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JAPAN'S 2050 NET-ZERO EMISSION POLICY
A CASE FOR DEGROWTH?

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Abstract

On 26 October 2020, Prime Minister Yoshihide Suga pledged that Japan would aim to become a carbon-neutral country by 2050. Despite doubts about the achievability of the goal, several steps have already been undertaken to reach this objective. Suga's vision of a green society is strongly ingrained with the idea of economic growth. However, questions concerning this logic have arisen over the course of the last decade or so and the concept of *degrowth* has received increasing attention. In this paper, Japan's case will be assessed and linked with different aspects of degrowth. Factors that will be considered are Japan's energy mix, its efforts towards securing sustainable energy, and its initiatives with regards to tackling climate change. Finally, several policy suggestions will be made, and the feasibility of degrowth policies, as well as possible ways of addressing the idea will be briefly discussed.

Keywords: Climate Change, Green Growth, Degrowth, Japanese Domestic Policy, Climate Policy, Renewable Energy, Fossil Fuels, Decoupling

Index

Introduction

During his first parliamentary speech on 26 October 2020, Japanese Prime Minister Yoshihide Suga announced that Japan will seek to achieve net-zero greenhouse gas (GHG) emissions by 2050. The pledge came shortly after China set its eyes on the same objective by 2060. Japan previously aimed at an 80% reduction by 2050, but the country has now raised the stakes and increased its efforts. Suga declared that renewable energy sources will be broadly introduced and laid emphasis on the importance of innovation, mentioning carbon recycling technology and solar battery storage. Additionally, the statesman promised a nuclear energy comeback.[1] Following up on his speech in parliament speech, Prime Minister Suga has pledged a JPY 2.2 trillion fund (EUR 17.5 billion) to promote ecological business and technological innovation.[2] The commitment is a welcome development and comes with major implications, as Japan currently holds the title of world's fifth largest carbon emitter, producing 1.16 gigatons (GT) of CO_2 in 2018. This amounts to roughly one tenth of China's or one fifth of the United States' carbon emissions.[3] However, the Japanese economy is also considerably smaller than that of the two economic giants. Combined, they make up roughly 40% of the global economy, whereas Japan only accounts for about 6%, making its lower carbon footprint to be expected.[4] Japan has already made several policy changes and is eying at further progress, both in its legislation and its private sector. It has built cutting-edge facilities and aims at cooperating with other players on the international stage. In light of the country's many changes and ambitions, this paper will provide an overview of the situation, offering a glimpse at possible future paths and developments. Furthermore, inspiration can be drawn from Japan's case by other countries or international bodies holding similar aspirations.

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[1] Retrieved from https://www.marketwatch.com/story/japan-to-go-carbon-free-by-2050-prime-minister-suga-says-11603727604. On 26 November 2020.
[2] Retrieved from https://japantoday.com/category/politics/japan-pm-pledges-19b-to-promote-ecological-businesses. On 9 December 2020.
[3] Retrieved from https://www.ucsusa.org/resources/each-countrys-share-co2-emissions. On 25 November 2020.
[4] Retrieved from https://www.investopedia.com/insights/worlds-top-economies/. On 25 November 2020.

Japan's ambitions

Though change is on the horizon, Suga's pledge currently still contrasts with Japan's Nationally Determined Contribution (NDC), the country's national climate plan revealing concrete GHG reduction targets as agreed under the Paris Agreement. Japan submitted a new NDC in March 2020. Yet the target dating from the 2015 version remained unaltered.[5] Under the plan, Japan aims at a 26% reduction of 2013-level GHG emissions by 2030 (an 18% reduction compared to 1990), a target that has been categorised as "highly insufficient". [6,7] Upon the submission of the 2020 plan, Environment Minister Shinjiro Koizumi announced that additional information will be provided following a revision of the *Plan for Global Warming Countermeasures*, well in advance of the United Nations Climate Change Conference (COP26) in November 2021. He claimed that the government does not intend to leave the current national target level unaltered and will "aim for aspiring figures in the NDC".[8,9] In December 2020, PM Suga confirmed that the new goal would be submitted before the November 2021 deadline, additionally stating that "Japan is determined to lead the efforts to realize the decarbonized world that the Paris Agreement aims for, in cooperation with other countries".[10]

On 25 December 2020, the Japanese government adopted its *Green Growth Strategy*. Some of the main objectives include increasing renewable energy to 50-60% of Japan's energy mix by 2050 and phasing out the use of gasoline-powered vehicles by the mid-2030s.[11] In order to achieve this goal, the strategy aims at reducing the cost of Electric Vehicle (EV) batteries by

[5] Retrieved from https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Japan%20First/SUBMISSION%20OF%20JAPAN%27S%20NATIONALLY%20DETERMINED%20CONTRIBUTION%20(NDC).PDF. On 27 January 2021.
[6] Ohta, Hiroshi. (2020). *The Analysis of Japan's Energy and Climate Policy from the Aspect of Anticipatory Governance*. Energies. p. 2.
[7] Retrieved from https://climateactiontracker.org/countries/japan/. On 1 December 2020.
[8] Retrieved from https://www.env.go.jp/press/200330_Message.pdf. On 1 December 2020.
[9] Retrieved from https://player.admiralcloud.com/?v=d49d44fd-93ad-4c9d-87aa-c37a711541f8. On 9 December 2020.
[10] Retrieved from https://mainichi.jp/english/articles/20201213/p2g/00m/0na/034000c. On 8 January 2021.
[11] Retrieved from https://www.politico.com/news/2020/12/25/japan-carbon-free-climate-change-450447. on 14 January 2021.

up to 50%. Furthermore, it will aim to make zero-emission technology the norm in the construction sector by 2030.[12]

The newly adopted strategy projects a rise in electricity demand of 30-50%, which coincides with an expected annual growth rate of JPY 90 trillion by 2030 and of JPY 190 trillion by 2050. Besides renewable energy, 30-40% of the energy mix is planned to come from nuclear power and thermal power plants equipped with *Carbon Capture, Utilisation and Storage* (CCUS) technology. Hydrogen would make up for the remaining 10%.[13]

Green Growth Strategy (Projected Energy Mix 2050)	
Renewable Energy	50-60%
Nuclear & Thermal	30-40%
Hydrogen	10%

Japan's Energy supply

The Fukushima nuclear disaster of 2011 resulted in a sudden drop in the availability of nuclear energy in Japan. At this time, the government mainly turned towards fossil fuels to address the country's energy demands, leading to peak emission levels in 2013.[14,15] Consequently, environmental commitments were dialled back. Under the Copenhagen Accord of 2009, a 25% decrease from 1990-level emissions was pledged by 2020. Instead, an adjusted goal released in 2013 roughly corresponded to a 3.1% *increase*.[16,17] Yet, this goal was already met two years later and by Fiscal Year (FY) 2018, emissions dropped below 1990 levels for the first time.[18]

[12] Retrieved from https://www.oedigital.com/news/484202-japan-s-green-growth-strategy-to-help-hit-carbon-neutrality-target. On 14 January 2021.
[13] Ibid.
[14] Retrieved from https://www.eia.gov/international/analysis/country/JPN. On 30 November 2020.
[15] Retrieved from https://www.env.go.jp/press/814.pdf. On 30 November 2020.
[16] Retrieved from https://www.carbonbrief.org/carbon-brief-profile-japan. On 27 November 2020.
[17] Retrieved from https://stanleycenter.org/climatechange/Kameyama-RecentDevClimateChangePolicy-Japan.pdf. On 7 December 2020.
[18] Retrieved from https://www.env.go.jp/press/814.pdf. On 30 November 2020.

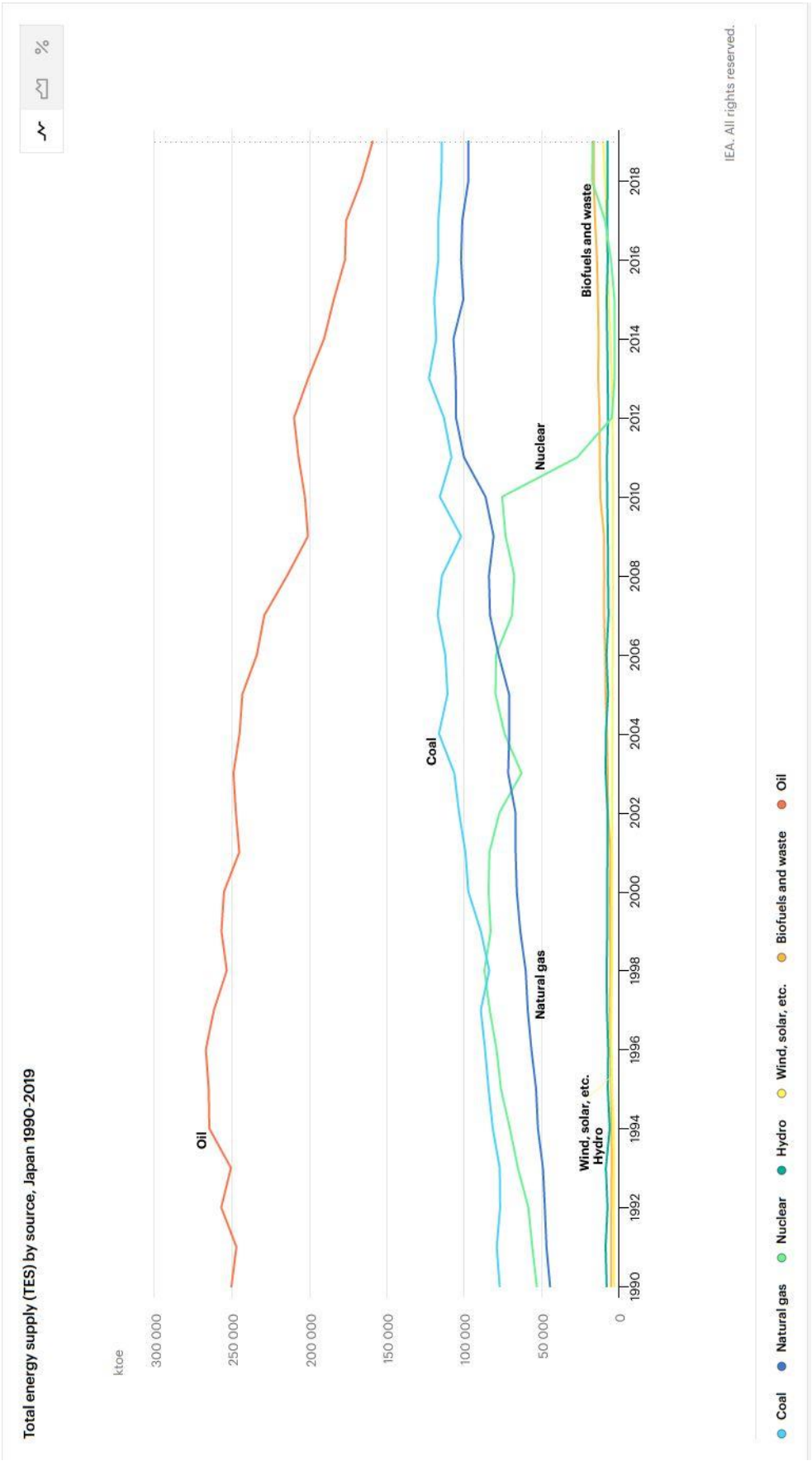

Image retrieved from https://www.iea.org/countries/japan. On 26 January 2021.

With the gradual reintroduction of nuclear energy in 2015, the rising trend of thermal power generation came to a halt (the use of natural gas and coal had been increasing until 2014 and 2013 respectively). When combined, coal and gas continue to make up roughly half of Japan's energy supply. Meanwhile, oil has been steadily decreasing since the late 1990s, undergoing only a short period of revival between 2009 and 2012. Still, oil remains Japan's most important primary energy source. Overall energy consumption in Japan peaked in the mid-2000s, followed by a period of gradual contraction, up until the present.

A Complicated Relationship with Coal

Even though an increase in the use of natural gas was able to make up for some of the energy loss post-2011 (preventing a more exponential rise in coal-based energy) it can be questioned whether this really amounts to climate change mitigation. Natural gas is generally seen as cleaner than coal, but the methane that escapes during the extraction and utilisation of natural gas could possibly pose an even larger threat than CO_2. Over the course of a century, this methane is roughly 28-36 times more heat-trapping than CO_2 and recent findings have shown that leakage from natural gas extraction and utilisation is more substantial than was previously assumed.[19,20,21]

[19] Retrieved from https://www.epa.gov/ghgemissions/understanding-global-warming-potentials. On 9 December 2020.
[20] Retrieved from https://www.nationalgeographic.com/science/2020/02/super-potent-methane-in-atmosphere-oil-gas-drilling-ice-cores/. On 1 December 2020.
[21] Parrique T., Barth J., Briens F., C. Kerschner, Kraus-Polk A., Kuokkanen A., Spangenberg J.H. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau. p. 41.

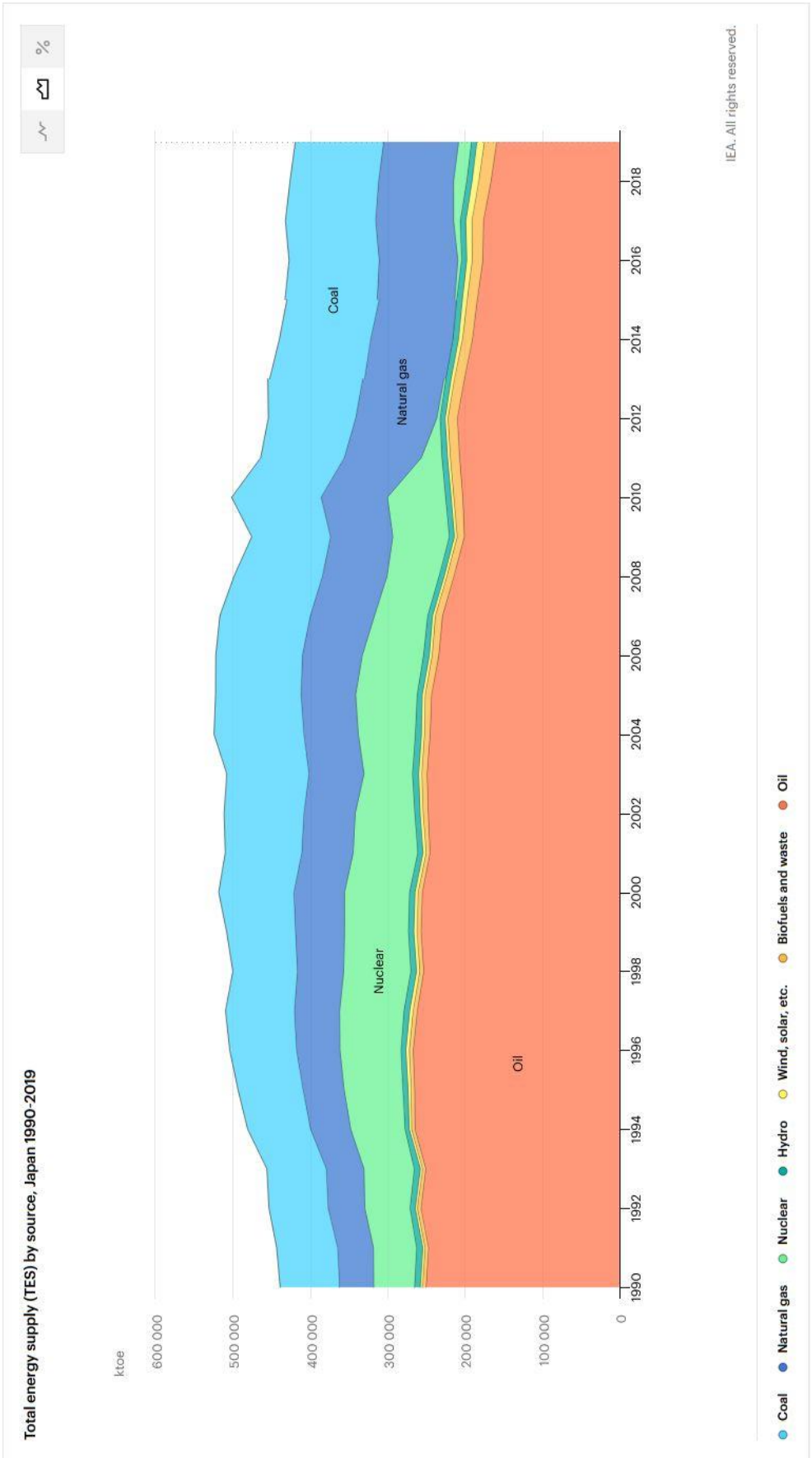

Image retrieved from https://www.iea.org/countries/japan. On 26 January 2021.

Japan's coal policy has been the subject of severe criticism. The country heavily relies on coal for its thermal energy generation and has funded several coal-fired plants overseas. In his parliamentary speech, Suga announced a fundamental shift in coal policy.[22] Some precursors of this shift had already been emerging during the final months of the Abe administration. For example, the Abe government announced that it would stop much of its funding of overseas coal-fired facilities. Additionally, Japan's Ministry of Economy, Trade and Industry (METI) Minister Hiroshi Kajiyama announced that the government would shut down 100, mostly older and small-scale, coal-fired power plants by 2030.[23]

On the other hand, the government will continue supporting overseas projects that curb emissions, such as plants making use of "clean coal" technology or thermal plants making use of both coal and biomass.[24] Furthermore, Japan reportedly intends to build 22 new (and more efficient) coal-fired power plants over the course of the next five years, though this decision has gone largely unnoticed.[25,26] These policies go against the United Nations' request to cease the building of coal-fired plants after 2020 and are arguably incompatible with the 2050 pledge. Building new plants today will result in decades more of emissions, even if they are lower. According to METI Minister Kajiyama, Japan cannot simply rule out coal, because the country is limited in terms of its natural resources.[27] Still, with the 2050 pledge in mind, it would be beneficial to reduce its use to the fullest extent possible.

Japan's above-mentioned unaltered 2020 NDC does not project a significant decrease in coal use. Most notably, it projects a decrease in oil and natural gas use, while nuclear and renewable

[22] Retrieved from https://www.washingtonpost.com/world/japan-climate-emissions/2020/10/26/b6ea2b5a-1752-11eb-8bda-814ca56e138b_story.html. On 24 November 2020.
[23] Retrieved from https://www.japantimes.co.jp/news/2020/07/10/business/japans-coal-closures-whats-next/. On 1 December 2020.
[24] Retrieved from https://asia.nikkei.com/Business/Energy/Japan-to-halt-state-support-for-overseas-coal-fired-power-plants. On 26 November 2020.
[25] Retrieved from https://www.nytimes.com/2020/02/03/climate/japan-coal-fukushima.html. On 1 December 2020.
[26] Retrieved from https://www.nsenergybusiness.com/projects/yokosuka-coal-fired-power-plant/. On 4 January 2021.
[27] Retrieved from https://thediplomat.com/2020/07/japan-promotes-clean-coal-in-the-battle-against-climate-change/. On 8 December 2020.

energy are projected to increase.[28] Under the NDC, fossil fuels would still account for more than 50% of the energy mix in 2030.[29] However, it has become clear from Suga and other officials' statements that a more ambitious goal for 2030 will be set in the near future, which will hopefully align with the promised shift in coal policy.

Nevertheless, Suga is also looking at carbon recycling technology to curb emissions. Concretely, *carbon capture, utilisation, and storage* (CCUS) technologies are meant to ensure that the by-product CO_2 from generating thermal energy does not, or at least to a lesser extent, end up in the atmosphere. Instead, the heat-trapping gas is stored underground or in the ocean (CCS), or repurposed for other processes, thus recycled (CCU).[30,31] One problem with CCU technology is that it has not been sufficiently developed yet, and it may take years, or even decades to make it a viable option.[32] On the other hand, CCS technology is already tentatively being used in several countries and is currently being heavily invested in, as demonstrated by the involvement of two Japanese companies in an Indonesian CCS project starting in 2021.[33] Japan's Trade Ministry has estimated that at least 10 years' worth of Japanese emissions can be buried in Asia using CCS technology.[34] However, this also means that carbon storage cannot be implemented as a long-term solution. Storing carbon in the ocean (Marine CCS) may furthermore negatively impact ecosystems. Its ecological effects, such as ocean acidification, are still being investigated. Gradual release of CO_2 from ocean storage could also become an

[28] Retrieved from https://www.carbonbrief.org/japans-2030-climate-pledge-leaves-room-for-coal-expansion. On 1 December 2020.
[29] Ohta, Hiroshi. (2020). *The Analysis of Japan's Energy and Climate Policy from the Aspect of Anticipatory Governance*. Energies. p. 2.
[30] Retrieved from https://cordis.europa.eu/article/id/422374-carbon-capture-utilisation-and-storage-the-key-to-revolutionising-global-energy-use. On 24 November 2020.
[31] Retrieved from https://www.reuters.com/article/us-japan-carbon-storage-idUSKBN1HQ0WZ. On 24 November 2020.
[32] Retrieved from https://www.japantimes.co.jp/news/2020/10/26/national/yoshihide-suga-carbon-pledge-japan/. On 26 November 2020.
[33] Retrieved from https://www.thejakartapost.com/news/2020/09/21/japan-firms-to-demonstrate-underground-co2-storage-in-central-java.html. On 4 January 2021.
[34] Retrieved from https://asia.nikkei.com/Spotlight/Environment/Japan-looks-to-ASEAN-nations-for-carbon-capture-and-storage. On 8 December 2020.

issue, though this happens relatively slowly (when stored at 1.000 m depth, up to 35% of stored CO_2 could escape over the course of 100 years).[35,36]

Nevertheless, the Japanese government has faced criticism for its resort to CCUS technology while simultaneously failing to address Japan's coal reliance. The degree to which the technology will contribute to reaching a state of carbon neutrality remains to be seen.[37,38]

Comparison of Japan's NDC and its Green Growth Strategy		
	NDC	**Green Growth Strategy/ Carbon Neutrality Pledge**
GHG reduction	18% compared to 1990 by 2030 (=26% compared to 2013)	Net-zero emissions by 2050
Coal use	No significant change projected	Shift in coal policy announced
Fossil Fuels in Energy Mix	more than 50% by 2030	(Significantly) less than 40% by 2050 and making use of CCUS technology (Nuclear and *Thermal* combined projected to make up 30-40%)

[35] Retrieved from https://www.global-greenhouse-warming.com/marine-ccs.html. On 4 January 2021.
[36] IPCC (2005). Summary for Policymakers. In: *IPCC Special Report on Carbon Dioxide Capture and Storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change* [Metz, B., O. Davidson, H. C. de Coninck, M. Loos, and L. A. Meyer (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. p. 14
[37] Retrieved from https://www.climatechangenews.com/2019/06/12/japan-says-will-carbon-neutral-fails-set-timeline/. On 24 November 2020.
[38] Retrieved from https://www.kikonet.org/wp/wp-content/uploads/2019/08/pp-ccus-f.pdf. On 9 December 2020.

Nuclear Energy

Nuclear energy has two main advantages; it delivers energy consistently and causes only negligible emissions. The obvious disadvantages are the significant risk of nuclear accidents and the storage of nuclear waste, next to water pollution and uranium scarcity. Since the oil crisis of 1973, energy security has been a priority in Japan's energy policy. At this time, nuclear energy was considered Japan's most reliable energy source. Between 1974 and 2011, Japan had built out its nuclear energy capacity to a total of 45-49 gigawatt (GW), which made it the third largest nuclear energy producer in the world.[39,40] After the 2011 nuclear disaster, Japanese nuclear energy policy was thoroughly revised. The government, then led by the Democratic Party of Japan (DPJ), announced a nuclear phaseout by 2030, a policy which the succeeding government led by the Liberal Democratic Party (LDP) – of which Suga is now President – reversed.[41]

The planned re-emergence of nuclear energy under the 2050 pledge contrasts with the considerable percentage of Japanese citizens that opposes nuclear power. A 2015 poll by the Japan Atomic Energy Relations Organisation (JAERO) indicated that 47.9% of its participants supported a phaseout of nuclear power, while 14.8% would opt for an immediate shutdown. 10.1% supported a continuation of nuclear energy use at pre-2011 levels, and only 1.7% supported an increase. Meanwhile, an Asahi Shimbun poll of 2016 revealed that 73% of its participants backed a phaseout of nuclear power, while 14% supported an immediate abolition of nuclear plants.[42,43]

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[39] Ohta, Hiroshi. (2020). *The Analysis of Japan's Energy and Climate Policy from the Aspect of Anticipatory Governance*. Energies. p. 8.
[40] Moe, Espen. (2011). *Vested interests, energy efficiency and renewables in Japan*. Energy Policy. p.11.
[41] Ohta, Hiroshi. (2020). *The Analysis of Japan's Energy and Climate Policy from the Aspect of Anticipatory Governance*. Energies. p. 1.
[42] Retrieved from https://theconversation.com/six-years-after-fukushima-much-of-japan-has-lost-faith-in-nuclear-power-73042. On 24 November 2020.
[43] Retrieved from https://www.jaero.or.jp/data/01jigyou/pdf/tyousakenkyu27/r2015.pdf. On 27 November 2020.

A 2017 Mainichi Shimbun poll furthermore showed that 55% of its participants opposed restarting nuclear reactors that were suspended because of the nuclear disaster, in contrast to the 26% who were in favour of restarting them.[44]

Japanese opinion on the future of nuclear energy				
Support:	Phaseout	Immediate shutdown	Continuation at pre-2011 levels	Increase
2015 JAERO	47.9%	14.8%	10.1%	1.7%
2016 Asahi	73%	14%		

Japanese opinion on restarting nuclear reactors suspended after 2011		
Restart nuclear reactors?	Yes	No
2016 Asahi		57%
2017 Mainichi	26%	55%

Renewable Energy

Renewable energy has been on the rise worldwide; a favourable development, yet unlikely to provide sufficient and consistent energy for global energy demands.[45] Additionally, renewable energy has its own set of problems. The production of solar panels causes significant pollution and GHG emissions, and the extraction of rare minerals used in green technology causes considerable environmental damage.[46] For such (and other) reasons, energy expert and environmentalist Michael Shellenberger suggests that the only solution seems to be ramping up

[44] Retrieved from https://mainichi.jp/english/articles/20170313/p2a/00m/0na/006000c. On 27 November 2020.
[45] Retrieved from https://www.emerald.com/insight/content/doi/10.1108/08288661311319166/full/html. On 25 November 2020.
[46] Parrique T., Barth J., Briens F., C. Kerschner, Kraus-Polk A., Kuokkanen A., Spangenberg J.H. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau. p. 40.

nuclear energy.[47] Yet, nuclear energy comes with its own risks and significantly upscaling the use of nuclear energy is *the* formula to prompt the occurrence of future nuclear disasters. This is especially the case in Japan, a country that is prone to earthquakes.

A concrete problem for Japan with regards to renewable energy is that the country's geographical features (with its many mountainous regions) make it rather difficult to build solar farms or other renewable energy facilities requiring a significant amount of space.[48] On the other hand, it has been argued that the country has greater potential with regards to geothermal energy, with experts believing that it could provide up to 10% of Japan's energy demand (compared to 0.2% in 2019). This potential is currently "wasted" on the *onsen* (hot spring) industry.[49]

Additionally, vested interests have hindered the transition to renewables. It has been argued that wind energy has developed significantly slower than solar energy in Japan, as it generally lay outside of the existing vested interest structure.[50] This seems to be changing, as Japan has announced a considerable upscaling of offshore wind farms. Yet, when compared to solar energy, the difference is still clearly visible, even considering its new ambitions. Solar capacity in 2019 already amounted to 62 GW, while wind energy only produced 4 GW.[51] Over the next two decades, Japan will aim to build offshore wind infrastructure reaching a total capacity of 35-45 GW by 2040.[52] Offshore wind farms provide a solution to the above-mentioned space problem associated with renewable energy. In contrast, it has been argued that Japan has a much larger potential for wind energy, of up to 144 GW onshore and 608 GW offshore generation.[53] If these estimates are accurate, a further upscaling of wind energy would be strongly advisable.

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[47] Retrieved from https://www.youtube.com/watch?v=N-yALPEpV4w. On 2 December 2020.
[48] Retrieved from https://www.eubusinessinjapan.eu/sectors/energy/renewable-energy. On 11 December 2020.
[49] Retrieved from https://www.japantimes.co.jp/life/2019/03/09/environment/unlocking-japans-geothermal-energy-potential/#.XIbbVRP7T-Y. On 11 December 2020.
[50] Moe, Espen. (2011). *Vested interests, energy efficiency and renewables in Japan*. Energy Policy. p.1.
[51] Retrieved from https://www.renewable-ei.org/en/statistics/re/?cat=solar. On 28 January 2021.
[52] Retrieved from https://www.reuters.com/article/us-japan-windpower-idUSKBN28P0C6. On 28 January 2021.
[53] Retrieved from https://www.bloomberg.com/news/articles/2014-02-26/ge-says-japan-has-more-potential-to-harness-wind-energy. On 28 January 2021.

The government is also aiming to establish a commercial hydrogen fuel supply by 2030, with Kajiyama calling the renewable energy source an "essential energy for decarbonisation".[54] The idea of a hydrogen-based society goes back to the 1990s and was further accelerated following the nuclear disaster of 2011. In 2017, Japan became the first country to devise a hydrogen strategy. It was followed by the European Union, which released its own EU Hydrogen Strategy in 2020.[55]

Currently, Japan can import hydrogen either originating from low-cost renewable energy, or from low-cost fossil fuels combined with CCS technology.[56] Both of these methods are currently being tested. However, some problems have surfaced with one of the pilot projects making use of Australian brown coal. Currently, the Australian plant is operating for one year without CCS, under the assumption that the technology can be added later when the project is successful and starts operating commercially in 2030.[57] Over the course of the trial period, the project is expected to emit roughly 100 tons of CO_2.[58] It is clear then that, at least for the time being, the hydrogen from this facility cannot be considered clean or renewable.

Additionally, Japan is importing so-called "blue hydrogen", produced from Bruneian natural gas and crude oil from Saudi Arabia.[59] The project in Saudi Arabia is an example that does make use of CCS technology to store the carbon dioxide produced in the process. However, much of this CO_2 is injected underground for the purpose of "enhanced oil recovery", which

[54] Retrieved from https://www.reuters.com/article/us-japan-energy-hydrogen/japan-aims-to-set-up-commercial-hydrogen-fuel-supply-chain-by-2030-idINKBN2700PM. On 11 December 2020.
[55] Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/FS_20_1296. On 26 January 2021
[56] Retrieved from https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/japan?fbclid=IwAR23q7agIHcb2rJi4IdZ6tZ20oGBaykbJ5Eiv5gsXdYqBxOLQ-pHtAqkaC8. On 17 December 2020.
[57] Arias, J. (2019). Hydrogen Market in Japan. In: *Hydrogen and Fuel Cells in Japan*. EU-Japan Centre for Industrial Cooperation. p. 84.
[58] Retrieved from https://www.thesaturdaypaper.com.au/news/politics/2019/11/30/hydrogen-strategy-backs-dirty-coal/15750324009156?fbclid=IwAR22W6KszjfSomJ7TGVsHpWWtPXtVjmNheiJPSZpGug1gAVjPoYiwlsJv1Y#hrd. On 17 December 2020.
[59] Retrieved from https://thescoop.co/2019/11/27/brunei-exports-first-shipment-of-hydrogen-to-japan/. On 17 December 2020.

simply leads to the procurement of more fossil fuels.[60] Thus, it becomes clear that hydrogen still has a long way to go before it can truly be considered a renewable energy source.

Japan has also recently built an advanced hydrogen plant on its own territory, called FH2R. Besides producing hydrogen, the plant – located at Namie in Fukushima prefecture – simultaneously serves as the world's largest hydrogen research facility. FH2R can operate completely carbon-free, as it fully operates on renewable energy. This provides a considerable advantage, as renewable energy can be stored for future use when exceeding energy demand, thus preventing significant energy loss.[61,62] Roughly *one third* of renewable energy in Japan (excluding hydro) remained unused in FY 2018, highlighting the potential of this technology.[63] The plant was built by the New Energy and Industrial Technology Development Organization (NEDO), Japan's largest public management organisation and key player in the development of energy technologies.

Image retrieved from https://www.nedo.go.jp/english/introducing/introducing_index.html. On 14 December 2020.

[60] Retrieved from https://www.power-technology.com/news/saudi-aramco-ships-blue-ammonia-japan-zero-carbon-power-generation/. On 17 December 2020.
[61] Retrieved from https://www.intelligentliving.co/fukushima-largest-renewable-hydrogen-plant/. On 26 November 2020.
[62] Retrieved from https://renewableh2.org/. On 14 December 2020.
[63] Retrieved from https://www.ene100.jp/www/wp-content/uploads/zumen/e1-2-3.pdf. On 14 December

Japan's Efforts

In contrast to its bad reputation when it comes to coal, Japan is well regarded for its various efforts towards combating climate change and other environmental issues. It recycles roughly 84% of its plastics, although the majority is "recycled" through burning for energy generation.[64] Still, the country has a rather advanced recycling system. Over 60% of aluminium cans in Japan are recycled and waste is meticulously separated. One particular problem is that due to a lack of space for landfills, Japan burns much of its waste, resulting in further emissions. In 2000, the *Basic Act for Establishing a Sound Material-Cycle Society* (Basic Recycling Act) came into force, emphasising the "three Rs": *Reduce, Reuse, Recycle*. The United Nations Environment Programme (UNEP) confirms that despite Japan's above-average consumption of single-use plastics, relatively little ends up leaking into the environment.[65]

Since 2005, the "Cool Biz" initiative has been in place in Japan, which aims at reducing energy consumption by raising awareness and promoting simple ways to combat the heat during the summer season, rather than using air-conditioning. This initiative alone is reported to have prevented the emission of millions of tons of CO_2.[66] Furthermore, various global warming countermeasures are being taken in Japanese cities, such as the building of green walls and "low carbon model areas", among other efforts.[67]

Japan has several programs and funds, designed for diffusing and developing low-carbon technologies and other ways of climate change mitigation in Low- to Middle-Income Countries (LMICs). Noteworthy examples are the Joint Crediting Mechanism (JCM)[68], the Japan Conference on Overseas Development of Eco-Cities (J-CODE)[69], and the work done by the

[64] Retrieved from https://www.japantimes.co.jp/news/2019/07/06/national/media-national/japan-faces-uphill-battle-reduce-plastic-consumption/. On 14 December 2020.
[65] Retrieved from https://www.weforum.org/agenda/2019/08/the-japanese-have-a-word-to-help-them-be-less-wasteful-mottainai/. On 26 November 2020.
[66] Retrieved from https://foreignpolicy.com/sponsored/japanus/global-commitment/. On 15 December 2020.
[67] Retrieved from https://www.env.go.jp/earth/coop/lowcarbon-asia/english/localgov/. On 17 December 2020.
[68] Retrieved from http://gec.jp/jcm/about/. On 15 December 2020.
[69] Retrieved from http://www.j-code.jp/. On 15 December 2020.

Japan International Cooperation Agency (JICA).[70,71] Japan also contributes to the Green Climate Fund (GCF), an international fund targeting GHG reduction in LMICs.[72] Furthermore, it hosts the Innovation for Cool Earth Forum (ICEF) annually, bringing together governments, industry, and academia to address climate change with a focus on technological innovation.[73]

In order to stimulate renewable energy, Japan introduced the *Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities* in 2011.[74] Based on the act, a Feed-in Tariff (FIT) scheme was launched in 2012, which set a fixed selling price for renewables at a higher rate than non-renewable energy. The FIT scheme has arguably been the most impactful government policy with regards to promoting renewable energy. By 2019, renewable energy capacity – mostly from solar photovoltaic (PV) – had more than tripled under the FIT scheme. More recently, the country has decided to introduce a similar Feed-in Premium (FIP) scheme starting in April 2022. This scheme will allow the producers of certain renewable energies to sell their energy at higher prices in spot markets.[75,76]

These schemes primarily rely on market mechanisms and private producers to promote renewables in Japan. While this has been effective to a certain extent, the question remains whether this can be sufficient. As mentioned above, Japan now intends to diversify its renewables, betting mostly on wind and hydrogen energy. Government spending on renewable energy rather than solely relying on tariffs will most likely be a more effective approach, and such proactive measures should be applauded. A combination of tariffs and investment will likely lead to the most optimal results.

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[70] Retrieved from https://www.jica.go.jp/english/our_work/climate_change/index.html. On 15 December 2020.
[71] Retrieved from https://www.jica.go.jp/english/publications/j-world/1910_01.html. On 15 December 2020.
[72] Retrieved from https://www.mofa.go.jp/ic/ch/page1we_000106.html. On 15 December 2020.
[73] Retrieved from https://www.icef-forum.org/about/. On 15 December 2020.
[74] Retrieved from https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/laws/1409.pdf?fbclid=IwAR1E8zSQ9_1GVNxADJ3pwSL3urlzDszjSHivCjzp5ibu-x7Wspnpb47hwb0. On 30 November 2020.
[75] Retrieved from https://www.meti.go.jp/english/press/2016/0603_06.html. On 30 November 2020.
[76] Retrieved from https://www.argusmedia.com/en/news/2112632-japans-fip-renewables-system-likely-to-exclude-biomass. On 30 November 2020.

Preceding the FIT scheme, a series of support measures for renewable energy had already been introduced. Japan started subsidising renewables in 1997. In 2003, the government introduced a *Renewables Portfolio Standard* (RPS) system, which required power companies to use a certain amount of renewable energy. The RPS system was abandoned in 2012 and replaced by the FIT scheme. In 2009, the *Excess Electricity Purchasing* scheme (the FIT scheme's predecessor) was introduced.[77] Furthermore, Japan introduced a carbon tax or *Tax for Climate Change Mitigation* in October 2012, yet it ranks among the lowest in the world.[78,79]

A low carbon tax can have advantages and disadvantages. The most important advantage is that lower income households do not face the burden of shouldering the costs of such tax. The obvious disadvantage is that a low carbon tax is unlikely to have the desired effect on carbon emissions. However, as I will argue below, there are ways to address these problems.

During Japan's Ordinary Diet Session, which started on 18 January 2021 and will last for 150 days, unless extended, several tax-related bills with the objective of reaching climate neutrality will be discussed.[80] The tax reform proposals, on which the ruling coalition (LDP and Komeito) has already agreed, include tax incentives for companies investing in facilities that contribute to decarbonisation. A revision of the carbon tax and the creation of an emissions-trading system (ETS) will also be considered.[81,82]

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[77] Retrieved from https://www.egnret.ewg.apec.org/sites/default/files/meetings/egnret49/pdf/02%20Renewable%20Energy%20Development%20in%20Japan.pdf. On 11 December 2020.
[78] Retrieved from http://www.env.go.jp/en/policy/tax/env-tax/20121001a_dct.pdf?fbclid=IwAR0ari6ZJs4yqhucJvjVJ4qHIytHJG92U29Fi4MejUhN-RLK234OXmeRFgw. On 30 November 2020.
[79] Kojima S., and K. Asakawa. (2020). Expectations for Carbon Pricing in Japan in the Global Climate Policy Context. In: *Carbon Pricing in Japan*. Springer, open access. 4.
[80] Retrieved from https://www3.nhk.or.jp/nhkworld/en/news/20210118_01/. On 19 January 2021.
[81] Retrieved from https://home.kpmg/jp/en/home/insights/2020/12/en-tax-newsletter-20201218.html. On 21 January 2021.
[82] Retrieved from https://www.reuters.com/article/japan-environment-finance/japan-to-mull-bolder-emissions-target-carbon-pricing-scheme-next-year-minister-idUSKBN28V0XM. On 21 January 2021.

Cooperation with the European Union

Being a strategic partner to Japan and a frontrunner in climate policy – now aiming at a 55% reduction of GHG emissions by 2030 compared to 1990 levels[83] - further cooperation with the European Union seems likely and favourable. Following Suga's 2050 pledge, European Commission President Ursula von der Leyen supported the leader's decision via Twitter, stating that the EU looks forward to working with Japan to reach the goal.[84]

Japan now aims at the same goal as the EU, as set out in the European Green Deal.[85] Furthermore, the two parties have recently signed several partnership agreements, including the *Economic Partnership Agreement* (EPA) and the *Strategic Partnership Agreement* (SPA). One of those agreements, the *Partnership on Sustainable Connectivity and Quality Infrastructure*, mentions sustainable energy connectivity building, sustainable energy infrastructure investments, and low-carbon energy systems.[86]

Japan is already cooperating with the EU in different areas related to clean energy and environment. One example is the International Urban Cooperation program, which pairs European with Japanese cities. This strategy aims at sustainable urban development through the sharing of expertise.[87] There are several examples of cooperation between public and private players from EU countries and Japan, for example overseeing the construction of renewable energy facilities (Vestas (Denmark) & Mitsubishi; Ideol (France) & Taisei; …). The intention to further cooperate is also visible by the creation of the *EU-Japan Cooperation for Climate*, an initiative by the EU-Japan Centre for Industrial Cooperation. In this context, a series of events with the objectives of "promoting European climate policies and business initiatives

[83]Retrieved from https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en. On 8 December 2020.
[84] Retrieved from https://euobserver.com/environment/149870. On 24 November 2020.
[85] Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#actions. On 23 November 2020.
[86] Retrieved from https://eeas.europa.eu/sites/eeas/files/the_partnership_on_sustainable_connectivity_and_quality_infrastructure_between_the_european_union_and_japan.pdf. On 2 December 2020.
[87] Retrieved from https://iuc.eu/japan-en/home/. On 2 December 2020.

towards Japanese stakeholders" and "encouraging further climate cooperation between the EU and Japan" started in September 2020.[88]

The EU has cooperated with the United States and Japan to create research programmes aimed at optimising hydrogen production. Furthermore, both Japan and the European Commission are members of the *International Partnership for Hydrogen and Fuel Cells in the Economy* (IPHE).[89,90] Other areas of further cooperation will include offshore wind energy and sustainable batteries.[91]

A Case for 'Degrowth'?

The Intergovernmental Panel on Climate Change (IPCC), a leading body of climate scientists endorsed by the UN, has warned against a rise in global temperature of more than 1,5°C compared to pre-industrial levels. A further rise in temperature will result in more drastic effects on ecosystems and climate conditions. For example, keeping levels at 1.5°C as compared to 2°C (the Paris Agreement threshold) could keep roughly 420 million people from being frequently exposed to extreme heat waves. Other natural phenomena such as flooding, droughts, and biodiversity loss would also increase in severity. Thus, preventing a rise above 1.5°C could negate some of the most disruptive impacts that a 2°C rise would cause.[92,93,94]

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[88] Retrieved from https://europe-japan-climate-cooperation.net/?page_id=9. On 2 December 2020.
[89] Retrieved fromhttps://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0301. On 21 January 2021.
[90] Retrieved from https://www.iphe.net/partners. On 21 January 2021.
[91] Retrieved from https://europe-japan-climate-cooperation.net/?page_id=1157. on 21 January 2021.
[92] Retrieved from https://www.carbonbrief.org/in-depth-qa-ipccs-special-report-on-climate-change-at-one-point-five-c. On 15 December 2020.
[93] IPCC. (2018). Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. *World Meteorological Organization, Geneva, Switzerland, 32 pp*.
[94] Hoegh-Guldberg, O., D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K.L. Ebi, F. Engelbrecht, J. Guiot, Y. Hijioka, S. Mehrotra, A. Payne, S.I. Seneviratne, A. Thomas, R. Warren, and G. Zhou. (2018). Impacts of 1.5ºC Global Warming on Natural and Human Systems. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-

In order to stay below the IPCC's 1.5°C threshold, a 5% yearly decrease in global emissions will be required. This is roughly 18 times more than was the case in *Organisation for Economic Co-operation and Development* (OECD) countries between 2001 and 2015. For comparison, in order for the EU to reach a 95% reduction by 2050, its emissions will have to drop five times faster than in the 1990-2017 period. On the contrary, decoupling [95] in wealthy countries generally seems to be slowing down.[96] These observations are a testament to the challenge that Japan is now facing by aiming for net-zero emissions.

During his policy speech, Prime Minister Suga claimed that "responding to climate change is no longer a constraint on economic growth"[97] and that "global warming countermeasures could transform the economy and *foster growth*, not hinder it."[98] One should keep in mind that Japan's economy has been relatively stagnant for the last decades.[99] Suga seems to attach great importance to reinvigorating the Japanese economy and has opted for green growth and digitalisation in order to achieve this goal.[100]

The line of thinking which Suga follows is similar to that of the *New Climate Economy* report, published by the Global Commission on the Economy and Climate.[101] The report promises a new era of economic growth, "driven by the interaction between rapid technological innovation, sustainable infrastructure investment, and increased resource productivity." It stresses the potential of the circular economy, underlines the creation of new low-carbon jobs and reasons that by preventing more intense climate hazards, the loss of billions of dollars can be

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Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

[95] "Decoupling" refers to a decreasing impact of economic growth on resource consumption. This can happen up to a point of so-called "absolute decoupling", which is the case when GDP rises, while resource use and/or carbon emissions fall. Therefore, absolute decoupling is to be achieved in order to meet NDC's and net zero emission targets.

[96] Parrique T., Barth J., Briens F., C. Kerschner, Kraus-Polk A., Kuokkanen A., Spangenberg J.H. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau. p. 25.

[97] Retrieved from https://www.reuters.com/article/japan-politics-suga-idUSKBN27B0FB. On 23 November 2020.

[98] Retrieved from https://www.japantimes.co.jp/news/2020/10/26/national/yoshihide-suga-carbon-pledge-japan/. On 26 November 2020. (Emphasis added)

[99] Retrieved from https://www.ceicdata.com/en/indicator/japan/real-gdp-growth. On 2 December 2020.

[100] Retrieved from https://japan.kantei.go.jp/99_suga/statement/202101/_00002.html. on 21 January 2021.

[101] Retrieved from https://newclimateeconomy.net/. On 5 January 2021.

prevented.[102] But this report paints a rather rosy picture, that allows for maintaining much of the status quo, assuming that technological innovation is heavily invested in and develops accordingly. It is the same idea that formed the gist of Suga's first policy speech in October 2020.

It can be questioned whether an adequate response to climate change without any repercussions on economic growth is plausible. Setting a net zero emission target while pursuing economic growth presumes that resource consumption and emissions can be decoupled from economic growth, be that through structural change, technological innovation, or other means. Proponents of green growth heavily emphasise the importance of innovation. But sceptics point out that there is no guarantee that technological innovation will advance fast enough to achieve a sufficiently fast and intensive global decoupling. A paper issued by the European Environmental Bureau (EEB) collects empirical data from relevant studies in order to assess the feasibility of decoupling and sustainable green growth. Based on collected data, the paper argues that adequate decoupling is extremely unlikely to occur in the near future.[103]

Indeed, there are several aspects to be considered with regards to decoupling. For example, one should be aware of the so-called rebound effect, meaning that increased resource efficiency often results in lower prices and therefore leads to higher demand, sometimes contradictorily leading to more intensive resource consumption (*Jevons* paradox). It has also been observed that psychological factors likely play a role in the rebound effect, with people tending to use less polluting technology (e.g., an EV) more often than its more polluting counterpart. Furthermore, the effects of depletion should not be overlooked. For example, accessible extraction sites for fossil fuels such as oil and gas have the tendency to be sourced before less accessible ones. This means that through gradual depletion, more energy is increasingly

[102] Retrieved from https://newclimateeconomy.report/2018/executive-summary/. On 8 December 2020.
[103] Parrique T., Barth J., Briens F., C. Kerschner, Kraus-Polk A., Kuokkanen A., Spangenberg J.H. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau. p. 32.

required to extract fossil fuels. For instance, in 1999 it took roughly one unit of oil or gas to extract 33 new units, whereas in 2005, this number declined to only 18 units.[104] Taking these observations into account, it becomes clear that solely relying on sectoral and technological improvements is not an option to achieve net-zero emissions.

Additionally, if a country succeeds in decoupling its resource use from economic growth, this does not mean that efforts can be relaxed. There is the possibility that economic growth and resource use become relinked at a later point in time. It will therefore be a constant challenge to, once achieved, keep emissions at net zero over time. To effectively combat climate change, a permanent decoupling would be required.[105]

Several of the cited studies have found that GDP is one of the most important drivers of CO_2 emissions, even when technological innovation is taken into account. Over the last decade, global energy demand grew at the fastest pace recorded in history. In 2018, energy demand increased by 2.3%, with global CO_2 emissions rising by 1.7%.[106] In Japan's case, low GDP growth – less than 0.7% real GDP growth for 2019 - has contributed to a suppression of energy demand and, consequently, GHG emissions.[107,108]

Taking these and other problematic aspects of decoupling into account, the EEB paper brings attention to the idea of "post-growth" or "degrowth". Degrowth is a concept which emphasises the unsustainability of perpetual growth. The concept can be defined as "a voluntary, democratically negotiated, equitable downscaling of societies' physical throughput until it reaches a sustainable steady-state"[109] or "a phase of planned and equitable economic contraction in the richest nations, eventually reaching a steady state that operates within the

[104] Ibid. p. 34.
[105] Ibid. p.14.
[106] Retrieved from https://thescoop.co/2019/11/27/brunei-exports-first-shipment-of-hydrogen-to-japan/. On 17 December 2020.
[107] Retrieved from https://www.eia.gov/international/content/analysis/countries_long/Japan/. On 27 January 2021.
[108] Retrieved from https://www.reuters.com/article/japan-carbon-idUSKBN28I15W. On 28 January 2021.
[109] Büchs M., M. Koch. (2019). *Challenges for the degrowth transition: The debate about wellbeing*. Futures. p. 155.

Earth's biophysical limits."[110] In essence, this means that rather than pursuing economic growth and counting on rapid technological innovation to mitigate its negative effects on the environment, degrowth proposes to cease the pursuit of economic growth after a satisfactory standard of living is reached. It is argued that the most effective way to combat climate change is to simply cause less environmental damage, rather than attempting to mitigate it afterwards. Degrowth also proposes to produce and consume less, especially when it comes to richer countries. It is argued that a circular economy based on the current extent of industrialized production and waste is not achievable. Many resources cannot be recycled and those that can, decrease in quality with every repurposing, meaning that the recycled resource will eventually become waste as well. It is therefore argued that even optimising the circular economy would still result in an abundance of waste and a high demand for virgin resources, due to high consumption levels. Recycling itself also requires energy and new materials. If new materials are required at a higher rate than the environment can produce them, a circular economy cannot be reached.[111] Furthermore, resource extraction causes significant GHG emissions, being responsible for roughly half of the world's carbon emissions.[112,113,114]

Degrowth argues that to combat climate change, the largest economies will have to shrink to a sustainable level. One study estimates that if the wages of the global poor were to be raised to USD 3-8 per day under current conditions, this would mean spending 66% of the 2°C Paris Agreement threshold.[115] Therefore, it is instrumental that countries aim for sufficiency, rather than abundance.

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[110] Retrieved from https://theconversation.com/life-in-a-degrowth-economy-and-why-you-might-actually-enjoy-it-32224. On 23 November 2020.
[111] Parrique T., Barth J., Briens F., C. Kerschner, Kraus-Polk A., Kuokkanen A., Spangenberg J.H. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau. p. 46.
[112] Retrieved from https://www.euractiv.com/section/circular-economy/news/resource-extraction-responsible-for-half-worlds-carbon-emissions/. On 7 January 2021.
[113] Retrieved from https://scalar.usc.edu/works/mere-hub/resource-extraction-and-climate-change. On 21 January 2021.
[114] Retrieved from https://ec.europa.eu/environment/biodiversity/business/news-and-events/news/news-130_en.htm. On 21 January 2021.
[115] Parrique T., Barth J., Briens F., C. Kerschner, Kraus-Polk A., Kuokkanen A., Spangenberg J.H. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau. p. 16.

Being home to the world's third largest economy, it is undeniable that the size of Japan's economy is large enough to sustain a comfortable living standard for its citizens. In 2019, Japan was the world's fifth-largest oil consumer, fourth-largest crude oil importer, world's largest LNG importer and third-largest coal importer. [116] In contrast, Japan's population has started to decline, with a further decrease of approximately 30% projected by 2065.[117,118] As mentioned above, energy consumption in Japan has been decreasing since the mid-2000s. These factors, combined with its consistent inclination for a stagnant economy, make Japan the perfect testing ground for exploring the possibilities of degrowth, with a primary focus on the downscaling of non-renewable energy imports. One paper contends that the lengthy absence of meaningful economic growth in Japan even makes a post-growth society the most likely outcome for the Asian archipelago.[119] On the other hand, if the possibility of this scenario is ignored and policymaking shaped by conservatism, this will result in unpreparedness and possibly a missed chance for creating a more sustainable society.

In his New Year's Press Conference, Suga claimed that the government will continue pursuing growth-oriented policies, based on green growth and digitalisation.[120] As mentioned above, Japan's Green Growth Strategy projects substantial economic growth and a significant increase in energy demand. There seems to be an inherent contradiction to this logic, especially keeping the above-mentioned empirical data on decoupling in mind. Reaching net-zero emissions will be a challenge as it is, therefore increasing parameters such as GDP and energy demand substantially will most likely make this goal even more difficult to reach.

It should be admitted that there currently exists a strong association between wellbeing and GDP. When considering the premise that GDP drives up emissions, this becomes a problem.

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[116] Retrieved from https://www.eia.gov/international/content/analysis/countries_long/Japan/. On 27 January 2021.
[117] Retrieved from https://www.statista.com/statistics/607936/japan-forecast-population-age-group/. On 16 December 2020.
[118] Retrieved from https://www.japantimes.co.jp/news/2017/04/10/national/social-issues/japans-population-projected-plunge-88-million-2065/. On 16 December 2020.
[119] Leblanc, R. M. (2017). *Designing a beautifully poor public: postgrowth community in Italy and Japan.* Journal of Political Ecology. p. 451.
[120] Retrieved from https://japan.kantei.go.jp/99_suga/statement/202101/_00002.html. on 21 January 2021.

Therefore, degrowth advocates propose a new framework for wellbeing, that is based on basic human needs rather than economic growth.[121] In fact, a stagnant or falling GDP may even be beneficial for human wellbeing, which could well be the case for Japan, a country which is notorious for its rigid work ethics and excessive working hours. Consuming and producing less could mean shorter working hours and a less taxing environment. In its turn, this could mitigate Japan's problems with high suicide rates, *karoshi* (death by overwork) and the phenomenon known as *hikikomori*, or social seclusion.

Logically, it is unfeasible that Japan would be the only country to implement a degrowth strategy while other rich countries continue pursuing growth, as this would likely put the country in a disadvantaged position. However, being a leading country on the global stage, Japan is capable of putting these ideas on the table at high-level meetings of international institutions such as the G7 and the UN. In this regard, the United Nations Framework Convention on Climate Change (UNFCCC) is of crucial importance in making such potentially impactful ideas accessible, even if – and perhaps especially when – they pose a challenge to the status quo. In the end, it was under this same status quo that the current precarious situation of deteriorating environmental conditions has been able to manifest itself.

It should further be recognised that degrowth would not be a minor adaptation in policymaking, but rather a major paradigm shift. Naturally, the idea will initially be met with much resistance and scepticism. However, when objectively considering the severity of climate change, it becomes clear that drastic measures are necessary. It has been argued that solely relying on technological innovation or the pursuit of a circular economy are risky bets for adequately addressing climate change. The necessary shift is one from the prioritisation of economic growth, to the prioritisation of climate, environment, and human wellbeing. If such changes

[121] Büchs M., M. Koch. (2019). *Challenges for the degrowth transition: The debate about wellbeing*. Futures. p. 156.

will not take place, targets may not be met, in which case extreme ecological conditions will continue to shape the further course of human history.

Though ambitions to reach net zero emissions should be applauded, climate change needs a global and comprehensive response. Offshoring, i.e., moving carbon-intensive processes abroad, is not a solution. Understanding emissions from a consumer-based perspective could therefore give us a better understanding of the issue. Sectors such as shipping and aviation are often excluded from national accounts, while CO_2 emissions from aviation (an already heavily polluting sector; 151 megatons (Mt) of CO_2 in 2014 for the EU28) are expected to rise a further 45% by 2035.[122] It should be noted that due to the COVID-19 pandemic, this number may be lower than projected in the paper. Still, such staggering numbers of CO_2 emissions accentuate the comparatively slower pace of CO_2 emission cuts, even in the most ambitious regions (e.g., 46Mt per year between 1990 and 2017 in the EU) [123].

Policy Suggestions

Japan's immediate climate policy should focus on addressing its reliance on fossil fuels, one of its most urgent problems. Firstly, the subsidising of fossil fuels should be halted.[124] Until recently, the Japanese government was still actively promoting the exploration and extraction of fossil fuels overseas to secure energy resources.[125] It would be advisable to also cease the building of new coal-fired plants. Even if fossil fuels must be resorted to due to a lack of alternatives at present, building new coal-fired plants will allow coal to remain for much longer than is desirable. Nevertheless, it should be noted that a recent energy shortage in Japan, mainly

[122] Parrique T., Barth J., Briens F., C. Kerschner, Kraus-Polk A., Kuokkanen A., Spangenberg J.H. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau. p. 27.
[123] Retrieved from https://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emission-trends-6/assessment-3. On 6 January 2021.
[124] Retrieved from https://www.nrdc.org/experts/han-chen/japan-second-worst-g7-reforming-fossil-fuel-subsidies. On 3 December 2020.
[125] Doukas A., S. Makhijani. (2015). *G20 subsidies to oil, gas and coal production: Japan*. Oilchange International. p. 2.

due to extremely low temperatures and an international increase in demand for liquified natural gas (LNG), will complicate the phasing out of fossil fuels in the short term.[126]

A higher carbon tax could significantly and rapidly cut carbon emissions, yet it should be ascertained that this does not hit poorer households disproportionately. As argued elsewhere, "carbon pricing needs to target big business, the wealthy, and heavy polluters if it is to be effective."[127] When not done effectively, social unrest, such as demonstrated by the yellow vests protests in France, will likely ensue.[128] Concretely, directly taxing the organisations responsible for the emissions is an option, rather than taxing fuel and energy at the consumer level. In this case, it should be ensured that the tax paid by the emitter is not redirected towards consumers by raising commodity or service prices, especially when it comes to essential goods and services.

It has also been observed that the world's most wealthy are responsible for the largest amounts of GHG emissions (according to the United Nations University, the 10% wealthiest people cause roughly 50% of individual consumption-based fossil fuel emissions).[129] Therefore, another approach could be to introduce a carbon tax that starts at relatively high incomes and increases in proportion to income levels. Furthermore, an additional tax could be introduced on heavily polluting luxury items, such as private yachts or airplanes. Such measures could be aimed for at the national, as well as the global level. A carbon tax that encourages less extravagant lifestyles should be welcomed, but under no circumstances should it cause scarcity or poverty. The funds obtained from such tax could consequently be allocated to make sustainable energy and transport more broadly available. This would logically further cut back GHG emissions. A well-devised carbon tax also seems preferable to an ETS system, as it has

[126] Retrieved from https://www.ft.com/content/7a98f9f3-3195-4f64-ba38-377c2f8ba1f3. On 21 January 2021.
[127] Retrieved from https://www.amfori.org/news/carbon-taxes-are-they-effective-tool-reduce-emissions. On 9 December 2020.
[128] Retrieved from https://theconversation.com/why-we-need-the-opposite-of-a-carbon-tax-to-reduce-emissions-133490. On 9 December 2020.
[129] Retrieved from https://ourworld.unu.edu/en/the-worlds-richest-people-also-emit-the-most-carbon. On 15 December 2020.

been observed that large businesses are often capable of benefiting from such a system, rather than contributing to lower carbon emissions.[130]

Another important pillar of a degrowth strategy would be the improvement of public transport. Japan already has a culture of efficient public transport, especially when it comes to railways, but there is room for improvement. For example, train fares could be made lower by subsidising or (partly) re-nationalising railways. Train networks could also be improved in more rural areas, which have seemingly been disregarded when it comes to public transport infrastructure.[131] It has been argued that degrowth could reinvigorate rural areas in Japan.[132] Combined with human wellbeing becoming ideologically more important under degrowth, this would likely result in more people returning to the Japanese countryside. It has furthermore been noted that under the influence of COVID-19, such relocation is already happening.[133]

These suggestions coincide with PM Yoshihide Suga's ambitions to revitalise the countryside, an objective which he mentioned in his 2021 New Year's speech.[134] Enhancing public transport networks in rural areas could be one way to make life outside of the cities more comfortable and accessible. Additionally, life outside of the cities would make it more feasible to (re-)localise the economy, another aspect of degrowth, as foodstuffs can logically be more easily produced in rural than in urban areas. This means less need for imports, which again contributes to less GHG emissions. Re-localisation has furthermore been observed to foster innovation, personal growth, and environmental awareness and – at least to a certain degree – seems rather achievable and undisruptive.[135]

Finally, degrowth policies should address consumerism. One article argues that, following the Second World War, many national design policies in Japan, England and Europe were devised to spur

[130] Retrieved from https://corporateeurope.org/en/environment/2015/10/eu-emissions-trading-5-reasons-scrap-ets. On 18 December 2020.
[131] Retrieved from https://www.weforum.org/agenda/2020/01/japans-much-admired-public-transit-system-is-leaving-its-rural-areas-behind/. On 4 December 2020.
[132] Retrieved from https://www.degrowth.info/en/catalogue-entry/can-degrowth-transition-contribute-to-the-wellbeing-of-rural-residents/. On 7 January 2021.
[133] Retrieved from https://www.weforum.org/agenda/2020/11/japan-tokyo-cities-city-countryside-pandemic-coronavirus-covid-19/. On 14 January 2021.
[134] Retrieved from https://japan.kantei.go.jp/99_suga/statement/202101/_00001.html. On 14 January 2021.
[135] Retrieved from https://www.emerald.com/insight/content/doi/10.1108/DPM-01-2020-0012/full/html. On 14 January 2021.

commodity production and consumption.[136] Today, planned and perceived obsolescence are still very much ingrained in our economic system. Therefore, in order to achieve a sustainable society, products will have to be designed to endure, rather than to make short-term profits. Sustainable standards for products could be determined in a similar way to the EU's product safety rules, and online stores could be asked, similarly to the *product safety pledge*, to refrain from selling products that have proven to be unsustainable. A global approach to sustainable products could be a topic to be further explored at the UN global climate talks.

It would also be beneficial if Japan made additional efforts to reduce its plastic consumption. In 2020, the Japanese government introduced a policy to charge customers for plastic bags in retail sectors, which has had some effects on plastic use, although many Japanese citizens consequently resorted to buying plastic bags in bulk online for the purpose of waste disposal.[137] Still, further policies aimed at plastics reduction would be advisable.

Conclusion

Japan's 2050 net-zero emission policy is a significant positive development in the battle against climate change. There is still a long way to go and many challenges and uncertainties await. It is therefore instrumental that leaders cooperate internationally and that a global response to climate change is further devised and strengthened, preferably via platforms such as the UNFCCC as this is expected to have the most significant impact.

With regards to climate and safety concerns, a gradual phasing out of nuclear and coal energy in Japan is desirable. Meanwhile, investment in clean energy, such as demonstrated by the implementation of offshore wind turbines, should be further enhanced. If degrowth were to be

[136] Retrieved from https://www.swinburne.edu.au/news/2015/05/degrowth-japan-models-design-for-steady-state-economies/. On 23 November 2020.
[137] Retrieved from https://japantoday.com/category/business/plastic-bag-usage-at-japanese-stores-down-by-50-but-plastic-bags-sales-through-the-roof. On 7 January 2021.

considered, the resulting lower energy demand could be redirected towards the scaling down of fossil fuels.

It is unavoidable that vested interests would hinder a potential transition towards degrowth. At this point, it seems to remain a long shot, especially with the conservative leaning LDP in power. It would require an exceptionally progressive government to seriously consider degrowth as a policy option. Yet, the prospects of degrowth look promising and might provide answers to the future problems which humanity is likely to experience under deteriorating environmental conditions. Given the global character of climate change, cooperation with the United Nations, the European Union and other international bodies would lead to an optimal response to *the* challenge of the 21st century.

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