Local Decarbonisation in Japan

Municipalities, Regions and Clusters on the Road to Carbon Neutrality

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Executive Summary

This report takes a look at Japan's decarbonisation strategies, with a focus on the local and regional levels. At the core of the report are a few main research questions. First, what role do Japanese municipalities and regions play in the transition to a decarbonised society? How do cities understand this role, and what programs have been implemented in service of a commitment to a greener future? What opportunities exist for a diversity of actors—residents, governments, businesses—to collaborate on decarbonisation?

In 2018, Japan was the sixth-highest emitter of CO_2 in the world, largely due to its dependence on fossil fuels. Oil, coal, and natural gas make up nearly 85% of Japan's total primary energy supply.[1] In addition, coal and natural gas are used to produce most of Japan's electricity.[2] Decarbonisation, therefore, is not a trivial issue. Japan has recently upgraded its decarbonisation targets, with leadership declaring, in 2020, their aspiration to achieve net-zero emissions by 2050.

Japan has been developing policy targeted at climate change since 1998, when the Global Warming Countermeasures Law was enacted in response to the Kyoto Protocol. The Japanese government has also formulated policy aimed at local and regional governments, including the Green Contracting Law and Green Procurement Act, which created guidelines for greener public procurement in cities and regions, and the Act Concerning Promotion of Low-Carbon Cities, which was developed specifically to assist cities comply with the Global Warming Countermeasures Law.

Cities and prefectures have a significant role to play in this energy transition, as they concentrate the majority of Japan's population, GDP, and emissions. This concentration goes hand-in-hand with the realities of the changing demographics and declining rural areas in Japan. The Regional Revitalisation Act emphasizes sustainable growth, meaning many revitalisation-related projects also dovetail with local and regional decarbonisation.

The national government has begun emphasising the importance of municipalities and its commitment to supporting local areas in their own transitions. In addition to flagship programmes including the Eco-Cities, Future Cities, and SDGs Future Cities programmes, the national government has developed a roadmap for regional decarbonisation and has stepped up at the ministry-level in terms of providing more abundant and dynamic funding for local decarbonisation projects.

Municipalities and prefectures are moving forward with their own strategies, including support for green start-ups and businesses, innovative initiatives from city government to expand the

[1] "Aggregation result or estimation result (comprehensive energy statistics)," *Agency for Natural Resources and Energy*, last modified April 13, 2021, accessed August 18, 2021, pg. 6. [Japanese]

[2] "Share of renewable energy electricity in Japan, 2019 (Preliminary report)," *Institute for Sustainable Energy Policies,* last modified April 10, 2020, accessed August 4, 2021.

usage of renewable energy, and resident-centred coalition-building and awareness-raising. While there are many advantages, there are also challenges to a locally tailored approach to decarbonisation, including resident concerns about the dangers of renewable energy development, lack of qualified personnel, digital tools, and limited funding for transformational municipal projects.

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List of abbreviations

ADF	Agency-Delegated Function
ANRE	Agency for Natural Resources and Energy (part of METI)
BEP	Basic Energy Plan
CCUS	Carbon Capture, Usage and Storage
CEEJA	European Centre for Japanese Studies in Alsace
CLAIR	Council of Local Authorities for International Relations
EJRC	EU-Japan Regional Cooperation
EMS	Environment Management System
EU	European Union
EV	Electric vehicle
GHG	Greenhouse gases
ICT	Information and Communications Technologies
IEA	International Energy Agency
IGES	Institute for Global Environmental Strategies
ISEP	Institute for Sustainable Energy Policies
ISEP	Institute for Sustainable Energy Policy
JETRO	Japan External Trade Organization
METI	Ministry of Economy, Trade and Industry
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MOE	Ministry of Environment
MoU	Memorandum of Understanding
MW	Megawatt
NDC	Nationally Determined Contribution
PM	Prime Minister
PV	Photovoltaic
SME	Small and Medium-sized Enterprise
SST	Sustainable Smart Town
UNFCCC	United Nations Framework Convention on Climate Change

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Methodology

This report was developed through a combination of desk research and interviews. These interviews were conducted with over 20 individuals based in both Europe and Japan, including policymakers, researchers, and business professionals from a range of sectors.

Figures concerning Japan's CO_2 emissions are sourced from the Global Carbon Project and Our World in Data. Energy production and consumption figures are sourced from Japan's Agency for Natural Resources and Energy (ANRE), housed within the Ministry of Economy, Trade and Industry (METI). Data from the International Energy Agency (IEA)'s Japan Energy Policy Reviews are also used in reference to Japan's energy mix.

Figures originally available in Japanese have been translated into English by the author of this report. These constitute provisional and unofficial translations. When sources are written in Japanese, [Japanese] is used to indicate this in the footnotes. Emphasis (bolding, italics) in each of the quoted sections has been added by the author of this report and is not present in the original, unless otherwise stated.

The annex contains a breakdown of Japan's energy sources (fossil fuels, renewables, nuclear, and others). This section may be useful for newcomers to Japan's energy landscape.

Defining Net-zero

The growing public conversation around climate change and its associated adaptation and mitigation strategies have given rise to an encyclopaedia of terms: carbon-neutral, carbon-zero, net-zero, and decarbonisation, among others. The definitions of these terms can vary depending on the context of their usage, which can complicate cross-national or cross-sectorial comparison.

"Net-zero" is emerging as the preferred term to describe decarbonisation commitments on the international level, but this term too is ambiguous, often lacking scope and concrete specifications when deployed in pledges.[3] It is necessary to examine the language of the commitments to net-zero to understand what "net-zero," in each case is referring to.

The EU Commission has set out a vision to: "…confirm Europe's commitment to lead in global climate action and to present a vision that can lead to **achieving net-zero greenhouse gas emissions by 2050** through a socially-fair transition in a cost-efficient manner."[4] This vision describes its view on decarbonisation based on the Paris Agreement, which aims to: "**achieve a balance between emissions by sources and removals by sinks of greenhouse gases on a global**

[3] For more information about net-zero, and strategies to address the issue of ambiguity, see: Rogeli et al., "Net-zero emissions targets are vague: three ways to fix," *Nature*, March 18, 2021.
[4] "A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy," *EU Commission*, November 28, 2018, pg. 3.

scale in the second half of this century."[5] The EU approach is premised on energy efficiency, reduction of energy usage, renewable energy transition (which speak to addressing "emissions by sources"), and carbon capture ("removal by sinks").

As expressed by PM Suga, the Japan approach is worded in a similar manner: "**We hereby declare that by 2050 Japan will aim to reduce greenhouse gas emissions to net-zero, that is, to realize a carbon-neutral, decarbonized society.**"[6] Japan is also party to the Paris Agreement, and its actions towards fulfilling its Nationally Determined Contribution (NDC) suggest that the government views its decarbonisation strategy as premised on technological innovation (particularly in hydrogen and ammonia fuels), carbon offsetting, emissions reductions (by increasing electrification and energy efficiency, as well as growing the renewable sector), and carbon removal and negative emissions technologies.[7]

"Decarbonisation" will be used throughout this report to refer to a reduction and elimination of total CO_2 produced through human activities.[8] The definition of "net-zero" will depend on its contextual usage, but it is possible to refer to the above descriptions from the EU and Japan to better understand the scope of the term in a given example.

[5] Ibid. pg. 4.
[6] Prime Minister of Japan and His Cabinet, "Policy Speech by the Prime Minister to the 203rd Session of the Diet," *Speeches and Statements by the Prime Minister*, last modified October 28, 2020.
[7] "Submission of Japan's Intended Nationally Determined Contribution (INDC)," *Ministry of the Environment*, Government of Japan, March 30, 2020.
[8] This report will not address demethanisation. Managing methane is a key problem for global emissions reduction, but is beyond the scope of this report.

1. Introduction

The recovery from COVID-19, the transition to a digitalized society, the revitalization of rural areas, the development of a circular economy: these are some of the challenges on Japan's horizon, as voiced by the nation's political representatives. **Enveloping all these challenges, both literally and figuratively, is the changing global climate.**

Future-proofing Japan's society and economy by embracing the green transition became, in fall 2020, a central pillar of the administration of Prime Minister (PM) Suga. In his inaugural speech to the Diet, **PM Suga pledged to achieve the net-zero target in Japan by 2050**, noting that "proactive climate change measures bring transformation of industrial structures as well as our economy and society, leading to dynamic economic growth."[9] Suga's statement echoes a larger hope: that new energy technology and infrastructure can jumpstart economic growth in declining areas in addition to reforming Japan's reputation as a heavy user of fossil fuels.

Meaningfully lowering the carbon intensity of Japan's economy and society will necessitate buy-in from all stakeholders and transformation at all scales, from micro to macro. The Suga administration has acknowledged the key importance of local actors in facilitating the green transition, and policy is quickly changing to provide additional opportunities for local-level decarbonisation. Political representatives have developed an organizational network—the National and Regional Decarbonisation Council—for national and local collaboration which serves to promote the portfolio of environmental policy tools and subsidies that exist for municipalities in Japan. Opportunities at the nexus between private enterprise and municipal governments in the form of business collaborations and subsidies have also increased in number and visibility. International cooperation on decarbonisation is a feature of the ongoing transformation as well, with many European cities, businesses, and clusters working on-the-ground with Japanese municipalities.

Japanese villages, towns, cities, and prefectures are well-positioned to respond to context-dependent challenges, including resident engagement and location-specific industrial transformation. The vast majority of Japan resides in cities, and cities are at the heart of all economic activity, and so it is not trivial matter to reflect on how the urban world might transform itself into a greener place.

In this report, **we explore Japan's energy policies, including recent reforms targeted at local actors, and examples of locally focused collaboration between businesses, municipalities, and clusters that can illuminate the path forward.** We aim to provide a comprehensive picture of current, on-the-ground tools available to municipalities and their partners in the public and private sectors.

[9] Prime Minister of Japan and His Cabinet, "Policy Speech by the Prime Minister to the 203rd Session of the Diet," *Speeches and Statements by the Prime Minister*, last modified October 28, 2020.

2. Japan's Energy Landscape: Needs and Opportunities

Section Summary:

In 2018, Japan was the sixth-highest emitter of CO_2 in the world, largely due to its dependence on fossil fuels. Oil, coal, and natural gas make up nearly 85% of Japan's total primary energy supply.[10] In addition, coal and natural gas are used to produce most of Japan's electricity.[11]

Several laws and policy frameworks govern Japan's response to climate change.

- **The Global Warming Countermeasures Law (1998)**, which was most recently updated in 2021 to grant more autonomy to cities and regions, was developed in response to the Kyoto Protocol and the need to reduce country-wide GHG emissions.
- **The Basic Energy Plans** (BEPs), produced every three years as instituted by **the Basic Act on Energy Policy (2002)**, present cogent descriptions of Japan's energy policy, including intended changes to the shares of fuels that make up the energy mix.
- **The Act Concerning Promotion of Low-Carbon Cities (2012)** was developed to help municipalities create Action Plans (part of the Global Warming Countermeasures Law).
- **The Green Procurement Act (2000) and the Green Contracting Law (2007)** create regulations and guidelines to govern public procurement in cities and regions.
- The reform of Japan's electricity market, which has been ongoing incrementally for decades but experienced a policy push in the form of **the Amended Electricity Business Act (2013)**, has had significant implications for electricity retail.

Meeting the 2050 net-zero goal will require Japan to continue developing its renewable energy sector and emphasise energy efficiency and decreased power usage across sectors. It is expected that nuclear energy will remain an important part of the energy mix.

[10] "Aggregation result or estimation result (comprehensive energy statistics)," *Agency for Natural Resources and Energy*, last modified April 13, 2021, accessed August 18, 2021, pg. 6. [Japanese]

[11] "Share of renewable energy electricity in Japan, 2019 (Preliminary report)," *Institute for Sustainable Energy Policies,* last modified April 10, 2020, accessed August 4, 2021.

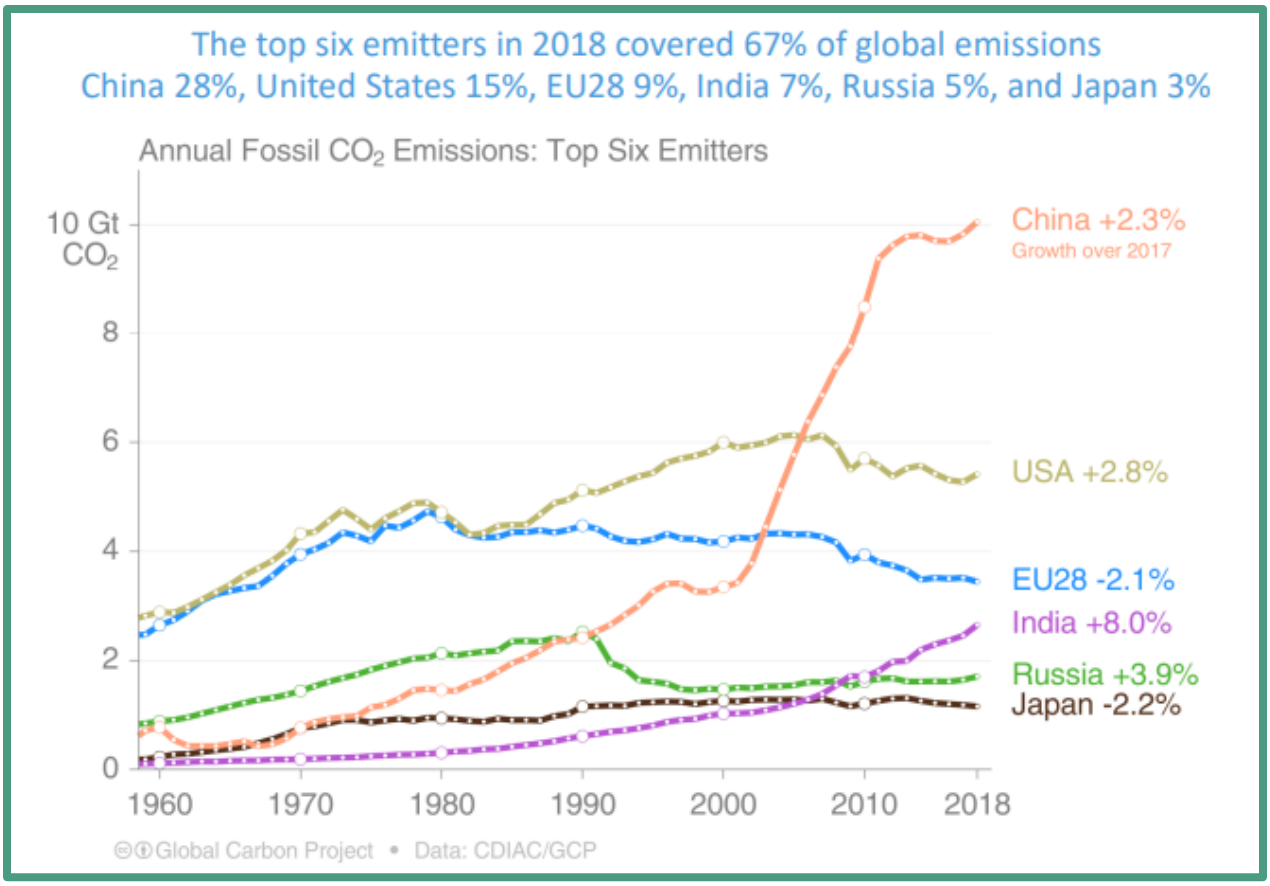
Japan's relationship to environment and energy, as well as the role of the environment in the public consciousness, has been in constant flux over the past fifty years. Japan's "Four Big Pollution Diseases," the latter three of which took place in the 50's and 60's, refer to a set of four diseases in which corporate environmental pollution was directly implicated, and which were influential in shaping policy and public understanding around environmental contaminants. Media coverage of these illnesses led directly to the creation of the Environmental Agency (now Ministry of Environment) in 1971, and **strong opposition to harmful pollution from activists resulted in several laws addressing environmental pollution** and pollution-related health damages.[12] While it may be simple to paint Japan's contemporary urban history in shades of smoggy grey, **there is more to the nation's cities than a polluted past**. It has been argued that Edo (now called Tokyo) was the first "eco-city," as city planners made efforts to harmonize the urban environment with the natural environment.[13] The "garden city" concept was popular in Tokyo as early as the beginning of the twentieth century, and the legacy of this concept is still identifiable in many urban areas, including Den'enchofu, a Tokyo planned community.[14]

Similarly, **circular economy**, which describes the systematic shift away from extractive industrial model towards a regenerative economic cycle,[15] **is not new to Japan**; the concept enjoyed mainstream attention as early as the 80's, with the creation of an ecosystem of terms including "amenity town," "eco-polis," and "eco-town," all representative of the intention to merge public policy, urban planning, and circular practices. These terms continue to be part of Japan's messaging on urban development in the form of city-level programmes including the "Eco-City" and "Future City" programmes.

2.1. Situating Japan's CO_2 Emissions in the Global Context

Japan is the world's third-largest economy. According to Global Carbon Project, **the nation is also the sixth-highest emitter of CO_2, accounting for 3% of total global CO_2 emissions in 2018**.[16,17]

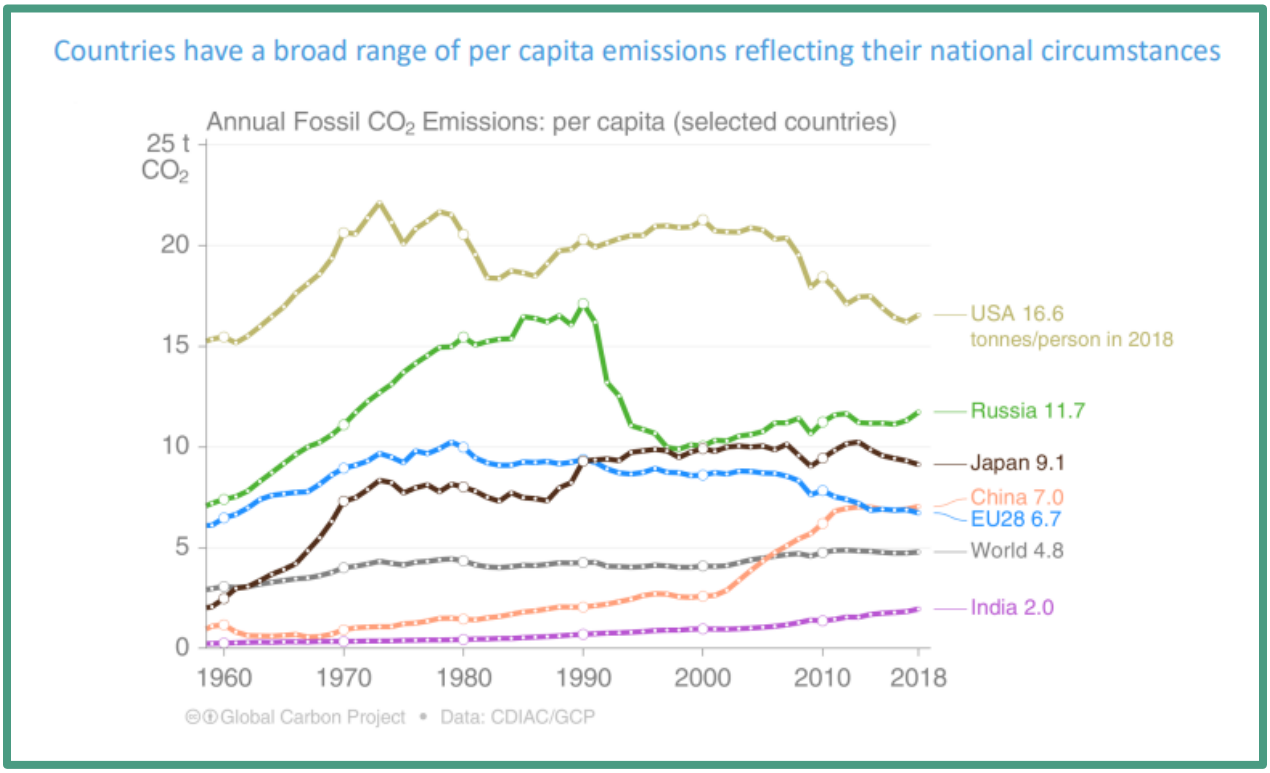
[12] "The History of Japan's Air Pollution," *Aozora Foundation*, July 22, 2011.
[13] Morris Low, "Eco-cities in Japan: Past and Future," *Journal of Urban Technology* 20.1 (2013): 11, pg. 9.
[14] Ibid, pg. 11.
[15] Helene Bangert, "Japan's Circularity," *Minerva Past Reports: EU-Japan Centre for Industrial Cooperation*, pg. 9.
[16] "Global Carbon Budget 2019," *Global Carbon Project*, December 4, 2019.
[17] Please note that accounting for CO_2 emissions exclusively not does provide the most complete measure of greenhouse gas (GHG) emissions. Other gases, such as methane, are significant contributors to climate change.



Source: Global Carbon Budget 2019 (with data sourced from: CDIAC; Peters et al 2019, Friedlingstein et al 2019; Global Carbon Budget 2019)

Figure 1: Six highest CO2 emitters in 2018

Of these six highest emitters, Japan has the third-highest per capita emissions rate.[18,19]



Source: Global Carbon Budget 2019 (with data sourced from: CDIAC; Friedlingstein et al 2019; Global Carbon Budget 2019)

Figure 2: Annual fossil CO2 emissions per capita (selected countries)

The timeline of Japan's history vis-à-vis its carbon emissions tells a story of changing trends in industry and consumption. It also reveals the outsize impact of key events in Japan's modern history.

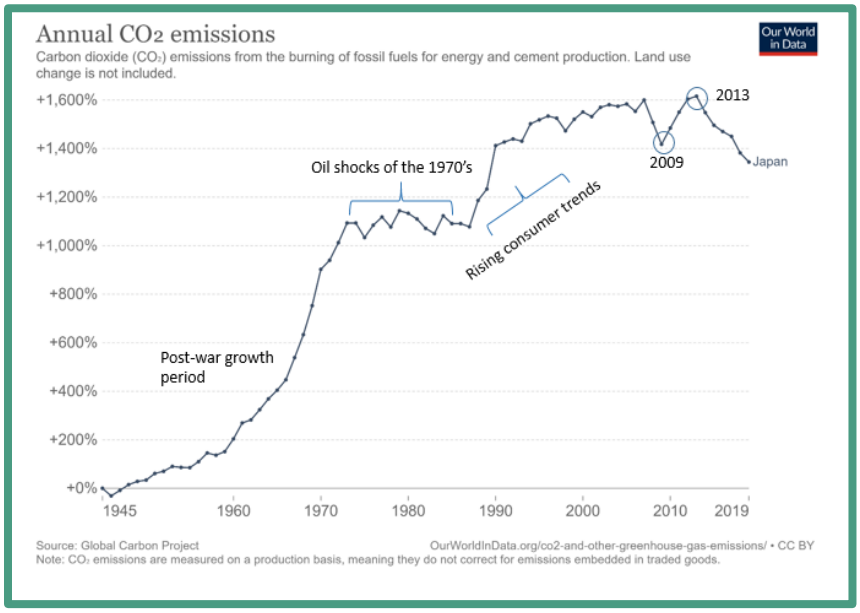
In the early years of the Japanese "economic miracle," Japan experienced an explosion of industrial growth, which quickly led to greater emissions, as well as noticeable air and water pollution and subsequent impacts of these on human health.

The oil shocks of the 1970's prompted Japan to move to decouple itself from foreign oil and invest in energy efficiency measures, leading to a corresponding decline in emissions. However, **emissions ramped up again in the 80's and 90's alongside an increase in consumer spending.**

In 1989, CO_2 annual emissions in Japan crossed 1 billion metric tons (t) and have crossed that threshold every year since. The 2008 global financial crisis and the 2011 triple disaster in

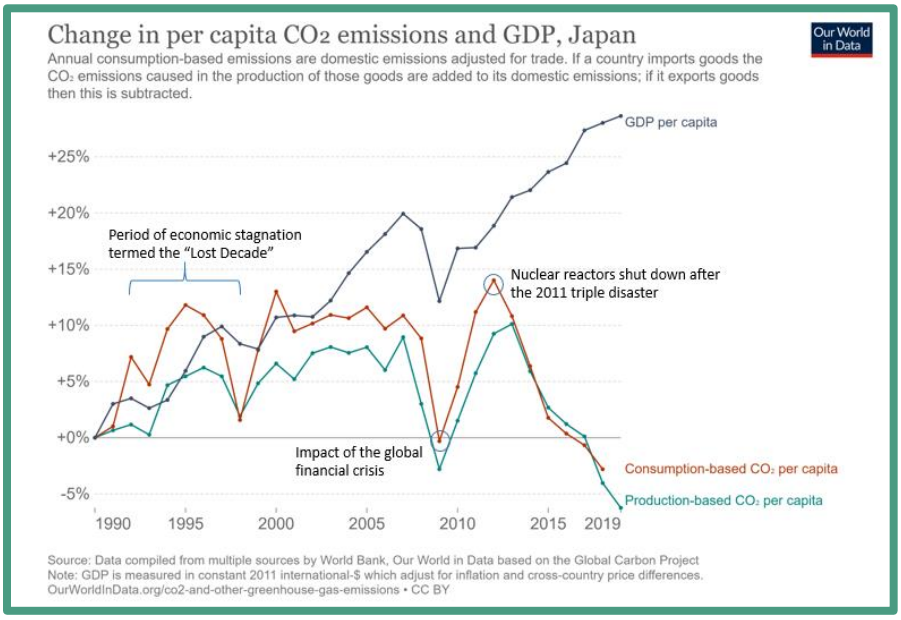
[18] "Global Carbon Budget 2019," Global Carbon Project, December 4, 2019.
[19] Please note that different sources may position Japan differently in their rankings based on their assessment of the data. Emissions may be evaluated on a production or consumption basis, and the difference between these can be significant in countries with high exposure to trade.

northern Japan are, from an emissions perspective, the two most salient events in the new millennium. **Japan's per capita emissions experienced a sudden and temporary decrease in 2009** to 9.04 t **due to the effects of the 2008 financial crisis and subsequent recession.** The per capita CO_2 emissions rate quickly bounced back in the years following, **reaching their peak in 2013 at 10.25 t following the 2011 triple disaster,** which required the shut-down of the nuclear fleet and the influx of power derived from LNG and coal to fill the gap.



Source: Our World in Data (with additional information about events added by the author)

Figure 3: Annual CO2 emissions in Japan from 1945 to 2019

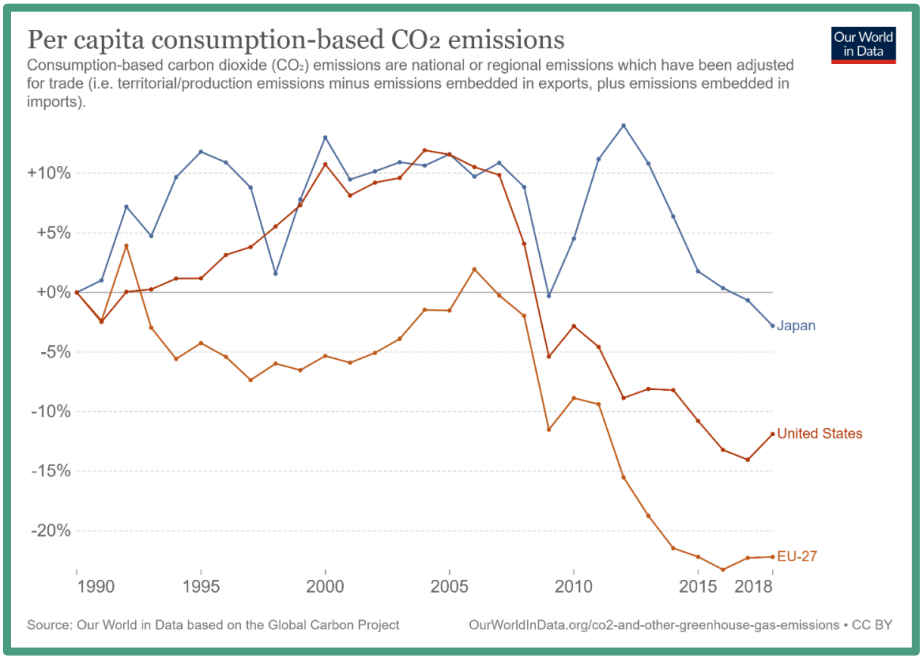


Source: Our World in Data (with additional information about event events added by the author)

Figure 4: Annual per capita CO2 emissions in Japan from 1990 to 2019

In absolute terms, CO_2 emissions in Japan peaked in 2013, reaching a total of 1.31 billion t that year. Recorded total annual emissions have declined every year since. By 2019, this amount had dropped to 1.11 billion t. This is roughly equivalent to the annual amount emitted by Japan nearly thirty years earlier, in 1990 (1.16 billion t).[20] In other words, **the annual recorded emissions in Japan have neither markedly declined nor markedly increased since 1990.**

When it comes to per capita CO_2 emissions, the data show a similar picture. Though the per capita rate of emissions in Japan has fluctuated over the past three decades in response to major events, by 2018, Japan's per capita emissions rate was within striking distance of the rate in 1990.



Source: Our World in Data

Figure 5: Per capita CO2 emissions comparison (Japan, USA, EU-27)

The stability of the per capita rate of emissions in Japan is noteworthy as, between 1990 and 2018, other developed nations significantly reduced their own per capita emissions rates. Comparing Japan and the European Union (EU) can serve as an illustrative example. In 1990, the EU and Japan emitted roughly similar amounts of CO_2 per capita. However, by 2018 per

[20] Hannah Ritchie and Max Roser, "Japan: CO_2 Country Profile," *Our World in Data*, last modified 2020, accessed August 4, 2021.

capita emissions had fallen in the EU to 7.85 t, a reduction of 22% compared with the 1990 figure.[21]

Change in the Rate of Per Capita CO_2 Emissions in Japan, EU, and US from 1990 to 2018				
Country	**1990**	**2018**	**Absolute Change**	**Relative Change**
Japan	10.62 t	10.32 t	-0.3 t	-2.81%
EU[22]	10.09 t	7.85 t	-2.24 t	-22.20%
United States	20.01 t	17.63 t	-2.38 t	-11.89%

Source: Author, with data from Our World in Data

Japan's high CO_2 emissions rate (both in absolute and per capita terms) is mainly a factor of its fossil fuel-heavy energy mix. Japan overwhelmingly relies on fossil fuels to generate its electricity, power its industries and households, and fuel its vehicles. The shutdown of nuclear power plants following the 2011 triple disaster in northern Japan led, in 2013, to a historic peak in emissions and a significant increase in the carbon intensity in Japan's energy. The visible troughs in figures 1 and 2 correspond to the massive influx, post-2011, of coal and natural gas that served to power Japan's electrical grids in the absence of nuclear energy.

While the nation has not yet been able to course-correct away from this carbon-heavy path, the discussion of dependence on fossil fuels is not absent from discussion of energy policy. Indeed, **achieving energy independence has been a mainstay of Japan's political and economic decisions and debate for decades.** This concern is chief among many in the shaping of Japan's energy policy.

Japan has been historically dependent on foreign-sourced fossil fuels, as the nation possesses limited coal and oil resources of its own**. Its energy policies have co-developed alongside this reliance on coal and natural gas, alongside a focus, beginning in the 1950's, on nuclear power.** Once touted as the Japanese candidate for fuel of the future, nuclear power fell into disfavour and disuse following the 2011 triple disaster, though the Liberal Democratic Party (LDP) has unfailingly continued since then to underscore the importance of nuclear in Japan's energy mix. **Today, most of Japan's energy mix is still dominated by fossil fuels, with a small percentage of that mix covered by the growing renewable sector and recovering nuclear sector.**

When it comes to renewables, their history in Japan is filled with false starts. In response to the oil crisis of the 1970's, Japan introduced the Sunshine Project, a solar photovoltaic subsidy programme, which was renewed for funding from 1973 until the year 2000. Despite this and other subsidy programmes, **the share of renewables in Japan was historically extremely low**, and the belief that renewables could not replace coal, LNG, and oil, in the energy mix was

[21] Hannah Ritchie and Max Roser, "Japan: CO_2 Country Profile," *Our World in Data*, last modified 2020, accessed August 4, 2021.

[22] Because the EU negotiates as a bloc in the United Nations Framework Convention on Climate Change, statistics list it as a unit. Of the 27 member countries, only two countries (Portugal and Iceland) have increased their per capita emissions since 1990, and both are low-emitting countries.

widespread among political actors.[23] As a result, renewables in Japan experienced what has been called "a 40-year Dark Age"[24] from the 70's up until the 2010's.

However, Japan is now embracing the potential of renewable energy. Inroads have been made into hydropower, solar, and wind energy, largely thanks to the government's implementation of a feed-in tariff in 2012. By 2019, renewables made up 8% of Japan's total primary energy supply,[25] up from 4% in 2008.[26] **Solar energy in particular has been the dominant player in this surge. Today, Japan is also known on the international stage for its support of newcomer technologies** in a gestational phase, including hydrogen energy. However, these technologies will only bear fruit in the mid- to long-term, and more immediate reduction of GHG emissions, particularly in the context of new decarbonisation goals established by the Suga administration, will require major changes to Japan's energy mix, as well as renewed attention to energy efficiency and energy demand.

With many countries coalescing around the shared goal of carbon neutrality, **Japan has moved to emphasize its commitment to decarbonisation** in various political fora. In October 2020, during his inauguration speech, Japanese Prime Minister Yoshihide Suga made headlines by pledging to achieve net-zero emissions by 2050. Following this pledge, in May 2021, on the heels of U.S. President Joe Biden's Earth Day summit, Prime Minister Suga set the bar high for decarbonisation in Japan by announcing a new government target of 46% reduction of GHG emissions by 2030 compared with 2013 (the peak year for such emissions in Japan).

Sample of Major NDC Pledges Announced at Leaders for Climate Summit 2021	
Country	Main pledge
United States	New 2030 NDC: Pledged to reduce its emissions by 50% -- 52% by 2030 relative to 2005
Japan	New 2030 NDC: Pledged to reduce its emissions by 46% by 2030 relative to 2013
EU	Pledged to embed in law a target of reducing GHG emissions by at least 55% by 2030
Canada	New 2030 NDC: Pledged to reduce by 40%-45% below 2005 levels by 2030
China	Pledged to strictly control coal consumption from 2021-2025 and to begin y phasing out coal from 2026-2030
UK	Pledged to embed in law a 78% GHG reduction below 1990 levels by 2035

[23] Rie Watanabe, "Breaking Iron Triangles: Beliefs and Interests in Japanese Renewable Energy Policy," *Social Science Japan Journal* 24, no. 1 (2021), 9—44, doi: 10.1093/ssjj/jyaa048, p. 10.
[24] Ibid.
[25] "Japan 2021 Energy Policy Review," *International Energy Agency*, last modified May 2021, accessed August 4, 2021, p. 92.
[26] Ibid.

Source: "Warming Projections Global Update," *Climate Action Tracker*, last modified May 2021, accessed August 4, 2020.

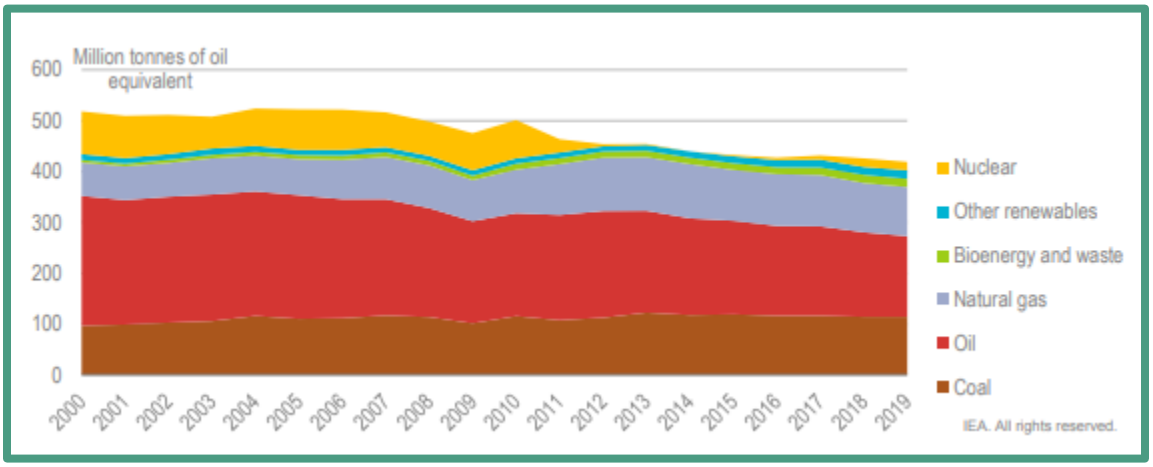
Table 1: Sample of major NDC pledges announced at the 2021 summit

However, as Climate Action Tracker puts it, "the Japanese target of 46% below 2013 levels fell short of expectations that the country would announce halving emissions in 2030, let alone adopt the more than 60% needed to be Paris compatible."[27] As with many other countries, Japan positions its reduction goal relative to its year of peak emissions, which means that the reduction is less significant than if the reduction were occurring relative to another calendar year. However**, the target, while not being Paris-compatible, is still ambitious enough that it is unclear how the Japanese clean energy sector can conclusively meet it.**

2.2. Japan's Energy Mix

In 2019, **fossil fuels accounted for 84.9% of Japan's total primary energy supply** (TPES), which refers to the total amount of power consumed domestically in final use, power generation, or refining activities.[28]

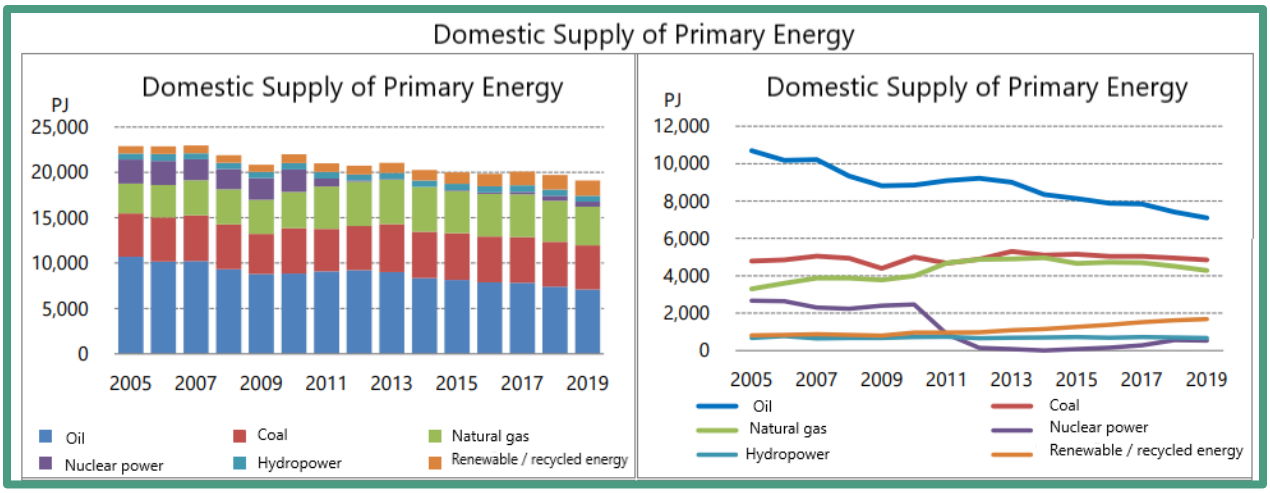
Oil made up 37.1% of Japan's TPES, followed by coal (25.3%) and natural gas (22.4%). Nuclear energy, bioenergy, hydropower, solar power, wind power, as well as what ANRE terms "unused energy" (recycled energy), contributed to the remaining 15.1% of TPES. [29]



Source: IEA, pg. 22

Figure 6: Total primary energy supply by source, Japan, 2000-2019

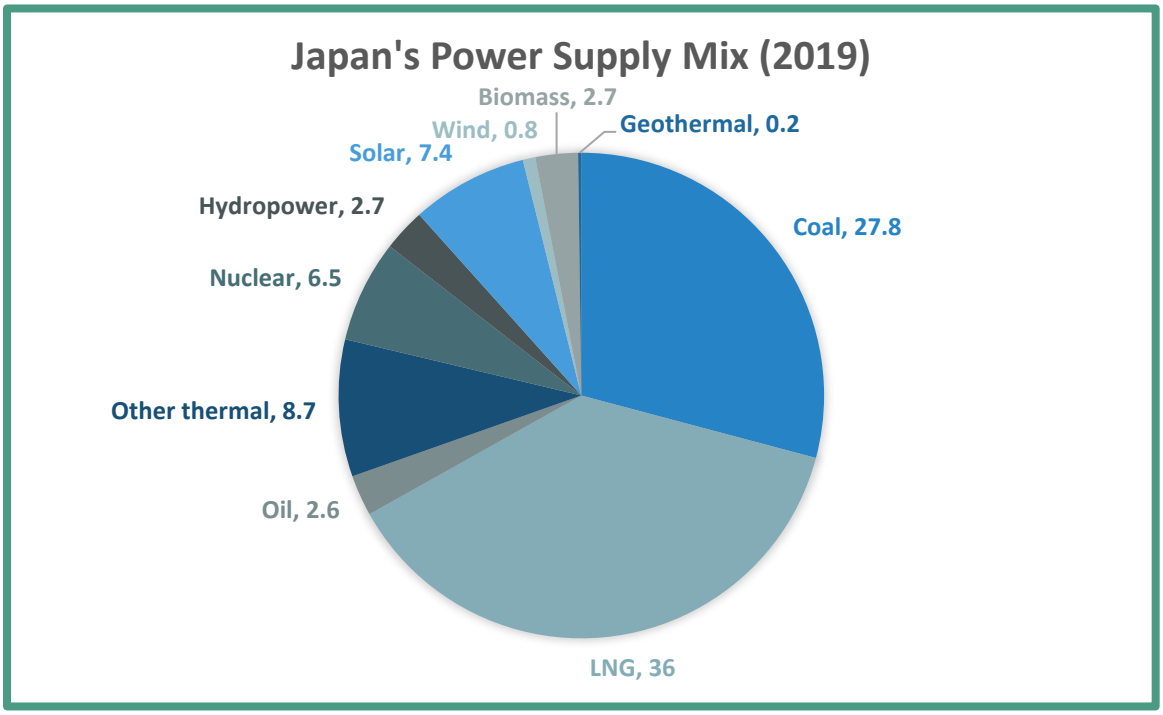
[27] Ibid. p. 3.
[28] "Aggregation result or estimation result (comprehensive energy statistics)," *Agency for Natural Resources and Energy*, last modified April 13, 2021, accessed August 18, 2021, pg. 6. [Japanese]
[29] Ibid.



Source: ANRE (original translated by author)

Figure 7: Domestic supply of primary energy, Japan, 2005-2019

Japan's power generation mix (i.e., the mix of fuel sources used to generate electricity) overwhelmingly favours coal and natural gas. In fiscal year 2019, according to analysis from the Institute for Sustainable Energy Policies (ISEP), coal and LNG accounted for nearly 70% of all electricity generation in Japan. The remaining electricity was generated via hydropower (7.4%), oil (2.6%), solar (7.4%), nuclear (6.5%), biomass (2.7%), wind (0.8%) and geothermal (0.2%).[30]

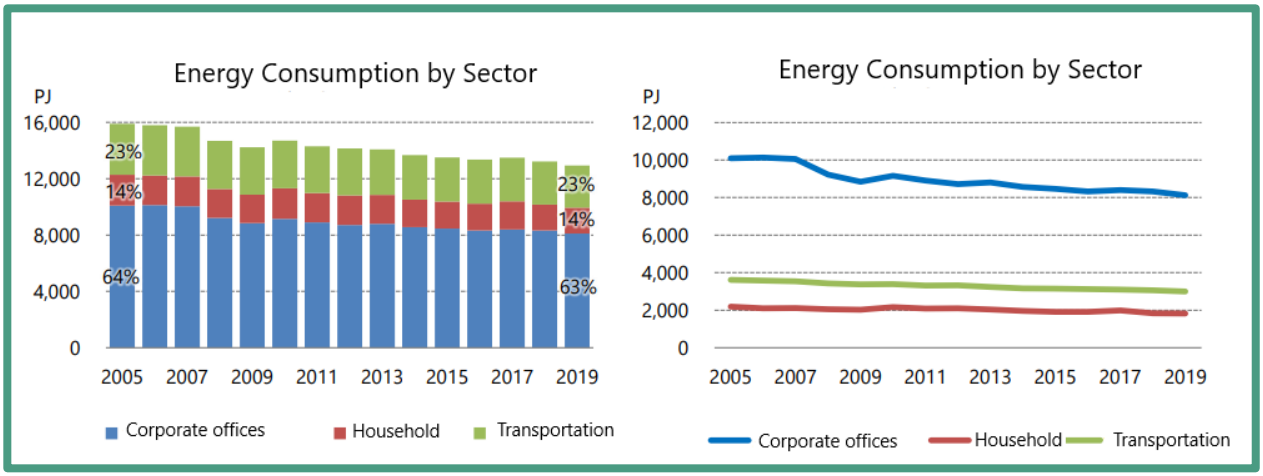


[30] "Share of renewable energy electricity in Japan, 2019 (Preliminary report)," *Institute for Sustainable Energy Policies,* last modified April 10, 2020, accessed August 4, 2021.

Source: ISEP

Figure 8: Japan's power supply mix (2019)

In terms of sectors, ANRE tracks the consumption trends of various sectors, with industry, transportation, and households constituting the most energy-intensive of these.



Source: ANRE (original translated by author)

Figure 9: Energy consumption by sector, Japan, 2005-2019

Energy Consumption by Sector

(単位:10^{15}J [PJ]、%)

Fiscal year	1990	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019 /2013
Energy consumption	13,553	14,711	14,305	14,154	14,086	13,690	13,523	13,355	13,494	13,226	12,942	-8.1%
(% of previous year)		(+3.3)	(▲2.8)	(▲1.1)	(▲0.5)	(▲2.8)	(▲1.2)	(▲1.2)	(+1.0)	(▲2.0)	(▲2.1)	
Company facilities, offices, etc.	8,835	9,160	8,908	8,722	8,808	8,564	8,467	8,322	8,404	8,325	8,118	-7.8%
(% of previous year)		(+3.6)	(▲2.7)	(▲2.1)	(+1.0)	(▲2.8)	(▲1.1)	(▲1.7)	(+1.0)	(▲0.9)	(▲2.5)	
(share %)	[65.2]	[62.3]	[62.3]	[61.6]	[62.5]	[62.6]	[62.6]	[62.3]	[62.3]	[62.9]	[62.7]	
Manufacturing industry	6,361	6,295	6,107	6,066	6,120	5,927	5,864	5,793	5,835	5,794	5,634	-8.0%
(% of previous year)		(+5.1)	(▲3.0)	(▲0.7)	(+0.9)	(▲3.2)	(▲1.1)	(▲1.2)	(+0.7)	(▲0.7)	(▲2.8)	
(share %)	[46.9]	[42.8]	[42.7]	[42.9]	[43.4]	[43.3]	[43.4]	[43.4]	[43.2]	[43.8]	[43.5]	
Agriculture, Forestry, Fisheries, Mining and Construction (% of previous year) (share %)	753	450	459	451	394	383	408	393	400	348	335	-15.0%
	[5.6]	(▲5.2) [3.1]	(+1.9) [3.2]	(▲1.7) [3.2]	(▲12.7) [2.8]	(▲2.8) [2.8]	(+6.6) [3.0]	(▲3.7) [2.9]	(+1.8) [3.0]	(▲13.0) [2.6]	(▲3.7) [2.6]	
Business activities	1,721	2,414	2,342	2,204	2,293	2,254	2,195	2,136	2,169	2,182	2,149	-6.3%
(% of previous year)		(+1.5)	(▲3.0)	(▲5.9)	(+4.0)	(▲1.7)	(▲2.6)	(▲2.7)	(+1.6)	(+0.6)	(▲1.5)	
(share %)	[12.7]	[16.4]	[16.4]	[15.6]	[16.3]	[16.5]	[16.2]	[16.0]	[16.1]	[16.5]	[16.6]	
Household sector	1,640	2,165	2,082	2,103	2,043	1,961	1,908	1,910	1,991	1,835	1,820	-10.9%
(% of previous year)		(+6.6)	(▲3.8)	(+1.0)	(▲2.9)	(▲4.0)	(▲2.7)	(+0.1)	(+4.2)	(▲7.8)	(▲0.8)	
(share %)	[12.1]	[14.7]	[14.6]	[14.9]	[14.5]	[14.3]	[14.1]	[14.3]	[14.8]	[13.9]	[14.1]	
Transportation sector	3,078	3,387	3,315	3,329	3,236	3,165	3,148	3,123	3,099	3,066	3,004	-7.2%
(% of previous year)		(+0.4)	(▲2.1)	(+0.4)	(▲2.8)	(▲2.2)	(▲0.5)	(▲0.8)	(▲0.8)	(▲1.0)	(▲2.0)	
(share %)	[22.7]	[23.0]	[23.2]	[23.5]	[23.0]	[23.1]	[23.3]	[23.4]	[23.0]	[23.2]	[23.2]	
Passenger transport	1,573	2,026	2,002	2,017	1,933	1,862	1,855	1,850	1,838	1,817	1,774	-8.2%
(% of previous year)		(▲0.2)	(▲1.2)	(+0.8)	(▲4.1)	(▲3.7)	(▲0.4)	(▲0.3)	(▲0.6)	(▲1.1)	(▲2.4)	
(share %)	[11.6]	[13.8]	[14.0]	[14.2]	[13.7]	[13.6]	[13.7]	[13.8]	[13.6]	[13.7]	[13.7]	
Cargo	1,505	1,361	1,313	1,312	1,303	1,303	1,293	1,274	1,261	1,249	1,230	-5.6%
(% of previous year)		(+1.4)	(▲3.5)	(▲0.1)	(▲0.7)	(▲0.0)	(▲0.7)	(▲1.5)	(▲1.0)	(▲0.9)	(▲1.5)	
(share %)	[11.1]	[9.2]	[9.2]	[9.3]	[9.2]	[9.5]	[9.6]	[9.5]	[9.3]	[9.4]	[9.5]	

(Note 1) Please note that the latest revision of the standard calorific value by energy source is applied from FY2018.
(Note 2) "2019/2013" is the percentage change from FY2013 in FY2019.
(Note 3) Final energy consumption of each sector includes consumption for non-energy purposes.

Source: ANRE (original translated by author)

Figure 10: Energy consumption by sector, Japan, 2019

For a breakdown of each energy source in Japan—fossil fuels, nuclear energy, renewable energy, and future fuels including hydrogen and ammonia—please see the annex.

2.3. Local Dimensions of Japan's Energy Policy

A close analysis of Japan's recent energy policy can begin with PM Suga's October 2020 speech, which sets the stage for Japan's new commitment to decarbonisation. The full text of the third section of his speech to the Diet (called "realizing a green society," this section is one of nine sections addressed in his policy speech) is reproduced below.

> *My administration will devote itself to the greatest possible extent to bring about a green society, while focusing on a virtuous cycle of the economy and the environment as a pillar of our growth strategy.*
>
> *We hereby declare that* ***by 2050 Japan will aim to reduce greenhouse gas emissions to net-zero****, that is, to realize a carbon-neutral, decarbonized society.*
>
> ***Addressing climate change is no longer a constraint on economic growth.*** *We need to adjust our mindset to a paradigm shift that proactive climate change measures bring transformation of industrial structures as well as our economy and society, leading to dynamic economic growth.*
>
> ***The key here is revolutionary innovations****, such as next-generation solar cells and carbon recycling.* ***We will accelerate research and development*** *aimed at realizing utilization of such technologies in society.* ***We will make our utmost efforts in this area, such as establishing a forum for the national and local governments to conduct a review towards realizing a decarbonized society****, while making green investment more common through the full mobilization of regulatory reforms and other policy measures. Also,* ***we will advance green transformation more efficiently and effectively through digital transformation*** *in fields related to the environment. We will lead the green industry globally and realize a virtuous cycle of the economy and the environment.*
>
> ***We will establish a stable supply of energy by thoroughly conserving energy and introducing renewable energies*** *to the greatest possible extent,* ***as well as by advancing our nuclear energy policy*** *with the highest priority on safety.* ***We will also drastically change our longstanding policies on coal-fired power generation****.*[31]

In Suga's remarks, several "green" tools for transformation, including green innovation, green R&D, digitalization, and green investment, are emphasized. Importantly, Suga addresses the energy policy, which is the foundational consideration when it comes to a country's emissions.

[31] Prime Minister of Japan and His Cabinet, "Policy Speech by the Prime Minister to the 203rd Session of the Diet," *Speeches and Statements by the Prime Minister*, last modified October 28, 2020, accessed August 2, 2021.

In Japan, the **energy policy can be said to be governed by the Basic Act on Energy Policy and the Global Warming Countermeasures Policy Framework**.

For municipalities, other key policies include **the Low Carbon City Act** and **the Amended Electricity Business Act,** which has had important implications for the deregulation of the Japanese electricity market and, from 2022, the electricity grid**.** The deregulation, notably, has made it possible for new, locally based energy providers to grow and proliferate. Sustainable public procurement, the guidelines for which were set down in the **Green Contract Law and Green Procurement Act,** are policies that enable municipal and prefectural government to assess their procurement process.

2.3.1. The Basic Act on Energy Policy and Basic Energy Plans

Japan's Basic Act on Energy Policy was passed by the Japanese government in 2002. In general, **the Act strives to support measures that increase Japan's energy independence, promote solar and wind energy and improved energy consumption efficiency, and employ deregulation and electricity market liberalization** to empower companies to work on improving their performance relative to environmental issues.

The Basic Act also states that public entities, businesses, and citizens all share responsibility in using energy in accordance with the guidelines set out in the Act. The Act itself states its fundamental mission as follows:

> ***The purpose of this Act is****, given that energy is essential for improving the stability of citizens' lives and for maintaining and developing the national economy and that its use has a major impact on the local and global environment,* ***to promote measures on energy supply and demand*** *on a long-term, comprehensive and systematic basis* ***by laying down the basic policy*** *and* ***clarifying the responsibilities of the State and local public entities*** *with respect to measures on energy supply and demand and by prescribing matters that form the basis of measures on energy supply and demand, thereby* ***contributing to the preservation of the local and global environment and to the sustainable development of the Japanese and global economy and society****.*[32]

The Basic Act on Energy Policy compels the government to institute specific forms of accountability and record-keeping. First, **the Act requires the government to submit a yearly report to the Diet** on the energy measures taken in that year. This yearly report is **called the "Energy White Paper,"** and it is available in a summarized form in English online.[33]

Furthermore, **the Act sets out the parameters for a "Basic Energy Plan" (BEP), to be created on a schedule of once every three years.** The BEP contains information regarding basic energy policy, measures related to the supply and demand of energy, and technology relevant to energy policy. As a METI press release indicates, the objective of the BEP is "to show to the

[32] "Basic Energy Policy," Japanese Law Translation, June 30, 2021.
[33] "Energy White Paper 2020 (Summary)," *Agency for Natural Resources and Energy,* June 2020.

public the basic direction of Japan's energy policy under the Basic Act on Energy Policy."[34] The BEP is therefore a major vehicle of information regarding Japan's energy outlook, and is covered widely by domestic and global actors upon publication.

Energy security, economic efficiency, environment (the three "E"s), and safety (the "S") are the pillars of Japanese energy policy. These values are succinctly represented in policy materials via "S + 3E," which has long been Japan's chief mission statement where energy is concerned.

As the fifth Basic Energy Plan, released in 2018, puts it:

> *The point of the energy policy is to first and foremost* ***ensure stable supply*** *("Energy Security"), and* ***realize low cost energy supply by enhancing its efficiency*** *("Economic Efficiency")* ***on the premise of "Safety."*** *It is also important to* ***make maximum efforts to pursue environment suitability*** *("Environment").*[35]

Source: METI

Figure 11: S + 3E diagram of Japanese energy policy

2.3.1.1. The 6th Basic Energy Plan

Five BEPs have been approved in Japan since the publication of the Basic Act on Energy Policy. The 6th is scheduled to be released in 2021. Initially, the development of the 6th BEP was mired in political disagreements and public backlash regarding the inclusion of nuclear energy in the plan.[36] A line about "fully utilizing nuclear assets" was removed from the plan after both public opinion and insider political voices coalesced around an anti-nuclear position.[37] However,

[34] "Cabinet Decision on the New Strategic Energy Plan," *METI*, July 3, 2018.
[35] "5th Strategic Energy Plan," *METI*, 2018, pg. 15.
[36] Mari Iwata, "As Nuclear Concerns Rise, Japan Delays Energy Plan," *The Wall Street Journal*, January 14, 2014.
[37] "Government removes 'maximum use' of nuclear power plants," *Kyodo News*, June 3, 2021. [Japanese]

in the end, no changes were made to reduce the nuclear target in a subsequent draft, despite opposition.

In July 2021, METI published a second draft version of the 6th BEP. **In late October 2021, the Cabinet voted on and officially approved the 6th BEP.**[38]

	5th BEP (2018)	6th BEP (2021)
GHG emissions reduction	26%	46%
Renewable power share	22%-24%	36%-38%
Nuclear power share	20%-22%	20%-22%
Coal-powered electricity share	26%	19%
Hydrogen share	X	1%

Source: Author, with data from the 5th and 6th BEPs

Table 2: 5th and 6th BEP comparison

The 6th BEP updates several provisions of the 5th BEP, showcasing Japan's increased ambition and commitment to a carbon-free future, with a few caveats.

The 5th BEP, published in 2018, aimed for a 22%-24% share of the energy mix for renewables.[39] **The 6th BEP has revised this target upwards, formalizing Japan's intention to generate 36%-38% of its energy from renewable sources by 2030.** The Renewable Energy Institute (REI) notes that this is a promising development, but that it is still lower than the 2030 target set by many European nations.[40] Given that the draft mentions that this target will be raised in light of future developments, REI asks the government to "urgently implement measures such as power system reform, a series of regulatory reforms and the introduction of carbon pricing" and to broaden the scope of its ambitions.

The 5th BEP aimed for **a 20%-22% share for nuclear energy in 2030**. Despite the aforementioned disagreement surrounding this target, it was ultimately left unchanged in the 6th BEP. REI notes that this target will require the restarting of Japan's entire nuclear fleet, including several reactors that will need to receive a license extension to remain operational.

Coal will play a diminished, though still important, role in Japan's energy mix in 2030. The previous BEP listed 26% as the target for coal-powered electricity, but **the 6th BEP aims for 19% of electricity to be generated by coal in 2030.** For reference, in 2019, 31.9% of Japan's electricity was generated by coal. REI is highly critical of this continued reliance on coal, stating that "it has to be said that the proposed energy mix, which makes clear the continued use of

[38] "Cabinet Decision on the Sixth Strategic Energy Plan," *METI*, October 28, 2021.
[39] "Japan's New Basic Energy Plan Until 2030 Approved," *EU-Japan Centre for Industrial Cooperation*.
[40] "Comments on the Proposed Power Supply Mix for 2030," *Renewable Energy Institute*, July 26, 2021.

coal-fired power, casts doubt on the seriousness of Japan's commitment to avoiding a climate crisis."

Notably, hydrogen is included in the 6th BEP. **The draft BEP proposes a hydrogen supply chain**, and adds this energy source to the proposed energy mix for the first time.

2.3.2. The Global Warming Countermeasures Policy Framework

The Act on Promotion of Global Warming Countermeasures was first enacted in 1998, after the ratification of the Kyoto Protocol, and revised in 2016 and 2021. The 2021 Revised Act responds to Japan's increasing ambitions to reduce GHG emissions in line with the Paris Agreement and PM Suga's carbon neutrality declaration in 2020. **The revision also explicitly creates provisions for the incentivisation and promotion of regional and local decarbonisation plans**, as well as new regulations to speed up the digitalized disclosure of private-sector emissions data.

As part of the promotion of regional and local decarbonisation, **this Revised Act sets out a robust set of new regulations aimed at simplifying the approval process of new renewable energy development and improving consensus-building** among residents and other stakeholders.

Key Aspects of the 2021 Revision of the Act on Promotion of Global Warming Countermeasures and their Impacts					
Incorporating the Paris Agreement and Suga's carbon neutrality declaration (*Article 2-2*)	Clarifies the standing of Suga's declaration as a basic legal principle rather than simple declaration	Legally recognizes the Paris Agreement targets	Legalizes long-term direction of Japan's climate change strategy	Ensures predictability of the initiatives undertaken by stakeholders including private and public entities	**Stability of commitment to decarbonisation is hoped to encourage innovation across society**
Promoting regional decarbonisation (*Article 22-2*)	Introduces the Regional Decarbonisation Promotion Project Planning System	Simplifies certification process for eligible Promotion Projects	Imposes requirement on cities to publicize Action Plan for Promotion Projects	Promotes consensus-building regarding green energy among local stakeholders (via the Action Plan)	**New renewable energy developments are aimed at revitalization of regions**
Enhancing digitalization and dissemination of GHG emissions data (*Article 29 onwards*)	Digitalizes the process of reporting emissions from the private sector	Requires business operators of certain size to report emissions	Abolishes request-based disclosure, and reduces the disclosure time required from 2 years to 1 year (or less)	Speeds up access to information regarding emissions and disclosures for investors	**Enhanced transparency is hoped to promote further ESG investment**

Source: Author, with data from Anderson Mori & Tomotsune, "Overview of the Revised Act on the Promotion of Global Warming Countermeasures and its Practical Impact" and Junko Ota, "Zero-Carbon Movement in Japan: Current Situation and Challenges"

Table 3: Key Aspects of the 2021 Revision of the Act on Promotion of Global Warming Countermeasures and their Impacts

2.3.3. Reforming the Electricity Market

The Japanese government substantially reformed its electricity market in 2013 via the Amended Electricity Business Act. [41] While the electricity industry had previously resisted proposed changes, the events of the 2011 triple disaster exposed major fault lines in Japan's power system, thereby generating strong political support for reform. As a result, the gradual liberalization of the electricity market, which had partially begun in the 90's, experienced rapid acceleration. **By April 2016, the Japanese electricity retail market was completely liberalized**, and included by this point low-voltage customers (households).

Prior to market reform, Japan's electricity market had been dominated by 10 regional utilities, each of which controlled the electricity supply in their respective area. These utilities controlled generation, transmission, distribution, and retailing of energy, thus effectively monopolizing the industry.

Major Electric Utilities in Japan (pre-2013)[42]	
Company	Region served
Hokkaido Electric Power Company (HEPCO)	Hokkaido
Tohoku Electric Power Company (TOHOKUDEN)	Aomori, Iwate, Akita, Miyagi, Yamagata, Fukushima, Niigata
Tokyo Electric Power Company (TEPCO)	Tokyo, Kanagawa, Saitama, Chiba, Tochigi, Gunma, Ibaraki, Yamanashi, Shizuoka
Chubu Electric Power Company (CHUDEN)	Aichi, Mie, Gifu, Shizuoka, Nagano
Hokuriku Electric Power Company (HOKUDEN)	Gifu, Toyama, Ishikawa, Fukui
Kansai Electric Power Company (KEPCO)	Osaka, Kyoto, Hyogo, Nara, Shiga, Wakayama, Fukui, Gifu, Mie
Chugoku Electric Power Company (CEPCO)	Tottori, Shimane, Okayama, Hiroshima, Yamaguchi, Hyogo, Kagawa, Ehime
Shikoku Electric Power Company (YONDEN)	Kagawa, Kochi, Tokushima, Ehime
Kyushu Electric Power Company (KYUDEN)	Fukuoka, Saga, Nagasaki, Oita, Kumamoto, Miyazaki, Kagoshima
Okinawa Electric Power Company (OKIDEN)	Okinawa

Source: Author, with data from Selectra

Table 4: Major Electric Utilities in Japan (pre-2013)

In addition to casting significant doubt on the long-term reliability of nuclear energy, the 2011 triple disaster led to blackouts caused by inadequate power supply. Japan is served by two separate and incompatible power grids that operate on different frequencies due to historical

[41] "Electricity System Reform in Japan," *Anderson Mori & Tomitsune*, January 2014.
[42] Fanny Berteaud, "Overview and History of the Japanese Electricity Market," *Selectra*, January 16, 2020.

differences in generator usage dating back to the 19th century. Because of this, **different regions of Japan are not easily able to supply energy to one another in case of a shortage**; this became obvious to many across Japan during the blackouts. The monopoly of the electrical utilities, coupled with infrastructural differences between Japan's two main grids, resulted in a fragmented national electrical grid relatively inflexible to spikes in demand.

The Japanese government was also prompted to seriously consider reform due to its strong interest in shifting to a system that encourages electricity saving and promotes demand response during peak times of electricity consumption, rather than simply supplying electricity in accordance with demand.

The reforms of the electricity market have had a significant impact on localities in Japan. "Local production for local consumption" is a popular phrase among business leaders and policy makers working on energy in Japan, and **the market reforms made it possible for smaller, locally tailored energy providers to emerge and proliferate.** One example is Shonan Electric Power, which since 2014 has supplied primarily renewable energy generated within Kanagawa Prefecture to households and businesses in that same prefecture.[43]

2.3.4. Act Concerning Promotion of Low-Carbon Cities

The Act Concerning Promotion of Low-Carbon Cities, also known as the Eco-City Act, was enacted in December 2012, following the release, two years prior, of the Low-Carbon City Development Guidance.[44] A translation into English of the Guidance developed by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), is available online.[45]

The Guidance was developed in part to assist municipalities in creating their Action Plans based on the Global Warming Countermeasures Law. Separately, in 2010, the Ministry of Environment published the Manual of the Action Plan for Greenhouse Gas Emission Reduction in Local Government Operations, also intended for municipalities developing action plans.[46]

MLIT's Low-Carbon City Development Guidance sheds light on the governmental perspective on sustainable urban development. The Guidance uses the comparative example of the cities of Maebashi and Kochi, which have similar area and population but are nonetheless very different in terms of CO_2 per capita emissions rate (in terms of passenger transport). Using data from the 2006 Environmental White Paper, the Guidance points out that Maebashi's annual rate is 40% higher than Kochi's rate due to its lower urban density and higher dependence on passenger vehicles.

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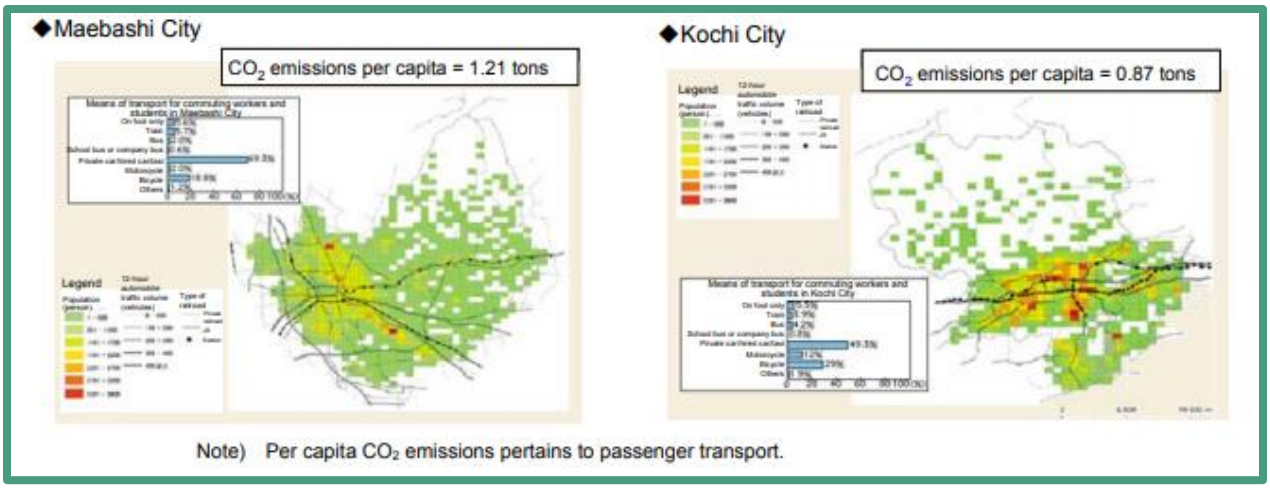
[43] "FAQ," *Shonan Electric Power Co., Ltd*. [Japanese]
[44] "Major Actions for Low Carbon City Development," *Low Carbon City Development*, Ministry of Land, Infrastructure, Transport and Tourism.
[45] "Low Carbon City Development Guidance [Digest]," Ministry of Land, Infrastructure, Transport and Tourism.
[46] "Publication of "The Manual of the Action Plan for Greenhouse Gas Emission Reduction in Local Government Operations - Abridged Version (1st Edition)" and information sessions for the Non-Designated Municipalities," Ministry of Environment, August 2, 2010.



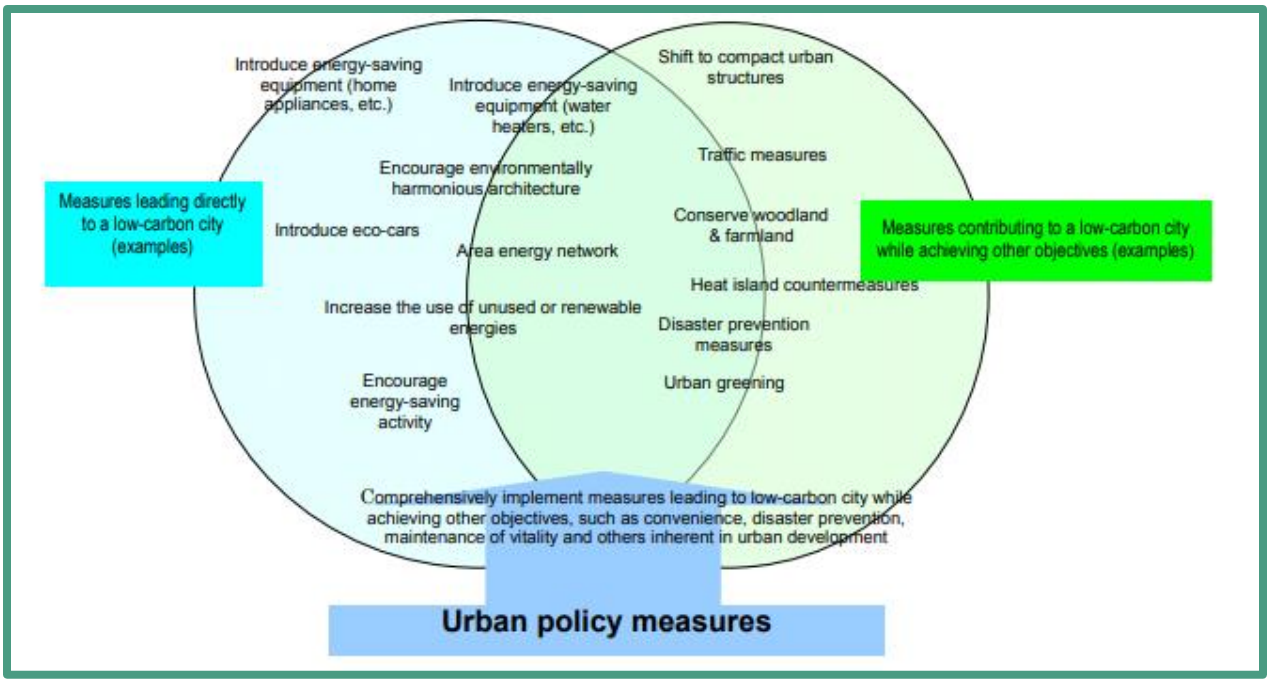
Source: MLIT

Table 5: Per capita CO2 emissions in Maebashi versus Kochi

The accommodation of growing population in suburbs and exurbs has led to "dispersed urban functions," and an increasing amount of passenger cars commuting in and out of city centres. This can contribute to environmental stress, higher CO_2 emissions, and traffic congestion, which adversely affects quality of life. This has prompted a shifting towards the "compact city" as an alternative to poorly connected urban sprawl.[47]

The Guidance also points out city characteristics that can go hand-in-hand with higher emissions. These include: the increasing number of high-rise office buildings and large retail centres, particularly those that operate 24/7; increasing average size of homes, consumer trends towards larger appliances; buildings that are not energy-efficient; the heat island effect, which results in greater amounts of energy spent on cooling; and, the loss of green spaces/carbon sinks in urban spaces.[48]

[47] "Low Carbon City Development Guidance [Digest]," Ministry of Land, Infrastructure, Transport and Tourism, pg. 6.
[48] Ibid, pg. 5.



Source: Overlapping Urban Development Policies and Low Carbon Measures (from Low Carbon City Development Guidance)

Figure 12: Overlapping urban development policies and low carbon measures

The Guidance proposes nine policies within three thematic areas: urban restructuring and transport development, energy efficiency and renewable energy, and nature conservation.

Policies Proposed in the Low-Carbon City Development Guidance		
(1) Urban Restructuring and Transport Development: A Shift from the Sprawling Urban Structure to a Compact Form	Policy 1: *Shaping a Compact Urban Structure*	Locating public facilities and service establishments in integrated centers and attracting residents close by
		Levelling energy demand by promoting mixed land use
		Locating or relocating large users of heat close to untapped energy sources
		Forming a metropolitan green network by increasing greenery in the built-up areas and conserving green belts or zones in the outlying areas
	Policy 2: *Shaping Traffic Flows*	Developing road links to allow smoother flows of motorized traffic
		Managing transport demand
	Policy 3: *Promoting the use of public transport*	Developing public transport facilities and improving their services
(2) Efficient Energy Consumption and New and Renewable Energy Sources: Transforming High Energy Urban Activities	Policy 4: *Replacing Built-up Areas with Energy Saving Low Carbon Buildings*	Raising energy efficiency on occasions for renovating existing buildings
		Inducing location or relocation of eco-minded buildings
	Policy 5: *Establishing Area Energy Networks*	Introducing an area energy network on occasion of land use readjustment
	Policy 6: *Utilizing Untapped and Renewable Energy Sources*	Connecting available untapped energy sources with potential users
		Utilizing renewable energy sources
		Establishing area networks for utilizing untapped and renewable energies on occasions of urban redevelopment
(3) Conserving Green Spaces and Greening Urbanized Areas: Towards Urban Symbiosis with Nature	Policy 7: *Securing Adequate CO_2 Sinks*	Conserving and creating green space
		Collaborating with citizens for urban greening
	Policy 8: *Expediting Utilization of Wood-based Biomass*	Utilizing wood-based biomass obtainable as byproducts from greening and conservation efforts
	Policy 9: *Improving Thermal Environment by Diminishing Heat Island Phenomena*	Deploying multi-scale measures against heat island phenomena

Source: Author, with data from MLIT.

Table 6: Policies proposed in the Low Carbon City Development Guidance

The Guidance also provides a proposed methodology for municipalities to calculate their emissions and set emissions targets. In the case of the transport sector, the Guidance suggests using trip surveys and data from road traffic. For the residential and commercial sectors, the Guidance suggests using the estimated floor area and unit energy loads. The effect of green spaces/carbon sinks can be measured using the number of trees and area of green coverage.[49]

2.3.5. Green Purchasing Policy

Public procurement, which refers to the purchase of goods and services by governments or state-owned organizations,[50] is a powerful tool to direct public funds towards purchases in the public interest. The sum involved is rarely trivial and, in Japan, it is estimated that the public procurement market is worth 73 trillion yen, or 550 billion euros.[51]

Government expenditure can be shaped via policy to respond to environmental or social issues. In this way, governments are able to react to public concerns, and to shape the market in sustainable directions. As an example, from 2015, the Netherlands implemented a 100% sustainable public procurement process for their public authority, backed by a ruling from the Dutch House of Commons.[52] The example of the Netherlands is one of the European case studies featured in a 2015 OECD report on best practices for green procurement, which also includes examples from Austria, Italy, Estonia, Denmark, Sweden, Belgium, the Slovak Republic, Hungary, Portugal, and France, in addition to Asian countries like China and Korea.

Japan is a known leader in formulating and implementing green purchasing policy, having begun actively planning within the central government on green purchasing as early as 1995.[53] This action plan culminated, in the year 2000, in the "Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities" ("Green Procurement Act," hereafter), which is aimed at the inclusion of environmental sustainability considerations in public tenders.

As a result of the Green Procurement Act, national government agencies have an obligation to develop green procurement policies and yearly targets for procurement. However, importantly, regional and local levels of government are not subject to the same obligations, and are instead required to make an effort to incorporate green procurement. Thus, **the extent of local municipal involvement with green procurement is left to the discretion of the individual municipalities.**

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[49] "Low Carbon City Development Guidance [Digest]," *Ministry of Land, Infrastructure, Transport and Tourism*, pg. 22

[50] "Public procurement," OECD.

[51] "Public Procurement in Japan: An Outline," EU-Centre for Industrial Cooperation.

[52] "Going Green: Best Practices for Public Procurement," *OECD*, 2015.

[53] Miyamoto, Takuro, Naonari Yajima, Takahiro Tsukahara, and Toshi H. Arimura 2020. "Advancement of Green Public Purchasing by Category: Do Municipality Green Purchasing Policies Have Any Role in Japan?" *Sustainability* 12, no. 21: 8979. https://doi.org/10.3390/su12218979

In 2007, a separate law (the "Green Contract Law") aimed at reducing emissions via public procurement was enacted. As with the Green Procurement Act, this law legally requires national government agencies to abide by certain rules, but does not impose such requirements upon regional and local levels of government.

	Green Procurement Act (グリーン購入法)	Green Contract Law (環境配慮契約法)
Description	Defines the environmental performance of goods and services	Specifies, for each contract type, recommended bidding and contracting methods
Main Aim	Procurement of goods and services that meet a certain level of environmental performance	Procurement of goods and services with the best environmental performance through comprehensive evaluation including price, etc.
Products Covered	Paper, stationery, office automation equipment, home appliances, automobiles, uniforms/work clothes, equipment, disaster stockpiling supplies, public works, services, etc. (as decided by the Cabinet in February 2014)	Purchase of electric power, procurement of automobiles, procurement of ships ESCO contracts, architectural design, and industrial waste disposal (as decided by the Cabinet in February 2014)
Entities Covered	• Government ministries and agencies, independent administrative agencies, national universities, etc. • Local governments are obligated to make an effort to implement the basic policy.	

Source: Author, with data from MOE (環境配慮契約法)

Table 7: Green Procurement Act and Green Contract Law comparison

In Japan, this set of laws has sought to accelerate the adoption of sustainability standards in public procurement, but implementation is inconsistent throughout the nation, and largely depends on municipal priorities. As the Helpdesk Report on Green Procurement from the Japan Tax & Public Procurement Helpdesk points out:

> *While the legal framework that could give public procurement a more important role to contribute to the transition towards a circular economy has been in place for 20 years, the picture in terms of systemic implementation of Green Public Procurement practices is quite diverse and often hindered by a lack of local capacity and resources. Public*

> *procurement-driven initiatives in the country are still isolated in nature and depend on willingness of local governments.*[54]

In 2016, the MOEJ sent out a survey to municipalities to determine their level of commitment to green purchasing. The survey responses were the subject of discussion in a 2020 article that comprehensively analyses the data in order to draw connections between green purchasing plans (GPP) and actual municipal purchasing patterns.[55]

The 2016 survey reveals that, while all prefectures and designated cities had enacted a GPP by that time, implementation was patchy among municipalities as a whole, as **only a quarter of municipalities in Japan had enacted a GPP by 2016.** This survey also measured the extent of municipal green procurement, and the types of products procured. The study authors determine that green purchasing at the municipal level is more likely to happen if the product is more frequently purchased (as this enables the municipal officer to develop experience in this type of purchase), if the product type has an associated eco-label certification (which makes identifying the greener products easier), and if the greener product is available at a low cost. The authors also observe that **municipalities that have formulated and enacted a GPP are more likely to measure their green purchasing and make greener purchasing decisions.**

A 2020 survey, also conducted by the MOE, shows little improvement in this area. **According to this survey, by 2020, only 27.2% of all municipalities had drafted a GPP.** Implementation remains particularly poor in smaller cities, towns, and villages.[56] This suggests a continued need to reach out to smaller Japanese municipalities and address their concerns when it comes to green procurement, with the hopes of reducing the implementation gap.

All 20 of Japan's designated cities have a GPP in place. Yokohama City, for example, rigorously incorporates environmental consideration into its electricity procurement. The City operates the Yokohama Green Power Procurement System, which sets environmental conditions for power supply contract bids for city-owned facilities. Retail electricity providers are evaluated based on "environmental consideration evaluation items," and contract acceptance is contingent upon the meeting of certain criteria.

2.3.5.1. PPP/PFI

In Japan, public-private partnerships and private finance initiatives are becoming increasingly popular in municipalities. PPP/PFI refer to procurement policies that involve entities from both the public and the private sector. According to a report by MLIT, in 2019 Japan posted a record

[54] Japan Tax & Public Procurement (JTPP) Helpdesk, "Public Procurement and Circular Economy in Japan," *EU-Japan Centre for Industrial Cooperation*, June 2021.
[55] Takuro Miyamoto et al., "Advancement of Green Public Purchasing by Category: Do Municipality Green Purchasing Policies Have Any Role in Japan?" *Sustainability*, 2020; 12(21):8979. https://doi.org/10.3390/su12218979.
[56] Japan Tax & Public Procurement (JTPP) Helpdesk, "Public Procurement and Circular Economy in Japan," *EU-Japan Centre for Industrial Cooperation*, June 2021.

amount of private finance initiative projects, and most of the growth in such projects is due to increased participation from municipalities.[57] As declining population, and therefore a reduction in tax revenue, is a common issue for municipalities, **PPP and PFI activities are becoming attractive to smaller cities and towns as a way to raise necessary capital.**

The regional decarbonisation roadmap developed in 2021 includes a proposal to support regional PPP/PFI platforms for localities interested in energy conservation. In August 2018, the Japanese Cabinet created a regional SDGs-focused PPP/PFI platform, with the hopes that this would spur both regional revitalization and the development of SDG-driven procurement. By the end of 2018, this platform counter 613 organizations among its membership, with 249 of these being prefectures and local governments.[58]

For a list of examples of public tenders from Japanese municipalities focusing on decarbonisation and renewable energy, please see the annex.

2.4. Current Policy Landscape and Outlook

When it comes to expanding the share of renewables in the energy mix, Japan has significantly increased the scope of its commitment. However, **the plans to achieve the renewable energy targets listed in the 6th BEP are still unclear.** The government has delivered a concrete plan to reach the 35% share for renewables, but specifics are lacking in terms of achieving the 36%-38% target.[59]

Furthermore, **the need to balance energy security with decarbonisation has led to important challenges.** In May 2021, the IEA published "Net Zero by 2050: A Roadmap for the Global Energy Sector," which called on governments worldwide to immediately divest from fossil fuels. The deputy director of international affairs at METI, however, made clear that such an action would run against official policy. "The [IEA] report provides one suggestion as to how the world can reduce greenhouse gas emissions to net-zero by 2050, but it is not necessarily in line with the Japanese government's policy," he said. **"Japan needs to protect its energy security including a stable supply of electricity, so we will balance this with our goal of becoming carbon neutral by 2050."**[60]

Meeting ambitious carbon-reduction goals will require more than the stated commitment to expand renewables. **There is increasing pressure from the government side to reduce power usage and increase energy efficiency** in order to meet reductions goals, particularly the interim 2030 goal of a 46% reduction. As Dan Shulman, an expert in Japanese electricity markets, notes: "What we see now with this first revision of the energy plan since these decarbonisation targets

[57] "Trends in PPP/PFI and efforts to promote public-private partnership projects," MLIT, pg.1. [Japanese]
[58] Jun Okubo, "Promoting Local Government SDGs for Invigoration of Localities," *Office for Promotion of Overcoming Population Decline and Vitalizing Local Economy in Japan, Cabinet Office*, March 28, 2019.
[59] Kazunari Hanawa, "Japan targets 36-38% renewable energy, but emissions remain high," *Nikkei Asia*, July 22, 2021.
[60] Sonali Paul and Yuka Obayashi, "Asia snubs IEA's call to stop new fossil fuel investments," *Reuters*, May 19, 2021.

were set is that the government is calling for a decrease in power demand between now and 2030 and then allowing it to rise again out to 2050, sort of in tandem with those larger-scale technologies for clean power hopefully having become scalable by then. So what this means is that energy efficiency is going to be a big part of how the government envisions us achieving these interim goals for 2030. […] **We're going to see pressure for the reduction of power usage.**"[61]

Energy efficiency can be presented as a consumer choice, as is the case with energy-efficient home appliances. But, according to Shulman, the scale of change required will be larger than what can be effectuated simply through consumer decision-making**. Japan is already one of the most energy-efficient countries in the world**.[62] In fact, Japan produces each 1,000 USD of its GDP in a less energy-intensive manner than countries like Germany and the United States, thanks to its achievements in energy efficiency.[63]

The central government has elaborated several policies to continue enhancing energy efficiency across a variety of sectors. Japan's Act on the Rational Use of Energy (Energy Efficiency Act) was enacted in 1979 and last revised in 2018 contains comprehensive, multisector policies for energy efficiency. The Building Energy Efficiency Act of 2015 regulates efficiency in buildings. METI has published guidelines to convert public facilities into zero-energy buildings (ZEBs). In addition, in 2021, MLIT developed a program to enhance the energy efficiency of buildings, which has long been an issue in Japan. These Acts have been successful in encouraging innovations in energy efficiency and regulating efficiency of buildings, transport, and industry. **However, more will be needed on this front if Japan is to meet its 2030 emissions reduction goals.**

The election of Fumio Kishida as Japan's new PM, in October 2021, has altered the calculus to a limited degree. Insiders expect PM Kishida to emphasize nuclear energy, as he is a known supporter. **His government has shown signs that they will promote nuclear energy in combination with renewable energy as a pathway to decarbonisation.** Industry minister Koichi Haguida has also pledged support for fixes to the power grids and increased domestic semiconductor chip production.[64] Among the varied recommendations for an upcoming stimulus package from PM Kishida's council are strong recommendations to support storage batteries for renewable energy, large-scale production of batteries for EVs, development of small modular nuclear reactors and semiconductors.[65]

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[61] Dan Shulman, "Key Renewable Energy Topics as Japan Aims for 2030 + 2050 Carbon Neutral Goals," *Seeking Sustainability in Japan with JJ Walsh* (ep. 286), August 18, 2021.
[62] "Japan 2021 Energy Policy Review," *International Energy Agency*, last modified May 2021, accessed August 4, 2021, p. 69.
[63] Kuwabara et al., "How Japan could reach carbon neutrality by 2050," *McKinsey & Company*, August 4, 2021.
[64] "Nuclear power crucial to Japan's net-zero goal: industry minister," *Nikkei Asia*, October 6, 2021.
[65] Yuki Fujita, "Japan kicks off debate on $265bn stimulus including batteries, chip factory," *Nikkei Asia*, November 9, 2021.

3. Japanese Municipalities and Approaches to Decarbonisation

Section Summary:

In Japan, over 90% of the population lives in an urban area. 70% of the population lives in a city with over 500,000 residents. Larger cities have more policy-making power over their jurisdictions. Designated cities, which have over 500,000 residents, can be said to have roughly equivalent power to prefectural governments, though the specifics of this can depend on the city and prefecture in question.

The "Act for Overcoming the Population Decline and Vitalizing Local Economy in Japan" (2014), also known as **the "Regional Revitalisation Act," was created to respond to Japan's demographic challenges**, which have contributed to the decline of rural areas across the country. Several policy tools and programmes created to revitalise regions have a "green" component. These include:

- "Compact city" programme (emphasized as well in the Low-Carbon Cities Act)
- **The Eco-Cities programme (2008)** [23 cities selected]
- **The FutureCities programme (2011)** [11 cities selected]
- **The SDGs FutureCities programme (2018)** [in 2020, 93 proposals were approved and, of these, 30 received funding as "Model Cities"]
- **Smart Cities**, several of which are known for their implementation of emissions-reduction strategies [183 projects in 2020; 19 are classified as "environmental"]

The national government also supports municipalities via other tools, including those outlined in **the 2021 Regional Decarbonisation Roadmap**. Different ministries coordinate their own programs for local decarbonisation, and the Regional Decarbonisation Roadmap provides a comprehensive, at-a-glance understanding of these. Cities also offer support for decarbonisation-related business, and the country as a whole is emerging as a major hub for green start-ups.

Surveys of municipalities, as well as insights from the Zero Carbon Council, highlight the exisiting priorities and challenges facing municipalities on their decarbonisation journeys, including:

- Resident concerns surrounding the possible environmental dangers of renewable energy projects in their jurisdiction, including landslides.
- Lack of qualified personnel in municipal governments with training and interest in advancing pro-climate policies and programs
- Lack of funding
- Lack of digital tools

3.1. How are Cities Relevant to Decarbonisation?

Cities are where the plurality of people live out their lives. Globally, cities account for 50% of the population and, by 2050, it is estimated that more than 70% of the world's population will live in an urban area.[66]

In Japan, this forecast has already come to fruition, as over 90% of the population currently lives in an urban area.[67] This population is particularly concentrated in large cities; **70% of Japanese residents live in cities of over 500,000 people.**

As of 2015, there are 790 cities, 745 towns, and 183 villages in Japan, for a total of 1,718 municipalities.[68] Local government is a **key part of political and administrative life in Japan.** There are almost 3,300 heads of local governments in Japan, and more than 65,000 local elected government representatives.[69] Local government employs more people than the national government does, and, in total, its budget is much larger. All in all, municipal and prefectural governments employ many thousands of people, control many millions of yen, and have direct impact on the lives of all Japan's residents.

It goes without saying that cities are major hubs of commerce, trade, and industry. In Japan, where rural areas have largely entered economic decline, Japanese cities are the major engines of prosperity. **Metropolitan areas contributed 80% of the GDP growth from 2000 to 2016 in Japan.**[70]

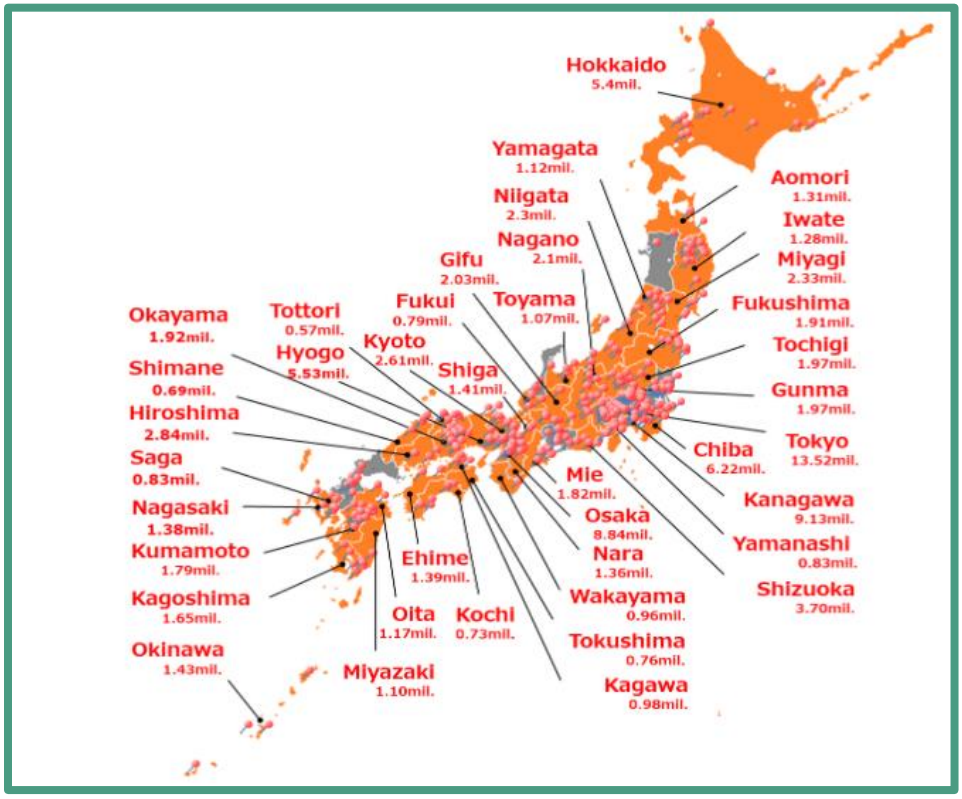
However, **this concentration of population and activity has an obvious cost.** Annually, 70% of the world's emissions originate in cities.[71] **In Japan, cities are considered to be responsible for about 50% of the nation's total emissions**, due to the cumulative impact of energy consumption in households, the business sector (including office energy use) and transportation.[72]

As such, the environmental policies at play within a city's jurisdiction and the beliefs that govern the behaviour of an urban resident have far-reaching consequences. **Japanese cities are a mosaic of differing strategies and targets for low-carbon development, suggesting greater**

[66] "Empowering Cities for a Net Zero Future: Unlocking resilient, smart, sustainable urban energy systems," *International Energy Agency*, last modified July 2021, accessed August 12, 2021, pg. 3.
[67] "Urban population (% of total population) – Japan," *The World Bank*, last modified 2018.
[68] "The Structure of the Tokyo Metropolitan Government (TMG)," *Tokyo Metropolitan Government*, accessed August 11, 2021.
[69] Kiyotaka Yokomichi, "The Development of Municipal Mergers in Japan," *National Graduate Institute for Policy Studies (GRIPS)*, last modified July 2007, accessed August 11, 2021, pg. 5.
[70] "OECD Regions and Cities at a Glance 2020," *OECD Publishing*, last modified November 30, 2020, https://doi.org/10.1787/959d5ba0-en.
[71] "Empowering Cities for a Net Zero Future: Unlocking resilient, smart, sustainable urban energy systems," *International Energy Agency*, last modified July 2021, accessed August 12, 2021, pg. 3.
[72] "CO_2 Emissions and Urban Planning," *MLIT*, accessed August 11, 2021. [Japanese]

individual political autonomy compared with East Asian counterparts.[73] In Japan, it has been argued that cities have significant "institutional political leeway in driving their low carbon development" compared with China and Korea. However, **much depends on the context of each individual Japanese municipality and the interplay between ambition and pragmatism among the key decision-makers.**

In the past three years, many hundreds of Japanese municipalities have announced a net-zero target for 2050. With the exception of Yamanashi Prefecture, which announced its zero carbon plans in 2009, all the commitments (as listed by the Ministry of Environment) were announced in 2019, 2020, and 2021 (current year). The governments of Tokyo, Yokohama, and Kyoto all made their declarations in 2019, following Environment Minister Shinjiro Koizumi's speech at that year's United Nations Framework Climate Change Conference in Madrid. By February 2021, there were 260 municipalities with declared carbon commitments, covering a population of nearly 100 million.[74] **By July 2021, that number had ballooned to over 400 municipalities.**[75]



Source: Ministry of Environment

Figure 13: Japanese net-zero municipalities

[73] "Comparative Analysis on Low Carbon City Development in China, Japan, and the Republic of Korea," *North-East Asia Low Carbon City Platform*, September 2021, pg. 15.
[74] "The local paths to net zero," *Unlock the Real Japan: Nikkei Asia*, 2020.
[75] "2050 Zero Carbon Cities in Japan," *MOE*, accessed July 30, 2021.

Many of these declarations from Japanese municipalities invoke the threat of a "climate crisis" induced weather event as a significant motivator for declaring the intention to pursue carbon neutrality.[76] **Adverse weather events, including torrential rain, flooding, typhoons, and landslides, can be aggravated by climate change and pose a considerable economic and social challenge for municipalities.**

Japanese cities also participate in a range of domestic and international city-to-city collaboration programmes, including the "Eco-Model City," "Future Cities," and "SDG Model City" initiatives in Japan, and Local Governments for Sustainability (ICLEI) and the Global Covenant of Mayors for Climate and Energy, two transnational city networks (TCNs).[77] The Carbon Disclosure Project (CDP), in partnership with Local Governments for Sustainability (ICLEI), lists Tokyo, Toyama, Kyoto, and Kitakyushu in its list of global cities with renewable energy targets.[78] Many smaller cities have reported renewable energy targets in domestic surveys.

91 local governments in Japan participate in the global "Race to Zero" campaign, organized by the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). This is the second-highest level of participation among listed countries. Only Argentina, with 194 municipalities, has more local governments participating in this campaign. The "Race to Zero" campaign aims to "build momentum around the shift to a decarbonized economy ahead of COP26" and requires participating actors to announce a pledge, develop a decarbonisation plan, take actions based on this plan, and publish results.[79]

However, the effectiveness of top-down programmes depends on the individual context of each Japanese city, including its ability to develop and execute its own municipal mandate, which depends on the specific powers of its local government.

3.2. Power & Purpose in Japan's Urban Areas

3.2.1. History of Cities and Their Types

While Japan has been divided into 47 prefectures since the 19th century, **the number of Japanese municipalities has changed considerably due to the use of consolidations.** Following the Great Meiji Consolidation of 1888, thousands of towns and villages were merged in order to create larger units with increased administrative capacity. Officials were particularly motivated to combine municipalities in order to facilitate the operations of elementary schools—an early example of how municipalities change shape in order to accommodate resident needs. As a consequence, the number of municipalities decreased from 71,314 to 15,859 in the space of a

[76] "Commitment to Net Zero Carbon Emissions by 2050 by Local Governments in the Kyushu Region of Japan," Institute of Global Environmental Strategies, February 2021, pg. 4.
[77] Ibid, pg. 20.
[78] "2020 – Cities Renewable Energy Targets," *Carbon Disclosure Project (CDP)-ICLEI Unified Reporting System*, July 16, 2021.
[79] "Race to Zero Campaign," *United Nations Climate Change*.

year, from 1888 to 1889. Two Great Consolidations in the Showa and Heisei eras followed, in 1954 and 1999, respectively.

While the sum total of municipalities has decreased as a whole since 1888 as a cause of these Great Consolidations, new cities were also created during these municipality mergers. Thus, although the number of towns and villages has steadily declined since the first Consolidation, the number of cities has actually increased. Continued urban growth throughout the nation meant that, by the time of the Great Heisei Consolidation **in 1999, there were 777 cities** throughout Japan.[80]

In the contemporary era, as towns and small cities experience demographic decline, it is not uncommon for these smaller municipalities to be absorbed by nearby municipalities. In this way, larger municipalities can grow their tax base and ensure the continued provision of essential services to residents of less populated areas.

Today, a city in Japan must fulfil certain criteria in order to be officially designated as such. These basic criteria include population requirements (a city must have a population of at least 50,000 people) as well as requirements relating to the percentage of households located in the urban area and their professional occupations. **A town or village can be "upgraded" to city status should it apply for the status and fulfil the established criteria.** To date, no city has been "downgraded" to town or village status for falling below the given threshold for any of the requirements.

Cities in Japan can be classified into one of several different categories: "designated city," "core city," "special city,"[81] and, most simply, "city."[82]

There are 20 cities "designated by government ordinance," also known by the shorthand "designated cities." These include cities with a population greater than 500,000 and that have received a specific designation from the Cabinet of Japan under the Local Autonomy Law. Not all cities with a population greater than 500,000 are official designated cities, as applications for this status are not conferred automatically but must be approved by both the city and

[80] Kiyotaka Yokomichi, "The Development of Municipal Mergers in Japan," *National Graduate Institute for Policy Studies (GRIPS)*, last modified July 2007, accessed August 11, 2021, pg. 2.

[81] Due to a 2015 revision of the Local Autonomy Act, "special city" is no longer a recognized category. As of 2015, special cities with populations over 200,000 can apply directly for core city status.

[82] Japan's capital, Tokyo, is an exception to this categorization. While there was once a "Tokyo City," from 1943 onwards this city ceased to exist, and Tokyo was transformed into a special prefecture composed of 23 special wards, each with the same status as a city. The Tokyo Metropolitan Government's jurisdiction includes these 23 wards in addition to the other municipalities within Tokyo prefecture. Tokyo is unique in that its metropolitan area is not confined to a single "city" but can be said to include cities, towns, one village, and two island groups. For more information, see: "Municipalities within Tokyo" and "Tokyo's History, Geography, and Population," *Tokyo Metropolitan Government*, both accessed August 11, 2021.

prefectural assemblies. **Designated cities perform some (though not all) of the functions typically delegated to prefectural governments and are subdivided into wards.**[83]

Source: List-Ranking, with city names translated by author.

Figure 14: Japan's designated cities

As of April 2021, there are 62 "core cities." Like designated cities, core cities also perform some of the functions of prefectural governments, though not as many as designated cities do**. Core cities have a population of over 300,000** (though exceptions have been made for cities with populations exceeding 200,000 people). They also have an area greater than 10 square kilometres. 7 former core cities have become designated cities. Cities can apply to become a core city if they meet the aforementioned requirements.

For municipalities that are not large enough to qualify as a city, the terms "town" and "village" can be used, though the criteria for these designations varies from prefecture to prefecture.

[83] Note that these wards are different from Tokyo's 23 "special wards."

3.2.2. Decentralization of Power

Autonomous cities embedded within a decentralized system, with their own strong internal administration, can develop and implement context-dependent, locally appropriate policies. The political power of Japanese cities in terms of their political destinies shapes the scope of their decision-making when it comes to climate change, energy, and environment.

In Japan, a series of political moves toward decentralization has made it possible for greater political power to be concentrated in municipalities. In the post-war period, policymaking was largely left up to the central government, setting the stage for rapid economic growth. However, by the 70's, decentralization had become a major topic of discussion within Japan's political sphere, with the Third Comprehensive National Development Plan in 1977 encouraging the redistribution of industrial and commercial centres to other cities other than the capital. While the bubble period quashed aspirations for decentralization as firms and industry coalesced around Tokyo,[84] **by the late 90's, Japan had made significant changes that profoundly altered the structure of governmental power.**

Following the 1995 Law for Promoting Decentralization, in 1999 the Diet enacted the Omnibus Law of Decentralization, a major package of reforms aimed at empowering prefectural and local government. **With the Omnibus Law of Decentralization, which took effect in spring 2000, decentralization in Japan entered a new period in its history.** Until this point, local government had been responsible for carrying out orders delegated by the central government under the agency-delegated function (ADF) system, which had been devised in the post-war to encourage fast-paced economic development.

Historically, roughly 70%-80% of administrative functions had been carried out by the prefectural governments and 30%-40% of municipal government functions had been part of the ADF system.[85] **The Omnibus Law of Decentralization ended the ADF system, created new functions for local government, and deregulated a wide variety of existing local functions.**

The consequences of this law for decentralization have been so significant that its passing has been called "the third wave of reform" in Japan, following the Meiji Restoration and the post-war democratic reforms.[86] **The decentralization reforms made it possible for local government to carry out administrative functions independently of the central government. This independence has also resulted in municipalities carrying out their functions in differentiated ways, meaning that cities can innovate based on their own priorities, though their freedom to innovate is not infinite.**

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[84] Carola Hein and Philippe Pelletier, "Decentralization and the tension between global and local urban Japan," *Cities, Autonomy and Decentralization in Japan*, Routledge (2006), pg. 11.
[85] Shunichi Furukawa, "Decentralization in Japan," Japan's Road to Pluralism: Transforming Local Communities in the Global Era, *Japan Center for International Exchange*, 2003, 21—45, p.2.
[86] Kiyotaka Yokomichi, "The Development of Municipal Mergers in Japan," *National Graduate Institute for Policy Studies (GRIPS)*, last modified July 2007, accessed August 11, 2021, pg. 6.

In general, city-level matters are left to the city government, while matters that are larger in scope are under prefectural authority. In some cases deemed to be of particular importance, prefectures are involved in licensing, approval, and regulation. For example, hospitals are licensed by the prefectural government, while cities can license clinics. Cooperation between the governments of prefectures and their designated cities is sometimes necessary to distinguish which functions are performed under which government. When problems cross city and prefectural boundaries and involve multiple jurisdictions, this can complicate administrative duties if responsibilities are unclearly allocated between designated cities and prefectures. It is important to note that government administration practices differ widely, and practices from one prefecture or municipality may not apply to another.

Typically, prefectural governments retain exclusive authority over several key aspects of environmental administration. For example, not even designated cities (the highest "level" of city) are authorized to develop policy for agriculture, forestry, and fisheries administration. They cannot rezone unused farmland, meaning that only prefectural governments can divert farmland to other purposes, such as solar-sharing. Similarly, as described in the 2021 Revised Act on the Promotion of Global Warming Countermeasures, **decarbonisation plans developed at the city-level must obtain relevant permissions before receiving certification; as is laid out in various Acts, permissions of this type are usually under the prefecture's authority.** For example, permissions relating to excavating under the flow path of a hot spring, cutting down protected forests, and developing in quasi-national parks all come under the purview of the Governor of the prefecture.[87]

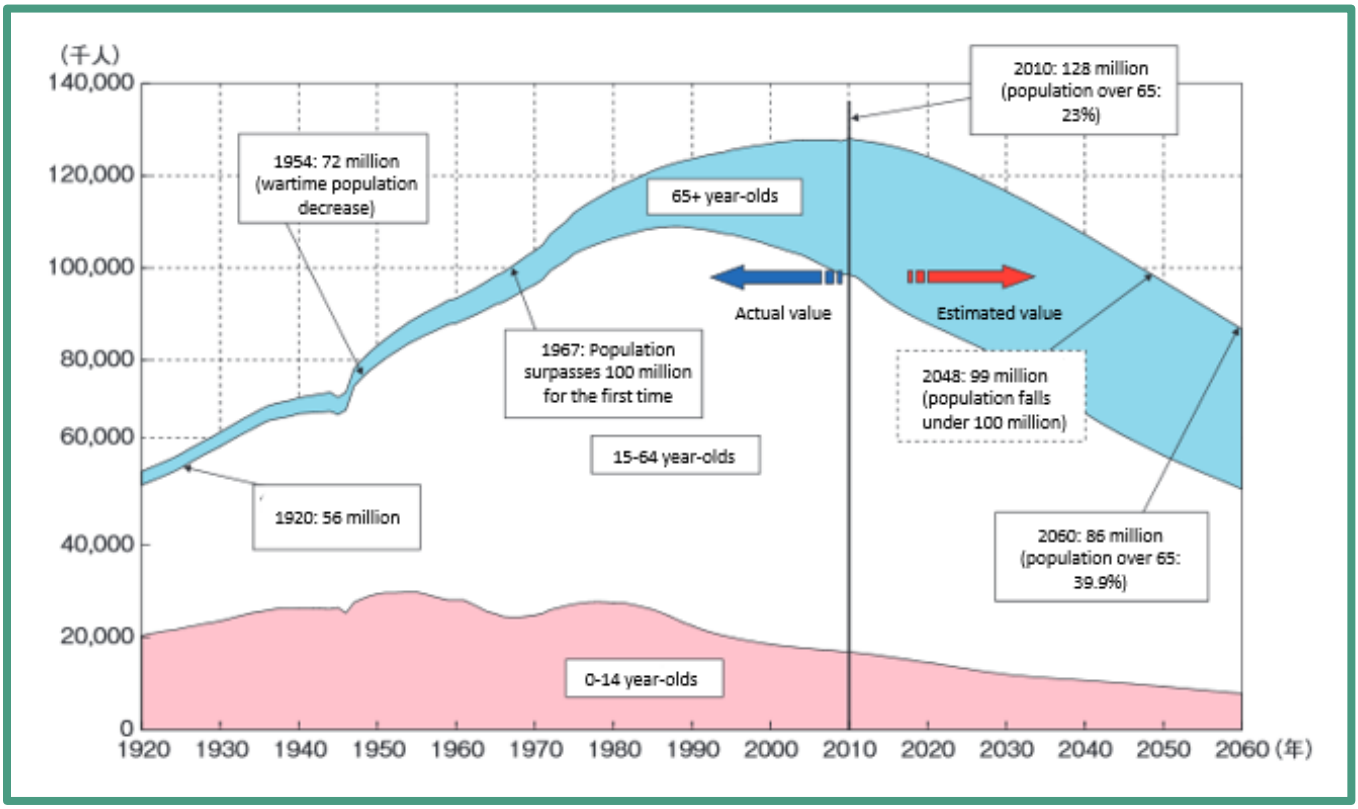
3.3. Regional Revitalisation in Japan

As described by the Japanese government, **regional revitalisation is a strategy that aims to "improve the Japanese economy by creating a flow of people from urban to rural areas, increasing income in rural areas, and conducting regional revitalization through such measures as reforms to tourism and agricultural industries."**[88]

The regional revitalisation strategy seeks to address key demographic challenges in Japan. **The population in rural areas has been steadily declining as the overall population ages and young people living in smaller communities depart to seek job opportunities elsewhere.** Even designated cities are not immune to this trend, with many losing population in record numbers according to the 2020 census.[89] However, greater Tokyo continues to grow in population size, causing overcrowding concerns, while smaller municipalities struggle to maintain essential services with a reduced tax base.

[87] "Energy Practice Legal Update - Overview of the Revised Act on the Promotion of Global Warming Countermeasures and its Practical Impact," *Anderson Mori & Tomitsune*, June 2021, pg. 6.
[88] "Regional Revitalization," JapanGov, *Cabinet Secretariat*.
[89] Yohei Hirose, "Not all Japanese towns are shrinking: 300 show how it's done," *Nikkei Asia*, June 26, 2020.

The covid-19 pandemic has altered this narrative somewhat; in 2020, the population growth in Japan's capital slowed notably, growing only 0.07%, due to the popularisation of telework.[90] In fact, there is some evidence that investing in childcare assistance and telecommuting spaces has helped smaller municipalities grow, rather than shrink, during the pandemic.[91] However, **greater Tokyo alone continues to be where 29.3% of Japan's entire population resides.**[92] As a whole, Japan has been shrinking for a number of years, with the 2015 census recording the first nation-wide population decrease since counting began in 1950. **In 2020, Japan fell out of the top 10 countries by population.**[93]



Source: Cabinet Office, pg. 6 (with captions translated by author)

Figure 15: Japan's demographic history and projections, 1920-2060

In order to grow municipalities currently in decline, the government has initiated a set of policy measures underneath the heading of "regional revitalisation." **Regional revitalisation, as a political strategy, was first developed during the Abe administration and formulated as policy in 2014 as the "Act for Overcoming the Population Decline and Vitalizing Local Economy in Japan," also known as the "Regional Revitalisation Act."** In 2016, the Act was revised. This Act aims to subsidize local revitalisation, develop a tax incentive for corporations that donate to

[90] "Tokyo population growth flattens as telecommuters exist," *Nikkei Asia*, August 5, 2021.
[91] Yohei Hirose, "Not all Japanese towns are shrinking: 300 show how it's done," *Nikkei Asia*, June 26, 2020.
[92] "Japan drops out of 10 most populous countries: 2020 census," *Nikkei Asia*, June 25, 2021.
[93] Ibid.

local revitalisation, and build a support network for the welfare of aging residents in rural regions.[94]

These policy instruments are not necessarily designed to "green" Japanese communities. **Regional revitalisation programmes are intended to boost birth rates, reverse rural exodus, and improve the overall well-being of Japan's residents, particularly its oldest members.** Such programmes, therefore, often seek to improve childhood education, support housing infrastructure, institute family-friendly policies, promote local industry and tourism, develop community infrastructure, build strong working communities, enhance opportunities for employment, and promote local governments.

However, **the goals of revitalisation and green transformation are not necessarily mutually exclusive. Indeed, several approaches for regional revitalisation are also "green."** The 2021 regional decarbonisation roadmap developed by the National and Regional Decarbonisation Council is a key document detailing how decarbonisation and revitalisation can be mutually beneficial.

In the case of urban planning, **"compact city" design is often emphasised as a core aspect of community revitalisation**, as this allows residents to access centralised services and more easily build community. "Compact cities," that is, cities that centralise their commercial activities within a smaller radius, thus reducing the need for car dependency, are associated with lower per capita emissions.

The "**Eco-Model City**," "**Future City**," and "**SDGs Future City**," three unique Japanese initiatives aimed at municipalities, also respond to the dual challenges of revitalisation and green transformation. [95] "**Smart cities**," which integrate ICT into cities to improve resident experiences, can also include green initiatives.

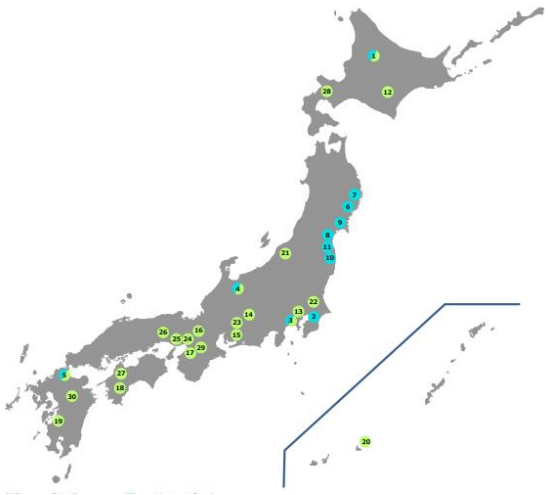
[94] "Outline of the Act for Partial Revision of the Regional Revitalization Act (enacted on April 20, 2016)," *Cabinet Secretariat*. [Japanese]
[95] "Examples related to regional revitalisation," *Cabinet Secretariat*. [Japanese]

3.3.1. Model City Programmes: Eco-Model and Future Cities

The Eco-Model City Programme and Future City Initiative, implemented since 2008 and 2011, respectively, are two nation-wide low-carbon development programmes tailored to the local level in Japan. In the case of the Eco-Model City, the Japanese central government aimed to promote the development of local action plans for decarbonisation and knowledge-sharing among cities. The Japanese government characterizes "Eco-Model Cities" as "cities that maximise the use of local resources and achieve both low-carbon and sustainable development." Similarly, the Future City Initiative was designed to disseminate decarbonisation best practices from Japan.[96]

However, Future Cities have a mandate broader than Eco-Model Cities; these cities "lead the way in responding to issues common to all humankind such as environment and aging." Future City projects commonly invoke the three integrated values of environment, society, and economy.[97]

11 cities were selected in 2011 as "Future Cities." Since 2013, 23 cities have been selected as "Eco-Model Cities."



["FutureCity"]

1	Shimokawa Town (Hokkaido)
2	Kashiwa City (Chiba Prefecture)
3	City of Yokohama (Kanagawa Prefecture)
4	Toyama City (Toyama Prefecture)
5	City of Kitakyushu (Fukuoka Prefecture)
6	Kesen Regional FutureCity (Iwate Prefecture)
7	Kamaishi City (Iwate Prefecture)
8	Iwanuma City (Miyagi Prefecture)
9	Higashimatsushima City (Miyagi Prefecture)
10	Minamisoma City (Fukushima Prefecture)
11	Shinchi Town (Fukushima Prefecture)

[Eco-Model City]

[Selected Cities in fiscal 2008]		[Selected Cities in fiscal 2012]	[Selected Cities in fiscal 2013]
1 Shimokawa Town (Hokkaido)	19 Minamata City (Kumamoto Prefecture)	21 Niigata City (Niigata Prefecture)	28 Niseko Town (Hokkaido)
12 Obihiro City (Hokkaido)	20 Miyakojima City (Okinawa Prefecture)	22 Tsukuba City (Ibaraki Prefecture)	29 Ikoma City (Nara Prefecture)
13 Chiyoda City (Tokyo)		23 Mitake Town (Gifu Prefecture)	30 Oguni Town (Kumamoto Prefecture)
3 City of Yokohama (Kanagawa Prefecture)		24 Amagasaki City (Hyogo Prefecture)	
14 Iida City (Nagano Prefecture)		25 Kobe City (Hyogo Prefecture)	
4 Toyama City (Toyama Prefecture)		26 Nishiawakura Village (Okayama Prefecture)	
15 Toyota City (Aichi Prefecture)		27 Matsuyama City (Ehime Prefecture)	
16 Kyoto City (Kyoto Prefecture)			
17 Sakai City (Osaka Prefecture)			
18 Yusuhara Town (Kochi Prefecture)			
5 City of Kitakyushu (Fukuoka Prefecture)			

Source: "Future City" Initiative 2016 pamphlet

Figure 16: "Eco-Model" & "Future City" cities in Japan

[96] Ying Qiu, "North-East Asian Cities: Moving Towards Low Carbon, Green Cities," *North-East Asian Subregional Program for Environmental Cooperation*, November 2013, pg. 8.
[97] "Introduction of Selected Cities," *Cabinet Secretariat*.

The Japanese government maintains a dedicated website detailing the activities of each Future City and Eco-Model City. As an example, the webpage for Kamaishi City is reproduced below. The city's activities have been provisionally translated into English in the table.

Source: "Future City" webpage for Kamaishi City

Figure 17: Description of Kamaishi City's efforts as a Future City

Kamaishi City "Future City" Activities		
Title	Description	Content tags
Promotion of local production of energy for local consumption	Promote the use of renewable energy sources such as solar, wind, and small-scale hydroelectric power generation to ensure the stable long-term supply of energy and to promote the creation of green lifestyles that are healthy and environmentally friendly.	Solar, small-scale hydro, wind, biomass
Creation of industries that make use of diverse forms of energy	In addition to attracting companies to develop new independent energy businesses, we will increase employment through the creation of new industries, such as the development of wooden housing and the introduction of energy from biomass (wood), utilizing the abundant local timber.	Biomass, agriculture & fisheries
Building a welfare-centric city	In addition to promoting the establishment of a comprehensive care system and the enhancement of local medical care, the city will encourage the creation of a society where seniors can actively contribute to the community, aiming to become a city where people can live their entire lives in good health and with peace of mind.	Community welfare, welfare of the elderly, social activity
Town development that incorporates the town's history and culture	Promote the awareness of the city as a rugby-centric town as well as industrial heritage sites and increase the number of people visiting with the city.	Tourism, urban planning

Source: Kamaishi City (Future City programme)

Table 8: Kamaishi City "Future City" Activities

3.3.2. SDGs Future City Programme

Following the success of these two city-based programmes, the Japanese government launched the "SDGs Future City Programme" in 2018. To participate, cities can submit candidacy proposals to become a "SDGs Future City," which, if approved, comes with reporting obligations for the following three years and direct support from the central government. In addition to knowledge-sharing resources, in some cases, municipal proposals can receive governmental funding. **Between 2018 and 2020, 93 city proposals were approved, and 30 proposals received national subsidies as "SDG Model Cities."** These proposals require city officials to describe how their city will integrate SDGs into their planning, and also to supply information that includes, but is not limited to, key performance indicators, stakeholder engagement and follow-up, as well as plans for the integration of social, economic, and environmental factors into their proposed activities.[98]

The SDGs Future City Programme is housed within the Cabinet Office's Committee on Evaluation and Investigation of the Progress of Local Government SDG Promotion, and is a response to the central government's desire to decarbonize and revitalize local economies. As described in the 2020 revision of the Cabinet Office's "Comprehensive Strategy for Overcoming Population Decline and Vitalising Local Economy," the government hopes to develop work opportunities and promote industry in local areas, reverse rural exodus and decrease population concentration in Tokyo, and support families in the new generation to combat demographic decline. As discussed in the comprehensive strategy, one angle to target these issues is fomenting the SDGs in local and regional areas. The government hopes to increase the number of cities participating in the SDGs Future City Programme from 93 to 210 by 2024, and to increase the percentage of municipalities working on the SDGs to 60% by that same year.[99]

The 17 SDGs encompass a variety of goals; for the purposes of decarbonisation**, four SDGs can be said to be directly relevant.** These are SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). As SDGs are part of an integrative framework, the remaining SDGs can also be understood to complement the activities of the aforementioned SDGs.

Regional revitalization and environmental sustainability are closely linked in the Japanese government's "Expanded SDGs Action Plan 2019."[100] Sustainable regional growth is propelled by innovation through the SDG Future City programme, public-private partnerships, promotion of smart industry, and the promotion of the circular economy, climate change countermeasures, and sustainable consumption and production cycles. From the government's

[98] Ortiz-Moya et al., "State of the Voluntary Local Reviews 2021: From Reporting to Action," *Institute of Global Environmental Strategies*, July 2021, pg. 11.
[99] "Comprehensive Strategy for Overcoming Population Decline and Vitalising Local Economy (2020 revision)," *Cabinet Office*, December 12, 2020. [Japanese]
[100] Jun Okubo, "Promoting Local Government SDGs for Invigoration of Localities," *Office for Promotion of Overcoming Population Decline and Vitalizing Local Economy in Japan, Cabinet Office*, March 28, 2019, pg. 6.

perspective, **the reversal of demographic decline in rural areas depends on the establishment of a "virtuous cycle" in which economy, society, and environment are all integrated.**

The "Local Government SDGs Model Programme" offers subsidies to municipalities that propose "pioneering initiatives with strong potential [to] achieve sustainable development by creating new value in the three aspects of economy, society, and environment, and aim to implement programmes expected to produce self-directed virtuous cycles in the region through cooperation with diverse stakeholders."[101]

The selected SDGs Model Projects for 2019 were: Niseko Town (Hokkaido), Shimokawa Town (Hokkaido), Yokohama City (Kanagawa), Kamakura City (Kanagawa), Kanagawa Prefecture, Toyama City (Toyama), Maniwa City (Okayama), Kitakyushu City (Fukuoka), Iki City (Nagasaki), and Oguni Town (Kumamoto).

2019 SDG Model Project	Main proposed environmental initiatives
Niseko Town	Establish a heat supply for the region in front of JR Niseko station, Constructing environmentally conscious housing and public buildings
Shimokawa Town	Expansion of forest biomass utilization, "Ichinohashi bio-village", establishment of rental system of energy-efficient home appliances, promotion of carbon-zero consumption
Yokohama City	Development of low-carbon circular society
Kamakura City	Anti-congestion measures for roads
Kanagawa Prefecture	Expansion of introduction of photovoltaic power generation facilities, Promotion of installation of hydrogen stations, Expansion of use of fuel cell vehicles and electric vehicles, Promotion of energy-independent houses, Implementation of Business Activities for Global Warming Countermeasures Planning System
Toyama City	Formulation of a wood biomass utilization plan
Maniwa City	Development of sustainable forests Transformation of kitchen garbage into resources Promotion of micro and small hydroelectric power generation

[101] Ibid, pg. 5.

Kitakyushu City	Regional recycling of energy and resources Promotion of environment-related international cooperation and businesses Preservation of nature, including undeveloped woodland
Iki City	Educational events
Oguni Town	Introduction of wood biomass boiler equipment and promotion of power generation using unutilized resources Further promotion of low-carbon forest management Promotion of ecology through community activities

Source: Author with data from Jun Okubo, "Promoting Local Government SDGs for Invigoration of Localities"

Table 9: 2019 SDG Model City Projects

3.3.3. Smart Cities and Super Cities

As Clarisse Pham discusses in "Smart Cities in Japan," a report from the EU-Japan Centre for Industrial Cooperation:

> Establishing what a Smart City is can be challenging: the definition differs depending on the sources and on the projects, and have changed over time. Indeed the branding of projects ranges from "Smart City", "Smart Community", "Smart Grid", "Sustainable Smart Town", "Eco-city", "Active Aging City" to "Green Community" among others.[102]

It is necessary to differentiate "smart cities" from "Eco-cities," "Future Cities," and "SDGs Future Cities." As seen above, there can be overlap; indeed, eco-cities are often labelled as "smart cities" in the literature. Some notable city projects are "Future Cities" and "Smart Cities," as is the case with the Fujisawa Sustainable Smart Town (SST). "Compact cities" that obey transit-oriented development (TOD) guidelines are also considered "smart cities." **What makes a Japanese city "smart," however, is how it collects and analyses information, and how it implements solutions based on this information. Information and Communications Technologies (ICT) are the lynchpin.**

Indeed, the difference between a "green city" and a "smart city" is ICT; while a green city promotes environmental sustainability more generally, **it is understood that smart cities utilise information in their energy management strategies.**[103]

The goal of a Smart City is to improving quality of life for residents while also promoting sustainable development and economic competitiveness. Like other city-based programs,

[102] Pham, Clarisse. "Smart Cities in Japan" *EU-Japan Centre for Industrial Cooperation*, 2014, pg. 8.
[103] Ibid, pg. 18.

therefore, it seeks to merge environmental and economic goals, with an eye toward long-term urban planning. As the Smart City is program is housed within the Cabinet Office's Office for Promotion of Regional Revitalisation, it is also understood to belong to a larger programme of regional development across Japan's urban and rural areas. However, while many smart cities incorporate decarbonisation initiatives, particularly in the context of energy management and recycling, this is not necessarily true of all Japanese Smart Cities. **Japanese Smart Cities often seek to chiefly address social issues arising from its demographic challenges by way of technology; it is not a requirement, therefore, that a Smart City address environmental challenges in order to receive the title.**

According to MLIT, which maintains a Smart City public-private partnership platform, as of 2020, there are 183 Smart City projects, 19 of which are labelled as particularly environmentally focused.[104] These are:

1. Izumi-ku, Sendai (Miyagi Prefecture)
2. Kumagaya City (Saitama Prefecture)
3. Moroyama Town (Saitama Prefecture)
4. Chiyoda-ku, Tokyo (Tokyo Prefecture)
5. Yokohama City (Kanagawa Prefecture)
6. Toyama City (Toyama Prefecture) [*2 projects*]
7. Kaga City (Ishikawa Prefecture)
8. Hamamatsu City (Shizuoka Prefecture)
9. Fujieda City (Shizuoka Prefecture)
10. Okazaki City (Aichi Prefecture)
11. Kisosaki Town (Mie Prefecture)
12. Osaka City (Osaka Prefecture)
13. Kakogawa City (Hyogo Prefecture) [*2 projects*]
14. Mihama Town (Tokushima Prefecture)
15. Fukuoka City (Fukuoka Prefecture)
16. Goto City (Nagasaki Prefecture)
17. Kamiamakusa City (Kumamoto Prefecture)

Of these 19, 8 refer specifically to a municipal council, 3 to a consortium, 1 to a public-private platform co-developed by the municipality, and 7 to pilot projects involving local renewable energy and data utilisation to reduce emissions.

The Fujisawa SST, developed by Panasonic since 2014, is a smart city famous for its dramatic reductions in CO_2 emissions. This Smart City is home to about 2,000 residents, and each residence is equipped with solar panels and smart monitoring. In the case of the Fujisawa SST, residents were the first concern for developers, and the urban plan was designed with their

[104] "Smart City Projects," *MLIT*.

lifestyles in mind. Particular attention, in addition, was paid to the need for a disaster plan; the Fujisawa SST can be energy independent for three days in case of emergency. [105]

A 2020 report about Japan's Smart Cities from the central government lists the below cities as smart cities that display "efficiency use of energy and realizing energy conservation and zero emissions."[106] The Fujisawa SST figures among them.

City/Town Name	Issues & Goals	Japan's Solutions
Mutsuzawa Town, Chiba Prefecture Fujisawa City, Kanagawa Prefecture Shikaoi Town, Hokkaido Prefecture Obihiro City, Hokkaido Prefecture	Issues • Efficient use of energy. • Developing urban infrastructure which is less dependent on utilities companies. • Increasing greenhouse gas emissions. • Stable use of renewable energy. • Strengthening resilience at the time of disaster including securing energy in the event of a large-scale disaster. • Treatment and utilization of livestock manure generated by the livestock industry. Goals • Reducing CO2 emissions. • Reducing greenhouse gas (GHG) emissions. • Smart energy management. • Realizing local production and local consumption of renewable energy. • Industrializing local resources (example: establishing a hydrogen supply system). • Strengthening the resilience of urban cities.	• Local production and local consumption of energy with a focus on renewable energy. • Industrialization of local resources, Shikaoi Town and Obihiro City (hydrogen, which does not generate CO2, is produced from biogas obtained from livestock manure and used for fuel cell vehicles, aquaculture, etc.). • Establishing autonomous distributed energy system. Dispersing electricity peaks according to demand response by using Community Energy Management System (CEMS). • Establishing a locally produced and locally consumed energy system that utilizes CEMS, Home Energy Management System (HEMS), Building Energy Management System (BEMS), Electric Vehicle (EV), etc. • Standardization of smart homes equipped with solar power generation system and storage battery unit.

Source: "Japan's Smart Cities," *Cabinet Secretariat*, 2020.

[105] "Smart cities for a sustainable Japan," *euronews*, January 12, 2020.
[106] "Japan's Smart Cities," *Cabinet Secretariat*, 2020.

Table 10: Japanese Smart Cities working on energy (2020)

In May 2020, the Japanese government passed a revision to law governing strategic zones that will allow local governments to more easily work with private ICT firms in order to develop smart city plans.[107] A recent notable example of such a partnership is Woven City by Toyota, which aims to build a hydrogen-powered, "programmable" city at the base of Mount Fuji.

The reforms to the National Strategic Special Zone system are designed to facilitate the development of "Super Cities." The "Super City" initiative was introduced in October 2018, and the pilot cities will be selected in 2021. A "super city" can be defined as "a city that (1) interconnects various systems in used in everyday life, (2) implements cutting-edge technology in practical ways, and (3) is informed by the lifestyle of the people who live there."[108] **"Super Cities" are a next step for urban planning, and must cover at least five thematic areas** (mobility, logistics, payment, administration, healthcare, education, energy and water, environment and garbage, crime prevention, and disaster prevention) **in an integrative and data-linked way.**[109]

3.4. Opportunities and Challenges Faced by Japanese Municipalities

All politics is local," as the old saying goes. **In the case of energy in Japan, "there are signs that, in fact, all energy politics is local."**[110] While decarbonisation politics tends to play out on the national and international stages, **it is essential to involve local actors in order to achieve full-scale "green" transformation of infrastructure, services, and public life.** Local actors in Japan—including private citizens, local business owners, and municipal officials—have a long history of both enabling and preventing the development of renewable energy production.

Strong organizational efforts by civil society can very effectively impede development. Geothermal energy development provides a compelling case study of this phenomenon. As scholar Jacques Hymans argues, the widespread utilization of geothermal resources in Japan has been hampered for over five decades due to strong opposition from local stakeholders who, thanks to national laws and policies, are able to effectively strong-arm geothermal project development.[111] This is despite the fact that, due to its location in an active seismic area, Japan possesses significant geothermal energy potential. In terms of existing geothermal energy capability, Japan is ranked third globally. Furthermore, Japanese companies are at the forefront of geothermal power development outside of Japan's borders, including in the U.S., Kenya, and

[107] "Japan enacts high-tech 'super-city' bill," *Japan Times*, May 27, 2020.
[108] "About the Super City Initiative," *National Strategic Special Zones*.
[109] "Japan's Smart Cities," *Cabinet Secretariat*, 2020.
[110] Koppenborg, Florentine. "Introduction: Japan's Energy Transition 10 Years after the Fukushima Nuclear Accident." *Social Science Japan Journal* 24.1 (2021): 3-7.
[111] Hymans, Jacques EC. "Losing steam: why does Japan produce so little geothermal power?." *Social Science Japan Journal* 24.1 (2021): 45-65.

Iceland.[112] However, developing geothermal energy itself is a non-starter in Japan, and Japan generates only a fraction of its electricity via geothermal energy.

There are several factors at play in the case of geothermal energy, and all revolve around the local context and the use of local power. First, the Hot Springs Law is a significant obstacle, as this allows hot springs owners virtually carte blanche to reject development. The fear that developments may alter water quality is often sufficient reason for a hot springs owner to oppose geothermal development proximal to their area of operation.

Second, Japan's 1997 Environmental Impact Assessment Law requires developers to engage in "*nemawashi*," literally "going around the roots," which refers to the process of consensus-building. **When developers want access to locally controlled land, they are required to court local actors for their approval, fully consider all concerns from residents, and ultimately achieve consensus before moving forward.** "*Nemawashi*" is considered to be so time-consuming and laborious process that developers will avoid regions known for strong civil networks entirely.

Without securing local support, it is difficult for development proposals to receive official approval from the municipal government. **Municipalities take citizen voices seriously when it comes to regulating development.** According to a 2021 Mainichi Shimbun poll, 80% of Japanese prefectures have reported problems with solar power plants, with governments specifying myriad concerns including landslide risk, damage to landscapes, and environmental damage.[113] **Citing citizen concerns about destructive practices including deforestation, municipalities throughout Japan have been prohibiting the construction of renewable energy facilities** for decades. By 2020, the number of municipalities banning renewable energy facilities had doubled to 60 over a period of fifteen years.[114]

But the outlook is not entirely negative, nor are local communities universally anti-renewable or anti-development. When there is local support for new production, and when companies make earnest efforts to communicate with residents, municipalities can break new ground for the rollout of renewable energy plans and decarbonized facilities. Interestingly, in the case of geothermal production, there is at least one case of successful development despite strong laws in opposition. This is the case of Hachiojima, which is described in the study by Jacques Hymans. Although Hachiojima is an island protected from power plant development under the 1972 National Parks Law, it nonetheless served as host to a TEPCO-built geothermal plant in 1999, as the local government was interested in the construction jobs that would come along with the plant. Thus, local opinions can make or break geothermal power's viability as a resource—as a well as the viability of other forms of renewable energy, if there is compelling reason to do so. Further compounding this point, Hymans' study reveals that, if agricultural

[112] Ryo Mukano and Azusa Kawakami, "Geothermal power sector gains steam in renewable energy race," Nikkei Asia, June 14, 2021.
[113] "80% of Japan's 47 prefectures have problems with solar power plants," *Mainichi Shimbun*, July 4, 2021.
[114] "Doubling of ordinances banning renewable energy facilities," *Nikkei*, May 31, 2020. [Japanese]

incomes are declining in a given area, residents are more likely to look upon geothermal development favourably. This suggests that leveraging renewable energy's advantages as a generator of job growth is significant when it comes to gathering local support.[115]

Furthermore**, supporting activities within the local community can help familiarize stakeholders with company activities.** An example is X-Elio, a Spanish energy company in Japan that has fomented community ties by sponsoring a local soccer team in Sendai.[116] Similarly, in 2021, Vena Energy announced that it had become the gold sponsor for the Tottori Blue Birds, a young team founded with the aim of "Reviving Tottori."[117]

Top-down schemes to encourage local engagement with decarbonisation can be powerful. This is particularly the case when policy and vision combine active engagement with local stakeholders with incentives. **The Japanese central government has also sought to encourage city-level participation in environmental issues through "model city" programmes, including the Eco-Model City programme, Future Cities programme and, most recently, the SDGs Future City programme.**

Ultimately, the development of renewable energy cannot be divorced from the context of the municipalities where the energy is produced and consumed. The constraints of transmission and grid connectivity mean that renewable energy in fundamentally a decentralized, regional form of energy.

Renewable energy can be contingent on the availability of natural resources and particular weather conditions in a given area. Solar and wind energy depend on the topography and meteorological conditions, as well as the time of day. Hydropower can only reasonably be deployed in areas adjacent to flowing water. Geothermal energy makes use of the Earth's internal heat and is usually only feasible in areas of high seismic activity. Biomass energy, to be considered renewable under most sustainability programmes, must be produced using locally sourced materials. **Because these forms of energy are circumscribed within a specific spatial domain, proximal to naturally occurring resources, and because transmission over long distances is frequently costly and impractical, the production and consumption of renewable energy tends to stay local.** And, as their jurisdiction is local, renewable energy projects can be smaller in scope than those powered by fossil fuels. Utility-scale renewable projects exist and fill an important gap in energy ecosystems, but renewable energy is still perceived as a "local" form of energy. **Local energy relies entirely on local buy-in, localised assessments, and local labour.** In Japan, local attitudes towards renewable energy have an impact on whether new renewable energy developments succeed or fail.

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[115] Hymans, Jacques EC. "Losing steam: why does Japan produce so little geothermal power?." *Social Science Japan Journal* 24.1 (2021): 45-65.

[116] "Vegalta Sendai X-Elio Japan Matchday held," *X-Elio*, October 9, 2018. [Japanese]

[117] "Vena Energy signs gold sponsorship contract with professional three-player basketball team Tottori Bluebirds," *Vena Energy*, September 10, 2021. [Japanese]

3.4.1. Survey of Prefectures and Municipalities on Renewable Energy

For a direct view of what Japanese municipalities think about decarbonisation, and renewable energy in particular, it is useful to refer to the "Third Survey of Municipalities on Renewable Energy" and the "Third Survey of Prefectures on Renewable Energy." Hitotsubashi University's Natural Resource-based Economics Project, in partnership with Asahi Shinbun, Hosei University, and the Institute for Sustainable Energy Policies (ISEP), are the authors of these surveys, which were conducted from May to July 2020. **This survey provides one of the most comprehensive pictures available of Japanese local and regional assessment of renewable energy, including approaches to governance, policy frameworks, and multi-sectorial involvement.**

As their name suggests, this pair of surveys has been conducted three times, with three years elapsing between each survey period (2014, 2017, 2020).[118] In order to inform the public and to disseminate the results of the survey, Asahi Shinbun publishes a feature article covering the main highlights.

Two subject groups were the focus of the research: Japanese prefectures and Japanese cities, towns, and villages (grouped under the heading of "municipalities"). Each group received a different set of survey questions based on the differing contexts of municipalities versus prefectures. In 2020, the research team was able to reach all 47 prefectures and 1,288 of Japan's 1,741 municipalities (74% of municipalities).

Nearly half of municipalities reported that they have a GHG reduction goal in place, and an additional 15% report that they are considering implementing one. In addition, 69% of municipalities report that they promote renewable energy. Municipalities appear to be motivated to promote renewable energy in the interest of reducing GHG emissions, developing systems for local production and local consumption of energy,[119] strengthening their disaster response, and enhancing regional revitalization.

However, overwhelmingly, Japanese municipalities do not have bylaws for renewable energy embedded in policy. In addition, although municipalities have largely instituted GHG reduction goals, the majority of municipalities report to have never considered setting a renewable energy introduction goal. More than half of municipalities also report not having formulated any administrative plan, such as a set of guidelines, for the promotion of renewable energy. Thus, **there is an implementation gap between local interest in reducing GHG emissions and developing renewable energy to address the issue of emissions.**

Although many municipalities reportedly do not have bylaws or targets in place for renewable energy introduction, this does not mean that Japanese municipalities have implemented no policies to promote renewable energy. **Many hundreds of the surveyed municipalities**

[118] The first iteration of the survey was jointly developed by Hitotsubashi University and Asahi Shinbun, and the research team has also included, from 2017 onwards, Hosei University and ISEP.

[119] "Local production for local consumption" is oft-cited as a motivator for cities in the development of microgrids. For more information, see: Developing microgrids for urban resilience, from this report.

reported, for instance, that they had implemented subsidies for the installation of renewable energy equipment, or that they had installed solar panels on the roofs of public buildings. Less popular, but still prevalent among municipalities, was the introduction of tax incentives, low-interest loans, land leasing to renewable energy companies, and subsidies for battery storage. Municipalities also have other tools available to them to address GHG emissions; energy efficiency measures and awareness campaigns to lower energy usage, for instance, are common strategies for reducing GHG emissions in a local area.

The limited presence of actionable policy on renewable energy in municipalities may also be related to resident concerns, which have been increasing steadily with each iteration of the survey. The majority of reported complaints are related to fears that renewable energy developments will alter the appearance of the landscape, create noise pollution, and increase local vulnerability to natural disasters, chiefly landslides. A mountainous country, Japan is prone to landslides, which frequently result from seasonal torrential rain. Several well-publicized landslides have severely damaged public confidence in developments located on high ground. One key example is the case of a landslide in Atami, Shizuoka in summer 2021, which lead to scrutiny of a solar farm in the area. Although the local government determined that this development was not the cause of the landslide, a July NHK investigation found that 1,186 mid- and large-sized solar farms were nonetheless located in "landslide risk areas,"[120] echoing the pattern of resident concerns. Indeed, according to the Local Government Research Institute, local governments have been increasingly utilizing municipal ordinances to restrict solar power facilities. As of July 2021, four prefectures and 148 municipalities have enacted such ordinances.[121]

The current involvement of the private sector in the development of renewable energy at the municipal level appears to be limited. When asked if the private sector contributed to the investment and procurement of renewable energy, 814 municipalities answered either in the negative, or that they were not aware of any efforts from businesses on this front. Other municipalities, however, reported that equipment and installation for renewable energy projects were procured from local companies, and that renewable energy employed residents, or was the target of investment from residents, businesses, and the local government.

According to the surveys, as a sector, renewable energy presented several benefits for municipalities. **Municipalities reported that renewable energy was able to supply emergency power during a disaster, and that the sector contributed in in the development of local production and consumption networks, as well as in environmental education and environmental conservation.** 100 municipalities reported that the renewable energy sector contributed to the local area by donating part of the revenue obtained by selling electricity, which was then used to support local cultural events, such as festivals. The private sector also contributed to local welfare, education, and culture, as well as to infrastructure and the

[120] "Analysis of the location of solar power generation facilities," *NHK News*, July 18, 2021. [Japanese]
[121] Ibid.

promotion of local industry. Businesses also utilized locally produced biomass for energy, and the surplus heat was used locally. The private sector offered discounts for residents in some municipalities, or engaged in farm-based solar power generation.

Municipalities also reported several challenges in growing the renewable energy sector. The most prevalent issue, as captured by the survey, is the lack of know-how among governmental officials. This may be exacerbated by the rotation of officials, as it is common in Japan for municipal officers to move to different departments or areas after a short period. Importantly, 359 municipalities reported that issues between operators and residents was a challenge. Difficulty raising funds and the low level of prioritization given to renewables within the government were also cited as issues.

On the prefectural level, it appears that goal-setting is more commonly implemented than at the municipal level. In the case of prefectures, all 47 stated that they had a GHG reduction goal. 41 prefectures mentioned having a renewable energy goal as well, and nearly half also had an energy and electricity conservation goal in place. Like municipalities, surveyed prefectures stated that their main reasons for promoting renewable energy were GHG reduction, regional revitalization, local production for local consumption, and disaster prevention. They expressed similar levels of private sector involvement in renewable energy development, and similar challenges.

3.4.2. Proposals from the Zero Carbon Municipal Council

Yokohama City chairs the Zero Carbon Municipal Council, established in February 2021. This Council has 186 member municipalities of varied characteristics, and its aim is to share knowledge and best practices about decarbonisation.[122]

In March 2021, the Zero Carbon Council submitted a document containing several concrete proposals to further progress toward decarbonized society to the Ministry of the Environment. This document highlights several priority areas and includes concrete suggestions from the member municipalities.[123]

Priority areas as discussed in the Zero Carbon Municipal Council Proposal to MoE	
Priority Area	Concrete suggestion from member municipalities
財政支援の規模拡大と柔軟化 (“Expand the scale and flexibility of financial support”)	• Request for further funding from the national government to support decarbonisation • Given that single-year subsidy system is too inflexible to allow for

[122] “Zero Carbon City Council,” *City of Yokohama*, last modified September 22, 2021.
[123] “Proposals for building a decarbonized society,” *Zero Carbon City Council*, March 29, 2021.

	decarbonized urban development, develop more flexible support system
情報の整備・発信及び人材派遣の支援強化 ("Strengthen support for the development and dissemination of information and human resources")	• Support the introduction of more specialized professionals • Support local-level data collection relevant to climate change
縦割りを廃した国・地方の連携強化 ("Strengthen cooperation between national and local levels of government without vertical divisions")	• Create a collaborative framework for national and local governments to better integrate and harmonize efforts
意欲的な 2030 年温室効果ガス削減目標の設定 ("Set ambitious targets for GHG reduction by 2030")	• Harmonize the 2030 GHG reduction goal with the 2050 decarbonisation goal • Suggest a minimum 45% reduction target[124]
自治体の取組を加速化させる新たな再生可能エネルギー目標の設定と、脱炭素を見据えたエネルギー政策の推進 ("Set new renewable energy targets to accelerate the efforts of local governments and promote energy policies with an eye to decarbonisation")	• Expand the use of renewable energy • Clarify targets for renewable energy introduction in the nation
脱炭素化への機運醸成に向けた国民運動の推進 ("Promote national movement for decarbonized society")	• Promote environmental education and dissemination of information to build public awareness of decarbonisation
脱炭素社会の実現に向けたデジタル化の推進 ("Promote digitalization for decarbonized society")	• Given that decarbonisation and digitalization are coupled in green growth strategy, develop digital infrastructure
Sector-specific areas that require further institutional and financial support from the central government	• Local production and consumption of energy • Housing • Urban development and local transportation • Public facilities and equipment

[124] This document was written and sent prior to Prime Minister Suga's commitment, in May 2021, to a 46% reduction of GHG by 2030.

	• Infrastructure for sanitation and waste management • Rural communities • Work style (telework) • Support for innovation in industry

Source: Zero Carbon Municipal Council

Table 11: Priority areas as discussed in the Zero Carbon Municipal Council Proposal to MoE

Japanese municipalities, in summary, face key challenges in the green transition.

- They often lack qualified personnel, and the rotational system of employment means that dedicated, climate-savvy officials are not always able to remain in the long-term.
- They don't always have access to sufficient funding to implement ambitious ideas; this is particularly the case of smaller, cash-strapped municipalities. In the case where funding is available from the national government, it may only cover one-year projects, which limits the scope of potentially transformative projects.
- Digital tools to assess emissions and develop databases may be lacking.
- Finally, as the survey of municipalities and prefectures shows, there may be limited interest from a city's residents, or even dissatisfaction with decarbonisation-related projects, such as power plants developed in vicinity to their homes and places of business.

3.5. Supporting Decarbonisation at the Local Level

3.5.1. The Regional Decarbonisation Roadmap

In June 2021, the Japanese national government released a roadmap for decarbonisation specifically aimed at local actors.[125] The "*chiiki* roadmap" or regional roadmap, was developed by the National and Regional Decarbonisation Council, a coalition formed by representatives from various Japanese ministries and municipalities.[126]

This roadmap is aligned with a larger national strategy to involve municipal governments in the process of decarbonisation. Prime Minister Suga, at a meeting of the Council of National and Local Decarbonisation, discussed the necessity of coordination between central and local governments, with an eye toward regional initiatives that could contribute to the decarbonisation effort.

The roadmap includes a proposal to nominate 100 municipalities as pilot studies in net zero by 2030, in order to assemble best practices. While this originally included a plan to rank the

[125] "Statement by KOIZUMI Shinjiro, Minister of the Environment, Japan, at G20 Climate and Energy Ministers' Meeting (July 23, 2021)," *MOE*, July 23, 2021.
[126] National and Regional Decarbonisation Council, "Decarbonisation Roadmap," *Cabinet Secretariat*, last modified June 9, 2021, accessed August 8, 2021. [Japanese]

municipalities competitively, push-back from local representatives caused this aspect to be dropped, showing once again how influence from local areas can operate at larger scales.

This roadmap contains detailed decarbonisation support tools for municipalities provided by each participating ministry. A provisional and unofficial translation into English (developed by the author of this report) is available from the following page.

* A list of tools and frameworks for more comprehensive support of regional decarbonisation efforts. It does not include individual subsidies or budgeted projects such as surveys and studies for the introduction of renewable energy or energy-saving measures.

Ministry of the Environment

Name	*Overview*	*Application to the envisioned regional decarbonisation efforts*
Local government action plans (including the Local Government Action Plan Planning and Management Support System [LAPSS])	Comprehensive planning and progress management of global warming countermeasures for the whole area and local government initiatives (in particular, this is aimed at the development of targets and measures to promote the introduction of renewable energies for local benefit)	Draw an overall picture of decarbonisation in the region with a focus on renewable energy that involves businesses and citizens, and use it to identify suitable locations to maximize the use of renewable energy in a way that benefits the local community
Renewable energy information provision system [REPOS]	Provides information on potential for introducing renewable energy by region and at the national level, as well as information on the creation and visualization of regional environmental data	Consensus-building with local residents and stakeholders when creating a plan for introducing renewable energy by visualizing the potential of renewable energy and establishing a zone for promoting the Global Warming Countermeasures Law
Environmental Assessment Database [EADAS]	Allows for the map-based visualization of natural and social environment information, which is necessary for understanding regional characteristics in terms of environmental assessment	Consensus building with residents, stakeholders, etc. in the creation of plans for the introduction of renewable energy and the establishment of promotion zones under the Global Warming Countermeasures Law through the visualization of environmental information related to renewable energy
Regional economic cycle analysis	Tools for analyzing the flow of funds within the region from the perspectives of production, distribution, and expenditure, the actual state of industry, and the relationships outside the region	Tools to support the preparation of data and materials for estimating the economic effects of introducing renewable energy and for building consensus among local residents

Ministry of the Environment's Local SDGs - Regional Recycling Symbiosis Platform	Provision of information on precedent cases, etc., for regions and businesses working to create a regional recycling and symbiosis zone, and provision of opportunities for mutual learning among regions, etc.	Provide case studies of organizations engaged in renewable energy projects, search for business partners, and build networks among regions
Regional Energy and Global Warming Countermeasures Promotion Council	Conference to promote local voluntary efforts to combat global warming (with participation of local branch offices, local governments, etc.)	Establishment of a platform for supporting local climate change measures, centred on regional branch offices.
Climate change adaptation information platform	Provision of information on adaptation to the impacts of climate change to promote the efforts of local governments and businesses.	Provide information and promote collaboration on initiatives that contribute to both $_{CO2}$ reduction and resilience improvement, such as the introduction of distributed renewable energy.

Ministry of Internal Affairs and Communications

Name	*Overview*	*Application to the envisioned regional decarbonisation efforts*
Distributed energy infrastructure projects	Support for the development of master plans for the establishment of local energy businesses using local resources such as biomass and waste.	Creation of local economic cycle and significant reduction of greenhouse gas emissions by launching local energy business using local resources such as biomass and waste.
Local 10,000 Project	Subsidies are provided for initial investment costs of private businesses that receive loans from local financial institutions and work on commercialization using local resources.	Create a regional economic cycle through the development of regional energy businesses utilizing local resources such as biomass and waste.

Advisor for the Creation of Local Power	Support for municipalities working on regional revitalization to provide information on human resources and expenses for inviting external experts.	Promote local energy projects by dispatching highly specialized personnel in energy and other fields.

Cabinet Office

Name	*Overview*	*Application to the envisioned regional decarbonisation efforts*
SDGs Future City	Selection and announcement of local governments and model projects that implement outstanding or leading initiatives to achieve the SDGs.	Horizontal development of model projects related to decarbonisation efforts, visualization of know-how, and inter-regional sharing and networking
Subsidy for promoting local development	Support for independent, proactive, and leading efforts by local governments based on local comprehensive strategies	Public-private partnerships for the creation of new services linked to the introduction of renewable energy and attractive urban development.
Subsidy for telework for regional development	Support for local governments' efforts to create a new flow of people to local areas by promoting telework that contributes to regional development, including the development and operation of satellite offices and support for the establishment and operation of private facilities.	Development of satellite offices and other environments for use by companies and organizations that have established themselves in the region and are working to solve regional issues through decarbonisation.

Corporate version of hometown taxation	Corporate tax credit for corporate donations to local government initiatives for regional development	Corporate tax credit for companies engaged in renewable energy projects that lead to regional development
Local Human Resource Development Support Programme	Dispatch of national public officials, university researchers, and private sector experts to local municipalities as assistants to the mayor	Dispatch of highly specialized personnel for energy and planning in the implementation of renewable energy projects
Local development SDGs public-private partnership platform	Dissemination of information and support for matching among members for the purpose of regional development by promoting the implementation of the SDGs	Provide opportunities and information for public-private partnerships to deepen partnerships with a wide range of stakeholders in decarbonisation projects.
PPP/PFI regional platforms	Support for the formation of regional platforms that bring together local companies, financial institutions, and local governments to promote PPP/PFI in the region, and dissemination of information	Efforts to introduce ESCO to public facilities that contribute to the introduction of energy conservation and renewable energy
Smart city public-private partnership platform	Implementation of business support, matching support, and promotion activities to accelerate smart city initiatives through public-private partnerships toward the realization of Society 5.0	Provide support, know-how, and information on case studies through the smart city-related projects of relevant ministries and agencies.

Ministry of Agriculture, Forestry and Fisheries

Name	*Overview*	*Application to the envisioned regional decarbonisation efforts*

Biomass Industrial City	Selection and announcement of regions that will establish an economically viable integrated system and implement initiatives based on the biomass industry, taking advantage of regional characteristics.	Promote commercialization in the selected regions through collaboration among the seven relevant ministries and agencies, including the use of various measures and systems.
Basic Plan for the Rural Areas Renewable Energy Act	Promote the introduction of renewable energy in harmony with the sound development of agriculture, forestry, and fisheries based on the basic plans of municipalities.	Promote the introduction of renewable energy based on regional agreements in rural areas.
Livestock Biomass Local Production for Local Consumption Project	Support for the introduction of biogas plants that utilize biomass such as livestock waste.	Promote local consumption of energy by introducing biogas plants at livestock farms.
Local Resource Utilization Development Support Project	Set up a consultation counter for the introduction of renewable energy in rural areas, and provide consultation and on-site guidance to municipalities and farmers.	Embodiment of initiatives by solving problems of cities, towns, villages, and agricultural, forestry, and fishery companies that are interested in introducing renewable energy to rural areas.
Decarbonized Food Supply Chain Visualization (Mieruka) Promotion Project	Provide information on decarbonisation technologies in the food supply chain and systems for their visualization.	Promote the practice of decarbonisation at production sites in the agriculture, forestry, and fisheries industries, and the visualization of greenhouse gas emission reductions and absorptions.

Ministry of Economy, Trade and Industry

Name	*Overview*	*Application to the envisioned regional decarbonisation efforts*

"Mirasupport" plus	The national website for small and medium-sized enterprises (SMEs) to apply for subsidies and benefits, and to support their businesses	Provision of information to support decarbonisation efforts by local companies
Energy efficiency and conservation consultation regional platform construction project	Implementation of current status analysis through energy efficiency and conservation audits of local SMEs, etc., and support for implementation of energy efficiency and conservation efforts	Provision of know-how and case studies on energy efficiency and conservation for local companies
Council for Promotion of Local Energy and Global Warming Countermeasures (Re-posted)	Conference to promote local voluntary efforts to combat global warming (with participation of local branch offices, local governments, etc.)	Platform for supporting local climate change countermeasures centred on local branch offices
"Nattoku!" Renewable Energy	Widely disseminate the latest information on renewable energy and the operation of the FIT system	Promotion of public understanding of renewable energy and promotion of introduction of renewable energy

Ministry of Land, Infrastructure, Transport and Tourism

Name	*Overview*	*Application to the envisioned regional decarbonisation efforts*
Compact City Formation Support Team	In promoting compact cities, relevant government ministries and agencies will provide cross-agency support for the efforts of municipalities, which are the main actors in urban development.	Improvement of support measures for compact city initiatives, and formation and horizontal development of model cities

Walkable promotion system	Promote the formation of walkable spaces through public-private partnerships.	Through the expansion of walking space and lawns in public spaces, we will create a comfortable and lively "town centre where people want to walk," and promote the shift from cars to people-centred spaces.
Local Public Transport Maintenance and Improvement Project	Subsidies and other support for efforts to secure, maintain, and improve the convenience of public transportation in the region	Promote the use of public transportation that contributes to the decarbonisation of the region based on the regional public transportation plan.
Green Infrastructure Public-Private Partnership Platform	Support for the provision of information and the establishment of partnerships to promote the social implementation of green infrastructure through cross-sectoral and public-private partnerships	Promotion of the social implementation of green infrastructure, including the conservation of ecosystems that serve as sinks for greenhouse gases.
Ministry of Land, Infrastructure, Transport and Tourism Smart City Model Project	In the field of smart cities, support for demonstration experiments of outstanding projects with a view to implementation that will lead the nation.	Support for demonstration experiments on smart cities, including the introduction of energy management systems and the use of renewable energy within the region.
Tourism Regional Development Organization (DMO)	Provision of information and support for the implementation of various projects to the corporations that serve as the headquarters for the development of tourism regions.	Cross-distribution of information on projects such as sustainable tourism and decarbonized transportation (e.g., EV, car sharing, solar sharing)

Ministry of Education, Culture, Sports, Science and Technology

Name	*Overview*	*Application to the envisioned regional decarbonisation efforts*
Basic research and development for decarbonisation of the region	Creation of cross-disciplinary knowledge from the humanities and social sciences to the natural sciences to promote social change in the region toward a decarbonized society.	Development and deployment of regional decarbonisation models that span multiple policy areas such as energy, mobility, and construction, and support for regional planning
University Coalitions Contributing to Carbon Neutrality	A place to share information and create projects to promote various efforts by universities and other organizations to decarbonize the region, in cooperation with local governments and industry. Collaboration with Ministry of Economy, Trade and Industry and Ministry of the Environment	Develop the latest research results and initiatives that contribute to decarbonisation of the region, and promote joint research between local governments and universities.
Eco-School Plus	The Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the Ministry of Agriculture, Forestry and Fisheries (MAFF), and the Ministry of the Environment (MOE) collaborated to certify the school as an eco-school and provided financial support.	Construction of school facilities that use energy conservation and renewable energy

Table 12: Support tools from the decarbonisation regional roadmap

3.5.2. Government Support & Funding Programmes for the Local-level Green Transition

The **2021 Regional Roadmap** provides a comprehensive overview of the major forms of support provided by each Ministry in the context of the local decarbonisation effort. Additional forms of support which have been announced after the publication of the Roadmap are addressed below.

In June 2021, METI released, in partnership with other ministries, a breakdown of their Green Growth Strategy Plan.[127] This plan is chiefly focused on governmental support of the private sector. However, in addition to discussing the contribution of the private sector, **the strategy plan discusses regulatory reform conducted in collaboration with local governments**, including carbon credit reform.[128] In its discussion of renewable project development**, the strategic plan emphasizes the importance of working with municipalities to develop an attractive domestic market for such projects**.[129]

Japan's Ministry of Environment provides important support to the Eco-Model City and Future City initiatives. In addition to this, **the MOE provides a number of subsidies under several different schemes** aimed at promoting supply chain decarbonisation, [130] consumer-oriented point schemes, [131] and new-generation technologies.[132] Japan's MOE also supports local governments in a similar fashion. In August 2021, **the MOE released plans to establish a new subsidy system in fiscal year 2022 to support local governments with five-year plans to reduce GHG.** Between 20 and 40 local governments are expected to receive subsidies, and this system is expected to subsidize 50%-75% of project costs.[133]

The MOE also announced in July 2021 that it had offered subsidies to 6 organizations through the Regional Circular and Ecological Society Promotion Association.[134] According to a press release**, the theme of the projects selected is "independent and decentralized local energy systems and decarbonized transportation."** The six projects are divided into three categories based on their exact goals and are all affiliated with a specific municipality.

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[127] "2050 Carbon Neutral Green Growth Strategy Formulated," *METI*, June 18, 2021. [Japanese]
[128] Ibid, pg. 18.
[129] Ibid, pg. 43.
[130] "MOEJ selected 5 companies to participate in the Supply Chains Decarbonisation Project," *MOE*, August 20, 2021.
[131] "MOEJ selected 5 companies to participate in the Supply Chains Decarbonisation Project," *MOE*, August 20, 2021.
[132] "Establishing a point system for purchasing environmentally friendly products to encourage a change in awareness," *Mainichi*, August 30, 2021.
[133] "Japan to introduce new subsidy system for decarbonisation," *Japan Times*, August 23, 2021.
[134] "MOEJ selected 6 decarbonisation projects to be offered subsidies (third supplementary budget for FY 2020)," *MOE*, July 12, 2021.

1. **Project to support the creation of an independent and decentralized local energy system to improve local self-sufficiency in renewable energy and strengthen resilience.**
    a. Okuma-cho, Fukushima Prefecture
        i. Achieve a 50% ratio of micro grid and solar power by 2024.
        ii. Build, by 2030, a "Zero Carbon Town" and "RE 100 Factories" powered by renewable energy.
        iii. Produce hydrogen from surplus solar energy and biomass by 2040.
    b. Oki-machi, Fukuoka Prefecture
        i. Examine and decide the installation of solar power facilities (1,450 kW), self-operation lines (1,200 m), storage batteries (2,500 kWh), EV charging equipment, and EMS (Environment Management System).
        ii. Have all public facilities powered by 100% renewable energy by 2030, by utilizing the above facilities and equipment.
        iii. Build solar power facilities on rooftops, parking lots, and idle lands. Self-operation lines are also planned to be buried.
2. **Project to support the creation of a decarbonized regional transportation model by utilizing automobile CASE (Connected Autonomous Shared Electric). (Installation of equipment)**
    a. Tobu Railway Co. Ltd. (implemented in Nikko-shi, Tochigi)
        i. Position Nikko City, one of the prefecture's leading tourist destinations, as an advanced model region for decarbonisation, with the promotion of automobile CASE and the use of renewable energy at its core.
        ii. Form a virtuous cycle of branding as an environmentally friendly tourist destination, both tackling climate change and promoting tourism.
3. **Project to promote CO2 emission reductions by improving the efficiency of hot spring supply facilities.**
    a. Izu-Nagaoka Business Onsen Business Cooperative (implemented in Izunokuni, Shizuoka)
    b. Rausu-cho, Hokkaido
    c. Kijo-cho, Miyazaki

Source: Author, with data from MOEJ

Table 13: 6 decarbonisation city-level projects funded by MOE

3.5.3. Support Networks for Decarbonisation Start-ups and SMEs in Japan

3.5.3.1. Start-up Ecosystem for Decarbonisation

Historically, Japan has been viewed as an overlooked market for start-ups. However, that is quickly changing as Japan's centres for start-ups begin receiving more media coverage, and globally minded accelerators solidify their presence in Japan. In fact, **in 2020, Tokyo entered**

the top 10 global start-up ecosystems for the first time, as ranked by Startup Genome.[135] **Start-ups working on decarbonisation, green business, and smart city solutions are particularly sought-after in the Japanese market context.**

The central government provides support for start-ups in key environmental areas. The Japan Science and Technology Agency runs the "Programme for Creating STart-ups from Advanced Research and Technology" (START), which supports and promotes start-ups in Japan developing innovative technology in priority research areas. As of July 2021, START supports 7 start-ups in the environment and energy fields.[136]

Japanese Environment and Energy Start-Ups Supported by the Japan Science and Technology Agency		
TAKE-PLAS LLC	Kyushu Institute of Technology	Building plastic composite supply chain from bamboo
SIRC CO., LTD	Osaka City University	Compact, low-consumption sensor devices with energy sector applications
Ball Wave Inc.	Tohoku University	Sensor that acts as trace moisture analyzer and portable gas chromatograph; applications for natural gases (including hydrogen gas)
BioAlchemy xx	Okinawa Institute of Science and Technology	Advanced, clean, and low-cost water treatment; applications for reduction of waste sludge
OOYOO Co. Ltd.	Kyoto University	Air purification technology; applications for CO_2 capture in smaller industries
ORLIB Limited	The University of Tokyo	Lithium battery technology
Japan Carbon Cycle Lab, Inc.	Kyushu University	CO_2 capture and conversion technology

Source: Author, with data from START.

Table 14: Japanese environment and energy start-ups supported by START

Start-ups incubated in research institutions can be major movers of change and innovation. A low-cost hydrogen model, for instance, was announced through a partnership of Sumitomo Mitsui Trust, Asahi Pretec, and a venture from Ibaraki University called FC Development.[137]

Municipalities in Japan are keen to encourage start-up growth in their jurisdictions. Shibuya City, a special ward of Tokyo, is a key example. This city launched a special one-year visa for start-up entrepreneurs looking to expand into Japan, and also hosts the Shibuya Start-Up Support initiative. For instance, a European company, SolarDuck, which makes offshore floating

[135] "Rankings 2021: Top 30 + Runners-up," The Global Startup Ecosystem Report, *Startup Genome*, September 2021.
[136] "List of Start-Ups," *Japan Science and Technology Agency*, July 2021.
[137] "Hydrogen production at 1/3rd the cost," *Nikkei*, September 20, 2021.

solar panels, has received a visa for a staff member through this initiative's Start-Up Visa.[138] This initiative is notable for an abundance of useful resources for entrepreneurs, including a list of active venture capitalist funding in Japan.[139] A similar initiative, the Osaka Innovation Hub, exists in Osaka City. The Osaka Innovation Hub, together with start-up pitch event "Get in the Ring," supports start-ups entering the 2021 "Get in the Ring Osaka" competition, focused on sustainable business. More precisely, this competition is aimed at "startups that challenge the existing status quo with innovative solutions."[140]

Start-up centres in Japan are often developed in collaboration with pre-established ventures. Many of these have a specific focus on sustainable business and decarbonisation.

Major Start-Up/SME Hubs & Resources in Japan (partial list)	
Shibuya Startup Support	Shibuya City-led concierge service to grow start-up businesses in Shibuya; they offer professional advice, resources, and visa sponsorship.
Startupbootcamp Osaka (2021 program)	Startup accelerator offering "an equity-free opportunity for high-growth mature startups" under the theme of "Smart Cities & Living" The programme has several Japan-based partners, including Hankyu Corporation, Dentsu, JR West INNOVATIONS, the Yomiuri Shimbun, JT Group, Sakura Internet, and SMBC,[141] as well as Mitsubishi Corporation and Nippon Yusen Kabushiki Kaisha (NYK).[142]
Osaka Innovation Hub	Osaka City-backed startup community; they provide concierge services, collaboration opportunities, and visa sponsorship.
Climate LaunchPad Japan	Business competition for green business funded via EU initiative. The Japan team is led by the Purpose Driven Innovation Ecosystem (PDIE)
Accelerate Aichi by 500 Start-Ups	6-week accelerator program based on the "Aichi Startup Strategy" in collaboration with 500 Start-Ups
Kobe Startup Hub	Support hub for founders to locate partners and mentors in Kansai and globally, supported by Kobe City and Innovation Dojo Japan LLC
Urban Innovation Japan	"Startups x Municipality" platform that matches local governments with private companies to solve community problems. Previous collaborations in the environmental sector can be found here
Venture Café Tokyo	Community space that aims to connect innovators through events, pitch nights, and their flagship "Thursday Gatherings." Often coordinates events with Cambridge Innovation Center (CIC) Tokyo

[138] "Interview with Shibuya's Startup Visa Holder: Meet the Dutch founder developing offshore floating platforms for Japan," *Shibuya Startup Support*, August 4, 2021.
[139] Kei Furukawa, "List of VCs in Japan." See also: "Japan VC Map."
[140] "Get in the Ring Osaka 2021," *Osaka Innovation Hub*.
[141] "Startupbootcamp Scale Osaka," *Startupbootcamp*.
[142] "Accelerator Decarbonize," *Startupbootcamp*.

Google for Startups Campus	Accelerator that provides mentors and resources to start-ups targeting Japan's social programs
X-Hub Tokyo	Global accelerator with programs operated by the Tokyo Metropolitan Government, JETRO, and Deloitte
TechBIZKON	Yearly pitch event connecting start-ups, corporates, and venture capitalists; organized by the German Chamber of Commerce and Industry in Japan. TechBIZKON V (2022) is seeking German and Japanese start-ups working on carbon-free business solutions
La French Tech Tokyo	"A bridge for startups between Japan and France," this start-up community offers events, a community fund, and the possibility to apply for a French visa
AsiaBerlin Summit	Cross-border summit to facilitate collaboration between Asia and Berlin. One key theme of the 2021 summit is "smart city/climate tech."
Hello Tomorrow Japan	Global NPO that aims to "accelerate deep tech technology research and entrepreneurship, and to bring breakthrough innovation to commercial scale." They have developed a "Japan Challenge" and also host carbon-neutrality events
Japamburg	Hamburg-based business network aimed at increasing business cooperation between German and Japanese companies. In 2021, they featured several "sustainable future" start-ups

Source: Author, with data from start-up hub webpages

Table 15: Major Start-Up/SME Hubs & Resources in Japan

For a comprehensive list of all major players in the Japanese Innovation Ecosystem, see this list from JETRO: Key Players in Japanese Innovation Ecosystem.

4. Collaboration: Clusters, Municipalities, Businesses

Section Summary:

Because of its historical and cultural context, Japanese businesses commonly cite community well-being as a key part of their company purpose. Though there are challenges in adapting to greener operational practices, Japanese companies have shown leadership in transitioning to a climate-friendly business outlook in a variety of ways. These include pledging to follow the Science Based Targets initiative (SBTi), forming new eco-clusters and associations, and partnering with municipalities to craft and implement decarbonisation projects.

Japanese municipalities and prefectures can work together with other partners—including residents, community leaders, local businesses and non-profits, and other levels of governments—to institute meaningful, long-term, transformative change that is embedded within the community's context. In particular, Japanese municipalities have demonstrated that they are able to connect with residents and engage them on issues of sustainability, and that awareness-raising campaigns are particularly powerful when held in conjunction with a local partner. In addition to social innovation aimed at residents, municipalities have particular impact on renewable energy projects, and can work together with residents and businesses to establish development projects that are to the benefit of the entire community. Japanese municipalities have shown initiative in spearheading actions that increase the share of community participation in energy ecosystems, particularly in the context of microgrids and local production for local consumption.

Municipalities in Japan also work together with European partners on issues of decarbonisation and sustainability. Through the International Urban Cooperation (IUC) programme, several Japanese cities have partnered with Europe-based cities to share best practices, meet for informational sessions and tours, and exchange updates on a regular basis.

In Japan, it is not unusual for company officials to express a sense of responsibility for the wellbeing of the community, which includes their employees and other stakeholders. In fact, this sense of responsibility has roots within traditional Japanese business culture, in which **companies evaluate their performance based on their impact both on their shareholders and on the larger community.**

In "Effective Advocacy: Lessons from East Asia's Environmentalists," scholar Mary Alice Haddad describes several reasons why social responsibility figures within East Asian, and specifically Japanese, business culture: first**, a large proportion of firms in East Asia are family-owned**, and thus concerns about personal legacy hit closer to home. Second, Japan's traditional "lifetime employment" system means that an employee typically works at a specific company for life. **The relationship between employee and firm is, therefore, a lifelong connection that echoes**

the larger social commitment a company makes to its host community. Finally, East Asian companies do not depend on capital markets for financing, relying instead on financing from banks. Because of this, **Japanese firms are able to make longer-term, environmentally oriented investments without needing to worry about the longer time-horizon implicit in such investments.**[143]

Industry **insiders in Japan have expressed the view that the Japanese business approach could be fully compatible with environmentally friendly policies and practices.** "Sanpo-yoshi," a Japanese business principle meaning "three-way satisfaction," is frequently referenced in this context.[144] **"Sanpo-yoshi" was developed during the Edo era, during which time merchants in Japan "would ensure that there's a value added to the buyer, the seller, and society" embedded in their transactions.**[145] According to this perspective, growing your business and greening the community are not mutually opposed goals.

If one subscribes to "sanpo-yoshi" and takes the on-the-ground conditions of Japanese businesses seriously, it is possible to see a sustainable future take shape. This is not to say that the future outlook is entirely rosy—**incorporating environmental impact into company planning more holistically will require major changes to operations, and this is a significant challenge.** Relying too heavily on traditional concepts such as "sanpo-yoshi" can lead companies to "miss the chance to re-examine" these traditions and update them to fit a new context, as Takayuki Kokon discusses in "Seeking Sustainability in Japan."[146] There are other challenges: for instance, Japanese companies are often caught up in the myriad reports required to legitimate sustainable business operations and comply with international reporting requirements. However, **incorporating decarbonisation as part of a larger mission or sense of purpose can is perceived as an important way to "solidify position as a leading company," and this can be a powerful motivator in Japan given the historical linkages between purpose, society, and business.**[147] While traditional business values and historical conditions alone cannot catalyse the green transition, such values can speak to the larger, sometimes untapped, potential of business to contribute to local transformation in Japan.

4.1. The "Green Spiral"

Growing attention from the private sector on environmental issues can help build critical mass towards transformation; this is known as the "green spiral." This term, originally from

[143] Mary Alice Haddad, "Make it Work for Business: Crafting Win-Win-Win-Win Outcomes," from *Effective Advocacy: Lessons from East Asia's Environmentalists*. MIT Press, 2021, pg. 138—139.
[144] "What is sanpo-yoshi?" *Organization to Spread Sanpo-yoshi Globally, Japan Tourism Group*, 2010.
[145] "Why startups should be better than charities at solving social problems," *Disrupting Japan Podcast*, November 9, 2020.
[146] Takayuki Kokon, "How Typical Japanese Businesses React to Sustainability," *Seeking Sustainability in Japan with JJ Walsh* (ep. 282), July 30, 2021.
[147] Takayuki Kokon, "How Typical Japanese Businesses React to Sustainability," *Seeking Sustainability in Japan with JJ Walsh* (ep. 282), July 30, 2021.

the social science and first explored by scholars Nina Kelsey and John Zysman, refers to a positive feedback loop that results in powerful impacts on climate change mitigation:

> *To explain how states have successfully initiated green policy experimentation despite the near-term uncertainty surrounding green growth, we introduce the idea of a "green spiral"—* ***a process of policy feedback in which initial, incremental steps to jointly address economic and environmental issues might over time build up industrial coalitions with material interests in favor of sustaining and expanding efforts at climate change mitigation.*** *This process is not straightforward or necessarily intentional. In our successful cases, these efforts have rarely involved climate change as the primary motivator for action. Rather,* ***they often begin with policies created in response to other concerns, such as local pollution or energy crises.***[148]

The "green spiral" speaks to the climate-forward relationship that can be forged between local policymakers and the business community, even in times of uncertainty surrounding green growth. As one journalist puts it, "policy, technology, business, and politics can all work together, lowering the cost of zero-carbon energy, building pro-climate coalitions, and speeding up humanity's ability to decarbonize."[149] While "governance" and "business" are often presented as opponents on either ends of a rope, this expectation can be turned on its head by examining the ways in which municipalities and businesses have cultivated positive relationships and built on each other's successes to speed up transition.

Today, many examples of partnerships between Japanese communities and businesses exist in the area of sustainability and decarbonisation. One recent example, the Association for Renewable Energy Regional Revitalisation formed in June 2021 to promote partnerships between businesses and local stakeholders.[150] As the name suggests, this association aims to promote knowledge-sharing on renewables, the development of new renewable energy facilities, regional economic revitalization and the deepening of ties between communities and businesses. Other initiatives include the Japan Climate Initiative, created in July 2018, which unites Japanese companies, NGOs, research institutions, and local governments under the common mission of climate action.[151] Energy and environment clusters, in particular, can serve as incubators of business and knowledge that bring together governance and business needs, though official clusters are less common in Japan than in other markets.

The national government has made several moves to emphasize its commitment to innovation in decarbonisation from the private sector. The Green Growth Strategy Plan,

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[148] Kelsey, Nina, and John Zysman. "5. The Green Spiral." *Can Green Sustain Growth?*. Stanford University Press, 2020, pg. 79-88.
[149] Robinson Meyer, "How the U.S. Made Progress on Climate Change Without Ever Passing a Bill," *The Atlantic*, June 17, 2021.
[150] "Tokyu-Fuji, Tokyo Gas, and 10 Other Companies Establish New Organization to Support Expansion of Renewable Energy Installation in Local Communities," *Kanyou Business Online*, June 2, 2021. [Japanese]
[151] "FAQ," *Japan Climate Initiative*.

released in June 2021, notes that "there are many companies in the industry that need to fundamentally change their business models and strategies," and that supporting investment and innovation for the green transition is understood to be the role of government. Thus, the mission statement of the Green Growth Strategy Plan is to develop concrete plans, set ambitious goals, and create an environment in which the private sector is empowered to take on challenges.[152] The framework of the strategy mobilises a variety of policy tools (budgeting, tax, regulatory reform, standardisation, and funding tools) and directs 240 trillion yen towards these tools.[153]

As part of the Green Growth Strategy Plan**, METI offers support to companies working on decarbonisation through the NEDO Green Innovation Fund** (2 trillion yen). Priority fields for this fund include storage batteries, offshore wind, next-generation solar cells, hydrogen and carbon capture. The fund's associated Project Subcommittee has formulated an evaluation rubric, prioritising projects based on their carbon reduction potential, support needs, and market competitiveness, with a pledge to encourage the participation of SMEs and the development of new industries.[154] A description of first round of selected projects, all hydrogen-related, can be found in the "Future Fuels" section of this report. Other ministries, particularly the MOE, also offer funding under specific application calls. For instance, in August 2021, the MOE selected 5 companies that would receive financial support under a supply chain decarbonisation project.[155] In September 2021, MOE announced an environmentally friendly point scheme aimed at consumers.[156] MOE funds individual companies with promising technology, including a wave power generation project[157] and a CCUS project.[158]

There are also signs that several companies that feature prominently in the Japanese commercial landscape are reorienting their decisions towards greater sustainability. As of August 24, 2021, the MOE reports that 152 Japanese companies have pledged to follow the Science Based Targets initiative (SBTi), created to ensure compliance with the Paris Agreement. Of these, 125 have obtained certification. [159] A full list is also available on the SBTi website, with details about participating companies' targets.[160] By February 2021, 50 Japanese companies

[152] "2050 Carbon Neutral Green Growth Strategy Formulated," *METI*, June 18, 2021, pg. 3. [Japanese]
[153] Ibid, pg. 8. [Japanese]
[154] Ibid, pg. 10. [Japanese]
[155] "MOEJ selected 5 companies to participate in the Supply Chains Decarbonisation Project," *MOE*, August 20, 2021.
[156] "Establishing a point system for purchasing environmentally friendly products to encourage a change in awareness," *Mainichi*, August 30, 2021.
[157] "Wave power generation under development at tsunami-damaged breakwater, aiming for local production for local consumption of energy," *Asahi Shimbun*, September 7, 2021.
[158] "Toshiba ESS and 13 other companies selected for the Ministry of the Environment's CCUS demonstration project,"*Kankyou Business*, September 14, 2021.
[159] "International Efforts," *Green Value Chains*, *MOE*, last modified September 14, 2021, accessed September 29, 2021.
[160] "Companies Taking Action (Japan)," *Science Based Targets Initiative*, last modified September 2021, accessed September 29, 2021.

had joined RE100, representing 1/6th of RE100's global membership.[161] The fact that Japan's business community is gravitating towards the issue of decarbonisation serves as a positive bellwether, in this way, for future improvements and greater accountability.

4.2. Examples of Multi-stakeholder Collaboration

Japanese municipalities, particularly those with a history as an Eco-City or Future City, often partner with the private sector to launch innovative sustainability initiatives, or to accelerate the development of green infrastructure.

Below, **we identify recent examples that showcase efforts to decarbonise in which municipalities play a key role, and use these case studies to illuminate the larger context of governmental efforts.** Please see, as well, the "Future City," "SDGs Future City," and "Smart City" case studies, which are discussed in this report and online.[162] The examples below are included to highlight examples not contained within those programmes.

4.2.1. Promoting social transformation and innovation

In collaboration with BRITA Japan, the #mymizuChallenge is a month-long campaign in which Kameoka City residents can compete to save plastic waste via an in-app, gamified experience. Kameoka City has signed agreements with both BRITA Japan and mymizu to promote the reduction of plastic PET bottles.[163]	
mymizu	Described as a "refill app and and sustainability movement," mymizu is the first water bottle refill app in Japan.[164]
BRITA Japan	A global water purification product company with a Japanese branch, BRITA first originated in Germany.[165]
Kameoka City (Kyoto Prefecture)	City with around 90,000 residents known for its history as a farming community and as a modern-day tourist destination.[166] Kameoka was the first city in Japan to ban the free distribution of plastic bags and aims to eliminate disposable plastic waste by 2030.

Table 16: Kameoka City example

[161] "50 member companies now! RE100 goes from strength to strength in Japan but government action still needed," *RE100*, February 1, 2021.
[162] For "Future City" case studies, see this link. For "Smart City" case studies, see this link.
[163] "BRITA Japan Co., Ltd. x mymizu Challenge in Kameoka, an initiative to reduce PET bottles, will be held for the first time in Japan with citizen participation in the environmentally advanced city of Kameoka!" *PR Times*, August 24, 2021. [Japanese]
[164] "Our Story," *mymizu*.
[165] "BRITA History: 50 Years as a Success Story," *BRITA Japan*. [Japanese]
[166] "Explore Kameoka," *Kameoka City Tourism Association*.

So-called "social innovation" can assist in building awareness among residents, and incentivising behavioural change, in response to changing environmental issues. **Given their proximity to residents and ability to closely interface with them, Japanese cities are well-positioned to develop social innovation programs that are tailored to their context.**

In partnership with mymizu and BRITA, Kameoka City launched a month-long program to incentivise plastic reduction among its residents. This case study showcases municipality efforts to engage its residents in the reduction of waste and "waste-free town development."

To promote this initiative, Kameoka City also hosted a panel discussion featuring academics, high school students, city officials, and company representatives, in order to discuss sustainability in more depth. **In Japan, it is not unusual for municipalities to organize and host awareness-raising seminars for the public**, often in collaboration with a private entity. Through the Japan Center for Climate Change Actions (JCCCA), established by the Japanese government in 1999 under the Global Warming Countermeasures Act,[167] several prefectures and municipalities have set up their own educational centres to inform the public about climate change adaptation and mitigation measures. The JCCCA maintains a searchable database of active, municipal-level initiatives on climate change.[168]

Municipalities often host "Green Growth Advisory Councils," which aim to promote cooperation between communities and businesses. The Kita-Kyushu Advisory Council is one prominent example. [169] The city has also developed, as part of its "Green Growth Strategy," an industry promotion council to facilitate networking among environmental businesses and promote the industry as a whole.[170] There are also government-led opportunities for businesses to learn about decarbonisation. In Toyota City, the "Toyota City Decarbonisation School" offers opportunities for companies, particularly SMEs, to learn about climate change risks and opportunities, as well as supply chain impacts.[171] The "*furusato nozei*" (hometown tax) system, which allows corporations and residents to redirect their tax money to a specific municipality in exchange for a token gift or tax deduction, has been used to promote renewable energy in specific municipalities.[172] As "green spiral" scholars note, subsidies are a known tool to speed up improvements in decarbonisation technology and uptake, and thus innovative systems like the hometown tax program or other subsidies have an important role to play.

Cities also often promote environmental initiatives through their own Environmental Policy Divisions. Larger cities may have a dedicated section for climate change, as is the case with

[167] "About JCCA," *Japan Center for Climate Change Actions*. [Japanese]
[168] "Examples of local efforts," *Japan Center for Climate Change Actions*. [Japanese]
[169] "Formulation of Kitakyushu City Green Growth Strategy," *Kitakyushu City*, updated October 11, 2021. [Japanese]
[170] "Kitakyushu City Environmental Industry Promotion Council," *Kitakyushu City*, updated February 8, 2021. [Japanese]
[171] "Toyota City Decarbonisation School (for SMEs)," *Toyota City*, August 5, 2021. [Japanese]
[172] "Renewable energy electricity is accepted as a return item for hometown tax payment," *Nikkei*, June 28, 2021. [Japanese]

Yokohama. In Yokohama, the Climate Change Policy Headquarters (also known as the Global Warming Countermeasures Headquarters) exists to promote governmental initiatives to counteract climate change. It is a hub for comprehensive management of the issue from within the city government and engages civil society, local business, the non-profit sector, academic institutions, and other groups, in order to develop and promote Yokohama's efforts on this front.

In the case of Kameoka City, the mymizu and BRITA Japan partnership is conducted through the city's Environmental Conservation Section (within the Environmental Policy Division).[173] **Environmental departments embedded within city governments can also provide consultation services to residents and local companies.** In Sendai City, for instance, the environmental department provided insights and shared best practices regarding composting to a local SME, 土帰 doki Earth. 土帰 doki Earth runs a subscription-based delivery service for locally produced farm goods, as well as a pick-up service for biowaste. According to this SME, city officials were open to conversation on this topic, and shared information on city-level subsidies and informational pamphlets targeted at promoting composting.[174]

Prefectural governments in Japan also promote climate change mitigation and adaptation measures via specific administrative units. Nagano Prefecture's Zero Carbon Promotion Office boasts an extensive list of resources for residents and businesses, including consultation desks for renewable power generation (particularly solar power), subsidy application information, progress reports on the environmental strategy, and more.[175]

4.2.2. Developing microgrids for urban resilience

Regional microgrid development project built from 2020-21 and operated thereafter to enhance energy resilience in the area and promote local production and consumption of energy.	
A.L.I. Technologies	Japanese company operating in the drone, hoverbike, AI, and blockchain sectors. Beginning in 2021, A.L.I. established an energy solutions business. This division spun out as its own company called "zeroboard."
Kyocera Co., Ltd.	Major Japanese electronics manufacturer founded in 1959 and headquarters in Kyoto, Japan. As the project leader, Kyocera organized the consortium of companies working on this microgrid project (which, in

[173] "Call for Participants! We will hold the BRITA Japan x mymizu challenge," *Kameoka City*, August 20, 2021. [Japanese]

[174] "Concept," *土帰 doki Earth.*

[175] "Introduction of Zero Carbon Promotion Office," *Nagano Prefectural Government*. [Japanese]

	addition to A.L.I., included REXEV Co., Ltd. and Shonan Electric Power Co., Ltd.
Odawara City (Kanagawa Prefecture)	Historic Japanese city located on Sagami Bay, not far from Mt. Fuji. The city has an estimated population of over 180,000 residents. The city provided land for this project (located in city-owned parks).

Table 17: Odawara City example

Generating "local power for local consumption" is a strong motivator for many Japanese municipalities. Locally produced power is associated with both sustainability and disaster resilience.

Odawara City, in partnership with several Japanese companies, developed a regional microgrid in 2020 within its jurisdiction in order to promote renewable energy, increase its resilience during natural disasters, and to supplement its energy production during non-disaster times. This project is also notable for its incorporated innovations, including EV and storage battery support and blockchain technology for supply and demand management.

A.L.I. Technologies, an SME involved in this project, supported the development of the microgrid by providing blockchain-assisted supply and demand balancing functions. A.L.I. is also providing energy solutions through "zeroboard," a new platform which enables companies to determine their emissions, visually chart them, develop mitigation strategies, and apply for emissions credits in Japan ("zeroboard" is now its own SME, having spun out from A.L.I. in late 2021).

In addition to A.L.I. Technologies, other Japanese companies are providing strategic innovations to the Odawara microgrid project, including REXEV (another SME), which has developed an energy management system for EVs and supporting infrastructure. Shonan Electric Power, which is an electricity retailer focused on locally produced renewable energy from the Kanagawa area, is the main energy supplier. The entire project is led by Kyocera, a major Japanese manufacturer of electronics.

Participating in the Kyocera-led project allowed the smaller companies, particularly the SMEs, the valuable opportunity to trial their technologies with the support of both larger companies and the Japanese government.

Odawara City is a key partner in this project, as it is coordinating the energy policies that form the backbone of the project. It is also tasked with disseminating key information about it to residents. Odawara City has been active in championing community energy since 2012 when, in

partnership with community leaders, it supported the launch of Hotoku Energy, an energy company financed by local companies.[176]

The example of the Odawara microgrid captures a growing trend in Japan to develop distributed energy systems (or "microgrids") throughout the nation.[177] Microgrids are independent from the main energy system, and can continue supplying energy in the case of an emergency, such as during a natural disaster. Japan is particularly vulnerable to disasters that can quickly disrupt access to power, including earthquakes and typhoons, and several incidents in recent years (such as the 2019 typhoon season and the Hokkaido earthquake of 2018) have caused significant hardship for affected residents and municipalities.[178]

In this context, METI has made several moves to encourage the development of microgrids in Japan. The Odawara City microgrid developed in tandem with A.L.I. Technologies, Kyocera, REXEV, and Shonan Electric Power, was made possible through support from METI's Regional Microgrid Project initiative.[179]

In April 2021, METI's Agency for Natural Resources and Energy released a comprehensive handbook on regional microgrids, discussing the merits of microgrids, the challenges of developing such grids, as well as a practical step-by-step guide on how to develop and implement regional microgrids. This handbook, targeted at businesses, contractors, and local governments, provides guidance on basic procedures for preliminary assessment, consultation with power transmission and distribution entities, equipment installation, obtaining resident consent, energy management, safety, laws and regulations, commercialization, and general business plan implementation.[180]

METI will also introduce a new distribution license, which is expected to enhance resilience of the energy network by making it possible for large developers to sell parts of their distribution grids. This may lead to the development of smaller, self-contained grids for local communities.

In addition, government funding exists under a special subsidy scheme for microgrids. The regional microgrid handbook includes examples of projects that have received funding under this scheme (sections 8.3 and 8.4). These projects allow local municipalities to jointly develop projects with Japanese companies, both large and small.

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[176] IRENA Coalition for Action, "Hotoku Energy and Shonan Power: An evolutionary community energy partnership in Japan," *Community Energy Toolkit: Best Practices for Broadening the Ownership of Renewables*, 2021, pg. 31.
[177] For more information about microgrids, see: "Distributed energy resources for net zero: An asset or a hassle to the electricity grid?" by the IEA.
[178] "The Emergence of Microgrid Development in Japan," *Shulman Advisory*, August 2021, pg. 1.
[179] "Adoption of the Project for the Construction of a Local Microgrid Using Renewable Energy in Odawara City, Kanagawa Prefecture," *A.L.I. Technologies*, September 9, 2020. [Japanese]
[180] "Regional Microgrid Construction," *METI*, April 16, 2021.

4.2.3. Bringing renewable energy to businesses and consumers

Shinjuku City (a special ward of Tokyo) and EnerBank have partnered to develop an electricity auction system ("Eneoku") to promote the switchover to renewable electricity in Shinjuku-area businesses.[181]	
EnerBank Co. Ltd	Japanese SME developer and operator of a renewable electricity auction system.
Shinjuku City (Tokyo Metropolitan Area)	As of June 2020, Shinjuku has declared its aim to reduce its CO_2 emissions to zero by 2050. Its partnership with EnerBank, starting in September 2021, is one of the key projects initiated to accomplish the zero carbon goal.

Table 18: Shinjuku City example

Good deployment of policy allows municipalities to develop and centralise resources, and then to make them accessible at scale and at reduced cost for interested parties, including residents and companies. Leveraging this ability in the context of decarbonisation can enable locals to participate in green initiatives that would have otherwise been out of reach.

Switching to a renewable energy provider can prove costly for end-users, both in terms of money and time spent researching different suppliers; EnerBank, in partnership with municipalities, shows **how innovative businesses can work with municipal networks to increase the scope and pace of energy switchover.**

EnerBank, a Japanese SME founded in 2018, has developed a web-based electricity auction platform (called "Eneoku") to support renewable electricity procurement for businesses and local governments. EnerBank has entered into several agreements with various municipalities across Japan, including Saitama City, Kanagawa Prefecture, Kasai City, and Masuda City, among several others. The Eneoku platform presents several advantages for both end consumers and municipalities. Eneoku is provided free of charge to consumers. By partnering with interested cities and towns, the platform is able to help the municipality lower both its administrative costs and the emissions of its local businesses. Eneoku can also be used by the municipalities themselves to procure renewable energy for public facilities; most recently, Kasai City, in Hyogo Prefecture, announced that it would utilise Eneoku in a bid to decarbonise all of its public facilities.

EnerBank has also entered a partnership specifically for SMEs through Toyama Prefecture's Regional Resource Recycling System Association. This Association, whose membership is largely composed of major Japanese energy companies, is interested in promoting energy development and saving measures for local production and consumption of energy.[182] The

[181] "For the first time in Tokyo! Shinjuku will start a renewable electricity auction," *PR Times*, September 21, 2021. [Japanese]
[182] "About the Association," *Regional Resource Recycling System Association*. [Japanese]

partnership between EnerBank and the Association aims to make it possible for SMEs to reduce their costs and switch to green energy.

Each of EnerBank's partnership involve a municipal or regional partner, showcasing how, by working together with companies, municipalities can innovate within the field of energy services to make the process of procuring renewable electricity more approachable for newcomers. As described by Shinjuku City, the electricity auction system is aimed at businesses interested in switching to a renewable source of electricity, but that have reservations over the potential high costs. The municipality has sought to make the changeover process simple by creating a 6-item form that allows companies to register to participate in the auction and locate a new electricity contract at a lower price. The municipality provides both usage of the auction platform and additional support at no extra charge.[183]

The company's platform has been featured by start-up hubs in Tokyo, including the Cambridge Innovation Center (CIC). In October 2021, EnerBank's start-up pitch received top marks at the CIC's anniversary event. EnerBank was also showcased alongside several other Japanese SMEs (including zeroboard and REXEV, featured in this report, and share-denki), at an event aimed at addressing regional decarbonisation challenges in local government.[184]

4.2.4. New market opportunities in solar and wind

A European developer and Japanese energy distributor and retailer joined forces to develop two floating solar plants, generating a total of 3MW of power to be used, in part, by the local community.[185]	
Ciel x Terre	French developer of floating solar plants
Minna Denryoku	Japanese energy retailer focused on renewable energy production and retail
Minamiawaji City (Hyogo Prefecture)	Located in Hyogo Prefecture, this city has 45,000 residents and is a long-time supporter of local renewable energy production and consumption

Table 19: Minamiawaji City example

As covered by the EU-Japan Centre Strategic Partnership for the Implementation of the Paris Agreement (SPIPA) team, this partnership was born in 2018 from a mutual interest in floating solar plant development. **Both Ciel & Terre and Minna Denryoku were interested in projects that could achieve financial feasibility without support from the central government, since the window of opportunity for attractive, state-supported feed-in tariff rates was quickly closing.** Given that floating solar plants are less environmentally destructive, Minna Denryoku

[183] "Shinjuku Renewable Energy Action," *Shinjuku City*. [Japanese]
[184] Cambridge Innovation Center, "Regional Decarbonisation YouTuber x CIC Energy & Environment Seminar for Regional Decarbonisation Roadmap," *Peatix*. [Japanese]
[185] "Floating Solar Power: Ciel & Terre x Minna Denryoku," *EU-Japan Centre for Industrial Cooperation Case Study Library*, September 2021.

was motivated to increase its share of energy generated in this way, but stressed the importance of getting key local stakeholders on board.

As with most energy development projects, the project's eventual success relied on developing a strong relationship with the local stewards of the area and the local government. Both partners worked to ensure that the community felt adequately provided for in this context. In the case of Minamiawaji City, bodies of water are owned by local cooperatives and the farmers who formed part of these cooperatives were offered rental income in order to use the ponds, which allowed them to cover the costs of pond maintenance. Ciel & Terre also set up a monitoring and alert system to avoid any harmful impacts on the ponds, and provided energy storage (to be supplied with electricity by the floating panels for the community to use in case of emergency. Because Minna Denryoku has developed a blockchain-facilitated distribution network, it is able to track the flow of energy from point of generation to point of consumption. Thanks to the company's knowledge in this area, stores in Minamiawaji were able to receive renewable electricity generated by the floating plants.[186]

This case study speaks to the concerns of the members of the solar business community, who are keen to explore opportunities in a post-FIT landscape. Furthermore, the partners involved relied on the participation of Miniamiawaji City to act as liaison between the businesses and the residents.

The Northern Akita Offshore Wind Farm Project, in development since 2016 by the Akita Offshore Wind Corporation (AOW), is Japan's first large-scale offshore wind power project. The project will supply 140MV of total power, to be sold under a power purchase agreement (PPA) to TEPCO. Commercial operation is expected sometime in 2022.	
Siemens Gamesa Renewable Energy	An engineering company with roots in Spain and Denmark and a multinational presence, Siemens Gamesa signed an MoU in 2019 with Obayashi Corp to supply wind turbines for the AOW wind farm.
Obayashi Corporation	One of Japan's major constructive companies and a member of the Nikkei 225 corporations.
Akita Prefecture	Akita is a mountainous prefecture located in northern Japan. The wind farm project is located in mainly in the Akita Port and Noshiro Port areas. The Prefectural Government of Akita's Energy and Resources Promotion Division is actively involved in developing surveys and environmental

[186] Ibid.

	assessments and shares these with the public on their website.

Table 20: Akita Prefecture example

In order to promote the development of offshore wind power generation in Japan, the Japanese national government enacted the "Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities," also known as the "Renewable Energy Marine Use Act," in April 2019. METI and MLIT then selected four areas that showed generative potential based on the stipulations in the law and data provided by prefectural governments. One of these areas was Akita Prefecture, which boasts an extensive coastline.

Notably, Article 5 states that local governments are required to "endeavor to provide cooperation" with the measures from the central government.[187] Unlike other Acts, which provide guidelines for governments and leave implementation up to their discretion, this Act is more forceful in its language.

Akita Prefecture had already been creating plans for the development of its offshore wind resources. As part of the second phase of its regional revitalisation scheme, the prefecture conducted a study in 2014 to assess the potential for offshore wind along its coastline.[188] **Akita Prefecture has been struggling with demographic and economic decline and has been cited as emblematic of Japan's "graying future,"[189] which has led to its exploration of offshore wind as a possible tool to combat regional decline.**

The Renewable Energy Marine Use Act requires the formation of an overseeing council, which includes members from the central government, prefectural government, relevant municipalities, and fishery cooperatives, to manage and implement the project. Therefore, in this case, there is no sole decision-maker in the approval process for development projects; it is a joint, multi-stakeholder process that requires consultation with the council. In the case of Akita Prefecture, the overseeing council held its first meeting in October 2019.

Several municipalities and port areas in Akita Prefecture are already undergoing development, which has led resident complaints regarding the possibility of environmental damage, as well as issues with construction noise and the potential impact to the fishing industry.[190] **A local mayor noted that, while assuaging resident concerns was important, he also hoped that the offshore wind operation would have a "ripple effect" on the economy and encourage regional**

[187] "Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities," *Japanese Law Translation*, May 20, 2020.
[188] "Interim summary of the second phase of the Akita Prefecture Hometown Plan," *Akita Prefectural Government*, November 14, 2016. [Japanese]
[189] Kiyoshi Takenaka, "Aging Japan: Akita prefecture may be glimpse of country's graying future," *Reuters*, July 4, 2018.
[190] Residents can complain directly to the Akita Prefectural government and receive a response on this page.

revitalisation in Akita Prefecture.[191] Importantly, the President of the AOW has noted that the official policy is to, whenever possible, subcontract to companies located locally in the prefecture.[192]

4.3. International Collaborations between the EU and Japan on Local Decarbonisation

The EU and Japan are linked strategically, commercially, and diplomatically by way of the Strategic Partnership Agreement (SPA), Economic Partnership Agreement (EPA) and the EU-Japan Energy Dialogue. Their business communities are served by the EU-Japan Business Roundtable (BRT), the Japan Business Council in Europe (JBCE), the European Business Council in Japan (EBC), and the EU-Japan Centre for Industrial Cooperation.

At a bilateral summit on May 27th 2021, the EU and Japan formed the historic Green Alliance, the first of its kind between the EU and another nation. This alliance reaffirms the commitment of both the EU and Japan to secure "climate neutral, biodiversity-friendly, circular and resource efficient economies" with the goals of achieving green growth and net-zero GHG emissions by 2050.[193] Both parties confirmed, as well, their shared commitment to the several international treaties and conventions that govern action on climate change and biodiversity, including the upcoming COP26 in Glasgow, the Convention on Biological Diversity, the 2015 Paris Agreement, and the 2030 Nationally Defined Contributions (NDCs).

The EU and Japan also commit to third-market cooperation via the Green Alliance, particularly in Asian, Indo-Pacific and African countries. This has been a focal point of relations between the two parties since 2019, when the Partnership on Sustainable Connectivity and Quality Infrastructure between the EU and Japan was signed.[194]

One area of connectivity between the EU and Japan concerns city-to-city, or paradiplomatic, relations. **European and Japanese cities and regions can pursue collaborative activities through various avenues.**

4.3.1. The EU-Japan Regional Cooperation Helpdesk

The EU-Japan Regional Cooperation (EJRC) Helpdesk is coordinated by the European Union via the European Centre for Japanese Studies in Alsace (CEEJA) and Japan via the Council of Local Authorities for International Relations (CLAIR).

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[191] "Offshore Wind is "Promising", "Promoted" Zones: Voices from Local Governments and Organizations," *Sakigake (local Akita newsource),* September 14, 2021. [Japanese]
[192] Yoichi Masuda, "Construction of Japan's first offshore wind farm continues steadily," *Asahi Shinbun*, August 8, 2021. [Japanese]
[193] "Towards a Green Alliance to protect our environment, stop climate change and achieve green growth," *EU-Japan Summit*, May 27, 2021.
[194] Masami Marbot, "Analysis of EU-Japan Business Cooperation in Third Countries," *Minerva Programme: EU-Japan Centre for Industrial Cooperation*, 2019, pg. 8.

This helpdesk aims to encourage cooperation between municipalities, regions, and clusters from both Japan and the EU. The sectors involved are varied and include digital technology, green technology, biotechnology, tourism, and other major industries. In addition to acting as a knowledge-sharing partner, the EJRC helpdesk develops match-making events in order to facilitate relations between localities in Japan and Europe. The helpdesk also works on cooperation between the EU and Japan in third-party countries.

In January 2021**, the EJRC helpdesk organized a webinar on renewable energy and regional revitalization as part of its "EU-Japan Regional cooperation and good practices" series.** This event featured Energy Agency.Fukushima (from Fukushima Prefecture, Japan) and Energy Agency.NRW (from the State of North Rhine-Westphalia, Germany).[195]

An upcoming webinar between Nagano Prefecture (Japan) and North Karelia (Finland) will be held in December 2021. These two regions signed a collaboration agreement in 2019, focused on advancing forest bioeconomy, and representatives have met on several occasions via collaboration meetings, leaders meetings, and fora and seminar participation. Because North Karelia and Nagano both have established ambitious climate goals, this is a fruitful interregional dialogue that helps advance learning in both areas.

4.3.2. International Urban Cooperation Programme (IUC)

The EU-funded International Urban Cooperation (IUC) programme "support[s] the achievement of bilateral policy objectives, as well as major international agreements on urban development and climate change, such as the Urban Agenda, the Sustainable Development Goals, and the Paris Agreement."[196] As part of its "Component 1," **the IUC supports city-to-city cooperation on sustainable urban development, with Japan being one of its target countries.** This initiative aims to facilitate the development of "local action plans" and knowledge-sharing between cities with similar sustainability challenges.

A regional IUC office for Japan was established by Nagoya University in 2017, and it is overseen by the Directorate-General for Regional and Urban Policy of the European Commission and the City Bureau of the Japanese Ministry of Land, Transportation, and Tourism.[197] Its intended activities are as follows:

> ***The programme is designed for cities in the EU and Japan to address unprecedented economic and social challenges as in aging and declining population, budgetary constraints, intense international competition, global warming and the energy mix and supply.*** *Cooperation is handled by pairing of Japanese and European cities who will exchange experiences of mutual interest under the course of 18 months. The recommended topics for cooperation are priorities within the 2030 agenda for Sustainable Development adopted in*

[195] For more information, see: Report from Energy.Agency.Fukushima on the webinar; presentation materials (Japan, Germany)
[196] "What is the IUC?" *International Urban Cooperation*.
[197] "About us," *International Urban Cooperation – Japan*.

September 2015 in Paris, and the New Urban Agenda adopted in October 2016 in Quito. Participants will be developing local action plans (LAP) that include specific activities and economically viable projects to be implemented in the short term to ensure results and open up market opportunities.[198]

The International Urban Cooperation's regional Japan office lists ten active pairings between Japanese cities and European Union counterpart cities.

Source: IUC Japan website

Figure 18: IUC partnerships between EU and Japan

The IUC-Japan secretariat has conducted six exchange meetings, the most recent of which took place online in November 2020.

[198] Ibid.

4.3.2.1. Yokohama and Frankfurt am Main

As part of the IUC programme, **Yokohama and Frankfurt am Main signed their Urban Cooperation Action Plan (UCAP) partnership agreement in August 2018**, committing to a programme of knowledge-sharing on their energy transition journeys. Yokohama and Frankfurt already had a strong relationship, as they had signed a previous partnership agreement in 2011.

At a glance, these two cities appear quite different. Yokohama is nearly double the size of Frankfurt in terms of area and has five times the population. However, **there are important commonalities between these partnered cities in terms of their mutual ambition to address climate change and achieve carbon neutrality in their jurisdictions.**

The cities were chiefly interested in sharing best practices in two main areas. First, **the cities were interested in developing forms of cooperation with other municipalities in their respective countries, with an eye towards increasing the utilization of renewable energy.** Yokohama, for instance, has developed a virtual power plant system that makes use of renewable energy from its northern neighbours in Tohoku. In addition, **Yokohama and Frankfurt shared an interest in the use of "nudging" as part of supporting environmental projects, and wanted to use their partnership to explore this concept.**

In April 2018, the Frankfurt team was able to visit Yokohama and directly observe the operations of a District Heating and Cooling facility in order to better understand Yokohama's approach to urban energy management. In August 2018, a delegation from Yokohama visited Frankfurt to get first-hand information on Frankfurt's use of low-carbon mobility in its airport, energy-saving practices in its old quarter, and environmental education programme for its junior high school students. The Yokohama delegation was impressed by Frankfurt's bonus programme, which offers incentives for households and public facilities that meet energy-saving targets, and the Frankfurt team expressed their admiration for the Yokohama Smart City project and their promotion of low-carbon mobility.

During the course of their partnership, Yokohama and Frankfurt have communicated by email and phone as frequently as once a week, with exchanges happening monthly at a minimum. Efforts have been made to translate concept papers in the fields of energy management, low-carbon mobility and environmental education into both Japanese and German to facilitate knowledge-sharing. While the teams mentioned that translation requires significant time and effort, it is worth it to be able to transcend the language barrier between the cities.

4.3.3. Global Covenant of Mayors for Climate & Energy

The European Commission established the Covenant of Mayors in 2008. In 2014, the Compact of Mayors was launched by Michael Bloomberg, the then mayor of New York City, ICLEI, and C40. Five Japanese municipalities (Okazaki City, Toyota City, Anjo City, Chiryu City, and Miyoshi City) participated in this Compact, which ran from 2014 to end-2018. In 2016, the Covenant of Mayors for Climate and Energy was launched.

The Covenant of Mayors Japan was launched in 2018, and, in 2019, its steering committee held its first meeting. **As of November 2020, there are 28 signatory municipalities in Japan.**[199]

4.3.4. Cluster-based Collaboration

Clusters are bottom-up, industry-specific collaborative networks of business leaders, SMEs, policymakers, venture capitalists, and financial institutions that seek to build community around a given business topic from within a given jurisdiction. Clusters are diverse in terms of field, scope, and governance, but common among them is an interest in spurring innovation and catalysing growth for start-ups and SMEs.

Clusters are linked with cities, as business communities tend to grow from within local networks. However, clusters can, and often do, cooperate with other clusters in other cities and transnationally, leading to opportunities for collaboration across borders. They can serve as valuable entry points for SMEs and ecosystems for learning and sharing best practices across a variety of industry players.

Below is a partial list of energy and environment clusters in Japan, as identified by the author and the EU-Japan Centre for Industrial Cooperation.

Name	Main area	Objectives
Kyushu Recycle and Environmental Industry Plaza	Environmental business support	Provides a platform for SMEs to obtain cutting-edge info and market development support (for both domestic and overseas markets)
Kitakyushu Interdependent Business Consortium for Sustainable Development	Environmental business support	A "member incubator" with ties to city government focused on recycling and environmental business
Fukuoka Prefecture Recycle Research http://www.recycle-ken.or.jpCenter	Recycling	To foster industry-business-academia collaboration for new recycling systems
Yamaguchi Green Materials Cluster	Green materials	To create a resource and energy-saving cluster which assists in R&D activities for novel LEDs, agricultural and fishery tech applications, waste-reduction and recycling, and nanoparticle-based materials and devices
Okinawa Industrial Wastes Association	Recycling; biomass energy	To support new businesses and to decrease the amount of waste in the region by developing biomass energy technology and supporting a local, circular management of waste.

[199] "Background of the Pledges/Japan," *Global Covenant of Mayors for Climate and Energy*.

Hiroshima Environmental Business Promotion Council	Environmental business support	Support Hiroshima-area businesses in their efforts to internationalise. Inroads have been made in Asia, and there are two MoUs active with European countries.
Nagasaki Marine Industry Cluster	Marine Energy	To develop local region in the field of marine energies. Aiming to find inspiration from UK based similar project EMEC.
Kawasaki Green Innovation Cluster	Environmental business support	To promote the four pillars of the "Promotion Policy on Kawasaki Green Innovation" and business development focused on industry-university public-private partnerships.
Association for Renewable Energy Regional Revitalisation	Environmental business support	To promote partnerships between businesses and local stakeholders, and to promote knowledge-sharing on renewables, the development of new renewable energy facilities, regional economic revitalization and the deepening of ties between communities and businesses.
Japan Climate Initiative	Environmental business support	To strengthen the dissemination of information and exchange of opinions among companies, local governments, and NGOs that are actively working on climate change.
Renewable Energy Association for Sustainable Power (REASP)	Energy business asociation	To support the spread of renewable power in Japan.

Source: Author, with data from the EU-Japan Centre for Industrial Cooperation mapping reports (2013, 2016)

Table 21: Energy/environment clusters in Japan

While clusters are uncommon in Japan, **clusters and regions are still an important locus for EU-Japan interaction on decarbonisation.** Below is a partial list of Japanese and European cluster-based collaboration on issues of decarbonisation.

Location (Japan)	Japanese partner	European partner (Country)	Activities	Year
Nagasaki	Nagasaki Dejima Incubator	Scotland House (Scotland)	Energy hub to build relationships between Japanese offshore renewables and marine energy stakeholders and Scottish companies	2015

Fukushima	Fukushima Prefecture	State of North Rhine Westphalia (Germany)	Promotion of use of renewable energy, hosting trade fairs, joint research, Memorandum of Understanding (signed in 2014 and renewed in 2019)	2014
	Fukushima Prefecture	City State of Hamburg (Germany)	Region-to-region cooperation to internationalize SMEs from both regions	2012
	Fukushima Energy Agency	Basque Energy Cluster (Spain)	Information exchange, preparation for the formation of joint-ventures, joint R&D	2019
Hiroshima	Hiroshima Prefecture (HEBC)	Green Tech Cluster (Austria)	Memorandum of Understanding	2019
	Hiroshima Prefecture (HEBC)	Cleantech Initiative Ostdeutschland (Germany)	Memorandum of Understanding	2019
Fujisawa	Commissioned Research of National Institute of Information and Communications Technology (NICT)	Santander (Spain)	Jointly funded by the European Union's Horizon 2020 research and innovation programme and by the Commissioned Research of National Institute of Information and Communications Technology (NICT), M-SEC is a EU-Japan research project that aims "to improve the security and connectivity of smart cities"[200]	
Japan	Japan Stadtwerke Network	Germany	Organization spreading awareness about the German "Stadtwerke" model in Japan; "stadtwerke" refer to public corporations funded by the local government that are managed like private companies. As of 2018, there were 32 member municipalities.	2017
Japan	Germany-Japan Energy Transition Council (GJET)	Germany	Research council that aims to support Germany and Japan in finding solutions to energy-related challenges. Council members meet twice a year and develop policy analysis premised on successful case studies from both countries.	2018

Source: Author, with data from Réka Lóczi, *EU-Japan Region & Cluster Cooperation* (Hiroshima and M-SEC examples excluded)

[200] Antoni Paradell and Jin Nakazawa, "M-Sec Project," *7th EU-Japan Symposium on ICT Research and Innovation*, December 2018.

Table 22: European-Japanese cluster cooperation on decarbonisation

Prefectural governments, particularly in the context of industry promotion, often cooperate with European clusters. Below we describe the activities of two Japanese prefectures: Fukushima Prefecture, which has collaborated with Germany and Spain, and Hiroshima Prefecture, which has collaborated with Germany and Austria.

4.3.4.1. Fukushima Prefecture: Cluster Activities

The lasting legacy of the 2011 Tohoku disaster has led Fukushima Prefecture to reorient its attention toward the development of new, innovative renewable technology. Fukushima Prefecture aims to promote new renewable energy industries through networking, knowledge-sharing, commercialisation, demonstration projects, R&D, and private and public sector collaboration.

Since 2011, Fukushima Prefecture has concluded memoranda of understanding with the German states of North Rhine-Westphalia, Hamburg, the Spanish Basque Country, the Royal Danish Embassy in Japan, and the Fraunhofer Gesellschaft in Germany. These MoU are specifically aimed at the development of renewable energy-related industries.[201] Fukushima Prefecture, in collaboration with other governments and industrial promotion organization in partner regions, has invited European companies to the Fukushima Renewable Energy Industrial Fair (REIF), held in Koriyama City. This fair provides networking and business-matching opportunities for European and Japanese companies.[202]

Furthermore, in the interest of promoting overseas expansion, Fukushima participates in international exhibitions, including "E-world Energy & Water," held in Essen, Germany. At the most recent "E-world Energy & Water" exhibition, five companies and one organization based in Fukushima Prefecture participated and met with companies from countries with which Fukushima Prefecture had concluded an MoU.[203, 204]

4.3.4.2. Hiroshima Prefecture: Cluster Activities

Hiroshima was traditionally the site of heavy industry, which led to pollution issues in the 1950's. This set off a cascade of governmental interest in the development of technological solutions to these environmental problems, and, as a result, **Hiroshima's business community today is active in waste treatment and management, recycling, clean agriculture and aquaculture, and air and soil treatment.**

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[201] "Initiatives for promoting industrial clusters in the field of renewable energy," *Fukushima Prefecture*, updated July 9, 2021.
[202] "REIF Fukushima 2021," *Fukushima Center for Industrial Promotion, EnergyAgency.Fukushima.*
[203] "E-world Energy & Water: Invitation to the Fukushima Booth," *Energy Agency Fukushima*, updated February 14, 2020.
[204] Information for this section was provided by the Next Generation Industry Division of the Fukushima Prefectural Government.

Hiroshima Prefecture founded the Hiroshima Environmental Business Promotion Council (HEBC) in 2012 as an "environmental business promoter for local players."[205] According to its profile page on the EU Cluster Collaboration website, the HEBC is made up of 167 companies, 135 of which are SMEs. Hiroshima Prefecture's strong name recognition has enabled the HEBC to help SMEs get their foot in the door. Because Hiroshima Prefecture has signed memoranda with local governments abroad, this has allowed HEBC-affiliated companies to develop a closer familiarity with target markets and their laws and regulations.

The HEBC exists to assist Hiroshima-based companies to internationalize. The main collaborations have taken place in nearby southeastern Asia, as well as with Europe. Hiroshima has concluded a memorandum with a province and city in Vietnam, as well as with two agencies in Indonesia. Hiroshima has also exchanged memoranda with Austria's Green Tech Cluster and Germany's Greentech Initiative. In Europe, the HEBC has been able to promote its sensor and water filtration technology.

In 2021, the participating companies in the HEBC reported 100 billion yen in revenue. By 2020, that figure had reached 163 billion yen. The participating companies also report, via survey, that internationalizing has been beneficial for their business in more ways than one. For instance, they report that promoting their products in the overseas market has revealed key insights that they are then able to utilize in the domestic Japanese market.

The HEBC can be found on the EU's Cluster Collaboration platform. As of 2021, there are three Japanese clusters available to view on this platform. Osaka's "Bio Headquarters" is focused on the life sciences industry, and Saga Prefecture's "Japan Cosmetics Center" is focused on the cosmetics industry. **Hiroshima's HEBC, therefore, is unique as it is Japan's sole official, listed eco-cluster.** [206]

[205] "Hiroshima Environmental Business Council (HEBC)," *European Cluster Collaboration Platform*.
[206] Information for this section was provided by the Hiroshima Environmental Business Promotion Council of the Hiroshima Prefectural Government.

5. Conclusion

Decarbonising our energy sources and supply chains, building energy awareness into our infrastructure, and modifying both corporate practices and consumer behaviour is easier said than done. Major diplomatic exchanges concerning climate tend to invoke national-level rights and responsibilities rather than emphasize the granularity of experiences at the local and regional levels.

However, though climate change is a global issue that will require a globally coordinated coalition to face, meaningful transitional steps can be taken by smaller players. Bottom-up approaches that are gestated within a community, however small-scale, can prove to be durable, effective, and beneficial for local stakeholders. Because climate change induces differentiated changes upon the vastly different collection of communities on Earth, it is necessary to think about locally tailored approaches that consider the needs, characteristics, and future outlook of individual residents, businesses, and organisations.

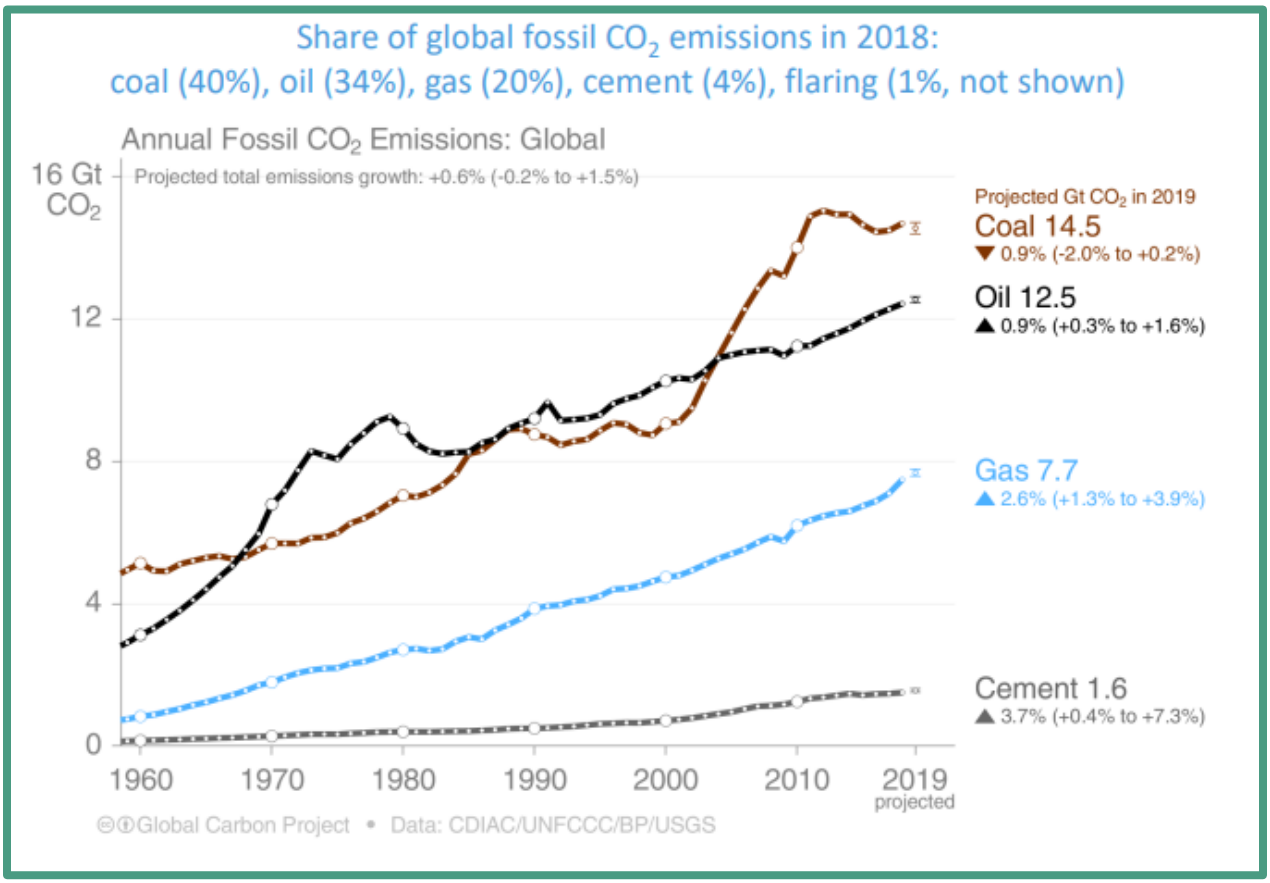
In Japan, fossil fuel resources may be scare (resulting in their large-scale importation from abroad), but resources of other kinds assuredly are not. Renewable resources are plentiful—Japan is ranked third in terms of installed solar capacity, wind energy (particularly offshore wind) represents a promising new area, and the potential for geothermal energy is among the very highest in the world. Human talent and ingenuity are other resources, and over the past few years Japan has demonstrated a commitment to incubate and support new technologies in alternative energy sources. Underreported but no less promising are the encounters that are happening on a continual basis in Japan—in municipal environmental consultation offices, online via local business collaboration platforms, during start-up seminars coordinated by government offices—to encourage collaboration between residents, businesses, and government on decarbonisation.

There are significant challenges ahead. For one, Japan will need to expand its deployment of renewable power and contend with power usage more concretely if it is to meet its reductions target and, beyond that, its net-zero goal. Local communities must be included in that conversation if large-scale deployment of various types of renewable power is to succeed. More resources for municipalities that seek to address local decarbonisation, particularly in the form of funding, permanent specialist personnel, enhanced digital reporting capacity, have been recommended by the cities and towns at the forefront of these initiatives. The national government has made a series of moves emphasising their interest in supporting such initiatives, including the publication of the 2021 Regional Roadmap and the announcement of ministry-led funding programs for municipalities. Additional targeting of local-level issues—including energy-aware housing and power usage in homes—are on the roster for future policymaking, and are an important area still left to explore.

Annex

5.1. Fossil Fuels

According to the Global Carbon Budget 2019, coal, oil, and gas were the three largest sources of global CO_2 emissions by fuel source in 2018. These three fuel sources are key players in Japan's energy mix, contributing significantly to the nation's emissions profile.



Source: Global Carbon Budget 2019 (with data sourced from: CDIAC; Peters et al 2019, Friedlingstein et al 2019; Global Carbon Budget 2019)

Figure 19: Share of global fossil CO2 emissions in 2018

Globally, Japan is the fourth-largest importer of crude oil. The vast majority of Japan's crude oil imports are sourced from the Middle East. **While oil is Japan's largest single source of energy, it is mainly used in transport and industrial applications** (chiefly in the chemical and petrochemical industries).

Crude oil demand in Japan has been falling for decades and is expected to continue decreasing due to a variety of ongoing transformations in the future energy outlook. These include the transition to electric and hybrid vehicles, increasing electrification and LNG usage in

households and in the industrial sector, improvements in energy efficiency, changes to demographic trajectory, and overall efforts to decrease GHG emissions.

Top 5 Oil Exporters to Japan (2019)		
Country	Quantity imported (millions of barrels per day)	Percent of total imported coal
Saudi Arabia	1,071	36%
United Arab Emirates	888	29%
Qatar	262	9%
Kuwait	254	8%
Russia	162	5%

Source: Author, with data from the U.S. Energy Information Administration

Table 23: Top 5 oil exporters to Japan (2018)

Though Japan is resource-scarce in comparison to other territories, the nation was able to develop a home-grown coal mining industry in the first half of the 20th century. The difficulty of extraction and transport, plus competition from low-cost foreign coal, ultimately resulted in a switch to foreign imports for coal sourcing in Japan. Japanese coal output peaked in 1961 and, despite several decades of government efforts to shelter the domestic mining industry from economic decline, Japanese coal production was unable to outcompete foreign imports, leading to slowing production and, in 2002, the closure of the last Japanese coal mine.

Today, **Japan is the world's third-largest buyer of coal** (behind India and China) and the nation imports 99% of the coal it consumes, mostly from its Pacific neighbour, Australia. In 2018, Australian coal accounted for 61% of Japanese coal imports, far and away Japan's most significant partner in the coal trade.[207]

Top 5 Coal Exporters to Japan (2018)		
Country	Quantity imported (millions of short tons)	Percent of total imported coal
Australia	128M	61%
Indonesia	32M	15%
Russia	21M	10%
United States	13M	6%
Canada	9.6M	4.5%

[207] "Japan is the world's third-largest coal-importing country," *U.S. Energy Information Administration*, last modified June 14, 2019, accessed August 4, 2021.

Source: Author, with data from the U.S. Energy Information Administration

Table 24: Top 5 coal exporters to Japan (2018)

Japan is the world's largest purchaser of liquefied natural gas (LNG), sourced in its plurality, as with coal, from Australia. In 2019, Japan imported approximately 77 million tons of LNG. Other nations, including Malaysia, Qatar, Russia, Brunei, Indonesia, Papua New Guinea, and the United States, also constitute significant LNG suppliers for Japan.[208]

Top 5 LNG Exporters to Japan (2019)		
Country	Quantity imported (millions of tons)	Percent of total imported LNG
Australia	30.1M	38.8%
Malaysia	9.3M	12%
Qatar	8.7M	11.2%
Russia	6.4M	8.2%
Brunei	4.3M	5.6%

Source: Author, with data from the International Trade Administration

Table 25: Top 5 exporters to Japan (2019)

The first shipment of LNG arrived in Japan in 1969 from Alaska, after the successful brokering of a landmark deal by the Tokyo Electric Power Company (TEPCO). This marked a dramatic shift for the Japanese energy sector, which had chiefly relied on coal, oil, and coal gas in the post-war period.[209]

From an infrastructure perspective, Japan's geographic isolation and lack of international pipeline connectivity means the country is only accessible via tankers for LNG shipments. This arrangement is at times logistically problematic, as shipping delays can lead to difficulties in supplying the grid. For instance, during a cold wave in winter 2020, COVID-19 delays and equipment failure severely limited LNG supply during a period of high weather-related demand in Japan. This forced the Federation of Electric Power Companies of Japan to issue an unusual request to businesses and the public to conserve energy to avoid a blackout.[210]

As **Japan's LNG market has matured and is no longer expanding**, China is set to overtake Japan as the world's largest purchaser of LNG in coming years.[211]

[208] "Japan Country Commercial Guide – Liquefied Natural Gas," *International Trade Administration*, last modified October 30, 2020, accessed August 4, 2021.
[209] "Japan marks 50 years of LNG imports with eye on Asia growth," *Reuters*, November 13, 2019.
[210] Akane Okutsu, "Japan scrambles to avoid blackout as cold wave grips East Asia," *Nikkei Asia*, January 12, 2021.
[211] Ryosuke Hanafusa, "Japan set to cede LNG import crown to China," *Nikkei Asia*, July 2, 2021.

5.2. Nuclear Energy

Beginning in the 1950's, politicians belonging to the Liberal Democratic Party (LDP) as well as other major government officials and industry players formed a pro-nuclear group premised on the shared belief that nuclear energy, rather than fossil fuels, would be the energy of Japan's future.[212]

The 2011 triple disaster in northern Japan had enormous and near-immediate implications for Japan's nuclear energy policy. Tsunami waves triggering several nuclear meltdowns in a plant in Fukushima, leading to the shuttering of plants, a subsequent shortage of energy supply and blackouts in the Tokyo grid area.

A year after the disaster, in response to public dissatisfaction with the handling of the crisis and the rupture of the so-called "safety myth" surrounding nuclear energy,[213] **Japan had closed down all but two of its fleet of 54 nuclear reactors**, significantly reducing the energetic output of nuclear energy and **creating a generative capacity gap of roughly 30% in the energy mix**.[214] In the aftermath of the disaster, **coal and LNG usage rapidly increased** to fill the space previously supplied by nuclear energy.

The LDP continues to consider nuclear energy to be a significant part of future energy policy. **Nuclear energy plants have gradually been restarted.** In the 5th Basic Energy Plan,[215] Japan's government states its basic position on nuclear as follows:

> *Nuclear power's energy output per amount of fuel is overwhelmingly large and it can continue producing power for several years only with domestic fuel stockpile.* ***Nuclear power is an important base-load power source*** *as a low carbon and quasi-domestic energy source, contributing to the stability of the energy supply-demand structure in the long term, on the major premise of ensuring of its safety, because of the perspectives; 1) superiority in stability of energy supply and efficiency, 2) low and stable operational cost, and 3) free from GHG emissions during operation*.[216]

The lasting presence of nuclear energy in Japan's energy policy has prompted significant research interest in innovations in nuclear energy. As a key example, small modular reactors, a next-generation type of nuclear reactor, have attracted interest from Japanese engineering firms and may play a part in future R&D efforts.[217]

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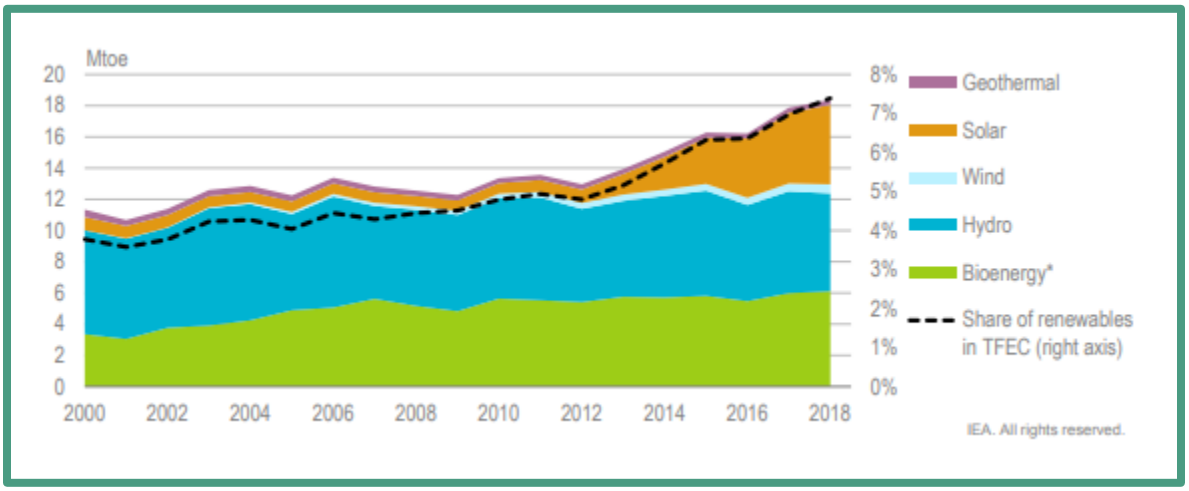
[212] Watanabe, Rie. "Breaking Iron Triangles: Beliefs and Interests in Japanese Renewable Energy Policy." *Social Science Japan Journal* 24.1 (2021): 9-44.
[213] Hiroko Tabuchi, "Japanese Prime Minister Says Government Shares Blame for Nuclear Disaster," New York Times, March 3, 2012.
[214] "Nuclear Power Plants in Japan," *The Federation of Electric Power Companies in Japan.*
[215] The Basic Energy Plans, also called Strategic Energy Plans, are a major policy document describing Japan's energy policy. They are discussed in more detail in the "Energy Policy" section of this report.
[216] "5th Strategic Energy Plan," *METI*, 2018, pg. 23.
[217] Yuko Sugigaki, "Cutting-edge US small nuclear plant enlists Japan builder JGC," *Nikkei Asia*, April 5, 2021.

5.3. Renewable Energy

In 2018, renewable energy accounted for approximately 7% of total final energy consumption in Japan, up from 4% in 2008, but still third-lowest among IEA member countries.[218] The gains in Japan's renewable sector are largely confined to electricity generation. In the transport and industrial sectors, Japan still heavily relies on fossil fuels for power generation. Thus, **although the share of renewable electricity energy has grown to 19% in 2019** (up from 10% in 2021), **the share of renewable energy in Japan's total energy supply has not increased as significantly.**

Currently, **bioenergy (also referred to as biomass energy) and hydropower are the two largest sources of energy in Japan's renewable energy sector**. **Together, these two account for almost 70% of the renewable energy consumed in Japan.** The development of new hydropower has slowed in Japan, due largely to the fact that most usable sites have already been exhausted of their generative potential. Bioenergy in Japan is chiefly used in power generation and industry (together, these represent 81% of biofuel consumption). Around half of bioenergy in Japan comes from solid biofuels, which are defined as "solid organic, non-fossil material of biological origin […] which may be used as fuel for heat production or electricity generation."[219] Another 40% is derived from non-renewable waste, with the remaining 6% coming from liquid biofuels, biogas, and renewable municipal waste.[220]



Source: IEA, pg. 92.

Figure 20: Renewable energy in total final energy consumption by source, Japan, 2000-2018

Solar energy and wind-powered energy play an important role as renewable sources in electricity generation. Solar energy in particular has enjoyed a major commercial boom, in no

[218] "Japan 2021 Energy Policy Review," *International Energy Agency*, last modified May 2021, accessed August 4, 2021, pg. 93.
[219] "Glossary: Biofuels," *Eurostat Statistics Explained*, September 9, 2019.
[220] "Japan 2021 Energy Policy Review," *International Energy Agency*, last modified May 2021, accessed August 4, 2021, pg. 93.

small part thanks to the Japanese government's feed-in tariff (FIT) scheme. This scheme has been deployed since 2009 (a preliminary phase aimed at solar photovoltaics) and more broadly enacted from July 2012 (for solar, onshore wind, small-scale hydropower, geothermal, and bioenergy).

The government's generous FIT scheme quickly and effectively incentivized development of solar energy in Japan, helping to reduce the need for coal and LNG and close the usage gap created by the shuttering of Japan's nuclear power plants. **Between 2012 and 2019, renewable energy nearly doubled in Japan, with solar power responsible for over 90% of this growth.** By 2018, solar represented a quarter of all renewable electricity generated in Japan.

Under Japan's FIT system, utilities and retailers purchase electricity generated from renewables at fixed prices determined by METI, and the cost is partially borne by the end-user via an energy surcharge. At the outset of FIT, the pricing was fixed at JPY 40 per kilowatt hour (kWh) for solar PV, a highly attractive rate for developers and retailers. Consider that, in 2012, the average system price on the Japan Electric Power Exchange (JEPX) was 14.43 JPY/kWh.[221]

Because METI would guarantee this rate for the duration of an established contract, **Japan's FIT rapidly set into motion a cycle of investment and innovation in solar.** For contracts established between June 2012 and March 2013, the Japanese government guaranteed a 40 JPY/kWh rate for the following 20 years, meaning that an electricity utility in possession of a contract signed in 2012 stood to make 40 JPY/kWh until 2032. Reflecting the changing competitive landscape, the rate was revised down by 2-4 JPY every subsequent year after 2013, and by 2020, the rate for solar PV was down to JPY 12/kWh (for contracts established between 2020 and 2021).

In terms of the manufacturing of solar panels, while Japanese companies once commanded considerable market share, they have since been largely replaced by Chinese panel-making companies, which produce 80% of global output. In 2020, Japanese panel-makers held 0.4% of the global solar panel market.[222] Indeed, **industry insiders comment that equipment and parts used in renewable energy development, with few exceptions, are dependent on value chains located in Europe and China.**

While the FIT scheme helped propel Japan's solar industry to new heights, the scheme will not be around forever. **In June 2020, the government passed new reform legislation (the "Proposal to Amend the Renewable Energy Act") that aimed to eventually transform the FIT system into a market-based feed-in premium (FIP) starting from 2022.** FIP would allow existing solar utilities and retailers to sell their energy but remove some aspects of the incentive structure. The FIP will not be as attractive as the early stages of FIT, from a profit perspective. It will also require energy producers to locate and develop a contract with an available off-taker (participate in the retail market, in other words) or sell to the wholesale market, rather than

[221] "The Electric Power Industry in Japan 2020," *Japan Electric Power Information Center, Inc*., pg. 50.
[222] Yukinori Hanada, "Xinjiang labor clouds solar sector as panel prices swell," *Nikkei Asia*, July 4, 2021.

simply sell directly to a utility, as with FIT. Because participating in the wholesale and retail electricity markets involves variable pricing and exposure to risk, FIP presents drawbacks compared with the FIT scheme from the retailer perspective.[223]

The transition from FIT to FIP is motivated by several factors. Because FIT offers a high rate simply for the sale of energy, it does not directly incentivize the development of energy storage, forecasting technology, and output adjustment, all of which are needed to optimize energy utilization and reduce emissions. In addition, the transition from FIT to FIP would take the burden of paying the surcharge off the end-user, and encourage market-based competition; this leaves energy producers presumably worse off than under FIT, but improves the consumer experience. However, given that it is still much more expensive to build and operate a generator in Japan than it is in other countries (particularly due to high construction costs), it remains unclear how renewables can remain profitable in the absence of FIT. While METI is still discussing the particulars of the FIP scheme, it is likely that the scheme will aim to balance investment incentivisation, market integration for renewables, and reduced burden on taxpayers. [224]

This new and more complex operational situation may explain why many foreign players in Japan's solar industry are reportedly finding it challenging to develop long-term plans domestically. However, **this transition to FIP has advantages from a decarbonisation perspective.** FIP will allow companies to directly purchase renewable power from producers; given that many companies are coming under increasing pressure to demonstrate their commitment to decarbonisation, this development may spur corporations to seek out transparent avenues of green power as part of their electricity procurement strategy.

The boom in solar also resulted in the development of some derelict, underperforming solar farms, which can be reinvested in as part of the secondary solar market. New regulatory changes could make it possible for companies to recoup investments in such farms and recover some of their original generative potential.[225]

Though FIT subsidizes wind energy, the introduction of FIT actually depressed growth in early wind energy development. This has been blamed on the approval process in Japan, which involves environmental assessments and consensus-building among local residents. High costs, resultant from the need to consider Japan's specific geography and vulnerability to typhoons, also play a part. Furthermore, Japan lacks a native industry for wind turbines and associated construction. As with solar panels, though several Japanese companies formerly produced wind turbines, they have since pulled out of that business. However, though the end of the solar FIT quickly approaching, the FIT rate for other energy sources, including wind, remain favourable.

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[223] Dan Shulman, "Key Renewable Energy Topics as Japan Aims for 2030 + 2050 Carbon Neutral Goals," *Seeking Sustainability in Japan with JJ Walsh* (ep. 286), August 18, 2021.
[224] Dan Shulman, "FIT, FIP, and the Future of Renewables in Japan," *Shulman Advisory,* June 19, 2020.
[225] Dan Shulman, "Key Renewable Energy Topics as Japan Aims for 2030 + 2050 Carbon Neutral Goals," *Seeking Sustainability in Japan with JJ Walsh* (ep. 286), August 18, 2021.

As a result, **some solar developers are redirecting their attention towards wind energy development**.[226]

Suga's government has helped to grow the wind energy industry by promoting concrete targets for the offshore wind market. A Business Spotlight article published by Nikkei Asia in May 2021 reported that, by 2030, the government is pushing to meet a target of 10GW of electricity generated by offshore wind in Japan, up from 0.06 GW in 2019.[227] The government had previously reported a target of 45GW of offshore power by 2040, which would turn Japan into the world's third-largest wind power producer.[228] Even with onshore turbines added to the mix, **in 2019, wind energy made up less than a percent of Japan's energy mix, so there is abundant room to grow in this sector**.

As a 2020 McKinsey & Company report on wind power in Japan emphasizes, there are challenges for Japan as the country embarks on its journey to towards further capacity in wind power. In particular, Japan needs to address cost competitiveness of wind, especially considering the high costs associated with Japan's unique topography, as well as increase wind energy's favourability among the public, clarify the project pipeline for wind projects, and align policy goals to ensure project success. In a remark that highlights the reliance on prefectural policy frameworks, the report mentions that "prefectural goals for local infrastructure and job creation must be balanced with the need to create a competitive market."[229] This is reminiscent of some of the challenges of solar plant development, which often encounter resistance from local players.

Another key renewable resource is geothermal energy, which Japan is unique posed to take advantage of due to its geologic past, though challenges have dogged its successful implementation for decades. Japan is located alongside the Pacific Ring of Fire, a zone of major seismic activity. This geographic position is responsible for the abundance of earthquakes that occur every year in Japan, and also for the country's geothermal energy potential. **Japan is ranked third in the world in terms of its potential generative capacity for geothermal energy, but only exploits a fraction of this capacity currently.**

Geothermal energy presents several attractive qualities. Geothermal is a baseload energy, meaning that, unlike solar and wind, it is a reliable supply of energy not dependent on changing meteorological conditions. Once a geothermal plant is built, there is no need to purchase fuel, as geothermal energy is derived from the Earth's heat. The technology used to develop and maintain geothermal plants is also well-understood and widely applied across the world.

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[226] Dan Shulman, "What Happened in the Japanese Energy Industry in 2019 and What Does It Mean For 2020?" *Shulman Advisory*, February 13, 2020.
[227] Akane Okutsu and Nana Shibata, "Suga plan for greener Japan stirs hope in wind energy sector," *Nikkei Asia*, May 7, 2021.
[228] "Japan aims to be world's No. 3 offshore wind power producer in 2040," *The Japan Times*, December 16, 2020,
[229] Sven Heiligtag, Katsuhiro Sato, Benjamin Sauer, and Koji Toyama, "Japan offshore wind: The ideal moment to build a vibrant industry," *McKinsey & Company*, August 12, 2020.

Despite these advantages, **geothermal energy plays only a minor role in Japan's energy mix, due to the outsize role of local players in site determination.** Here, too, the impact of local politics becomes key to the fate of renewable power. In its 5th Basic Energy Plan, the central government emphasize the core role of community power by noting that "it is expected that each local community, including regional governments and regional companies and residents to take the initiative in proceeding with the introduction of such energy sources."[230,231]

5.4. Future Fuels: Hydrogen and Ammonia

Japan is well-known as a champion of hydrogen energy, though the scope of implementation and the extent to which it can be considered a renewable source of energy have made it controversial both in Japan and internationally. Hydrogen is not a primary energy source, but rather a vehicle through which to store energy (generated through renewable or non-renewable means).

Types of hydrogen[232]	
Green hydrogen	Produced via electrolysis of water; assuming the electrolysis is powered by renewable energy, this process is pollutant-free
Blue hydrogen	Produced via steam methane reforming; releases CO_2 (which is then recaptured)
Grey hydrogen	Produced via steam methane reforming; releases CO_2

Source: Author, with data from Columbia Climate School

Table 26: Types of hydrogen

Part of Japan's interest in hydrogen and future fuels can be explained by the appeal of the potential first-mover advantage, and the drive to build up a value chain comprised of Japanese fnetworks and companies for hydrogen. As a key example, Eneos, a major Japanese refining company, has bet on green hydrogen by announcing a plan, in partnership with Chiyoda Corporation, to develop large-scale hydrogen by 2030.[233] In August 2021, Eneos started commercial sales of green hydrogen at the Yokohama Asahi Hydrogen Station.[234] Japanese giants are also making moves to establish networks for green hydrogen abroad. In July 2021, it was announced that Marubeni Corp had signed a PPA with Providence Asset Group (PAG) in Australia to buy the output from PAG-owned solar farms. These solar farms are purportedly unique in that they utilize "dual technology" utilizing lithium-ion batteries and green hydrogen

[230] "5th Strategic Energy Plan," *METI*, 2018, pg. 49.
[231] This aspect of geothermal energy will be explored in more detail in the "local energy politics" section.
[232] Renee Cho, "Why We Need Green Hydrogen," *Columbia Climate School. State of the Planet*, January 7, 2021.
[233] "Green hydrogen at one-third the price: ENEOS and Chiyoda," *Nikke*i, June 20, 2021. [Japanese]
[234] "ENEOS begins commercial sales of CO2-free hydrogen produced in its stations for the first time in Japan," *Response*, August 24, 2021. [Japanese]

production and storage facilities. **The goal is to develop an eventual green hydrogen export roadmap for Japan**.[235] It is anticipated that Japanese research may aid Europe's own use of hydrogen under the EU-Japan Green Alliance.[236]

Domestically, Japan is also making moves to rebrand as a future hydrogen society. Namie, a town in Fukushima Prefecture, has sought to distance itself from the legacy of the 2011 nuclear disaster by hosting hydrogen projects, including a 10GW green hydrogen facility co-developed by Toshiba, Iwatani, Tohoku Electric Power, and the New Energy and Industrial Technology Development Organization (NEDO), a branch of METI.[237]

The Green Innovation fund, an initiative housed under NEDO worth 2 trillion yen, was established in March 2021 to support R&D decarbonisation efforts for a period of ten years.[238] In August, NEDO announced that it had selected 11 hydrogen-related projects that would receive support via the fund. As part of its press release, **NEDO stated its aim to support the commercialization of hydrogen in Japan, and the development of a supply chain.** Highlighting the need to advance carbon-neutral hydrogen, NEDO emphasizes the use of hydrogen created via surplus renewable energy to decarbonize heating and chemical industries.[239]

An unofficial and provisional translation of the funded projects is included on the following page.[240]

[235] "Japan giant signs deal for 30 Australian solar farms with battery and hydrogen storage," *Renew Economy: Clean Energy News and Analysis*, July 6, 2021.
[236] For a more complete discussion of hydrogen in the European context, see: Fabrice Stassin, "Looking ahead: Hydrogen and its contribution to climate neutrality," *BJA Trade Flows and Cultural Newsletter*, September 2021.
[237] Akane Okutsu, "Fukushima disaster town looks to hydrogen tech for rebirth," *Nikkei Asia*, March 11, 2021
[238] "The Basic Policies for the Project for the Green Innovation Fund Formulated," *Ministry of Economy, Trade and Industry*, March 12, 2021.
[239] "Green Innovation Fund Project Launches Hydrogen Demonstration Research Project as First Project," *NEDO*, August 26, 2021. [Japanese]
[240] "List of planned recipients for the Green Innovation Fund project," *NEDO*, August 2021.

First round of projects selected by NEDO for funding (2021)				
Project to establish a large-scale hydrogen supply chain	Establishing international hydrogen supply chain	1) Development and demonstration of technologies to increase the size and efficiency of hydrogen transportation technologies, etc.	Large-scale demonstration of liquefied hydrogen supply chain	• *Japan Hydrogen Energy Co., Ltd.* • *ENEOS Co., Ltd.* • *Iwatani Corporation*
			Large-scale demonstration of MCH supply chain	• *ENEOS Co., Ltd.*
		2) Development of evaluation base for liquefied hydrogen-related materials	Development of material evaluation base to support research and development of liquefied hydrogen-related equipment	• *National Institute for Materials Science*
		3) Development of innovative liquefaction, hydrogenation and dehydrogenation technologies	Development of innovative liquefaction technology	• *Kawasaki Heavy Industries, Ltd.*
			Development of Direct MCH Electrochemical Synthesis Technology	• *ENEOS Co., Ltd.*
	Establishing technology to develop hydrogen power generation technology (mixed-firing and dedicated-firing)	Demonstration of actual hydrogen power generation technology (mixed combustion, exclusive combustion)	Hydrogen co-firing with a large gas turbine	• *JERA Corporation*
			Hydrogen co-firing / dedicated combustion with a medium-sized gas turbine	• *Kansai Electric Power Co., Inc.*
			Dedicated hydrogen combustion by a large gas turbine	• *ENEOS Co., Ltd.*

Hydrogen production project by water electrolysis utilizing electric power derived from renewable energy etc.	Development of technology for increasing the size of water electrolysers, large-scale demonstration of Power-to-X	1) Larger size / modularization technology development of water electrolyser 2) Development of technology for mounting excellent new components on equipment 3) Decarbonisation demonstration of heat demand and industrial processes	Development of large-scale alkaline water electrolyser, demonstration of green chemicals	• *Asahi Kasei Corporation JGC Holdings Corporation*
			Development of large-scale PEM type water electrolyser, demonstration of decarbonisation of heat demand	• *Yamanashi Prefecture Enterprise Bureau* • *Tokyo Electric Power Company Holdings, Inc.* • *TEPCO Energy Partner Co., Ltd.* • *Toray Industries, Inc.* • *Hitachi Zosen Corporation* • *Siemens Energy AG Co., Ltd.* • *Miura Co., Ltd.* • *Kaji Tech Co., Ltd.*
	Establishment of performance evaluation technology for water electrolysis equipment			• *National Institute of Advanced Industrial Science and Technology*

Source: Author, with data from NEDO

Table 27: First round of projects selected by NEDO for funding, 2021

Japan has also moved forward on research and development for ammonia fuel, which does not release carbon dioxide as a by-product when burned. Ammonia as a future-generation fuel has gained considerable traction among players in industry, such as Mitsubushi, which has backed an Indonesian ammonia-fuelled power plant, in a bid to become a global developer of ammonia fuel.[241]

As part of decarbonisation commitment, Japan has stated its aim to retrofit coal-fired plants to burn ammonia on the basis that it is a cleaner fuel. In September 2021, the Japan Coal Frontier Organization and METI hosted the "30th Clean Coal International Symposium," with the theme listed as "Pathway to Carbon Neutrality – Role of Coal Frontier."[242] Some major policy plans for coal include the alteration of existing coal-fired plants to make them more efficient,[243] and the reduction of carbon intensity by co-firing coal and ammonia.[244]

For a comprehensive report developed in 2019 on the hydrogen market in Japan, see: "Hydrogen and Fuel Cells in Japan" by energy expert Jonathan Arias.

5.5. Public Tenders

Japanese municipalities can publish tenders on various websites**. NJSS is Japan's largest bid information site**; NJSS staff collect information from government websites and provide basic information (title, tender participants) for free.

Searching "decarbonisation" on the NJSS website in September 2021 yielded a list of 121 calls from municipalities and government agencies. Using "renewable energy" as a search term produced significantly more results (2,747 results), largely relating to municipal contracts to supply renewable energy to a public building.[245] As reported by the JTPP Helpdesk**, since the liberalization of the electricity market in 2016, the number of tenders for provision of electricity at the local level has been increasing**.[246]

[241] Ryosuke Hanafusa, "Japan set to cede LNG import crown to China," *Nikkei Asia*, July 2, 2021.
[242] "The 30th Clean Coal International Symposium," *Japan Coal Frontier Organization*, 2021.
[243] For a case study from METI covering high-efficiency coal-fired thermal power, see: "Future Coal-Fired Thermal Power Generation," *METI Journal*, 2013.
[244] Stephen H. Crolius, "The Evolving Context of Ammonia-Coal Co-Firing," *Ammonia Energy Association*, July 18, 2019.
[245] Note that "再生可能エネルギ" (*saiseikanouenerugi*) and "再生エネルギ" (*saiseienerugi*) can both refer to renewable energy in Japanese. For the first search term, there were 2,747 results. For the second, longer term, there were 2, 659 results, which appeared to overlap with the results yielded by the first search.
[246] Japan Tax & Public Procurement (JTPP) Helpdesk, "Public Procurement and Circular Economy in Japan," *EU-Japan Centre for Industrial Cooperation*, June 2021, pg. 20.

Tender Examples from NJSS (脱炭素化 → "Decarbonisation")	
Title in Japanese	Provisional Translation into English
「一戸町の再生可能エネルギー最大限導入目標策定事業-脱炭素化による持続可能な一戸町の実現へ-」支援業務 (2021 年 08 月 17 日公示)	Support Services for **Ichinoche Town**'s Project to Establish Maximum Renewable Energy Introduction Targets – Towards the Realization of a Sustainable Ichinohe Town through Decarbonisation" (August 16, 2021)
高山村地域レジリエンス・脱炭素化自立分散型エネルギー設備等導入事業化調査・計画策定業務 (2021 年 07 月 01 日公示)	Survey and Planning for the Commercialization of Independent and Decentralized Energy Facilities in Support of Resilience and Decarbonisation in **Takayama Village** (July 1, 2021)
令和 3 年度移動データを活用した地域の脱炭素化施策検討委託業務 【総合評価落札方式】 (2021 年 07 月 05 日公示)	Financial Year 2021 Study of Regional Decarbonisation Measures Using Mobile Data [**Ministry of Environment**] (July 5, 2021)

Source: Author, with data from NJSS.

Table 28: Tender Examples from NJSS (Decarbonisation)

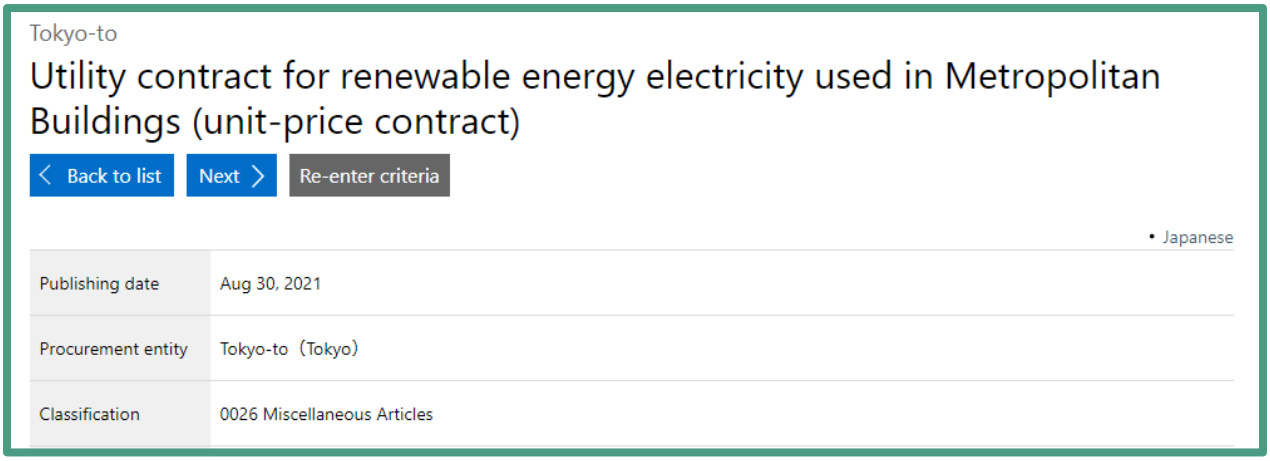
Tender Examples from NJSS (再生エネルギ → "Renewable Energy")	
Title in Japanese	Provisional Translation into English
国立市役所本庁舎の実質再生可能エネルギー100%使用電力供給契約 (2021 年 09 月 01 日公示)	100% Renewable Power Supply Contract for **Kunitachi City** Hall (September 1, 2021)
神奈川県立川崎高等学校で使用する再生可能エネルギー電力の購入 (2021 年 08 月 06 日公示)	Renewable Energy Purchase for **Kanagawa** High School (August 6, 2021)
綾部市再生可能エネルギー設備導入調査業務 (2021 年 08 月 13 日公示)	Survey for the Introduction of Renewable Energy in **Ayabe City**, Kyoto (August 13, 2021)

Source: Author, with data from NJSS.

Table 29: Tender Examples from NJSS (Renewable Energy)

The NJSS site is entirely in Japanese, which is true of most tender portals. However, a few websites also provide information in English. An English summary is a good indicator that a foreign company can apply for a listed tender. **Note that, under the Japan-EU Economic Partnership Agreement (EPA), foreign companies can only apply for tenders in which expected bids are higher than the WTO threshold.**[247]

On the JETRO tender portal (which offers information in English), a search for "decarbonisation/decarbonisation" yielded no tenders on September 9, 2021. However, using the search term "renewable energy" yielded 185 tender calls from the national government and 60 from local governments.[248]


Tokyo-to

Utility contract for renewable energy electricity used in Metropolitan Buildings (unit-price contract)

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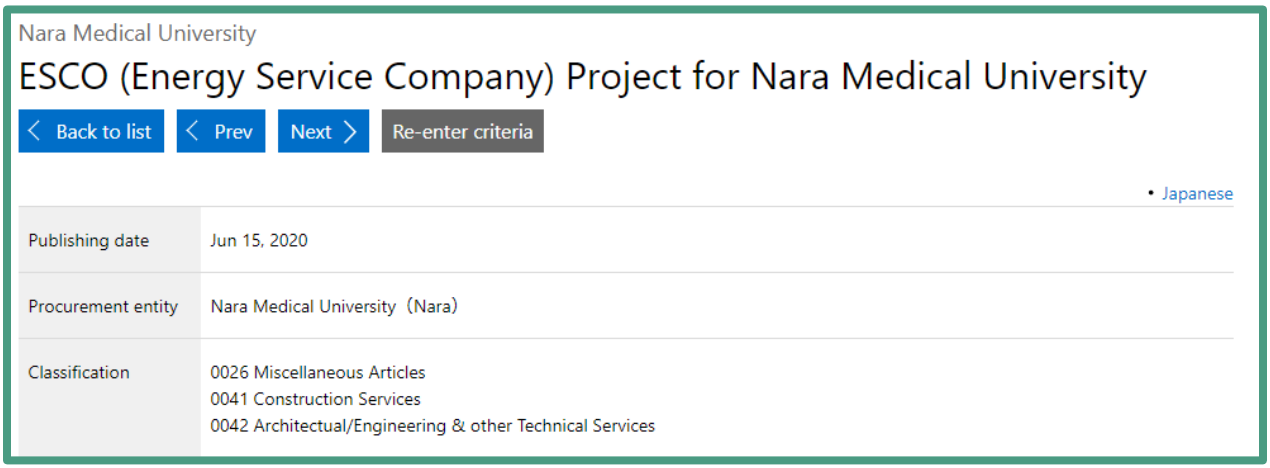
• Japanese

Publishing date	Aug 30, 2021
Procurement entity	Tokyo-to（Tokyo）
Classification	0026 Miscellaneous Articles


Nara Medical University

ESCO (Energy Service Company) Project for Nara Medical University

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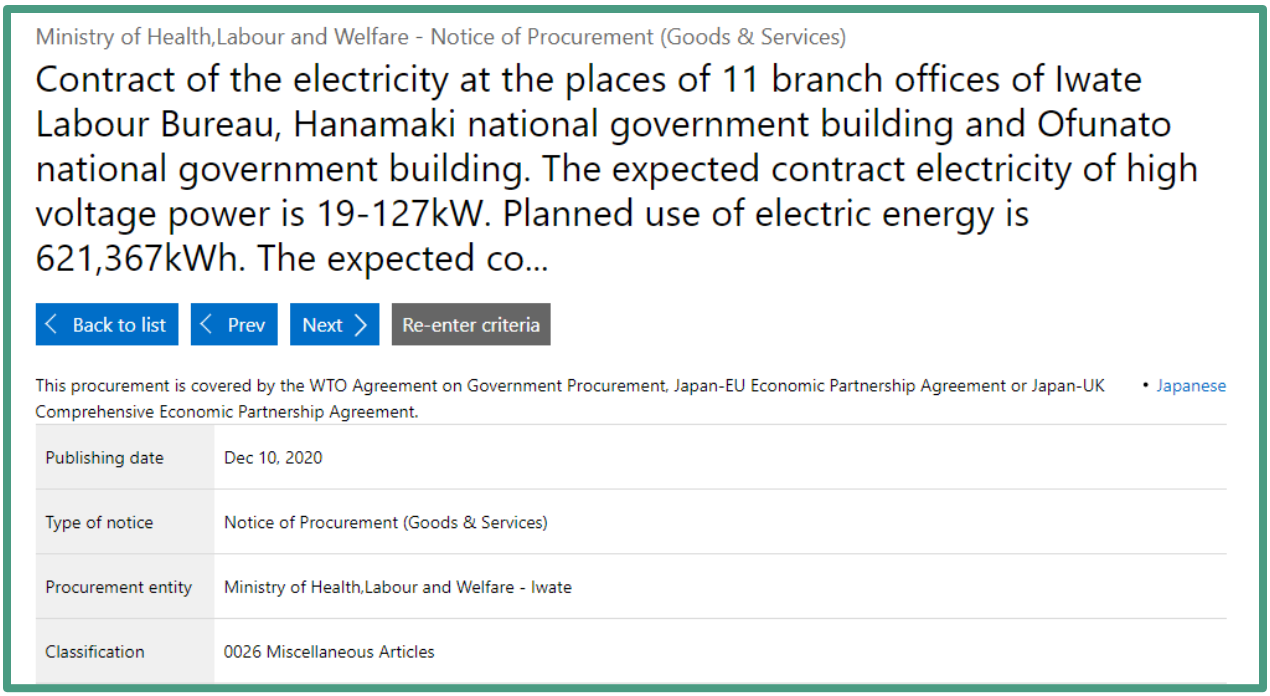
• Japanese

Publishing date	Jun 15, 2020
Procurement entity	Nara Medical University（Nara）
Classification	0026 Miscellaneous Articles 0041 Construction Services 0042 Architectual/Engineering & other Technical Services

[247] For more complete information about this, see: "Tender Notices Portals," *EU-Japan Centre for Industrial Cooperation*.

[248] Note, however, that care should be taken when proceeding with ambiguous search terms. In this case, some results related to scientific applications of electron microscopes rather than renewable energy projects.



Ministry of Health,Labour and Welfare - Notice of Procurement (Goods & Services)

Contract of the electricity at the places of 11 branch offices of Iwate Labour Bureau, Hanamaki national government building and Ofunato national government building. The expected contract electricity of high voltage power is 19-127kW. Planned use of electric energy is 621,367kWh. The expected co...

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This procurement is covered by the WTO Agreement on Government Procurement, Japan-EU Economic Partnership Agreement or Japan-UK Comprehensive Economic Partnership Agreement. • Japanese

Publishing date	Dec 10, 2020
Type of notice	Notice of Procurement (Goods & Services)
Procurement entity	Ministry of Health,Labour and Welfare - Iwate
Classification	0026 Miscellaneous Articles

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