Trends of the Zero Carbon Cities in Japan

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Abstract

The Paris Agreement sets the goal to limit the global warming to well below 2°C and preferably 1.5°C. The recent IPCC report warned that 1.5°C-warming may occur much earlier than expected. To meet the 1.5°C target, global emissions of greenhouse gases (GHGs) should be net zero by 2050 or earlier. Increasing number of countries, local governments, and private companies are committing for the 1.5°C target worldwide.

In Japan, this zero carbon movement was initiate by several local governments in 2019, followed by the national government's commitment in 2020. Now, over 400 local governments, representing nearly 90% of the national population in Japan, announced themselves as the "Zero Carbon City" under the national framework (as of July 30, 2021).

This article illustrates the rapidly increasing trends of the Zero Carbon Cities with the overview of emission and energy status in Japan, and analyzes the triggering and supporting elements including the new development of national policies and strategies to ensure the implementation of zero carbon measures at local level as well as to create social and economic co-benefit to the local regions.

1. Introduction

1.1. International call for carbon neutrality

The Paris Agreement is an international treaty on climate change adopted by 196 nations at the 21st Conference of Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC) in 2015. It set a goal to limit global warming to well below 2 degree Celsius (°C), more ambitiously 1.5°C above the pre-industrial level. In 2018, the Intergovernmental Panel on Climate Change (IPCC)[1] issued a special report entitled Global Warming of 1.5°C, which rang the alarm bell that an increase of 2°C in global temperature may cause higher and, in several cases, irreversible impacts and risks compared to 1.5°C (IPCC, 2018). From this report onward, increasing number of countries, local governments, and private companies, among others, are supporting the 1.5°C target, which requires that global carbon dioxide (CO_2) emissions should reach net zero by approximately 2050. Furthermore, the most recent IPCC report presented new projections that a global warming of 1.5°C may occur during the near term, that is, 2021–2040, which is earlier than expected (IPCC, 2021). This finding calls for further accelerated actions toward global carbon neutrality before 2050.

According to the Race to Zero Campaign[2] of the Climate Ambition Alliance by UNFCCC, 121 countries, 733 cities, 31 regions, 3,067 companies, 173 investors, and 661 organizations are registered as

Source: MOE, 2021

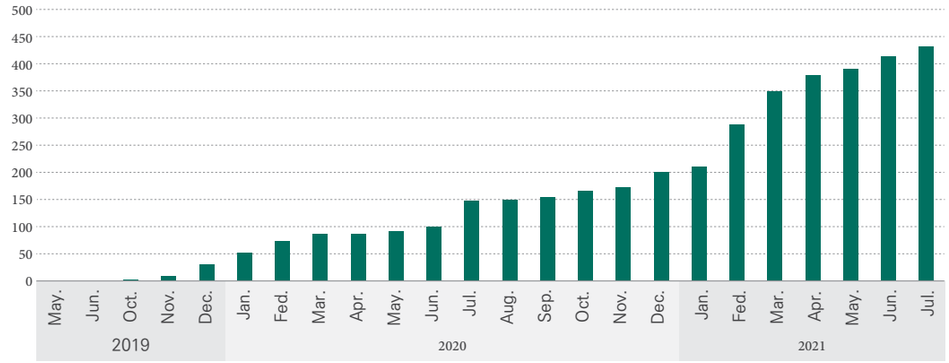

Figure 1. Number of Japanese local governments that announced net zero CO_2 emissions by 2050

actors who pledged net zero CO_2 emission by 2050. The country itself as well as 91 local governments are participating in this campaign from Japan. The number of registered Japanese cities (91) is the second largest after Argentina (254), followed by the United States (75) and Denmark (64) (UNFCCC, 2021).

1.2. Rapid expansion of zero-carbon cities in Japan

In Japan, a total of 432 local governments (i.e., 40 prefectures, 256 cities, 10 special wards,[3] 106 towns, and 20 villages) have announced their commitment to achieving net zero[4] CO_2 emissions (in certain cases, greenhouse gases [GHGs]) by the year 2050. These local governments represent a population of approximately 111 million and cover nearly 88% of Japan's national population. These announcements are registered in the national framework named zero-carbon city led by the Ministry of the Environment (MOE), Japan. MOE defines a zero-carbon city as "a local government in which head of the municipalities or the local government itself publicly announced a goal to achieve net zero CO_2 emissions by 2050." Figure 1 presents the number of local governments that announced that the zero-carbon city has grown rapidly from four local governments in June 2019 to 432 local governments in the present (as of July 30, 2021) within the past two years.

Apart from the international influence, certain domestic factors promote the participation of zero-carbon cities. Such factors can be categorized into three stages. The first was initiated voluntarily by the four frontrunner local governments (Yamanashi Prefecture[5], Kyoto City, Tokyo Metropolitan Government, and Yokohama City). This initiative then developed into the second stage after the inauguration of the Minister of the Environment Koizumi in September 2020, who vigorously called for participation in the zero-carbon city project. The initial number increased to over 160 before the national announcement on carbon neutrality in October 2020. The third stage was triggered by the national announcement to achieve net zero GHG emissions by 2050[6], which dramatically increased the number of zero-carbon cities to the current 432 (as of July 30, 2021).

[1] IPCC is a body of the United Nations established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) with the objective of providing scientific information related to climate change.

[2] Race to Zero is a global campaign by UNFCCC to mobilize the coalition of leading net zero initiatives of various actors who pledge efforts to net zero CO_2 emission by 2050.

[3] 10 special wards (Tokubetsu-ku in Japanese) are under the Tokyo Metropolitan Government (comprises 23 special wards).

[4] Net zero indicates achieving equilibrium between anthropogenic GHG emissions from sources and removal by sinks, such as forests.

[5] Yamanashi prefecture stated "CO_2-zero Yamanashi" as a long-term vision toward 2050 in their Action Plan for Global Warming Countermeasures in 2009.

[6] In the speech, Prime Minister used a mixture of terms, such as GHGs, carbon-neutral, and de-carbonization.

In terms of number, zero-carbon cities (432) account for approximately 24% of the total local governments in Japan (1,765 local governments: 47 prefectures, 792 cities, 743 towns, and 183 villages[7]) (Ministry of Internal Affairs and Communications, 2021). Large units of local governments tend to display high percentage of zero-carbon cities: 85% of prefectures (40 out of 47), 32% of cities (256 out of 792), 14% of towns (106 out of 743), and 11% of villages (20 out of 183) (Figure 2).

1.3. Greenhouse gas emissions in Japan and zero-carbon cities

Japan's national GHG emission reached 1,213 metric tons of carbon dioxide equivalent ($MTCO_2e$) for fiscal year (FY) 2019, which translate to a decrease of 14% compared with emissions for FY2013 (base year for Japan's nationally determined contribution to the Paris Agreement). This statistics is lower than the emissions for FY1990, which was the original base year of the UNFCCC (MOE, 2021). Japan's GHG emission reached its peak in FY2013 and has been declining ever since (Figure 3). However, Japan accounts for 3.2% of global emissions and ranks as the fifth largest emitter in the world.

The main factors for the decline in GHG emission in Japan are the decrease of energy consumption (e.g., energy savings) and reduction of CO_2 emissions from electricity through the expansion of renewable energy and restarting of nuclear power plants. A total of 84.9% of Japan's GHG emissions (FY2019) were energy-related CO_2 (Figure 4; MOE, 2021). Therefore, energy-related policies and on-ground implementation at the local level are critical.

Source: MOE and Ministry of Internal Affairs and Communications, 2021

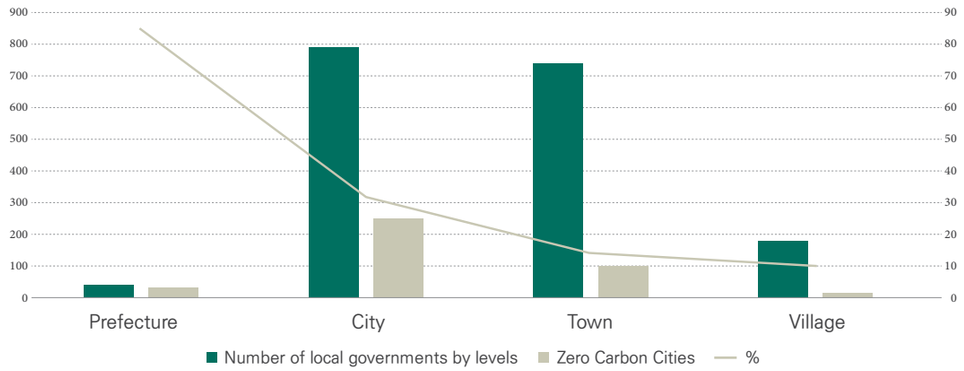

Figure 2. Ratio of Zero Carbon City announcement by levels of local governments

Source: MOE, 2020

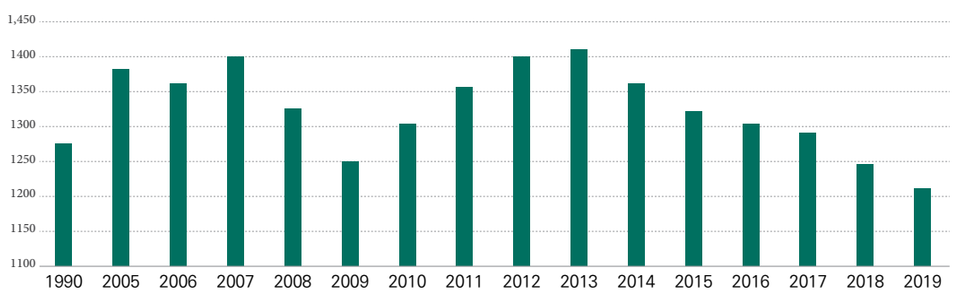

Figure 3. Japan's national greenhouse gas emissions (FY1990– FY2019)

[7] Prefecture overlaps with cities (generally population above 50,000), towns (condition set by respective prefecture, generally population above around 5,000–8,000), and villages (smaller population than town) (Ministry of Internal Affairs and Communications, Japan, 2021).

Data source: MOE, 2020

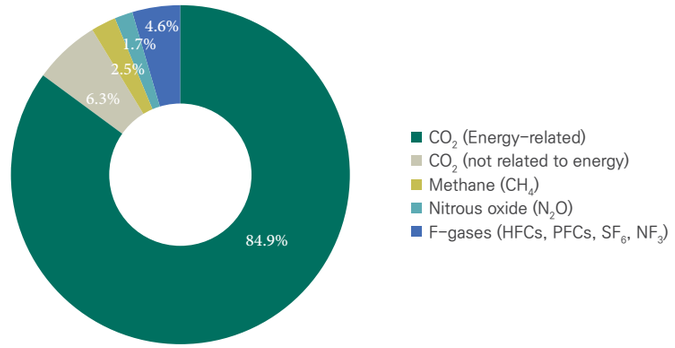

Figure 4. Japan's national greenhouse gas emissions by gas (FY2019)

data source: MOE, 2017

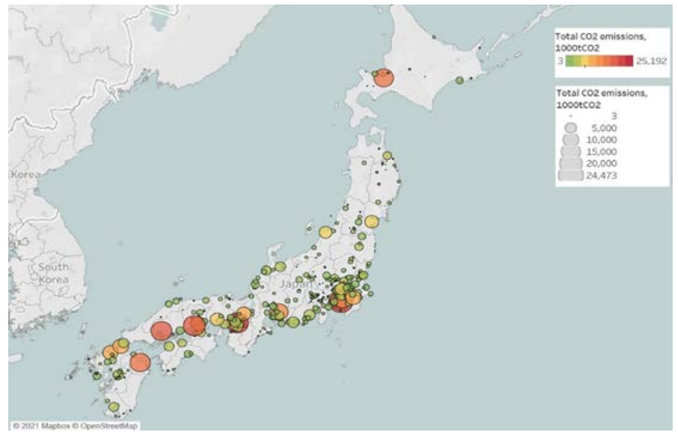

Figure 5. Distribution and size of GHG emissions (FY2017) of Cities, Towns, and Villages that announced their commitment to achieve net zero CO_2 emission by 2050[9]

The total emissions from zero-carbon cities in Japan are approximately 940 $MTCO_2e$ (FY2017 [8]), which accounts for approximately 72% of national emissions for the same year despite zero-carbon cities (432 as of July 30, 2021) and represents only approximately one-fourth of the local governments in the country (MOE, 2021). The reason underlying this statistics is that many zero-carbon cities include large or industrial cities that fall under the so-called Pacific Belt (an industry concentrated line from Kanto region to northeastern Kyushu). Approximately 35% of the national CO_2 emissions are derived from the industry sector (FY2019). Figure 5 illustrates the geographical distribution and scale of GHG emissions of cities, towns, and villages that announced themselves as zero-carbon cities (prefectures are excluded to avoid duplication). The size and color of the dots reflect the amount of CO_2 emissions of each zero-carbon city.

[8] The figure is calculated based on the MOE data source for local government emissions (Jichitai-karte) for FY2017. To avoid duplication, if a prefecture has announced itself a zero-carbon city, then the emissions of the prefecture are counted (emissions from cities, towns, and villages within the prefecture are excluded). If the prefecture did not announce, then all cities, towns, and villages that announced themselves as zero-carbon cities are included.

[9] The map is made by author with assistance of IGES intern, Mr. Fedor Myasoedov, using the MOEJ's emission data of FY2017 for local government, Jichitai-Haishutsuryo-Karte.

	Emission status in FY 2013 (Mt CO2eq.)	Under revision		Before revision (Reference)
		Reduction target in FY 2030 (%)	Reduction target in FY 2030 (%)	Reduction target in FY 2030 (%)
Total GHG emission	1,408	760	46%	26%
Carbon dioxide (CO2)	1,317	750	43%	24%
Energy-related CO2	1,235	680	45%	25%
Industry	463	290	37%	7%
Commercial and other	238	120	50%	40%
Residential	208	70	66%	39%
Transport	224	140	38%	28%
Energy transformation	106	60	43%	28%
CO2 not related to energy	82.3	70.0	15%	7%
Methane (CH4)	30.0	26.7	11%	12%
Nitrous oxide (N2O)	21.4	17.8	17%	6%
F-gases	39.1	21.8	44%	25%
Hydrofluorocarbons (HFCs)	32.1	14.5	55%	32%
Perfluorocarbons (PFCs)	3.3	4.2	+27%	+27%
Sulfur hexafluoride (SF6)	2.1	2.7	+29%	+23%
Nitrogen trifluoride (NF3)	1.6	0.5	69%	64%

Table 1. Japan's GHG emission status in FY2013 and reduction target in FY2030

2. National policy framework in Japan

2.1. Carbon neutrality by 2050 is now legally binding

The Act on Promotion of Global Warming Countermeasures (Law No. 107 of 1998) plays a central role in Japan's framework for its climate change policy, and the provisions have been amended through successive revisions based on domestic and international trends. In response to the declaration of Prime Minister Suga on carbon neutrality on October 2020, the latest revision was enacted on May 26, 2021, to position carbon neutrality as a basic principle in the law. Countries that stipulated carbon neutrality in their laws remain limited, such as the United Kingdom and France. Thus, this movement was widely recognized as the strong will and commitment of the Japanese government toward carbon neutrality.

Aligned with its long-term goal, Japan's mid-term goal was announced in April 2021 (i.e., reduce GHG emissions by 46% by FY2030 from its FY2013 level and continue strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%). Although this mid-term goal is not legally binding, this statement has further enhanced the predictability of Japan's policy.

Along this line, the GHG emission reduction target by sector has also been revised (Table 1). Although these figures remain tentative, a large increase in the rate of reduction is observed in all sectors, such as the residential and commercial sectors, which required a concerted national effort.

2.2. Development of carbon-neutral-related policies

The challenge of realizing a carbon-neutral society

[10] The latest plan was endorsed by the cabinet on May 13, 2016.
[11] The latest plan was endorsed by the cabinet on July 3, 2018.
[12] The latest long-term strategy was endorsed by the cabinet on June 11, 2019.

Source: Council for National and Local Decarbonization. Translated into English by authors.

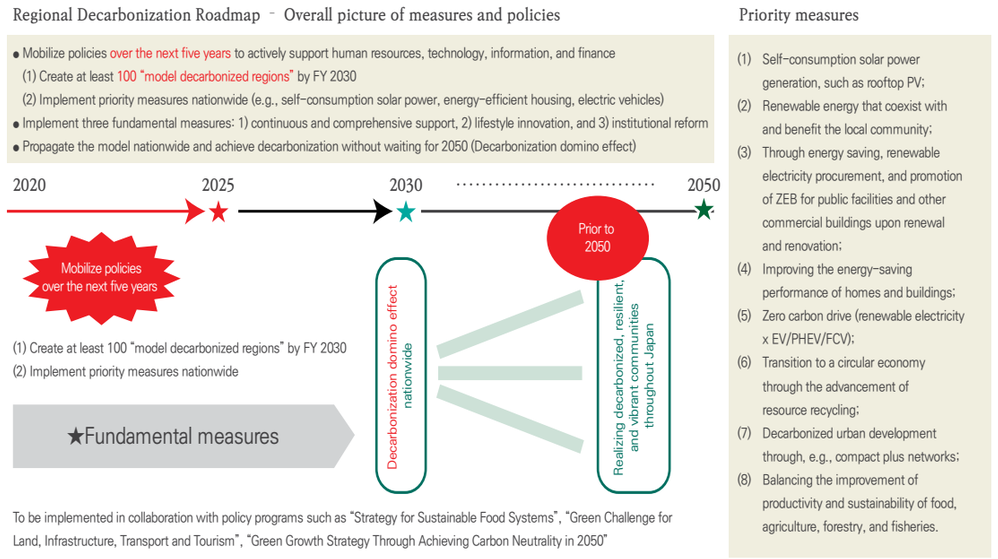

Figure 6. Outline of the roadmap for decarbonization of all local governments by 2050

by 2050 is currently positioned as the new growth strategy of Japan with a virtuous cycle of economic growth and environmental conservation. One of the four driving forces set by the Japanese government is the realization of a green society, which will be achieved through the promotion of private investment and innovation, the procurement of renewable energy as a main source of electricity, and the utilization of carbon pricing (Cabinet Office, 2021). This basic policy is reflected in the drafts of the Plan for Global Warming Countermeasures,[10] Strategic Energy Plan,[11] Japan's Long-term Strategy under the Paris Agreement,[12] as well as other sectoral plans. The Roadmap for Decarbonization of All Local Governments by 2050 (Council for National and Local Decarbonization, 2021) presents the following approaches: (1) establishing more than 100 "model decarbonized regions," where CO2 emission from commercial and residential electricity consumption should be reduced to net zero is a must, and (2) implementing priority measures throughout Japan by 2030 (Figure 6). The specifics of the requirement for the model decarbonization regions should be determined by the local governments with consideration of the local conditions. However, the roadmap calls for strong support from the national government and for collaboration among local governments, businesses, and financial institutions for implementation, because the local governments cannot tackle this project on their own.Along this line, the GHG emission reduction target by sector has also been revised (Table 1). Although these figures remain tentative, a large increase in the rate of reduction is observed in all sectors, such as the residential and commercial sectors, which required a concerted national effort.

2.3. Roles and responsibilities of local governments

Under the Act on Promotion of Global Warming Countermeasures, the local governments are required to formulate and implement comprehensive and systematic measures to control GHG emissions according to the natural and social conditions of each area pursuant to the Plan for Global Warming Countermeasures. Action plans can be grouped into two categories, namely, action plans for administrative operations and action plans for area-wide policies (Table 2). The first focuses on the management of public facilities and operations, where all local governments should formulate the necessary policies. The second is obligated only for municipalities with

a population of more than 200,000 given that its comprehensive nature targeting area is within the jurisdiction of the local government. For municipalities that aim to become zero-carbon cities, action plans for area-wide policies are essential. However, reading national policies into local conditions and planning for the year 2030 with a long-term vision up to 2050 is difficult for them in a situation of high uncertainty, where national policies are being formulated one after another, whereas discontinuous innovation is foreseen (Ota and Akagi, 2021). Other challenges exist, such as the lack of local data or the lack of expertise. With the objective of addressing these issues, the national government has been promoting the enhancement of local capacity by setting up a menu of support for the formulation of local action plans (MOE, 2021). Furthermore, with the recent amendment to the law, the local governments are required to include targets for implementing measures in the action plan and to support projects that utilize renewable energy. By certifying projects that meet the conditions set by the local governments and providing support through the application of special exemptions, the introduction of renewable energies that benefit the region is expected to progress in a smooth manner.

Source: Ota and Akagi, 2021

Plan	Outline	Target	Formulation status
Action plan of administrative operations	A limited plan to promote the reduction of GHG emissions associated with office work and operation of local governments.	All local governments are obliged to formulate a plan (3,349 organisations).	63%
Action plan of area-wide policies	A comprehensive plan to promote GHG emissions control according to the natural and social conditions of the area. Measures include the promotion of renewable energy, energy conservation, convenience of public transporttion for user, greening, sound material-cycle society such as reduction of waste generation, etc.	Prefectural governments, ordinance-designated cities, and core cities (Chukaku-shi: more than 200,000 population) are obliged to formulate a plan (152 organisations) Cities that are smaller than the core city (Chukaku-shi), such as wards, towns and villages are encouraged to formulate a plan (no obligation).	100% of 152 organisations 26.6% of a whole (1,788 organisations)

* The above status is from the results of a FY 2019 survey by the Ministry of the Environment. The Survey was conducted targeting a total of 3,349 organisations, including 1,788 prefectures and municipalities (including special wards) and 1,561 local public organisations (including unions).

Table 2. Outline of action plans by local governments

Source: MOE , 2021

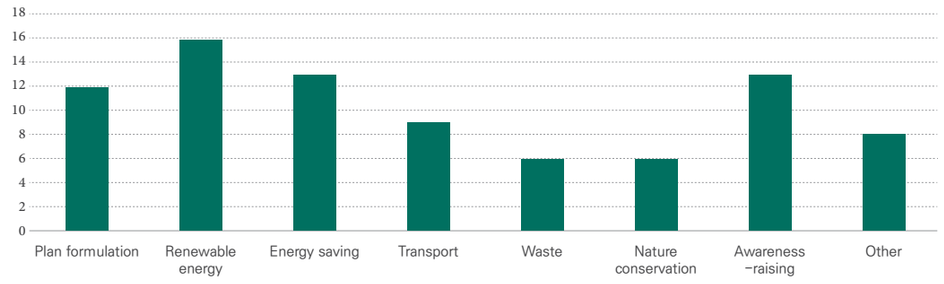

Figure 7. Sectors covered by the overview of initiatives in each zero-carbon city in Kyushu

Note: Adapted for the Agency for Natural Resources and Energy and the Institute for Sustainable Energy Policies (2021)

	Actual status for FY2019			Prospective target by 2030 (Japan's Sixth Basic Energy Plan)
Renewable	18%	Hydro	7.4%	36–38%
		Solar	7.4%	
		Biomass	2.7%	
		Wind	0.76%	
		Geothermal	0.24%	
Hydrogen and Ammonia			0%	1%
Nuclear			6%	20–22%
Liquefied Natural Gas			37%	20%
Coal			32%	19%
Petroleum And Others			7%	2%

Table 3. Energy mix in Japan (actual status for FY2019 and prospective target by 2030)

2.4 Carbon neutrality related policies in Kyushu

Kyushu region, which consists of seven prefectures, is located in the south-most part of the main lands of Japan and accounts for approximately 10% of the national population, 10% of the national GDP, and also 10% of GHG emissions of Japan, with a high potential for renewable energy (Ota and Akagi, 2021). Since Kumamoto Prefecture became the first municipality in Kyushu region to declare itself a zero-carbon city in December 2019, a number of other municipalities have followed suit. By the end of July 2021, this number reached more than 50. Although the majority of the declared cities are in the process of developing or revising their action plans, a few of the early movers, such as Kumamoto Prefecture, Ooki Town, and Kumamoto Cooperation Center Urban Area[13], have released new plans. In any case, many municipalities are focusing on measures in the energy sector, such as renewable energy, energy saving, and transport sectors (Figure 7). Awareness-raising, which includes the promotion of life style change and capacity building initiatives, are also important, because collaboration with local stakeholders is essential for implementing the action plans for an area-wide policy.

The private and academic sectors have also issued a series of expression of carbon neutrality commitment. For instance, the Kyushu Economic Federation, which is composed of approximately 1,000 organizations, expressed its commitment through the formulation of the Future Vision of Kyushu 2030 (Kyushu Economic Federation, 2021). Furthermore, three financial institutions have joined an international initiative called the Task Force on Climate-Related Financial Disclosure (Regional Banks Association of Japan, 2021).[14] A total of 19 universities have joined a domestic initiative called the University Coalition for Achieving Carbon Neutrality (Ministry of Education, Culture, Sports, 2021). Moreover, the Kyuden group, the major electric power company in the region, developed the Carbon Neutral Vision 2050 (Kyushu Electric Power Co., 2021). The number of local energy companies that promote local economy revitalization through local production and local consumption of energy with local governments has increased five-

[13] Kumamoto Cooperation Center Urban Area consists of the following 18 local governments: Kumamoto City, Kikuchi City, Uto City, Uki City, Aso City, Koshi City, Misato Town, Gyokutou Town, Ozu Town, Kikuyo Town, Takamori Town, Nishihara Village, Minamiaso Village, Mifune Town, Kashima Town, Mashiki Town, Kosa Town, Yamato Town. Net zero GHG emissions by 2050 was announced jointly in January 2020.

[14] Fukuoka Financial Group (Fukuoka Bank, Juhachi-Shinwa Bank), Nishi-Nippon Financial Holdings (Nishi-Nihon City Bank), and Kyushu Financial Group (Higo Bank, Kagoshima Bank) have expressed their support for the recommendations of the TFCD.

fold after the deregulation of the electricity market (Ministry of Economy, Trade and Industry 2021).[15] In this manner, the enabling environment for carbon neutrality is being developed. To embody projects that will benefit the local community and to promote a fair transition, the creation of a mechanism that enables local stakeholders to collaborate organically and to develop human resources who can act as local coordinators is urgent. Specifically, learning about specific examples of renewable energy projects that benefit local communities can drive local action.

3.1. Wind power in Japan

Among the various renewable sources, recent years has seen the special attention given to the possibility for wind power after the widespread use of solar power. Wind power was introduced in Japan in the 1990s. Currently, 2,414 wind turbines (the sum of onshore and offshore units) generate approximately 3,920,000 kW as of 2019 (Figure 8). However, it accounts for less than 1% of the national energy (Table 3).

Furthermore, a great number of wind power projects are certified and waiting to be installed. Figure 9 indicates the regional amounts of introduction (under operation) and certification (pending operation) of wind power generation (the sum of onshore and offshore units) through the Feed-in-Tariff system. Tohoku has the largest introduction of wind power (1,467,000 kW) followed by Hokkaido (541,000 kW) and Kyushu (513,000 kW). For the certified amount, Kyushu (1,350,000 kW) ranks second after Tohoku (2,375,000 kW).

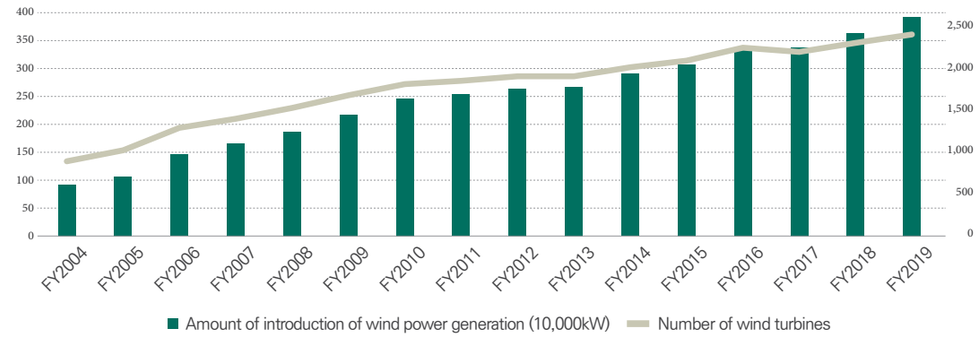

Figure 8. Accumulated amount of wind power generation and number of wind turbines in Japan (FY2004 to 2019)[16]

Source: Agency for Natural Resources and Energy, 2021

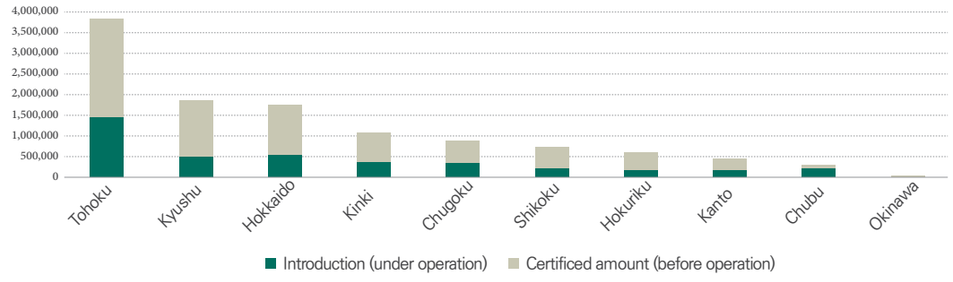

Figure 9. Introduced and certified amount of wind power
(sum of onshore and offshore) through the Feed-In-Tariff System by regions in Japan in the FY2019

[15] Out of the 75 regional energy companies partially owned by the local governments in Japan, 16 are based in Kyushu. When the liberalization of the electricity market began in April 2016, the region contained only three.

[16] Figures until FY2016 are based on Japanese fiscal year (April to March), and figures after 2017 are calendar year (January to December)

Source: Public–Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation, 2020.

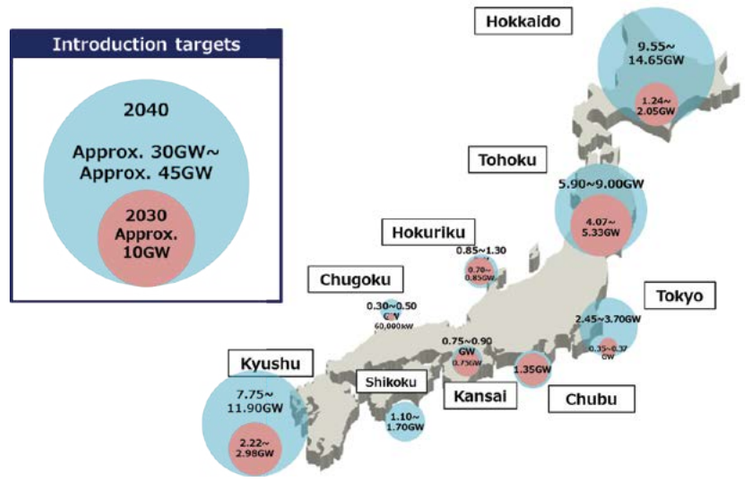

Figure 10. Introduction target by 2030 and 2040 for offshore wind power in Japan

As the Japanese archipelago is surrounded by several bodies of water, it has the large potential for offshore wind power. However, certain natural conditions, such as the lack of shallow ocean beds and frequent incidences of typhoons, remain challenging for offshore wind power as well as the active fishing industry. In addition to onshore wind power, the Japanese government has been promoting offshore wind power in recent years. The Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities, which was enacted in April 2019, designates promising sea areas, which render large-scale offshore wind farms more feasible for long-term operation. The first version for the Vision for Offshore Wind Power Industry was developed in December 2020 by the Public–Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation.[17] It set a new target to increase offshore wind power to 10 GW by 2030 and 40 to 25 GW by 2040, with the consideration of regional targets (Figure 10).

3.2. Decarbonized local models: Goto City and Kitakyushu City in Kyushu

The national government plans to create approximately 100 model decarbonized regions by 2030, which are expected to initiate the domino effect to all regions in Japan and to revitalize local societies at the same time. This section showcases promising and potential models from two zero-carbon cities in Kyushu, namely, Goto City (a remote island off Nagasaki Prefecture) and Kitakyushu City in Fukuoka Prefecture. In these cities, flagship offshore wind pilot projects were conducted, which are currently stepping up as large commercial operations.

<Case of Goto City>

A pilot project of a floating-type wind turbine (2,000 kW) was conducted in Goto City from 2010 to 2015 through funding from the MOE (Figure 11). The project was verified as durable against typhoons and to bring local benefits. The foundation parts, which are made of concrete and steel anchors, were manufactured in Goto City and other parts of Nagasaki Prefecture, which, thus, created new local industries and employment. Furthermore, the project was found to be a sound environment for nesting micro marine organisms, which, therefore, attracted various species of fish (photo on the right; Figure 11).

[17] A public–private council established in 2019 by the Ministry of Economy, Trade and Industry (METI), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and the industry to advance the offshore wind power generation and competitiveness of industries.

Renewable-related councils, study groups, and local energy companies have been actively established by local stakeholders, such as city administrations, the industry, academics, and civic organizations. Together with other renewables, such as solar, renewable energy reached 51% of the entire electricity consumption in Goto City (FY2019), which is outstandingly high compared with the national average of approximately 20%. Eight other offshore wind turbines are under construction via private consortium, with a total generation capacity of 16,800 kW (2100 kW × 8) and are expected to boost the renewable ratio in the city to 80%. Furthermore, Goto City sets the target of renewable supply at 132% by 2030 in its Basic Energy Plan (Goto City, 2014).

<Case of Kitakyushu City>

Kitakyushu City, which is located in northeastern Kyushu and features a 200-km coastal line, implemented a pilot project for offshore wind turbines. Currently, it plans to build a large-scale offshore wind farm with a maximum of 44 offshore units. This prospect plan aims not only to install wind power but also to create an integrated base for a wind energy industry named Green Energy Port Hibiki (Figure 12). This port is expected to be the base for the following functions: (1) wind turbine shipping, (2) import and export, (3) operation and maintenance, and (4) wind turbine-related industries. The city aims to create new industries and employment along with related research and education.

Figure 11
(left). Floating-type offshore wind turbine named "Haen-kaze" in Goto City / Source: Goto City
(right). Fish attracted to the offshore wind turbine foundation under water in Goto City / Source: Marine Renewable Energy and Fisheries

Source: Green Energy Port HIBIKI: A Wind Energy Industry Hub in Japan, Kitakyushu City, 2021

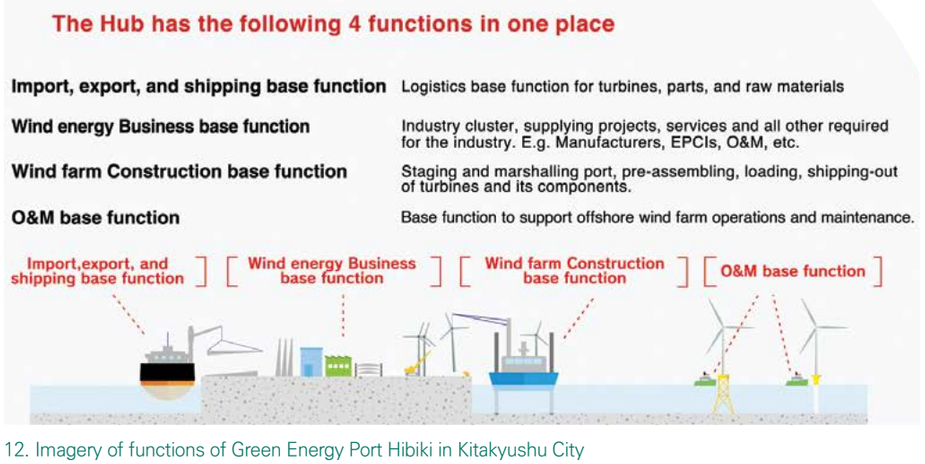

Figure 12. Imagery of functions of Green Energy Port Hibiki in Kitakyushu City

4. Conclusion

The zero-carbon movement has been spreading globally to meet the preferable 1.5 °C target of the Paris Agreement, which is grounded on the findings of IPCC. In Japan, zero-carbon movement was initiated using a bottom-up approach implemented by several local governments in 2019 followed by the vigorous call by the MOE, and, lastly, the national pledge in 2020. In only nearly two years, over 400 local governments joined the zero-carbon city initiative established by the MOE. In 2021, epoch-making legal foundations and policies were built and formulated, respectively, to realize all levels of commitment. The revision of the Act on Promotion of Global Warming Countermeasures afforded a legal status to the announcement of net zero GHG emissions by 2050 and created an assured environment for local government and private sectors to invest in long-term measures toward zero CO2 emission. The Regional Decarbonization Roadmap indicated a clear timeline toward 2050, that is, intensive mobilization of policies by 2025; creation of 100 model decarbonized regions by 2030; and promoting the domino effect to all regions by 2050. The Sixth Basic Energy Plan increased the renewable energy target to 36%–38% by 2030.

At the present, the legal framework, strategies, and plans are harmonized toward the common goal shared by the national government and numerous local governments and private actors. Thus, the next step entails the creation of a roadmap and concreate plans and actions by each actor as well as the fostering of human resources who can effectively manage and implement such plans and with certain knowledge of rapidly advancing technologies and information. Under the big slogan of a zero-carbon society, integrating other important issues, such as regional revitalization, aging and depopulation, circular economy, resilient society, adaptation, and digitalization, is crucial. Therefore, determining common values and avoiding tradeoffs among various issues and stakeholders is essential for building a sustainable zero-carbon society. Inevitably, industrial transformation will occur nationwide, which may exert negative impacts to certain industries and people. Thus, ensuring a just or fair transition is important, especially from the local perspective.

Local regions hold a large potential for realizing the zero-carbon society, especially when multiple groups of people are engaged in determining the synergetic effects to other important issues in a region. To create a domino effect from 100 model decarbonized regions, learning from one another at the local and national levels is necessary for the carefully design of a foundation, where a model domino piece will knock down an adjacent domino piece. Research institutions, such as the Institute for Global Environmental Strategies (IGES), can provide assistance in bridging the national/international communities and local actors. IGES is eager to contribute by providing perspectives on how local actors can create synergetic effects in their region and continue the domino effect.

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Decarbonizing Road Transport Sector through Electric Mobility in Pakistan

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Abstract

Electric vehicles (EVs) are anticipated to play an important role in meeting global goals on climate change. Electrification of road transport is one of the crucial pathways that can considerably mitigate the emissions in this sector that could limit warming to well-below 1.5◦C, which would be inline with the Paris Agreement's targets (Logan et al., 2020).

Road transport sector in Pakistan relies heavily on fuel imports; hence it takes a heavy toll on Pakistan's fuel import bill (Anwar, 2016). Pollution in major cities has reached alarming levels (Usman et al., 2019). Apparently, Pakistan currently faces a power surplus crisis. Increased EVs penetration could serve as a productive power demand to achieve adequate level of utilization of existing power capacity and bring down unit cost of electricity. Electrification of transportation is one of the effective means to reduce energy intensity in the road transport sector (Lee et al., 2021). Besides, EVs offer lower running and operational costs, as well as lower tailpipe emissions. All these factors put together make a strong case for EV adoption in Pakistan.

While recognizing the multiple economic, environmental and social benefits of electric mobility, Government of Pakistan (GoP) introduced its first ever National Electric Vehicle Policy (NEVP) in 2021, which outlines a number of fiscal and regulatory incentives to promote Electric Mobility (eMobility) in the country. The two major drivers behind the rollout of this NEVP are; to reduce Pakistan's heavy reliance on fuel imports to reduce energy intensity and Greenhouse Gas (GHG) emissions in the road transport sector.

Electric mobility is quite a new space in Pakistan and it is at the very initial stages of its development. Hence, the Economic Cooperation Organization Science Foundation (ECOSF) immediately recognized the need for capacity building of various state regulators, market players and grid planners towards accelerated adoption of EVs. This is a critical step to enable evidence and knowledge based policy decision making to help promote the accelerated transition towards eMobility in the country.

In this backdrop, the ECOSF in collaboration with United Nations Development Program (UNDP) provided strategic support to the Government of Pakistan through Ministry of Climate Change (MoCC) and National Energy Efficiency and Conservation Authority (NEECA), Ministry of Energy (MoE) to explore the potential development pathways of the eMobility market. This chapter provides some brief highlights of the work undertaken by the ECOSF on decarbonizing the road transport sector in Pakistan as part of its support program to the Government of Pakistan in meeting its climate goals. Through this effort, we assessed the climate benefits of accelerated adoption of eMobility in Pakistan in terms of lower demand for transport fuels, reduced GHG emissions and the need for grid expansion and strengthening of distribution network in Pakistan (Cornell, 2019).