers final lowest price of $0.10/kWh*.
[16] The Japan Times (2020). *Japan's Cabinet approves bill aimed at securing electricity supply in times of disaster*.
[17] Ministry of Economy Trade and Industry (2018). *Fifth Strategic Energy Plan*.
[18] https://asia.nikkei.com/Business/Energy/Japan-seeks-massive-jump-in-offshore-wind-power-over-10-years2#:~:text=TOKYO%20%2D%2D%20The%20Japanese%20government,decade%20beginning%20next%20fiscal%20year
[19] https://japanclimate.org/english/news-topics/re2030increment/
[20] The Japan Times (2020b). *Japan's coal closure plan a historic milestone, but what's next*?
[21] Institute for Energy Research (2020). *Japan Is Building Coal Fired Power Plants Despite Its Paris Accord Commitment*.
[22] https://www.meti.go.jp/english/press/2020/1225_001.html

would be a combination of nuclear, thermal power (coal or gas) with CCS, and hydrogen or ammonia – placing high expectations on new technologies that are yet to be proven effective or commercially viable. The Japanese government is considering increasing nuclear power generation in the near term while reducing dependence on nuclear power in the longer term. A new energy strategy will need to address these critical uncertainties about the role of nuclear power and emerging technologies.

The Ministry of Economy, Trade and Industry (METI) has been advancing power market reforms since 1995 and is currently engaged in the fifth system reform that is due to be completed in 2020. As part of this fifth system reform, Government has targeted greater inter-regional electricity trade by promoting the development of electricity transmission and distribution infrastructure, and has liberalised the electricity retail market.

In 2017, Japan had 29 GW of pumped hydro storage capacity, which was the second highest in the world behind China[23]. Government provides subsidies for grid-scale battery deployment (Deloitte, 2018). In addition to grid-scale energy storage leadership, Japan is home to the world's largest behind-the-meter energy storage market, amounting to over 200 MW of sales in 2019.[24] Government has a target to rollout smart electricity meters for all households by 2024[25] and has been trialling dynamic electricity pricing.[26] Japan also has an operating demand response industry for commercial and industrial customers, with large international utilities including Enel and Centrica invested in the market.

Japan's connectable amount rules in the power sector lead to renewable power curtailment. Existing renewable capacity already exceeds the connectable amount by a factor of two in Hokkaido, Tohoku, and Kyushu.[27] Despite recent increases in transmission capacity, there is insufficient high voltage transmission infrastructure to adequately connect regions of high renewable potential, like Hokkaido, with demand centres, like Tokyo.[28]

METI has signalled it intends the next Strategic Energy Plan to indicate a pathway towards net zero emissions and necessary policies to achieve this. METI has convened a group of experts to contribute to this process. The recent announcement of a 2050 net zero goal for Japan and the approaches considered in the Green Growth Strategy will need to be translated into ambitious new policies to bridge this gap and to provide industry and investors with the long term clarity that is needed to facilitate large-scale investments in low carbon energy.

[23] IRENA (2017). *Electricity storage and renewables: costs and markets to 2030*.
[24] IEA (2020). *Energy Storage*.
[25] Ida, T., Murakami, K. and Tanaka, M. (2015). *Electricity demand response in Japan: Experimental evidence from a residential photovoltaic generation system*.
[26] Smap Energy (2018). *Time for an energy change: A deep-dive into Japan's first smart-meter-enabled TOU tariff*.
[27] Matsubara (2018). *Renewable Energy Policies and the Energy Transition in Japan*.
[28] Wakiyama, T. and Kuriyama, A. (2018). *Assessment of renewable energy expansion potential and its implications on reforming Japan's electricity system*.

KEY POLICY RECOMMENDATIONS

- Develop and implement a clear plan for deep decarbonisation of electricity by 2050. The plan should be supported by detailed technical and economic analysis on pathways to decarbonise electricity, set targets for wind and solar PV generation for 2030 in line with these pathways, and schedule a series of auctions to deliver the necessary levels of wind and solar PV capacity. It should support the most cost-efficient technologies, and technologies which are at or near commercial viability at scale and can attract private capital investment.
- Review the current power market arrangements and remove unnecessary impediments to investment and generation of low-carbon power, such as the connectable amount rules that lead to renewables curtailment.
- Ensure sufficient investment in high voltage transmission infrastructure to adequately connect regions of high renewable generation potential with demand centres.
- Cancel all new thermal coal plant projects that are in a pre-construction phase.
- Carry out a comprehensive feasibility study on phasing out coal generation, and set near to mid-term targets to phase out all unabated coal generation.

Economic and impact analysis

In the power sector, building new renewable generation capacity will soon be cheaper than either new or existing coal plants. In addition to health and environmental benefits, investment in low-carbon power generation and a flexible power grid, and the technologies to deliver them, can deliver significant employment and export opportunities for Japan. Power market reforms will reduce the cost of decarbonising the power sector.

The abatement cost for low-carbon power is low. Building new onshore wind, offshore wind and utility-scale solar PV could be cheaper than new coal in Japan by 2025, 2022 and 2023, respectively. Building new offshore wind and solar PV could be cheaper than operating existing coal plants by 2025 and 2027, respectively.[29] There will be additional costs associated with integrating renewables into the electricity grid, for example through higher storage needs and investment in transmission infrastructure.

An auctioning mechanism is an efficient policy instrument that can unlock investment in renewable capacity and deliver renewable deployment at least cost. Auctions provide a stable stream of revenue for renewable owners over a fixed time horizon, and therefore reduce investor risk, unlock renewable investment, and accelerate the economic shift away from fossil fuel power.

An expansion of renewables can drive economic opportunities. In 2018, Japan had 250,000 jobs in the solar PV supply chain and 270,000 jobs in renewable energy overall.[30] The low-carbon supply chain can create employment in Japan and provide an economic stimulus, especially in response to the COVID-19 pandemic. Japan had a 7% global share of solar PV exports in 2018, and an expansion of low-carbon power domestically support enable long-term export opportunities.[31]

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[29] Carbon Tracker (2019). *Japan could face US$71 billion of stranded coal assets without policy reform*.
[30] IRENA (2019). *Renewable Energy and Jobs Annual Review 2019*.
[31] IRENA (2019). *Renewable Energy and Jobs Annual Review 2019*.

New infrastructure investment will be needed to exploit the largest and lowest cost sources of electricity. Transmission infrastructure investment can create employment downstream in the construction of the transmission infrastructure and upstream in the manufacture of the components. Investment in transmission infrastructure can act as an effective economic stimulus in response to the COVID-19 pandemic given its high economic multipliers and positive climate impact.[32]

As renewables fall in cost and are possibly complemented by the reintroduction of nuclear power to Japan, the utilisation rates of coal power will decline, creating the risk of stranded assets. Carbon Tracker estimate that this could produce US$71bn of stranded assets in coal-fired generation in Japan by 2030. However, Japan could avoid US$29bn of this stranded asset risk if it ends the development of planned and under construction coal-fired power capacity.[33]

There will be a limited need for public subsidy as part of a phase out of unabated coal generation capacity as the cost of renewables falls to competitive levels.[34] A coal phase out can deliver high health and environmental benefits and can also increase the security of energy supply in Japan. Japan is the world's largest importer of coal, representing US$23bn and 18% of the global total in 2019.[35]

ROLE FOR INVESTORS

The market size for renewable investment is large and investors are critical to deliver this capital. Japan was the world's third largest market for renewable investment between 2010 and the first half of 2019, amounting to US$200bn, behind only China and the US.[36] McKinsey estimate that low-carbon power deployment requires at least US$8bn-US$22bn of additional cumulative investment by 2030 in Japan under a pathway that reduces emissions by 80% in 2050 on 1990 levels.[37]

Investors can provide financing to businesses to enable the expansion of renewables in Japan. As the market for renewables grows, the market valuation of businesses in the low-carbon supply chain, including storage companies, aggregators, and manufacturers of low-carbon power equipment, will rise.

Power market reforms, including an end to the "connectable amount" rules can reduce the risk of renewable investments and increase their profitability. Investment requirements for electricity grid infrastructure to accommodate an increase in variable generation could amount to US$27bn-US$69bn between 2016-30 in Japan, creating large investment opportunities.[38]

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[32] Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J., & Zenghelis, D. (2020). *Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?* Oxford Smith School, Working Paper No. 20–02.
[33] Carbon Tracker (2019). *Japan could face US$71 billion of stranded coal assets without policy reform*.
[34] Carbon Tracker (2019). *Japan could face US$71 billion of stranded coal assets without policy reform*.
[35] World's Top Exports (2020). *Coal Imports by Country*.
[36] ARC (2020). *Will COVID-19 change the future of the electric grid*?.
[37] McKinsey (2020). *Meeting Japan's Paris Agreement targets—more opportunity than cost*.
[38] McKinsey (2020). *Meeting Japan's Paris Agreement targets—more opportunity than cost*.

INDUSTRY DECARBONISATION

CURRENT ACHIEVEMENTS AND POLICIES

Industry contributes around 19% of Japan's CO2 emissions in the energy sector. Industry CO2 emissions totalled 200 $MtCO_2$ in 2018, a 5% decrease on 2010 levels.[39]

Japan has a mandatory energy efficiency target of a 1% annual reduction in energy intensity for factories, covering around 90% of industrial energy consumption in Japan.[40][41] Energy consumption in the manufacturing sector has remained roughly constant since 1980. In 2009 the government set sectoral benchmark energy efficiency targets for industry based on best performing companies.[42]

Government supports industrial energy efficiency through several financial incentives, including an investment tax credit to all companies for investments in technologies that deliver energy savings, under the Energy Saving Promotion Tax System. Policies also offer a range of incentives for SMEs to enable industrial energy efficiency investment, including investment subsidies, special interest rates, tax exemptions and free energy audits.[43]

Japan's Long-term Strategy under the Paris Agreement in 2019 aims to achieve "decarbonized manufacturing" in the future, with an emphasis on CO2-free hydrogen; carbon capture and storage (CCS); carbon capture and utilisation (CCU); and energy efficiency to reduce industrial emissions.[44] As part of its strategy to decarbonise manufacturing, the government has provided around US$800m of R&D funding for CCS between 2013 and 2018.[45]

Current policy is insufficient to decarbonise the industrial sector. Japan does not yet have a comprehensive strategy on how to decarbonise the energy- and emissions-intensive steel, chemicals, and cement industrial sectors. The new Green Growth Strategy outlines new proposals to focus on electrification and the use of hydrogen technology to improve efficiency and cut emissions in sectors including steelmaking, and that the government should increase incentives to support decarbonisation.[46] The IEA estimates that current policy will lead to Japan's industrial emissions being 1.5 times those of an emissions pathway consistent with the Paris Agreement by 2040.[47]

The IEA estimates industrial energy consumption will be around 25% higher in Japan under current policy compared to a Paris Agreement scenario in 2040.[48] For Japan's industrial energy consumption to align with the Paris Agreement, there must be a 2% annual increase in industrial energy efficiency between 2018-40, which is double the existing mandatory target of 1% per year.[49]

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[39] IEA (2019). *World Energy Outlook 2019*.
[40] The Institute of Energy Economics. (2016). *Japanese Energy Efficiency Improvement Achieved and Planned*.
[41] New Climate Policy Database. *Law Concerning the Rational Use of Energy (Energy Conservation Act) (Law No.49 of 1979) Japan 1979*.
[42] IEA Policy Database (2017). *Sectoral Benchmarking for Industry*.
[43] IEA Policy Database (2017). *Financial measures for small- and medium-sized businesses (preferential loan, tax, subsidy)*.
[44] Government of Japan (2019). *Outlines of Japan's Long-term Strategy under the Paris Agreement*.
[45] Nagashima (2018). *Japan's Hydrogen Strategy and its Economic and Geopolitical Implications*.
[46] https://www.meti.go.jp/english/press/2020/1225_001.html
[47] IEA (2019). *World Energy Outlook 2019*.
[48] IEA (2019). *World Energy Outlook 2019*.
[49] IEA (2019). *World Energy Outlook 2019*.

KEY POLICY RECOMMENDATIONS

- Build on Japan's Basic Hydrogen Strategy, and develop and implement strategies on low-carbon steel, chemicals, and cement. Strategies should set the objective of decarbonising energy intensive industry by 2050, and set out a roadmap to shift production to electric, hydrogen, and CCS technologies to meet this objective.
- Assess the technical and economic feasibility of raising the mandatory average annual reduction in industrial energy consumption from 1% to 2%, and aim to set a target of greater than 2%.

Economic and impact analysis

Abatement costs for energy intensive industries are uncertain, but they are likely to be high. The cost in industry is dependent on the role and costs of key inputs, including electricity, hydrogen, CCS, and bioenergy. For example, biomass for heat with CCS to capture process emissions may be the cheapest decarbonisation route for cement production; however, if zero-carbon electricity has a wholesale price below US$42/MWh, then cement makers may instead find it more cost effective to use electricity for heat to reduce emissions rather than bioenergy. Globally, abatement costs could be around US$130/$tCO_2$ for cement production and US$60/$tCO_2$ for steel plants. Industrial decarbonisation can increase the price of cement by between 30-100% and the price of steel by 20%.[50]

To avoid these price increases reducing industry competitiveness relative to countries who are slower to decarbonise, Government will likely need to provide policy support to industry. This might include consideration of a carbon border adjustment for imports of industrial products into Japan, which would need to be coordinated with carbon pricing measures. The timing of action and coordination with major trading partners will be important to achieve emissions reductions while sustaining the competitiveness of Japanese manufacturers and minimising the risk of carbon leakage. Industrial energy efficiency gains in Japan have the potential to raise international competitiveness for firms in energy-intensive sectors by lowering input costs.

The abatement cost will be low and rates of return good for many other industrial energy efficiency investments, and industrial firms should be able to finance these investments. But there may be a need for public subsidy for investments with longer payback periods over five years.[51] Government may need to provide public subsidy for these investments to reduce the cost burden on firms.

ROLE FOR INVESTORS

Investment opportunities in energy intensive industries with high abatement costs will shift to low-carbon manufacturing processes in the steel, cement, and chemicals sectors; and to businesses deploying such processes, equipment and technologies.

Investors can finance industry investment in energy efficiency measures, for example energy management systems, buildings fabrics, heating and cooling systems, and ventilation. Larger investors can invest in businesses that supply this market, including energy service companies and the manufacturers of materials and energy efficient technologies.

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[50] Energy Transitions Commission (2018). *Mission Possible: Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-Century*.
[51] AEA (2012). *Next phase of the European Climate Change Programme: Analysis of Member States' actions to implement the Effort Sharing Decision and Options for further Communitywide Measures*.

ROAD TRANSPORT

CURRENT ACHIEVEMENTS AND POLICIES

The IEA estimates that existing policy in Japan will lead to transport sector CO_2 emissions that are over two times those of an emissions pathway consistent with the Paris Agreement in 2040.[52]

Transport contributes around 19% of Japan's CO_2 emissions in the energy sector, totalling 200 $MtCO_2$ in 2018, a 9% decrease on 2010 levels.[53] Around 40,000 electric cars were sold in Japan in 2019, accounting for 1% of total car sales.[54] In several other countries, including France, Germany, the UK, and the US, the market share of electric cars is more than double the share in Japan in 2019.

Japan provides purchase subsidies for new clean energy vehicles, which includes battery electric vehicles, fuel-cell electric vehicles, and plug-in hybrids.[55] New clean energy vehicles also benefit from a range of tax exemptions.[56] Japan also provides public subsidies for charging infrastructure and refuelling stations to enable the uptake of electric and low emissions vehicles, which have contributed to Japan having the highest number of hydrogen refuelling stations in the world at 113 as of June 2020.[57]

Japan has mandatory fuel economy standards for passenger and heavy-duty vehicles. In 2019, policy makers announced new fuel economy standards for passenger vehicles that would come into force in 2030; these standards would be the second most stringent globally behind those in the EU.[58] Government has also announced a new phase of heavy-duty vehicle fuel economy standards that will come into force in 2025. However, these standards lag those in China, the US, and the EU.[59]

In 2018, policy makers announced a target of a 90% fall in passenger car GHG emissions per vehicle by 2050, and a goal that all vehicles produced by Japanese automakers would be electrified by 2050.[60] This includes conventional (non-plug-in) hybrids and does not preclude the import of fossil fuelled cars and vans. As such, it does not amount to a full internal combustion engine (ICE) vehicle phase out.

Policy makers have recently signalled an intention to shift away from fossil fuelled vehicles more quickly and Prime Minister Suga has announced a goal to end the sale of internal combustion engine (ICE) cars and vans by 2035. Policies to deliver this shift have not yet been set out in detail.[61] Japan does not yet have a comprehensive strategy to decarbonise heavy road transport but the Green Growth Strategy outlines proposed steps to achieve this.[62] Decarbonisation of heavy road transport is assessed to be technically and financially possible for Japan and other developed nations by 2050.[63]

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[52] IEA (2019). *World Energy Outlook 2019*.
[53] IEA (2019). *World Energy Outlook 2019*.
[54] IEA (2020). *Global EV Outlook 2020*.
[55] IEA Policy Database (2019). *Subsidies for new clean energy vehicles*.
[56] IEA Policy Database (2017). *Exemption automobile tax*.
[57] Hydrogen Tools (2020). *International Hydrogen Refuelling Stations*.
[58] ICCT (2019). *Japan 2030 fuel economy standards*.
[59] ICCT (2019). *Second-phase fuel economy standards for on-road heavy-duty vehicles in japan*.
[60] Ministry of Economy Trade and Industry (2018). *Japan Promotes Electrified Vehicle (xEV) Strategy ahead of 2050*.
[61] https://japan.kantei.go.jp/99_suga/statement/202101/_00013.html
[62] https://www.meti.go.jp/english/press/2020/1225_001.html
[63] Energy Transitions Commission (2018). *Mission Possible: Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-Century*.

KEY POLICY RECOMMENDATIONS

- Develop and implement a policy regime to deliver on the commitment to end sales of internal combustion engine (ICE) cars and vans by 2035, and achieve 100% zero emission light duty vehicles. The definition of ICE cars and vans should include conventional (non-plug-in) hybrid vehicles. An effective long-term policy regime is likely to include a combination of tapered price support for electric vehicles, as well as tightening fuel economy or CO2 standards.
- Build on Japan's Basic Hydrogen Strategy to develop and implement a comprehensive heavy road transport decarbonisation strategy. The strategy should set a clear objective of decarbonising heavy road transport by 2050 at the latest; set out a programme of RD&D and demonstration projects to commercialise low-carbon trucks; and identify policy options to drive mass-market deployment once commercialisation is achieved.

Economic and impact analysis

Electric vehicles (EVs) are expected to achieve cost parity with fossil fuelled cars and vans during the mid-2020s. The ICCT estimates that EVs will attain cost parity between 2024 and 2028 depending on the required range of the vehicle.[64] To ensure continued adoption of electric vehicles, there may be some need for public subsidy until EVs achieve cost parity with ICEs.

Japan exports 16% of all electric vehicles globally, second only to China which has a market share of 20%. Given Japan's existing strength in the low-carbon automotive sector, an end to the sales of fossil fuel cars and vans can generate sustained domestic demand for electric vehicles, supporting automakers to improve their manufacturing capabilities and realise global export opportunities.

Current analysis estimates that a long-term transition from fossil fuelled trucks to electric vehicles will impose no additional ownership costs by 2030 over the range where it is technical feasible. For longer range journeys, fuel-cell vehicles can be a more cost effective transportation mode than diesel and biofuel vehicles by 2030. However, shifting to zero emissions trucks will entail some infrastructure costs. These costs include the costs of installation, and the operation and maintenance of recharging or refuelling infrastructure. Global infrastructure abatement costs for heavy duty vehicles are estimated to be between US$10 and US$20/tCO_2.[65]

ICE vehicles are a key driver of air pollution in urban areas, and therefore can lead to negative health impacts including respiratory illnesses and premature deaths.[66] A phase out of ICE vehicles can reduce local air pollution and the associated negative health impacts.

[64] ICCT (2019). *Global and U.S. electric vehicle trends*.
[65] Energy Transitions Commission (2018). *Mission Possible: Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-Century*.
[66] Yorifuji, T., Kashima, S., Tsuda, T., Takao, S., Suzuki, E., Doi, H., Sugiyama, M., Ishikawa-Takata, K. and Ohta, T. (2009). *Long-term exposure to traffic-related air pollution and mortality in Shizuoka, Japan*.

ROLE FOR INVESTORS

Investment opportunities will shift to low-carbon cars and vans for domestic and international markets. As the domestic market transitions away from fossil fuel cars and vans, the market for consumer vehicle finance will also shift from conventional vehicles to electric vehicles. Furthermore, there will be large and growing opportunities to invest in electric vehicle charging infrastructure.

The investment market size for electric vehicles and electric charging infrastructure will be large. Japan is the third largest market for car sales globally, and the second largest producer of cars. McKinsey estimate that deployment of 5.3m battery EVs in Japan by 2030 would require US$225bn of investment, with US$9bn of this need for electric charging infrastructure.[67]

Investors will have an opportunity to provide finance to freight companies to purchase zero-carbon trucks. This is likely to be a large financing opportunity given the high truck volumes in Japan, which amounted to over 14m in 2017. In addition, investors can invest in the expansion of associated infrastructure, which is likely to include a combination of electric charging points, hydrogen refuelling stations and hydrogen production plants.

Investors will have long-term opportunities to invest in low-carbon truck manufacturing capacity. Once low-carbon trucks have commercialised, investors can fund the repurposing of existing ICE truck manufacturing capacity for low-carbon production and new manufacturing capacity, especially for the manufacture of electric batteries and fuel cells. Investors may need to evaluate freight companies' exposure to rising carbon prices as part of future investment decisions in this sector.

[67] McKinsey. (2020). *Meeting Japan's Paris Agreement targets - more opportunity than cost.*

BUILDINGS

CURRENT ACHIEVEMENTS AND POLICIES

Buildings contribute around 11% of Japan's CO2 emissions in the energy sector. CO2 emissions totalled 110 $MtCO_2$ in 2018, a 7% decrease on 2010 levels.[68]

From 2020, mandatory thermal efficiency standards cover all new buildings for the first time in Japan.[69] Japan targets average net zero primary energy in new buildings by 2030, as part of the 2014 Strategic Energy Plan.[70] Government reaffirmed this target as part of Japan's Long-term Strategy under the Paris Agreement in 2019 and provides subsidies to support implementation.[71]

The Ministry of Economy, Trade and Industry provides a subsidy for energy efficiency investments in existing buildings - the Subsidy for Promoting Investment in Energy Conservation. These subsidies include up to half of the cost for factories to install more energy efficient equipment and up to one third of the cost for households to retrofit insultation in buildings.[72]

However, Japan does not have a clear plan to realise the energy savings potential in the existing buildings stock. This will delay and prevent the decarbonisation of the buildings sector given the inherent inertia of households and businesses to retrofit buildings for energy efficiency. While retrofitting to increase thermal efficiency may be less important in Japan than comparable developed countries given Japan's consumer preference for new builds, retrofitting remains an important policy objective.[73]

KEY POLICY RECOMMENDATIONS

- Publish a detailed plan for identifying and realising the energy savings potential in the existing buildings stock. This plan should include financial incentives for retrofitting, building on the existing subsidy scheme, the Subsidy for Promoting Investment in Energy Conservation; set targets to retrofit all the buildings stock by 2050.

Economic and impact analysis

Retrofitting can increase the thermal efficiency of buildings and therefore reduce the demand for heating in Japan, and the cost of household and business energy bills. Although many of the retrofitting opportunities will be cost effective, with energy bill payers incurring the investment cost, some energy efficiency measures with long pay back periods, may require some form of public subsidy to support and accelerate implementation.

Given the prevalence of earthquakes in Japan, there is a frequent need for seismic retrofitting.[74] Households have an opportunity to pursue energy efficiency retrofits with seismic resilience retrofits, reducing the additional disruption associated with retrofitting. Combining these retrofits might reduce the

[68] IEA (2019). *World Energy Outlook 2019*.
[69] Ministry of Land Infrastructure Transport and Tourism (2016). *Overview of the Act on the Improvement of Energy Consumption Performance of Buildings*.
[70] The Energy Conservation Center (2018). *Overview of the recent Building Energy Efficiency related situation in Japan and ASEAN*.
[71] IEA Policy Database (2019). *Subsidies for commercial and residential building energy efficiency investments*.
[72] IEA Policy Database (2019). *Subsidies for commercial and residential building energy efficiency investments*.
[73] McKinsey. (2020). *Meeting Japan's Paris Agreement targets—more opportunity than cost*.
[74] Yamamoto, H., Tsuneki, Y. and Kohno, T. (2005). *Examples of seismic retrofitting in japan*.

costs of energy efficiency improvements if some advanced materials are able to deliver both energy consumption falls and improved seismic resilience.

Investment in retrofitting will create employment for installers of the energy efficiency measures and the companies that manufacture the materials that supply these energy efficiency materials and technologies. Energy efficiency retrofits are identified as being one of the key policies that can deliver both economic stimulus and climate goals as part of a COVID recovery package.[75]

ROLE FOR INVESTORS

Investors can finance energy efficiency investments directly through loans to households and businesses, or through energy service companies (ESCOs) acting as intermediaries. As the retrofitting market value rises, investors may increasingly invest in the businesses in the supply chain, including ESCOs and manufacturers of energy efficiency technologies. McKinsey estimate that Japan could retrofit the insulation of three million homes by 2030, along with replacing fossil-fuel heating devices with electric heat pumps, suggesting a substantial demand for financing.[76]

[75] Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J., & Zenghelis, D. (2020). *Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?* Oxford Smith School, Working Paper No. 20–02.
[76] McKinsey. (2020). *Meeting Japan's Paris Agreement targets - more opportunity than cost.*

HOW TO GET INVOLVED

If you are interested in keeping updated on the PRI's work in this area, learning more about relevant engagement opportunities as they arise and/or collaborating with the PRI and investors on policy engagement, please subscribe to the PRI's policy newsletter.

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