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103 Exploring direct and indirect investment schemes for installing small and medium size energy systems in remote local communities: Cases of clean energy systems in Japan

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Abstract

There is a strong focus on the diffusion of clean energy technologies under Paris Agreement. As part of its endeavours to achieve the goals under the agreement, each country is accelerating its efforts by setting their own targets for removing fossil fuel-based systems and introducing clean energy systems. In parallel, the scale of ESG finance including both equity and debt investments is growing recently in the financial community. Many central and local governments as well as financial institutions have issued green or sustainability bonds partly targeting toward investment into clean energy systems.

The research illustrated in this article addresses various funding mechanisms such as government subsidy, direct investment (equity) and indirect (debt) investment for installing clean energy systems in local communities in Japan. The target of the research is small and medium size systems in remote local communities, as they tend to bring more direct and positive social, economic, and environmental benefits to them. The remote local communities struggle to attract investors into such systems, as they face declining population causing various social issues. The introduction of the systems could support them to utilize their local resources such as biomass and solar, provide more opportunities for younger generations to reside in a nature surrounding local area, and become energy independent, especially among rural areas and remote islands that tend to be dependent on energy sources from other locations.

The target systems for analysis are small size photovoltaics, wind, biomass, geothermal, and mini-hydro projects in Japan. The focus on financial schemes for the size of the systems is a uniqueness of this research. It is expected that the lessons learned from the cases in Japan contributes to explore other cases on another country or region.

Keywords: Clean energy system, Renewable energy, Financial mechanism, Investment, SDGs

Introduction

In 2015, there were two key global agreements on sustainability. Sustainable Development Goals (SDGs) were adopted at the United Nations as 2030 Agenda for Sustainable Development Goals setting goals on global economic, social, and environmental issues. The Paris Agreement was adopted in the same year to cope with global climate change and reduce greenhouse gas emission reductions on the global scale. At the same time, in the finance community, there are stronger interests for investing into sustainability under ESG (Environmental, Social, and Corporate Governance) investing schemes. The movement toward ESG investing has accelerated as a growing number of investors started to recognize the investment into fossil fuel-based industries could become stranded assets in the near future and investment into clean or renewable energy could provide better investment opportunities in the time of decarbonization. Many central and local governments as well as financial institutions have issued green or sustainability bonds partly targeting toward investment into clean energy systems.

Under the Paris Agreement, there is a strong focus on the diffusion of clean energy technologies. As part of its endeavours to achieve the greenhouse gas emission reduction goals under the agreement, each country is accelerating its efforts by setting their own targets for removing fossil fuel-based systems and introducing clean energy systems. On the other hand, there is growing research interests as well as the needs from policymakers under SDGs to understand the interlinkages among the goals (Nilsson, M. et al., 2016, Nilsson, M. et al., 2018). The interlinkages could be synergies, trade-offs, or cancelations of each effort. There are also research focusing on the interactions between climate change mitigation issues and other issues related to SDGs (Shawoo, Z. et al., 2000, Bertheau, P., 2020). McCollum (2018) provides thorough review on various research specifically examining the interlinkages between energy and SDGs. Santika (2019) analysis the interlinkages quantitatively.

This article has twofold objectives. The first objective is to examine how and what types of financial arrangements are being made to implement clean energy systems in local communities in Japan. The article investigates funding mechanisms such as government subsidy, direct investment (equity) and indirect (debt) investment for installing clean energy systems in 14 local communities in the country. The research targets are small and medium size systems in remote local communities, as they tend to bring more direct and positive social, economic, and environmental benefits to them. The remote local communities struggle to attract investors into such systems, as they

face declining population causing various social issues.

The second objective of this article is to explore the interlinkages of the introduction of a clean energy system and social and economic agenda in Japan. The introduction of the systems could support local communities to utilize their local resources such as biomass and solar, provide more opportunities for younger generations to reside in a nature surrounding local area, and become energy independent, especially among rural areas and remote islands that tend to be dependent on energy sources from other locations.

Literature review: Finance and SDGs interlinkages

There have been numerous research initiatives and programs exploring financial opportunities in clean energy systems. Frankfurt School - UNEP Collaborating Centre for Climate & Sustainable Energy Finance publishes a report on global trends in renewable energy every year (Frankfurt School - UNEP Collaborating Centre for Climate & Sustainable Energy Finance, 2020). United Nations Environmental Program (2009) and Sustainable Energy for All and the Climate Policy Initiative. (2019) analyzes a variety of financial mechanisms such as government subsidy, venture capitals, development assistance, equity investment, debt investment, mezzanine finance, and risk guarantee. Josh Carmody and Duncan Ritchie (2007) summarizes roles and financial expectations of different investors in clean energy systems in different stages of technological development. The analysis of financial returns from the investment into clean energy systems as well as the risk assessment of such systems have been conducted among several studies (Hürlimann, 2019, Masini, A., & Menichetti, E., 2013, United Nations Environmental Program, 2009). Among international institutions, there have been a particular focus on the analysis of the trends in finance among developing economies (The World Bank 2017, United Nations Economic and Social Council 2019).

As for the SDGs interlinkages, there have been research initiatives empirically analyzing social, economic, and environmental impacts of the introduction of clean energy systems in emerging economies. For example, Bertheau (2020) analyzes how the implementation of solar power and batteries is linked to various SDGs in rural parts of the Philippines. Burney et al. (2017) examines the impacts of solar electrification on women's empowerment in the local community. Khellaf (2018) investigates economic and social impacts of renewable energy projects in Africa. In Europe, there have been a number of studies that attempt to investigate the acceptance of various clean energy systems in society based on the social acceptance research framework (Scherhaufer, P. et al., 2018, Fytili, D., & Zabaniotou, A., 2017). While there have been such research initiatives in Japan, many of research results have not been addressed in English.

Research targets: 14 local communities in Japan

As described above, there has been a variety of research examining social, economic, environmental impacts of the introduction of clean energy systems. Some research results suggest that there are positive impacts on improving current situations in education, health, workplace, employment in the rural area. In the case of emerging economies where electrification has not reached the rural area, small simple renewable energy devices could improve the quality of life among people in the rural community by providing electricity at night at home, workplace, or public and private facilities.

The situations in Japan are different with respect to electrification, as it has reached almost 100% rate of electrification. On the other hand, the declining population as well as the aging population have addressed serious social and economic issues particularly in the rural area in the country. According to Statistics Bureau of Japan (2021), the current number of populations of the country is 125 million in 2021, while according to Cabinet Office (2012), the number could decline to 99 million in 2048 and 86 million in 2060. Besides this country-wide trend in declining population, the economic gap between cities and rural farming, fishing, forestry communities have been widening. There are high expectations among people in the rural communities in Japan that the introduction of clean local energy systems could provide new economic opportunities by saving energy costs and using the resources for other activities, attracting younger generations inside and outside of the country to reside, and enhancing resilience to natural disaster by establishing independent off-grid systems.

The Japanese government announced that the country is going to reduce greenhouse gas emissions by 46% before 2030. This target is line with other targets among developed countries, for example, compared to 55% reduction targets in the EU. In its efforts to reduce the emissions to the level, the government started to support strongly the diffusion of clean energy systems in the country. According to the Institute for Sustainable Energy Policies (2020), the rate of electricity from renewable energy sources in Japan was 20.8% in 2020 and it is expected to increase in coming years.

This article examines financial arrangements such as government subsidy, direct investment (equity) and indirect (debt) investment to implement clean energy systems in 14 local communities in Japan. It could provide help us to understand what types of arrangements are being made and could be possible for different types of systems in rural communities where obtaining financial resources could be a major barrier for installing a clean energy system. The article also attempts to explore what social and

economic benefits, so-called SDGs interlinkages, could be brought or envisioned through the introduction of such systems.

Appendix to this article summarizes the information on the 14 projects including renewable energy types, locations, electricity capacity, investment size, project title, project description, financial arrangements, and impacts to local community. 14 projects are selected from various sources with a particular attention to unique features of the projects with respect to the financial arrangements as the impacts to local communities. The list contains biogas, biomass, gas-cogeneration, mega-solar, photovoltaics, small hydro, solar heat, and wind projects.

Results and Discussions

The results of the review of the 14 projects among local communities indicate that small or medium size local banks have started to participate in debt finance actively. Their participations were observed in most of the cases in the attached list. In the case of the combined biomass, biogas, and solar project in Aichi, a local bank, Hyakugo Bank provided debt finance equivalent to $47,77 million. The bank acted as the arranger and agent and another local bank participated in debt finance as well. In the case of the biomass project in Okayama (Project 7), a local bank, Chugoku Bank acted as the lead arranger and agent for the syndicated loan totalling $19.5 million. These cases may suggest that even though some part of the risk being involved in clean energy projects are still uncertain, local banks have gradually accumulated knowledge and know-how in financing such projects.

Another observable trend is that some projects have received a subsidy from different parts and levels of the governments such as Project 5, 7, 11, and 12. In the case of the small hydro project (Project 12), 75% of the initial investment costs are subsidized by the prefecture and the city. In the case of the other small hydro project (Project 8), it is being co-financed by a local bank and Development Bank of Japan. On the other hand, two large projects on the list are financed directly by private companies including Project 3 and 14. In the case of the large biomass project (Project 3), one of the largest trading companies in Japan, Sumitomo Cooperation is the main equity investor of the project.

There are two other points to note in the review of the projects. The geothermal project in Fukushima (Project 11) have received 80% of a guarantee of debt finance. If debt guarantee becomes more available for clean energy projects, it may encourage local banks to participate in debt finance and promote clean energy systems among local communities. The other interesting point is that the private company involved in the wind project in Nagasaki (Project 14) are collecting finance through the issuance of a

green bond. Green or sustainability bonds could be a promising financial vehicle to secure finance necessary for clean energy projects.

As for the interlinkages with social and economic agenda through of the introduction of a clean energy system in Japan, the review results suggest that designing a scheme where both production and the consumption of electricity could take place in the same community is the key for circulating financial resources in the community. This point is emphasized among Project 1, 6, and 10. For example, the mega-solar project in Hokkaido (Project 1) indicates that “the finance is mainly raised by local or regional financial institutions for electricity to be consumed in the local community. This may help to encourage the local economy.” (Daiwa Energy Infrastructure Corporation, Hokkaido Electric Power Company, & Hokuyo Bank, Ltd., 2020).

Several projects (Project 6, 10, 11, and 13) further indicate that this helps to lower the costs for the local community. The biomass/biogas/solar project in Aichi (Project 6) states that “the city is able to reduce its financial burden by about $120 million over 20 years.” (New Energy Foundation, n.d.). The geothermal project in Fukushima (Project 11) states “after the end of the Feed-in-Tariff Program, the company aims to contribute to the community by providing electricity at a price in the range of 10 cent per kWh.” (Ishida, 2018).

Apart from financial contributions to the local communities, several projects (Project 7, 12, 13, and 14) address that the introduction of clean energy systems has positive impacts on hiring local employment, encouraging resettlement in the rural community, and increasing the number of visitors to the area. This is an important contribution of clean energy systems, especially in Japan, as the declining population as well as the aging population have addressed serious social and economic issues particularly in the rural area in the country. In addition, Project 2 points out that the project could provide learning opportunities for the students in the community. In fact, several projects on the list provide opportunities for those who are interested in learning about clean energy facilities. This could be in line with the concept of eco-tourism or learning tourism on sustainability.

There are two other points to note about the impacts to local communities. The biomass projects (Project 3, 7, 13) suggest that the use of local biomass resources “encourages appropriate thinning and removal of leftover wood from the forest to keep the forest in a healthy condition” (Ishida, 2017) (Project 7). As majority of the land in Japan is covered with forest, biomass electricity generation projects would be helpful for forest management as well. The other point is that Project 9 and 10 demonstrate that the introduction of clean energy systems would help to increase resilience against natural disaster. Project 10 illustrates that when there was “a power outage in 2019 due to the damage on the central grid electricity distribution, the plant provided

electricity, hot water, and bathroom facilities to local residents" (CHIBA Mutsuzawa Energy Co., Ltd., 2019). Building an off-grid independent system would be particularly important for remote islands such as Project 9 where the islands could be vulnerable to the shortage of energy supply in the event of irregular weather patterns or disaster.

Conclusion

This article examined different financial arrangements being made to implement clean energy systems in local communities among 14 local communities in Japan. It turned out that small or medium size local banks have actively started to participate in debt finance in such systems. A guarantee of debt finance as well as issuance of bond investment are observed in two projects. These mechanisms could be instrumental in promoting clean energy systems in Japan. The possibility of the use of the mechanisms could be explored outside of Japan as well.

The article also explored the interlinkages of the introduction of a clean energy system and social and economic agenda in Japan. The review results indicated that designing a scheme where both production and the consumption of electricity could take place in the same community is the key for circulating financial resources in the community. It appears that the circulation of financial resource in the same community helps to lower the energy costs for the local community. The saved resources could be used for other economic or social activities in the community. Further research including interviews with stakeholders such as citizens, project developers, and financial managers as well as field observations are necessary to explore possibilities of financial arrangements as well as social and economic impacts through the introduction of clean energy systems in rural communities.

Notes

Japanese currency is converted into US dollar at the exchange rate of US $1 for 100 Japanese yen. The titles of the articles, names of the projects, and others in Japanese are translated in English by the authors. Some of the draft texts in Japanese used in the Appendix are translated into English using the free version of the Deep L translator.

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References

Bertheau, P. (2020). Assessing the impact of renewable energy on local development and the sustainable development goals: Insights from a small philippine island. Technological Forecasting & Social Change, 153, 119919. doi:10.1016/j.techfore.2020.119919

Burney, J., Alaofè, H., Naylor, R., & Taren, D. (2017). Impact of a rural solar electrification project on the level and structure of women's empowerment. Environmental Research Letters, 12(9), 95007. doi:10.1088/1748-9326/aa7f38

Cabinet Office (2012). Population Estimates in Japan.

https://www5.cao.go.jp/keizai-shimon/kaigi/special/future/sentaku/s2_1.html (Access: July 25 2021)

CHIBA Mutsuzawa Energy Co., Ltd. (2019). *Power and hot water supplied to Mutsuzawa smart wellness town amid power outages in the town and surrounding areas due to typhoon No. 15* [Press release]. https://mutsuzawa.de-power.co.jp/wordpress/wp-content/uploads/2019/09/むつエナ SWT 台風 15 号.pdf

Daiwa Energy Infrastructure Corporation, Hokkaido Electric Power Company, & Hokuyo Bank, Ltd. (2020, April 30). *Hokkaido Electric Power and North Pacific Bank to invest in Hokkaido mega solar private placement fund organized by Daiwa Energy Infrastructure* [Press release]. https://www.hokuyobank.co.jp/newsrelease/pdf/20200430_071812.pdf

Frankfurt School - UNEP Collaborating Centre for Climate & Sustainable Energy Finance. (2020). Global trends in renewable energy investment 2020. ().Frankfurt School of Finance & Management.

Fytili, D., & Zabaniotou, A. (2017). Social acceptance of bioenergy in the context of climate change and sustainability – A review. Current Opinion in Green and Sustainable Chemistry, 8, 5-9. doi:10.1016/j.cogsc.2017.07.006

Hürlimann, C. (2019). Valuation of renewable energy investments: Practices among german and swiss investment professionals Springer Gabler, Wiesbaden. doi:10.1007/978-3-658-27469-6

Institute for Sustainable Energy Policies (2020), Share of Electricity Generated from Renewable Energy in 2020 (Preliminary Report) https://www.isep.or.jp/en/1075/

(Access: July 25, 2021).

Ishida, M. (2017, June 20). *Local wood and operation know-how to support biomass power generation: Producing electricity for 22,000 households in Maniwa city, Okayama prefecture*. Japan Renewable Energy Foundation. https://www.renewable-ei.org/activities/column/img/20170620/column_REapplication02_20170620.pdf

Ishida, M. (2018, May 7). *Geothermal power generation brings vitality to affected hot spring areas: Using waste heat for shrimp farming in Tsuchiyu Onsen, Fukushima Prefecture*. Japan Renewable Energy Foundation. https://www.renewable-ei.org/activities/column/img/pdf/20180507/column_REapplication14_20180507.pdf

Josh Carmody and Duncan Ritchie. (2007). Investing in clean energy and low carbon alternatives in Asia, Asian Development Bank.

Khellaf, A. (2018). Overview of economic viability and social impact of renewable energy deployment in africa. Paper presented at the Africa-EU Renewable Energy Research and Innovation Symposium 2018 (RERIS 201, 59-70).

Masini, A., & Menichetti, E. (2013). Investment decisions in the renewable energy sector: An analysis of non-financial drivers doi:https://doi.org/10.1016/j.techfore.2012.08.003

New Energy Foundation. (n.d.). *Minister of economy, trade and industry award, new energy awards 2020: Regional symbiosis category.* http://www.nef.or.jp/award/kako/r02/g_02.html

Nilsson, M., Griggs D., and Visbeck, M. (2016). Map the interactions between Sustainable Development Goals. Comment in Nature, vol. 53, no. 7607.

Nilsson, M., Chisholm, E., Griggs, D., Howden-Chapman, P., McCollum, D., Messerli, P., Neumann, B., Stevance, A-s., Visbeck, M., Stafford-Smith M. (2018). Mapping interactions between the sustainable development goals: lessons learned and ways forward. Sustain Sci 13, 1489-1503. https://doi.org/10.1007/s11625-018-0604-z

Santika, W. G., Anisuzzaman, M., Bahri, P. A., Shafiullah, G. M., Rupf, G. V., & Urmee, T. (2019). From goals to joules: A quantitative approach of interlinkages between energy and the sustainable development goals doi:https://doi.org/10.1016/j.erss.2018.11.016

Scherhaufer, P., Höltinger, S., Salak, B., Schauppenlehner, T., & Schmidt, J. (2018). A participatory integrated assessment of the social acceptance of wind energy. Energy Research & Social Science, 45, 164-172. doi:10.1016/j.erss.2018.06.022

Shawoo, Zoha & Dzebo, Adis & Hägele, Ramona & Iacobuta, Gabriela & Chan, Sander & Muhoza, Cassilde & Osano, Philip & Francisco, Marie & Persson, Åsa & Linnér, Björn-Ola & Vijge, Marjanneke. (2020). Increasing policy coherence between NDCs and SDGs: a national perspective.

Statistics Bureau of Japan (2021). Preliminary counts of population of Japan in July 2021 https://www.stat.go.jp/english/index.html (Access: July 25, 2021)

Sustainable Energy for All and the Climate Policy Initiative. (2019). Energizing finance: Understanding the landscape 2019.

The World Bank. (2017). State of electricity access report. Washington D.C.

United Nations Economic and Social Council. (2019). Special edition: Progress towards the sustainable development goals: Report of the Secretary-General.

United Nations Environmental Program. (2009). Catalysing low-carbon growth in developing economies public finance mechanisms to scale up private sector investment in climate solutions.

Appendix

Appendix summarizes the information on the 14 projects including renewable energy types, locations, electricity capacity, investment size, project title, project description, financial arrangements, and impacts to local community. The list of references to generate this list is attached at the end of the Appendix. The titles of the articles are translated from Japanese to English.

Number	Renewable energy types	Location	Electricity capacity	Investment size	Project title	Project description	Financial arrangements	Impacts to local community
1	Mega solar	Hokkaido	9MW 2MW 1MW (3 locations)	$50 million	Hokkaido Renewable Energy Promotion Platform	A special purpose company (SPC), Hokkaido Renewable Energy Promotion Platform, starts operation in March 2020. The investment targets are three power plants in Hokkaido. The fund targets "local production for local consumption of energy and finance." Hokkaido Electric Power Company and North Pacific Bank (Hokuyo Bank) are participating in the fund through debt and private equity investment. The portfolio is unique in that it is limited to a specific region.	A local bank, the North Pacific Bank participated as an asset based lending (ABL) lender in this fund established by Daiwa Energy Infrastructure. The asset manager is Daiwa Real Estate Asset Management and others. The project receives a subsidy by the Ministry of the Environment. $1.9 million loan is provided through North Pacific Bank under its "green loan" scheme. The project has received a high rating by the Japan Credit Rating Agency for its environmental performance.	The local bank is providing debt finance through its green loan scheme. The finance is mainly raised by local or regional financial institutions for electricity to be consumed in the local community. This may help to encourage the local economy.
2	Biogas	Aomori	660kW	$22 million	Biogas Energy Towada (B-GET)	The plant starts operation in August, 2020. It is the first biogas powerplant being launched in Aomori prefecture. It processes up to 120 tons of organic sludge and garbage per day collected from households and companies. According to the website, It is a locally produced, locally consumed energy system that maximizes the use of local resources.	A local bank, Aomori Bank takes the lead in debt finance. Japan Finance Corporation and a local leasing company participate in finance.	Electricity is produced and consumed locally using local resources. According to the website, an educational facility is set up at the power plant where elementary and junior high schools can be invited to learn about waste disposal, recycling, and waste separation. Fermentation residue is converted into fertilizer and returned to farmland, contributing to agriculture by reducing the use of chemical fertilizers and improving soil quality.
3	Biomass	Yamagata	50MW	$250 million	Sakata Biomass Power Plant	The plant started operation in August 2018. It is one of the largest biomass power plants in Japan. It is operated by Summit Sakata Power being financed by Sumitomo Cooperation. 40% of fuel are wood chips that are unused wood and forest residues, mainly from forests in the region. The rest of fuel include wood pellets from North America and Palm Kernel Shell (PKS) from Indonesia and Malaysia. As for PKS, the plant attempts to collect certified sources of PKS such as Roundtable for Sustainable Palm Oil (RSPO).	One of the largest trading company in Japan, Sumitomo Cooperation is the main equity investor of the plant. A local bank, Yamagata Bank provided $20 debt finance. In addition, Yamagata Prefecture's systematic loan, The plant used other local loaning schemes including Yamagata Prefecture Commerce and Industry Promotion Fund's Industrial Location Promotion Fund.	According to the website, the plant promotes the domestic forestry industry by effectively utilizing wood resources such as thinned wood and unused wood. As it is a large power plant, it hires a large number of employees from the local community.

4	Wind	Hokkaido	4MW	$16 million	Atsuta Citizen's Wind Power Generation	Operated by Atsuta Shimin Wind Power Co. Two wind turbines (2MW each) were installed on a hillside in Ishikari City in Hokkaido. The turbines have been operating since December 2014 and there is a power purchase agreement under the Feed-in-Tariff Program until December 2034.	This is a syndicated loan between two local banks, Hokkaido Bank and Hokuto Bank, with a total loan amount of $12.9 million. In addition, the Green Finance Promotion Organization has invested $1 million and the Citizen's Wind Turbine Fund 2014 Ishikari Atsuta has invested $0.99 million. This project finance is a non-recourse loan that limits the repayment source to only the electricity sales income generated by the power generation project.	According to the website, part of the profit from the project is donated to the Ishikari City Environmental Town Development Fund. This is used for the maintenance of the environmental conservation forest area. In the region, the declining population and aging population is a serious social issue. The Aikaze Citizen Windmill Fund, which is one of the investors in this project is supporting local revitalization efforts by donating about 1% of dividend to the local community.
5	Solar	Iwate	1,607kW 2,367kW (2 locations)	N.A.	Miyako Solar Power Project	The project started in September 2015 being operated by Miyako Power Generation Company. This project was implemented in Miyako City, Iwate Prefecture, as part of the Miyako City Smart Community Project. The power plants are located in two locations, both of which are within the disaster risk zone caused by the earthquake in 2011. The objectives of the project are to create a decentralized power source in the community, to improve the efficiency of the energy supply-demand balance with a focus on the Community Energy Management System (CEMS) , to restore the affected area through land use, and to improve disaster resistance.	The loan was co-financed by a local bank (Iwate Bank) and the Development Bank of Japan (DBJ). A special purpose company (SPC) was formed with 80% equity investment by JDC Corporation. According to the website, Iwate Bank has provided various types of support for the Miyako Smart Community Project.	Electricity is supplied to 191 public and private facilities in the local community as of March 2021. The Miyako City Smart Community Project has introduced a rapid recharging service for electric vehicles using locally produced electricity at the Roadside Station. In addition, the project has started the Building and Energy Management System (BEMS) at five facilities as well as a car sharing business in the community.
6	Biomass/Biogas/Solar	Aichi	1,000kW (biogas)1,995kW (solar)	$137.2 million	Toyohashi Biomass Resource Utilization Center	The plant is operated by Toyohashi Biowill since October, 2017. Sewage sludge, manure, septic tank sludge, and food waste, which used to be treated separately , are integrated into a methane fermentation process. Biogas produced is used as fuel to generate electricity. In addition, the residue generated by the methane fermentation is also carbonized and converted into fuel. There is also solar power generation in the same location.	A local bank, Hyakugo Bank provided debt finance equivalent to $47,77 million in March, 2016. The bank acted as the arranger and agent and another local bank, Toyohashi Shinkin Bank, participated in the debt finance. Hyakugo Bank actively participate in the Private Finance Initiative (PFI) According to its website, PFI is a method of outsourcing a series of tasks from design, construction, operation, and maintenance of facilities to the private sector by	The biogas/biomass/solar resources are produced and consumed locally. According to its website, With the introduction of PFI, the city is able to reduce its financial burden by about $120 million over 20 years. The Biomass Utilization Center and the water treatment facility is open for visitors for educational purposes.

							actively utilizing private sector funds, management knowhow, and technical know how for public projects implemented by the national and local governments. According to its website, this project is the largest PFI project that the bank has involved until now.	
7	Biomass	Okayama	10MW	$41-43 million	Maniwa Biomass Power Generation	The plant started its operations in April, 2015. It is operated by Maniwa Biomass Power Generation. The power generation system uses wood chips generated from thinning, forest residues, and lumber mills in Maniwa City in Okayama Prefecture as fuel. It uses 10,000 tons of chips every month. The boiler is a stoker system and can burn bark, branches and leaves with high moisture content. The collection and supply of fuel involves forestry cooperatives, forestry business entities, lumber manufacturers, and chip manufacturers. With a power generation scale of 10 MW, the plant can generate electricity for 22,000 households, which is more than 17,000 households in Maniwa City.	A local bank, Chugoku Bank acted as lead arranger and agent for the syndicated loan totaling $19.5 million in July, 2014. National banks including Mizuho Bank and Aozora Bank acted as joint arrangers, with Bank of China, Mizuho Bank, Aozora Bank, Sanin Godo Bank, and Tomato Bank as participating financial institutions. The project has also received a subsidy of $14 million from the Ministry of Agriculture, Forestry and Fisheries' Fund for Acceleration of Forest Development and Forestry Revitalization, and $2.6 million subsidy from Maniwa City. The equity investment is conducted by a local construction company as well as Maniwa City.	In April 2018, the power plant began selling electricity to a total of 45 facilities, including elementary and junior high schools and water and sewage facilities. The project is expected to have a number of effects, including creation of a new biomass industry, revitalization of the forestry and timber industries, expansion of local employment, as well as recovery of forest functions, formation of a recycling-oriented society, and revitalization of mountainous regions. A total of 50 new jobs have been created: 15 at the power plant and 35 at the power plant-related businesses. According to the website, $5 per ton of lumber is given back to the forest owners who supplied the lumber. This encourages appropriate thinning and removal of leftover wood from the forest to keep the forest in a healthy condition.

8	Small hydropower	Kagoshima	995kW	$15 million	Funama Small Hydro Power Plant	The plant is operated by Kyushu Power Generation company since August, 2014. It is the largest small hydropower project in Japan.	The loan was co-financed by a local bank, the Bank of Kagoshima and the Development Bank of Japan. Generally speaking, small hydropower projects require a longer payback period relative to other renewable energy sources. The experience and knowledge of implementing and financing small hydropower projects is lacking compared to other renewables. On the other hand, the Bank of Kagoshima cited the following reasons for providing loan: the commercialization of small-scale hydroelectric power generation leads to industrial development, contribute to reducing environmental impacts, and build a cooperative system with the local community and companies related to the project.	The plant provides electricity that can cover 2,000 households.
9	Solar	Okinawa	N.A.(The capacity can increase as the application for the installation of roof-top PV under way.)	N.A.	Roof-top PV for individual houses, apartments, business facilities	The project takes place on a remote island, Miyako Island in Okinawa region. A local energy company, Miyakojima Energy. was established in April 2018 and promotes renewable energy including roof-top PV for individual houses, apartments, business facilities on the island. The company procures and owns solar power generation equipment, storage batteries, hot water heaters, and other equipment in bulk to reduce the installation cost. The equipment are installed free of charge at	The Okinawa Development Finance Corporation has invested $0.56 million in the company (Miyakojima Future Energy Company) promoting renewable energy on the island in September, 2020.	Remote islands could be vulnerable to irregular weather patterns such as typhoon and sudden increase of fuel price. The project is in line with the island goal to increase energy independence and resilience to natural disaster. The Okinawa Development Finance Corporation has evaluated this project as having high social significance., as, according to the organization, it is an effort to solve the problems faced by solar power generation facilities and make them a main power

						the locations The generated electricity is sold to the property owners or occupants for their own consumption, while surplus electricity is sold to a electricity company. An affiliate company remotely controls the equipment at all times to optimize the supply-demand balance, thereby reducing the impact on the power system and enabling the diffusion of solar power generation equipment.		source, the storage batteries of the facilities can be used as an emergency power source in typhoon towers.
10	Gas co-generation/Solar/Solar heat	Chiba	80kW (Co-generation) 20kW (Solar PV) 37kW (solar heat)	N.A.	CHIBA Mutsuzawa Energy: CHIBA Mutsuzawa Smart Wellness Town	The project is operated by CHIBA Mutsuzawa Energy, which was established by Mutsuzawa Town and local companies. In Mutsuzawa Smart Wellness Town, which opened in September 2019, electricity and heat generated by gas cogeneration, solar power, and solar heat are supplied in an integrated manner. The project also features a hot bath facility using waste heat, disaster countermeasures and curtailment of consignment fees through self-owned lines, and undergrounding of self-owned lines to improve the landscape and disaster prevention.	A local bank, Chiba Bank announced in 2016 that it has invested $4,500 in CHIBA Mutsuzawa Energy. The bank and the Organization for the Promotion of Private Finance Initiative also provided project financing to Mutsuzawa Smart Wellness Town Corporation. The amount is unknown. The bank participates as a member of the Mutsuzawa Town Council for the Creation of Town, People, and Work (Mutsusawa Town's general strategy promotion organization) and the Energy Service Management Business Feasibility Study Committee. In addition, he is also involved in the local production and local consumption of electricity. In addition, to promote local production and local consumption of electricity, the	According to the information source, since the business entity is a local capital, in addition to the reduction in consumer costs, business profits are also returned to the community. The project is also expected to attract visitors to the roadside station as well as to the town. In the event of a disaster, the gas engine generator can continue to supply necessary energy. In addition, the waste heat from the generator can be used to heat tap water and provide hot water to local residents. In the event of a power outage in 2019 due to the damage on the central grid electricity distribution, the plant provided electricity, hot water, and bathroom facilities to local residents.

							bank's neighboring branches purchase electricity from CHIBA Mutsuzawa Energy. According to the information source, the bank also made introductions to neighboring businesses to support their commercialization.	
11	Geothermal	Fukushima	400kW	$7.06 million	Geothermal power generation in Tsuchiyu Onsen, Fukushima Prefecture: Tsuchiyu Onsen Energy	Operated by Tsuchiyu Onsen Energy; started operation in November 2015. The business was launched to promote recovery from the reputational damage caused by the nuclear accident as well as the damage caused by the earthquake. Profits are used for the redevelopment of the hot spring resort. The plant uses a binary system, with a maximum output of 400 kW.	A local, bank, Fukushima Shinkin Bank provided a loan of $5.57 million. Japan Oil, Gas and Metals National Corporation (JOGMEC) guaranteed 80% of the debt. In addition, JOGMEC has received a loan of $0.84 million yen from Japan Finance Corporation and a subsidy of $0.65 million from the Ministry of Economy, Trade and Industry.	The waste heat generated by the power plant is used for shrimp farming. The shrimp farming business started in April 2017. The farm was built with the support of a subsidy from the Ministry of Economy, Trade and Industry. The profit from electricity generation is partly used to provide full support for school lunches and teaching materials for parents of children attending local elementary schools. The company will also donate commuter passes to the elderly and high school students. After the end of the Feed-in-Tariff Program, the company aims to contribute to the community by providing electricity at a price in the range of 10 cent per kWh.
12	Small hydropower	Gifu	100kW	$2.4 million	Small-scale hydroelectric power generation in Ishitetsuhaku	The electricity plant is operated by a NPO, Yasuragi-no-Sato Itoshiro. It started operation in March 2011. Water is drawn from a nearly river and a water turbine of about 100kW is installed and operated using a 110 m gap in the altitude. There	In June 2016, the power plant was constructed at a total cost of $2.4 million. $1.8 million was subsidized by Gifu Prefecture (55%) and Gujo City (20%), and the cooperative paid $0.6 million. $0.2 million of the $0.6 million yen was provided by local	The efforts to build a small-scale hydroelectric power generations well as to promote community development activities in Ishinomaki have been recognized as one of the leading examples of success in rural area with declining population

					Village, Gifu Prefecture : Yasuragi no Sato Itoshiro	are four hydroelectric generators. The annual income from electricity sales is about $0.195 million.	residents, and the remaining $0.4 million was financed by the Japan Finance Corporation.	and staggering economy. Since the beginning of the power plant, the area has attracted more than 500 visitors a year. Between 2008 and 2016, 32 people from 13 households have newly moved to the area.
13	Biomass	Hokkaido	550kW x 2 (boilers) 15kW (solar PV) Several other boilers in the area	N.A.	Biomass Use for District Heating System in Shimokawa Town in Hokkaido	The community in Shimokawa Town has developed a district heating system using wood chips obtained from local forest.	N.A.	The efforts to use local biomass resources as well as to promote local economy in Shimokawa Town in Hokkaido have been recognized as one of the leading examples of success in rural area with declining population and staggering economy. The project stimulates the local forestry industry and circulate energy resources within the community. The project has successfully contributed to increase local employment and attract young generations to move into the local area. Since the beginning of the power plant, the area has attracted more than 500 visitors a year.
14	Wind	Nagasaki	2MW	N.A.	Offshore floating wind power generation in Goto Islands in Nagasaki	The area is recognized as ideal for installing a offshore floating wind power generation facility with annual average wind speed 7.5 m/s. Toda Construction Company has chosen this location, conducted a research project since 2007,and installed a 2MW power generation facility for the operation in 2016. It has a plan to expand the facility including up to 10 wind turbines.	Goto City has provided the power generation facility to Goto Floating Wind Power, which is a 100% subsidiary of Toda Construction Company. There are additional costs related to the installed seabed cables and other facilities onshore. According to the information source, the actual total cost of investment is not uncertain but it is estimated around $10 million.	The area is not an exception with respect to declining population and staggering economy. The project is expected to provide opportunities for local employment.

							The project plans to increase power generation and Toda Company announced in November 2017 that it was going to collect $100 million through the issuance of a green bond.	

Agency of Natural Resources and Energy. (n.d.). A case study of commercialization using the Regional Low Carbon Investment Promotion Fund: Citizen's wind power generation project, Atsuta-ku, Ishikari city [Press release]. Ministry of Economy, Trade and Industry. https://renewable-energy-concierge.go.jp/media/activity-example/68e257057076449ea6dcd3c1a7cb2b8b.pdf
Agricultural cooperative in Gifu prefecture starts 125kW small hydropower project. (2016, May 27). Environmental Business Online. https://www.kankyo-business.jp/news/012699.php
Aitsu, M. (2020, February 8). CHIBA Mutsuzawa Energy, a new municipal electric power company, creates a disaster prevention energy base using local resources [PowerPoint slides]. https://www.env.go.jp/press/files/jp/113284.pdf
Akashi, K. (2016, December 19). Reviving the wisdom and spirituality of the land in a form suitable for the times. The challenge of 270 people living in the community of Itoshiro, Gifu prefecture, towards a "sustainable farming village" that began with small-scale hydroelectric power generation. Greenz. https://greenz.jp/2016/12/19/itoshiro/
Aomori Bank, Ltd. (2020, April 30). Construction of the first biogas power generation facility using waste materials in Aomori prefecture: Syndicated loan to Kennan environmental conservation center co [Press release]. https://www.a-bank.jp/contents/cms/article/20200430001/index.html
Biogas Energy Towada (B-GET). (n.d.). http://www.kkhozen.com/_src/17035/b-get_5.pdf
Biomass Tour Maniwa. (n.d.). History of the biomass industrial forest city "Maniwa". Retrieved July 24, 2021, from http://biomass-tour-maniwa.jp/history/
Business overview. (n.d.). Retrieved July 25, 2021, from https://wwwc.hepco.co.jp/hepcowwwsite/info/2017/__icsFiles/afieldfile/2017/12/22/171222c_1.pdf
CHIBA Mutsuzawa Energy Co. (2019, September 1). Mutsuzawa smart wellness town to start supplying energy for local consumption [Press release]. https://mutsuzawa.de-power.co.jp/wordpress/wp-content/uploads/2019/09/むつエナ SWT 開始.pdf
CHIBA Mutsuzawa Energy Co. (2019, September 12). Power and hot water supplied to Mutsuzawa smart wellness town amid power outages in the town and surrounding areas due to typhoon No. 15 [Press release]. https://mutsuzawa.de-power.co.jp/wordpress/wp-content/uploads/2019/09/むつエナ SWT 台風 15 号.pdf
CHIBA Mutsuzawa Energy Co. (2019, November 25). Project for building a system for 100% local production and local consumption of locally produced gas in Mutsuzawa smart wellness town [PowerPoint slides]. https://www.hkd.mlit.go.jp/ky/ki/renkei/splaat000001t1v6-att/splaat000001t1z9.pdf
CHIBA Mutsuzawa Energy Co. (2020, September 3). CHIBA Mutsuzawa Energy won the Gold Award at the 6th Japan Resilience Awards! [Press release]. https://mutsuzawa.de-power.co.jp/wordpress/wp-content/uploads/2020/09/むつエナレジリエンスアワード受賞.pdf
CHIBA Mutsuzawa Energy Co. (n.d.). Company profile. Retrieved July 25, 2021, from https://mutsuzawa.de-power.co.jp/wordpress/company
Chiba Bank, Ltd. (2016, May 24). Investment in "CHIBA Mutsuzawa energy corporation" [Press release]. https://www.chibabank.co.jp/news/company/2016/0524_01/
Chiba Bank, Ltd. (2020, May 19). Selection of "Examples of distinctive initiatives" by financial institutions contributing to regional development [Press release]. https://www.chibabank.co.jp/data_service/file/news20200519_01_001.pdf
Chugoku Bank, Ltd. (2014, July 29). Syndicated loan for woody biomass power generation project [Press release]. (2014, July 29). https://www.chugin.co.jp/up_load_files/news_release/779_pdf_1.pdf
Citizen Wind Power Co. (n.d.). Giving back to the community. Retrieved July 24, 2021, from https://www.cwp-wind.jp/company/reduction_area/
Commerce, Industry, Labor and Tourism Division, Planning and Economy Department, Ishikari City. (2019). Salmon rise in the mother river, Ishikari. Wind Energy, 43(2), 298-301. https://doi.org/10.11333/jwea.43.2_298
Daiwa Energy Infrastructure Corporation, Hokkaido Electric Power Company, & Hokuyo Bank, Ltd. (2020, April 30). Hokkaido Electric Power and North Pacific Bank to invest in Hokkaido mega solar private placement fund organized by Daiwa Energy Infrastructure [Press release]. https://www.hokuyobank.co.jp/newsrelease/pdf/20200430_071812.pdf
Development Bank of Japan Inc. (2013, December 16). Loan to Kyushu Electric Power Co., Ltd. for the construction of a small-scale hydroelectric power plant [Press release]. https://www.dbj.jp/topics/dbj_news/2013/html/0000014411.html
Development Bank of Japan, & Iwate Bank, Ltd. (2015, March 30). Syndicated loan for "Miyako solar power project" [Press release]. https://www.dbj.jp/topics/branch_news/2014/files/0000019189_file1.pdf
Fukken Survey & Design Co. (2015, January 27). Investment in Miyako power generation Godo Kaisha (SPC) for "Miyako city smart community solar power plant construction project" [Press release]. https://www.fukken.co.jp/news/9412/
Genki-up Tsuchiyu Co. (n.d.). Binary power generation buisiness. Retrieved July 25, 2021, from https://genkiuptcy.com/ホーム/バイナリー発電事業-2/?frame-nonce=f97ee11ac9
Goto City. (n.d.). Goto city renewable energy aforementioned basic plan. https://www.city.goto.nagasaki.jp/energy/010/010/039_4_2.pdf
Goto City. (n.d.). Goto city renewable energy basic plan. https://www.city.goto.nagasaki.jp/energy/010/010/039_4_1_1.pdf
Green Finance Promotion Organization. (2014, March 27). Decision to invest wind power project in Hokkaido [Press release]. http://greenfinance.jp/example/case140327_03.pdf
Green Finance Promotion Organization. (n.d.). Progress of investment projects. http://greenfinance.jp/example/progress/post_3.html
Hokkaido Bank, Ltd. (2014, August 29). Project finance for wind power generation business for Atsuta shimin wind power corporation [Press release]. https://www.hokkaidobank.co.jp/common/dat/2014/0828/14092086131253867692.pdf
Hokkaido Bank, Ltd. (2015, November 13). Tohoku-Hokkaido region exchange promotion regional bank cooperation project [PowerPoint slides]. http://tohoku.mof.go.jp/content/000125237.pdf
Hokuto Bank, Ltd. (2014, March 27). Formation of a project for wind power generation in Ishikari city, Hokkaido: Decision to invest from Green finance promotion organization [Press release]. https://www.hokutobank.co.jp/news/pdf/20140327-3.pdf
Hyakugo Bank, Ltd. (2018, March). Hyakugo bank's PFI initiatives [Press release]. https://www.hyakugo.co.jp/ir/disclosure/pdf/zp0509.pdf

Ishida, M. (2017, June 20). Local wood and operation know-how to support biomass power generation: Producing electricity for 22,000 households in Maniwa city, Okayama prefecture. Japan Renewable Energy Foundation. https://www.renewable-ei.org/activities/column/img/20170620/column_REapplication02_20170620.pdf
Ishida, M. (2018, January 11). Japan's first commercial operation of a floating offshore wind turbine: Aiming to coexist with the fishing industry in Goto city, Nagasaki prefecture. Japan Renewable Energy Foundation. https://www.renewable-ei.org/activities/column/img/pdf/20180111/column_REapplication10_20180111.pdf
Ishida, M. (2018, May 7). Geothermal power generation brings vitality to affected hot spring areas: Using waste heat for shrimp farming in Tsuchiyu Onsen, Fukushima Prefecture. Japan Renewable Energy Foundation. https://www.renewable-ei.org/activities/column/img/pdf/20180507/column_REapplication14_20180507.pdf
Isoyama, T. (2016, June 11). Restoring the spirit of self-reliance: Small hydropower in Itoshiro. National Council for the Promotion of Small Hydropower Use. http://j-water.org/tag/石徹白/page/2/
JFE Engineering Corporation, & Toyohashi Biowill Corporation. (2017, October 4). Completion of a biomass energy complex in Toyohashi city: Japan's largest scale biomass power generation PFI project starts [Press release]. https://www.jfe-eng.co.jp/news/2017/20171004.html
Japan Credit Rating Agency, Ltd. (2020, January 29). Green bond / Green bond program external review form [Press release]. https://www.jcr.co.jp/download/3e76d701dd268a0a16d996ed1708c67141f3960d3d36cd0001/20200129_DAIWAEIJ.pdf
Japan Credit Rating Agency, Ltd. (2020, March 27). Daiwa Green Finance Program trust beneficiary rights (Iwamizawa and Kushiro solar power plants) granted Green1 rating [Press release]. https://www.jcr.co.jp/download/c501a0145ee1aaf994e7f3e239f4e9fe3e2aeee72f7eff4cec/19d1253_1.pdf
Japan Finance Corporation for Okinawa Promotion and Development. (2020, October 8). Okinawa JFC invests in Miyakojima Mirai Energy Co., Ltd. to support renewable energy service provider business [Press release]. https://www.okinawakouko.go.jp/sp/newsrelease/detail/4080
Kagoshima Bank, Ltd. (2013, April 26). Financing for the construction of a small hydropower plant [Press release]. Retrieved July 25, 2021, from https://www.kagin.co.jp/kojin/newsrelease/20130426_water.html
Kaneko, K. (2015, December 22). Mega solar power plant in Iwamizawa adopts "Wooden piles". Nikkei XTECH. https://xtech.nikkei.com/dm/atcl/feature/15/302960/121800017/
Kawai, Y. (2015, June 30). Maniwa city, Okayama prefecture, Revitalizing the economy through woody biomass power generation (Electricity sales). Nikkei BP Research Institute. https://project.nikkeibp.co.jp/atclppp/PPP/061800007/062500008/?P=2
Kimotsuki Town Tourism Association. (2021, January 24). Kimotsuki information bureau: Construction of Funama small hydroelectric power plant enters final stage (2014). Retrieved July 25, 2021, from https://kankou-kimotsuki.net/archives/10347
Kimotsuki Town. (2018, December 27). Groundbreaking ceremony for the Funama power plant. Retrieved July 25, 2021, from https://kimotsuki-town.jp/soshiki/kikakuchoseika/2/enerugi/1229.html
Kobayashi, Y. (2019). Citizen's wind turbine with local community. Wind Energy, 43(1), 51-52. https://doi.org/10.11333/jwea.43.1_51
Kosugi, T., Saito, Y., Obata, N., Hiraoka, K., Ishikawa, I., Li, W., Enari, Y., Iwamatsu, Y., Murata, K., Nishimura, M., & Yang, J. (2021). Contributions to Sustainable Development Goals(SDGs)and Future Prospects of Circular Forest Management and Biomass Industries in Shimokawa Town, Hokkaido Prefecture. Policy Science, 28(2), 97-111. http://doi.org/10.34382/00014170
Kyushu Power Generation Co. (n.d.). Unit 1 Funama power station. Retrieved July 25, 2021, from https://kyushu-hatsuden.jp/power_plant/power_plants_01
Maniwa City. (2020, October). Maniwa biomass industrial forest city concept (revised version). https://www.city.maniwa.lg.jp/uploaded/life/2170_77261_misc.pdf
Miyako City Smart Community Promotion Council. (n.d.). Power supply configuration. Retrieved July 24, 2021, from http://www.miyakosumakomi.net/sindenryoku.php
Miyako City. (n.d.). About Miyako Smart Community. Retrieved July 24, 2021, from http://www.miyakosumakomi.net/about.php
Miyako City. (n.d.). Miyako city smart community project. https://www.city.miyako.iwate.jp/data/open/cnt/3/4385/1/20210326_2gatubun.pdf?20210326140926
Miyako City. (n.d.). Miyako city smart community. Retrieved July 24, 2021, from https://www.city.miyako.iwate.jp/energy/smartcommunity_2.html
Miyako City. (n.d.). Progress. Retrieved July 24, 2021, from http://www.miyakosumakomi.net/about_status.php
Nagaoka, T. (n.d.). Energy independence and regional development: Challenges of Shimokawa town, Hokkaido [PowerPoint slides]. https://www.env.go.jp/policy/local_keikaku/pdf/2_01_shimokawa.pdf
Nakajima, K. (2020, January 9). Maniwa biomass power plant: Reasons for its smooth operation and future challenges. Department of Renewable Energy Economics, Graduate School of Economics, Kyoto University. http://www.econ.kyoto-u.ac.jp/renewable_energy/stage2/contents/column0167.html
New Energy Foundation. (n.d.). Minister of economy, trade and industry award, new energy awards 2020: Regional symbiosis category. http://www.nef.or.jp/award/kako/r02/g_02.html
Obayashi Corporation. (n.d.). Funama power station. Retrieved July 25, 2021, from https://www.obayashi.co.jp/works/detail/work_1889.html
Offshore wind power producer off Goto city, Nagasaki prefecture: 21MW floating wind turbine, 36 Yen. (2020, June 25). Environmental Business Online. https://www.kankyo-business.jp/news/024166.php
Organization for the Promotion of Private Finance Initiative. (2017, September 13). Decision on support for Mutsuzawa smart wellness town base formation project [Press release]. http://www.pfipcj.co.jp/common/dl/support_023_201700913.pdf
Renewable energy initiatives overview. (n.d.). Retrieved July 25, 2021, from https://www.maff.go.jp/j/shokusan/renewable/energy/houkokusyo/pdf/ito3.pdf
Sakamoto, T. (2016, May 20). <Feature> The Maniwa biomass power generation project. Public Finance and Public Policy, 59, 19-22. https://doi.org/10.14989/217535
Sakoda, C., Sasaki, K., Yamazaki, Y., Kwon, J., & Hamasaki, H. (2016). A preliminary consideration on the feasibility of the commercialization of floating type offshore wind power generation in Goto City. Nagasaki University Research on the Integrated Environment, 19(1), 22-32. http://hdl.handle.net/10069/36830
Seikatsu Club. (2019, October 8). Why not choose "Seikatsu Club Denki" to create a future without nuclear power with renewable energy?. https://seikatsuclub.coop/news/detail.html?NTC=1000000424
Shinkin Central Bank, Community and Small Business Research Institute. (2015, December 22). Financing geothermal (hot spring binary) power generation to make use of local resources: Fukushima Shinkin Bank and Genki-up Tsuchiyu (Tsuchiyu hot spring energy Co., Ltd.) [Press release]. https://www.scbri.jp/PDFkinyuchousa/scb79h27s21.pdf

Sumitomo Corporation. (2018, November). One of the largest woody biomass power plants in Tohoku begins commercial operation in Sakata city, Yamagata prefecture. https://www.sumitomocorp.com/ja/jp/business/case/group/cc-181101
Sumitomo Group Public Relations Committee. (n.d.). Sumitomo group's exploring by Hiroki Tsuboi: Summit sakata power biomass power plant. https://www.sumitomo.gr.jp/act/public-relations/visits/07/
Sumitomo group. to start operation of biomass power plant in Sakata, Yamagata prefecture: One of the largest in Tohoku. (2018, August 28). Nihon Keizai Shimbun. Retrieved July 24, 2021, from https://www.nikkei.com/article/DGXMZO34694210Y8A820C1L01000/
Summit Sakata Power Corporation. (n.d.). About biomass power generation. Retrieved July 24, 2021, from https://summit-sakata-power.co.jp/ecology/
Summit Sakata Power Corporation. (n.d.). About fuel. Retrieved July 24, 2021, from https://summit-sakata-power.co.jp/fuel/
Summit Sakata Power Corporation. (n.d.). Efforts to ensure sustainability (legality) regarding biomass fuel generated from harvesting of agricultural products [Press release]. https://summit-sakata-power.co.jp/wp-content/uploads/2020/06/PKS_SSKP_20200617.pdf
Takahashi, Y. (2018, October 11). Shimokawa forest biomass initiative: Forest, forestry, and energy [PowerPoint slides]. https://www.pref.fukuoka.lg.jp/uploaded/attachment/46236.pdf
Tanaka, M., & Ichikawa, F. (2020, May 7). No. 4 Hyakugo bank: Assigned full-time staff from early on, involved in 48 PFI projects. Nikkei BP Research Institute. https://project.nikkeibp.co.jp/atclppp/PPP/434148/031300067/?P=2
Toda Corporation issues 10 billion yen in green bonds to fund a floating offshore wind farm project off the coast of Goto city, Nagasaki prefecture. (2017, November 2). Infrato. https://infrato.jp/7564/
Toda Corporation. (n.d.). Vol.2 Japan's first! Japan's first floating offshore wind power generation system. Retrieved July 25, 2021, from https://www.toda.co.jp/business/ecology/special/windmill_02.html
Toyohashi City Waterworks Bureau. (n.d.). Toyohashi city biomass resource utilization facility development and operation project. Retrieved July 24, 2021, from https://www.city.toyohashi.lg.jp/30705.htm
Toyohashi City Waterworks Bureau. (n.d.). Toyohashi city biomass resource utilization facility development and operation project [PowerPoint slides]. https://www.mlit.go.jp/common/001181196.pdf
Yanmar Energy System Co. (2020, August 7). Biogas generator installed at waste treatment facility in Towada city, Aomori prefecture, starts generating electricity [Press release]. https://www.yanmar.com/media/news/2020/08/17015033/pdf_news_20200807_011.pdf
Zha, L., & Taketoshi, K. (2016). Roles of Small Hydropower in Solving Problems in Rural Areas: A Case Study of Itoshiro Village and Yoshino Town. Journal of Agricultural and Forestry Issues, 52(4), 247-252. https://doi.org/10.7310/arfe.52.247