

FY2022
City-to-City Collaboration Programme for
Zero-Carbon Society

Promotion of Zero-Carbon Technology to Improve the
Environment in Hanoi City

Report

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Nippon Koei Co., Ltd.
Fukuoka Prefecture

**FY2022
City-to-City Collaboration Programme for
Zero-Carbon Society**

**Promotion of Zero-Carbon Technology to Improve the Environment
in Hanoi City**

Report

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List of Attachments

Attachment : Presentation Materials of the Technical Workshop in Hanoi City

1. Promotion of Zero-Carbon Technology to Improve the Environment in Hanoi City by Fukuoka Prefecture (Japanese/English)
2. Introduction of Joint Crediting Mechanism (JCM) and City-to-City Collaboration Project between Hanoi City and Fukuoka Prefecture by Nippon Koei (English)
3. Action Plan on Climate Change Response from 2021-2030 of Hanoi City by Hanoi Department of Natural Resources and Environment (DONRE) (English)
4. Current Status and Efforts on Energy Conservation by Hanoi Department of Commerce and Industry (DOIT) (English)
5. Potential for Renewable Energy in Viet Nam by Vina Hydrogen (English)
6. Introduction of VOC concentration and heat exchange technology by Seibu Giken (English)
7. Introduction of Solar Sharing system by Agritree (Vietnamese)
8. Micro Wind Power and Micro Hydropower Technology for Industrial Area in Hanoi City, Viet Nam by Riamwind (English)
9. Company profile, introduction of JCM equipment subsidy project by Kanematsu KGK (Japanese/Vietnamese)
10. Introduction of Climate Change Risk Countermeasure Service by Weathernews (Vietnamese)

Abbreviations

BAU	Business-As-Usual
BRT	Bus Rapid Transit
CCAP	Climate Change Action Plan
CCS	Carbon dioxide Capture and Storage
CNG	Compressed Natural Gas
COP	United Nations Climate Change conference
DARD	Department of Agriculture and Rural Development
DOIT	Department of Industry and Trade
DONRE	Department of Natural Resources and Environment
EMS	Eco-drive Management System
EPC	Engineering Procurement Construction
EVN	VIETNAM ELECTRICITY.
FIT	Feed-in Tariff
GEC	Global Environment Centre Foundation
GGs	Green Growth Strategy
GHG	Greenhouse Gas
IFC	International Finance Corporation
INDC	Intended Nationally Determined Contribution
IUCN	International Union for Conservation of Nature
JCM	Joint Crediting Mechanism
JICA	Japan International Cooperation Agency
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MOEJ	Ministry of the Environment, Japan
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MOT	Ministry of Transportation
MPI	Ministry of Planning and Investment
MRT	Mass Rapid Transit
MRV	Measurement, Reporting and Verification
NDC	Nationally Determined Contribution
NKV	Nippon Koei Vietnam
PDP	Power Development Plan
SDGs	Sustainable Development Goals
SPEC	U.S. Special Presidential Envoy for Climate
SS	Solar Sharing
TOE	Tonne of Oil Equivalent
VCCI	Vietnam Chamber of Commerce and Industry
VGBC	Vietnam Green Building Council
VNEEP	The National Target Energy Efficiency Program
VOC	Volatile Organic Compounds

CHAPTER 1 BACKGROUND AND OBJECTIVE

1.1 Background of the Programme

The 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC), held in November 2021, confirmed a new global goal of limiting the temperature increase to 1.5°C above pre-industrial levels. To achieve this goal, it is essential for each country to accelerate its efforts at various levels, such as state, city, and district levels. In Japan, the goal of a decarbonized society with zero greenhouse gas (GHG) emissions by 2050 has been declared, and the number of municipalities declaring virtually zero CO₂ emissions has rapidly increased to more than 600 (as of April 30, 2022). Under the regional decarbonization roadmap formulated in June 2021, advanced measures are being created in each region, and efforts are being made to expand these measures throughout the country.

As described above, the role of cities and municipalities in considering and implementing specific regional climate change measures and projects is becoming increasingly important. To realize a decarbonized society in the whole world, it is necessary to accelerate the movement toward building a sustainable decarbonized society, especially in Asia, where economic growth is remarkable, and there is a growing international movement to support cities' efforts to decarbonize their cities, which are places of activity that support social and economic development.

In addition, under the current situation of the spread of COVID-19, cities are being forced to recalibrate and consider new measures to achieve sustainable development at the same time as dealing with challenges related to the spread of the virus.

In this City-to-City Collaboration Programme, Japanese research institutes, private companies, universities, etc., together with Japanese cities that have experience and know-how in the formation of decarbonized societies, conduct research projects to support international municipalities in forming decarbonized societies and introducing facilities that will contribute to forming decarbonized societies.

In FY2022, the project for Zero-Carbon Society between Hanoi City and Fukuoka Prefecture (hereafter “the Project”) is positioned as the second fiscal year in the three-year plan under the City-to-City Collaboration Programme. The Project aims to develop human resources and transfer technologies on environmental fields (such as water, air, waste management) between both cities, in addition, identify the current status of main facilities factories, and farms, and then propose a solution by using environmental or zero-carbon technologies.

1.2 Cities of the Project

1.2.1 Fukuoka Prefecture Government

Fukuoka Prefecture, a representative prefecture of Kyusyu region and with approx. 5.1 million population, is located in the northern area, so they have trade with Asian countries mainly on the Chinese continent and the Korean Peninsula. Making use of its geographical advantage, Fukuoka Prefecture has been actively working on international support for Asian countries (Figure 1-1).

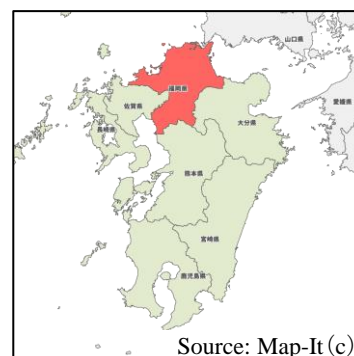


Figure 1-1 Location of Fukuoka Prefecture

Furthermore, Fukuoka Prefecture has promoted international environmental cooperation with the "Fukuoka Prefecture Comprehensive Plan" and "Fukuoka Prefecture Environmental Comprehensive Vision", and has concluded friendship alliances with multiple local governments overseas to conduct various environmental cooperation projects.

As for Hanoi City, the friendship alliance has been concluded with Fukuoka City in 2008 and a workshop in Japan for Hanoi City's environmental administrators and a seminar on environmental education have been implemented between the cities. In addition, with Fukuoka Prefecture's technical support, a waste treatment plant using "Fukuoka method" (quasi-aerobic landfill method), which has become the standard for waste disposal sites in Japan, has been completed in 2015. After that, the same type of waste treatment plant plans to be constructed in Thua Thien Hue in central Vietnam. In this way, Fukuoka Prefecture has made a big impact for improving environmental problems in Vietnam.

Statistical overview of Fukuoka Prefecture is shown in Table 1-1.

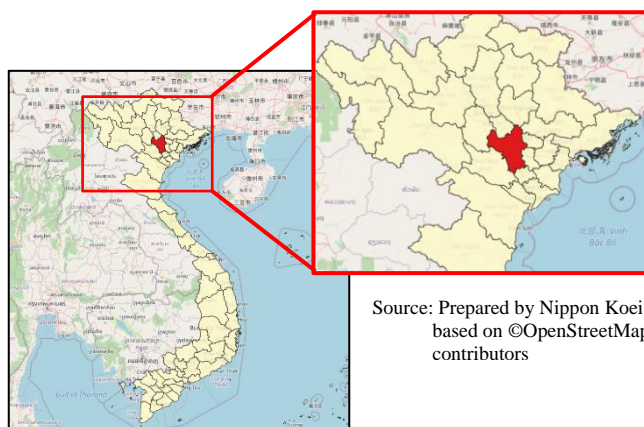
Table 1-1 The Overview of Fukuoka Prefecture

#	Item	Statistics
1	Area	4,987 [km ²] (as of 2019)
2	Population	5,114,881 [population] (as of 1 January 2023)
3	Population density	1,026 [population /km ²] (as of 1 January 2023)
4	Num. of household	2,372 [thousand households] (as of 1 January 2023)
5	Num. of private enterprise offices	205,965 [offices] (as of 1 June 2021)
6	GDP (nominal)	19.9 [trillion JPY] (as of 2019)

Source: Prepared by Nippon Koei base on "FY2022 the overview of Fukuoka Prefecture's policy" and the prefecture's official website

1.2.2 Hanoi City

Hanoi City (approx. 8.2 million population), the capital city of Vietnam, has the second largest economy following Ho Chi Minh City and is a central city of politics and culture in the country. The city is under the direct control of the central government, and has governmental organizations of other countries and international organizations, as well as local subsidiaries and representative offices of many foreign-affiliated companies.



Source: Prepared by Nippon Koei based on ©OpenStreetMap contributors

Figure 1-1 Location of Hanoi City

Currently Hanoi City has many environmental problems such as air pollution and river pollution due to open burning and use of briquette stoves. In addition, environmental issues related to agriculture, urban development, and climate change have become very serious because of recent rapid economic growth. So, the city is now considering the policies for solving these problems.

Statistical overview of Hanoi City is shown in Table 1-2 and the city views are shown in Figure 1-2.

Table 1-2 Overview of Hanoi City

#	Items	Statistics
1	Area	3,358.60 [km ²] (as of 31 December 2018)
2	Population	8,246.6 [thousands population] (as of 2020)
3	Population density	2,455 [population/ km ²] (as of 2020)
4	Num. of household	2,224,107 [households] (as of 1 April 2019)
5	Num. of private enterprise offices	165,875 [offices] (as of 31 December 2020)
6	GDP (nominal)	5.13 [trillion JPY] (as of 2020)

Source: Prepared by Nippon Koei based on "STATISTICAL YEARBOOK OF VIET NAM 2020" "COMPLETED RESULTS OF THE 2019 VIET NAM POPULATION AND HOUSING CENSUS" Hanoi Statistical Yearbook 2020" etc.



Tay Lake (Hanoi City's largest freshwater lake)



Traffic jam during rush hour in Hanoi City



Poster on environmental protection activities



Maintenance status of street trees



Electric bus



Garbage truck



Street cleaning



Smog in Hanoi City (February 2023)

Source: Photos taken by Nippon Koei

Figure 1-2 Current cityscape of Hanoi City

1.3 Objective of the Project

An objective of the project is 1) institutional support on promotion of zero-carbon and SDGs for improvement of environment in Hanoi City, and 2) support on formulation of JCM project to contribute to GHG emission reduction by introducing high efficiency equipment/renewable energy technologies which are in high demand in Hanoi City.

1.4 Implementation procedure and structure

1.4.1 Institutional Support

In the Project between Hanoi City and Fukuoka Prefecture, Department of Natural Resources and Environment (DONRE) of Hanoi City and Environmental Policy Division of Environmental Affairs Department of Fukuoka Prefecture Government are in charge, and a support on promotion of decarbonization in Hanoi City as an institutional support. Through the following activities, human resources development and information sharing and also consideration for introduction of advanced technologies were implemented.

- (1) Conducting city-to-city consultations to decarbonize Hanoi City and achieve the SDGs
- (2) Support for institutional development and human resource development in the field of climate change and environment by Hanoi City

1.4.2 Promotion of Energy Saving equipment

In Hanoi City, "energy shortage" and "air pollution" induced by economic activities are major issues. This year, in the field of energy efficiency and conservation, the project examined the possibility to launch business projects such as the "JCM model project" aiming to decarbonize Hanoi City to improve the environment through the following activities.

- (1) Support for business matching with local stakeholders in public and private facilities
- (2) Examine the possibility of launching the JCM model project by introducing energy-saving technologies in public and private facilities

1.4.3 Promotion of Renewable Energy technology

In the field of renewable energy, we studied to introduce the JCM model project, etc. through the following activities.

- (1) Examine the possibility of launching the JCM model project by introducing solar sharing and support the implementation of stakeholder consultations
- (2) Examine the possibility of launching the JCM model project by introducing small wind power generation and support the implementation of stakeholder consultations
- (3) Support for studying the use of meteorological data for the introduction of renewable energy technologies
- (4) Support for project formation and business matching for large-scale renewable energy projects

1.4.4 Promotion of Advanced technology (Hydrogen, CCS)

The information of needs for the utilization of hydrogen technology that Fukuoka Prefecture has been working on for many years was collected and examined regarding advanced

technologies possessed by companies in the prefecture, and technologies that will contribute to the future decarbonization of Hanoi City.

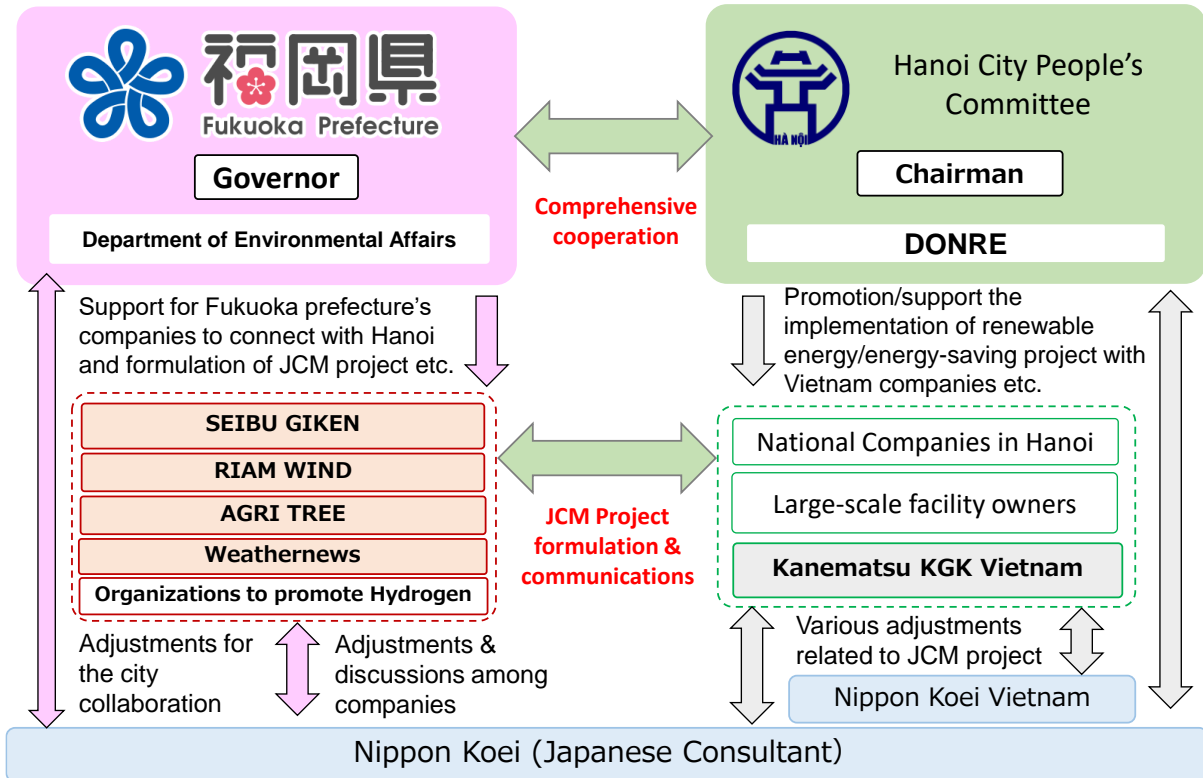
- (1) Collect information on highly innovative decarbonization technologies (hydrogen, CCS, etc.) and share it with Hanoi City
- (2) Identify the needs for innovative decarbonization technologies (hydrogen, CCS, etc.) in Vietnam

1.4.5 Implementation Structure

Study for formulation of JCM model project was implemented by cooperating mainly with Seibu Giken Co., Ltd that has their own energy saving technologies like high-efficiency total heat exchangers for commercial building or factories, RIAMWIND Co., Ltd. that has small wind turbine systems using “Wind-Lens Technologies” which can generate electric power even from breeze, Agritree Co., Ltd. that has many experiences of introducing solar sharing (SS) in Japan, and Kanematsu KGK Vietnam Co., Ltd. that their mother company has experienced a representative participants of JCM model project.

These companies considered to introduce their technology for JCM model project and proposed it to Hanoi City and local companies during this study. In addition, Weathernews Inc., the world's largest private weather company, participated in this project and provided technical information regarding Climate Change Mitigation/Adaptation using meteorological observation and weather prediction technology.

Nippon Koei Co. Ltd. (hereafter “Nippon Koei”) has supported these City-to-City Collaboration activities and carried out studies for introducing zero carbon technology and advanced environmental technologies. And Nippon Koei Vietnam (NKV, local subsidiary of Nippon Koei) collected the latest local information and discovered candidate companies for the target facilities of the project. The implementation structure of this project is shown in Figure 1-3.

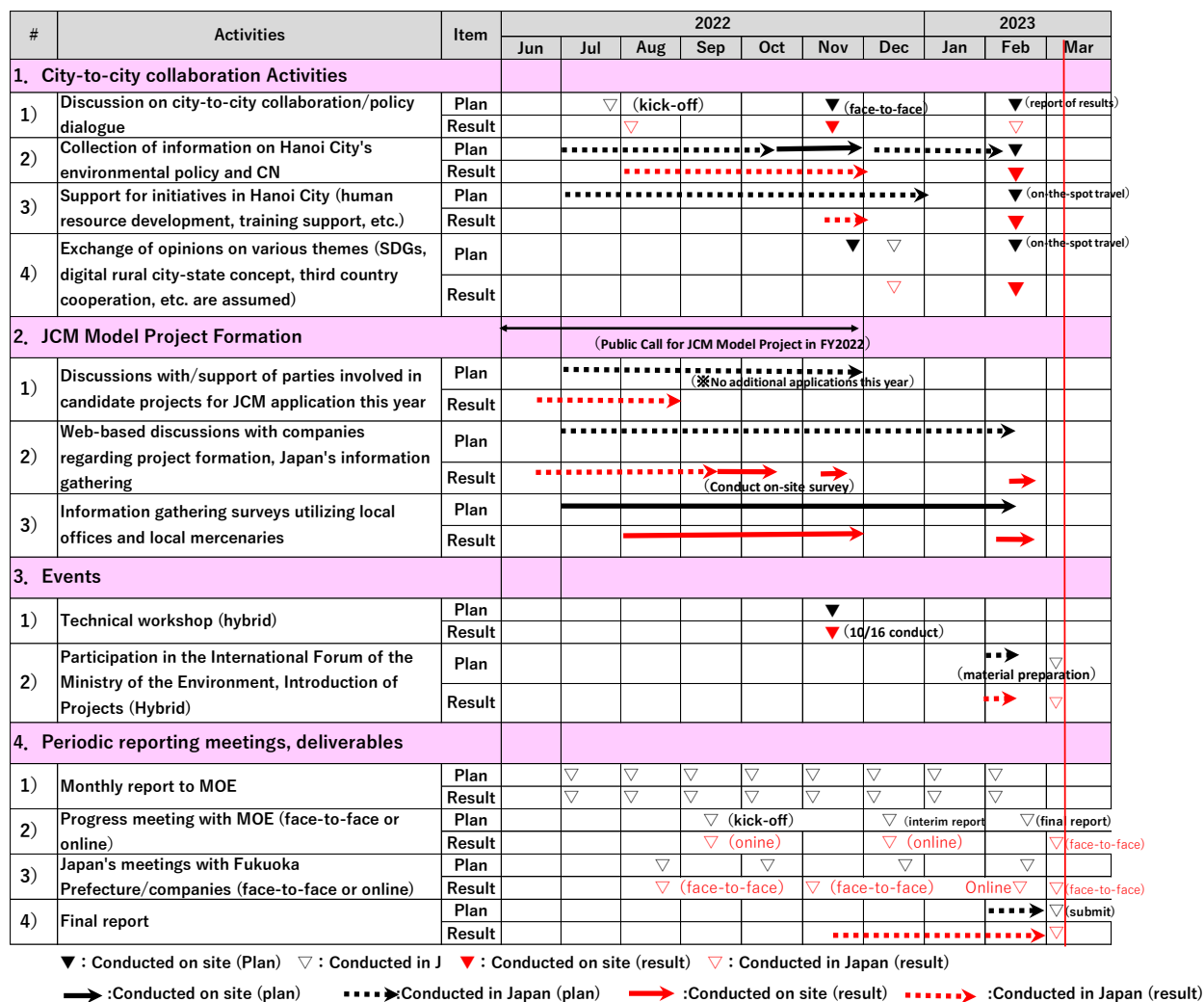


Source: Prepared by Nippon Koei

Figure 1-3 Implementation Structure

1.5 Project Schedule

The project period is from 17 June 2022 to 10 March 2023. The schedule is shown in Figure 1-4.



Source: Prepared by Nippon Koei

Figure 1-4 Project Schedule

CHAPTER 2 ACTIONS TO CLIMATE CHANGE BY FUKUOKA PREFECTURE AND HANOI CITY

2.1 Actions on Climate Change Countermeasures by Fukuoka Prefecture

2.1.1 Action Plan of Global Warming Countermeasures in Fukuoka Prefecture

Fukuoka Prefecture has established “Action Plan of Global Warming Countermeasures in Fukuoka Prefecture” to promote countermeasures to global warming, and support citizens, companies, and administrators to take their actions proactively. The action plan issued in March 2017. The plan includes “GHG emission reduction” and “measures for carbon sinks” for the promotion of energy saving and renewable energy, furthermore, “adaptation” to mitigate or avoid the impact of climate change. (Quoted from Fukuoka Prefecture homepage).

2.1.2 Main actions on Global Warming Countermeasures

Fukuoka Prefecture mainly implements or supports the following actions as global warming countermeasures (Table 2-1).

Table 2-1 Main countermeasures for Global Warming in Fukuoka Prefecture

#	Items	Activities
1	Actions for the citizen	1) Implementation of support project for eco-family 2) Enlightenment activities by Fukuoka Prefecture Global Warming Prevention Activity Promotion Center 3) Enlightenment activities by Staff of Fukuoka Prefecture Global Warming Prevention Activity Promotion 4) Distribution of Fukuoka Eco Life Support Book 5) Distribution of sub-material for Fukuoka environmental education
2	Actions for private entities	1) Implementation of eco-business support project 2) Implementation of Fukuoka Prefecture energy saving human resources development project 3) Implementation of Fukuoka Prefecture energy saving consultation project 4) Promotion of the spread of Eco Action 21 5) Establishment of Fukuoka Prefecture energy saving promotion council 6) Implementation of Fukuoka Prefecture information dissemination project
3	Actions related to automobile	1) Promotion of Eco-car (EV and its charging station, FCV and its hydrogen station) 2) Promotion of eco-driving 3) Promotion of green management certification system 4) Promotion of installing eco drive management system (EMS)
4	Public relations/ public hearing	1) Operation of Fukuoka Eco Life Support Portal Site 2) Operation of Ecoton's eco-diary (public relations blog) 3) Dispatch of a staff of Fukuoka Prefecture for on-site lessons

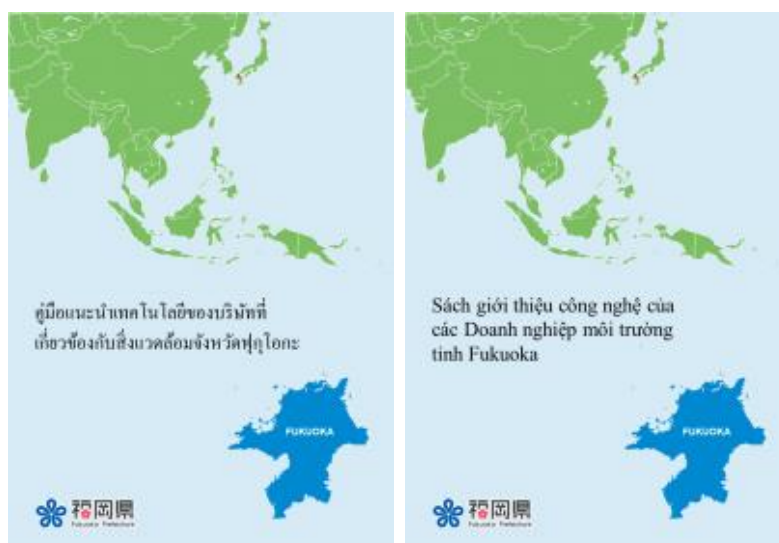
Source: Fukuoka Prefecture official website (<https://www.pref.fukuoka.lg.jp/contents/ondanka.html>)

2.1.3 Guidebook on technologies of Environment-related corporations in Fukuoka Prefecture

Fukuoka Prefecture has accumulated achievements and know-how on overcoming environmental problems over many years and is now taking advantage of this strength to promote exchanges in the environmental fields with Asian region. Due to the high level of interest from various regions in the environmental technologies cultivated in its prefecture through exchanges in the past, this “Guidebook on Technologies of Environment-Related Corporations in Fukuoka Prefecture (2020 edition)” has been published as a public relation material for investigating and organizing the environmental technologies of companies in Fukuoka Prefecture, introducing them in Japan and overseas to further promote exchanges on environmental technologies and industries based on the network of the prefecture and partner-local governments. The guidebook in Japanese has been translated into English, Chinese, Thai, and Vietnamese (Figure 2-1).

This guidebook not only presents the latest technologies for solving environmental problems in the areas of waste, water, and atmospheric environments, but has also been enhanced with technologies on energy saving and renewable energy based on the global trend of decarbonization (Table 2-2). This year, this guidebook was used and distributed to the Hanoi municipal government and local companies during technical workshop and field survey to introduce the technologies of Fukuoka Prefecture companies in concrete terms.





Source: Fukuoka Prefecture homepage (<https://www.pref.fukuoka.lg.jp/contents/env-tech-guide.html>)

Figure 2-1 Cover of Guidebook on technologies of Environment-related corporations in Fukuoka Prefecture (each language)

Table 2-2 Summary of Number of companies on Guidebook on technologies of Environment-related corporations in Fukuoka Prefecture (2020 edition)

Sector	Num. of companies	Companies related to the project
Waste	24	—
Water	17	—
Air	4	Seibu Giken Co., Ltd
Energy	12	Agritree Co., Ltd., RIAMWIND Co., Ltd.
Others	8	—
Total	65	—

Source: Prepared by Nippon Koei base on “Guidebook on Technologies of Environment-Related Corporations in Fukuoka Prefecture (FY2020)”

2.2 Actions in Vietnam and Hanoi City

2.2.1 National Policies of Viet Nam

(1) Carbon Neutrality by 2050

Vietnam Prime Minister Pham Minh Chinh has announced the country’s aim to achieve carbon neutrality by 2050 at UN Climate Change Conference (COP26) held in November 2021. Compared to the NDC target of reducing GHG emissions by 9% unconditionally and 27% with international cooperation by 2030, it is an ambitious target.

The 8th National Power Development Plan draft submitted by the Ministry of Trade and Industry (MOIT) in October 2021 states that Vietnam will reduce the proportion of coal-fired thermal power and increase the power generation capacity of renewable energy. It is currently being reviewed, and a specific roadmap for carbon neutrality in Viet Nam will be also formulated in parallel.

(2) Green Building regulation in Viet Nam

Green building regulations in Vietnam aim to promote sustainable building practices and reduce the environmental impact of buildings. In Hanoi and Ho Chi Minh City, specific regulations are in place to support green building practices.

In Hanoi, the city has adopted the Vietnam Green Building Council's (VGBC) green building rating system and requires that all new buildings of a certain size meet certain green building criteria. Additionally, the city has implemented a policy requiring all new public buildings to be certified green.

Ho Chi Minh City has also adopted the VGBC green building rating system and implemented similar regulations for new public buildings. Additionally, the city has established a green building fund to provide financial support for green building projects.

As of April 2020, Vietnam has nearly 150 works that have been recognized as Green Building¹ according to different technical standards: LEED (USA), EDGE (IFC), LOTUS (VGBC), and Green Mark (Singapore).

Up to now, there are quite a few strategies, orientations, and action plans of the State on sustainable development, environment, and energy. Directly related to green buildings, the following legal documents are relevant:

- Decision No. 1658/QD-TTg dated October 01, 2021, Approval for National green growth strategy for the 2021 - 2030 period, with a vision by 2050;
- Resolution No. 136/NQ-CP dated September 25, 2020, Resolution on Sustainable Development;
- Decision No. 280/QD-TTg dated March 13, 2019, Approval for National program for thrifty and efficient use of energy for the period of 2019 – 2030;
- Law No. 62/2020/QH14 dated June 17, 2020, Law on Amendments to Construction law.

Green building assessment and certification on the territory of Vietnam is being supported by international organizations in Vietnam, but it has not been managed by the State. The assessment and certification of the green building is an existing demand in the market. Therefore, the establishment of criteria, standards, and methods of assessment and certification of the above works need to be regulated by competent state agencies as a legal basis for evaluation activities and certified green building in Vietnam. The above contents have been shown (amended and supplemented) in the requirements of Law No.: 62/2020/QH14 dated June 17, 2020, the Law on Amendments to the Construction Law, in details specified in additional Clause 4 of Article 10, and amending Clause 2 of Article 162.

¹ Hanoi City People's Committee – Hanoi Urban Planning Institute
<http://vqh.hanoi.gov.vn/index.php?language=vi&nv=news&op=tin-lien-ket/phat-trien-cong-trinh-xanh-trong-dinh-huong-phat-trien-kien-truc-1492.html>

Overall, the green building regulations in both Hanoi and Ho Chi Minh City aim to promote sustainable building practices and reduce the environmental impact of buildings. These regulations include the use of energy-efficient technologies, materials, and systems.

(3) Legal system and current countermeasures for Waste Management in Viet Nam

According to The International Union for Conservation of Nature (IUCN) report of the Monitoring and assessment program on plastic litter in Viet Nam shoreline in 2020, based on the statistics of the Ministry of Natural Resources and Environment (MONRE), Hanoi and Ho Chi Minh City alone already release a daily amount of 80 tons of plastics and plastic bags into the environment. Notably, the amount of plastic waste and plastic bags nationwide accounts for about 8-12% of domestic solid waste. On average, one person uses and discards 1 plastic bag/day, and more than 31.4 billion plastic bags are discarded each year, of which only 17% are reused .

Ho Chi Minh City generates about 9,500 tons of domestic waste daily. The huge amount of the above-mentioned solid waste is mainly treated by landfill, accounting for 69%. While incineration, composting, and recycling accounted for only 31%, of which plastic recycling accounted for only 1% .

Ho Chi Minh City has implemented a number of initiatives to promote plastic bottle collection and recycling. According to the Ho Chi Minh environmental status report in 2021, some achievements in the management, collection and treatment of plastic waste in Ho Chi Minh City, such:

Aquaculture: plastic waste collection rate is 70% - 90%, the plastic waste classification rate is 40% - 50%, and the plastic waste reuse rate is >70%.

Fishing: plastic waste collection rate from 30% - 50%, plastic waste recycling rate 30%.

Scrap is sold to individuals/organizations who buy or give it to collectors.

The classification of industrial solid waste at source is now done at the manufacturing factory/plant. Some components can be reused and recovered materials right at the factory, such as plastic, paper, metal, etc. Others are collected, stored, and transported to recycling and treatment plants.

After making full use of recyclable and reusable components, normal industrial solid waste with the remaining inert substance will be treated by contracted units with the collection and treatment function.

By the end of 2021, 100% of supermarkets, commercial centers, etc., have used environmentally friendly packaging to replace non-biodegradable plastic bags; small traders in residential markets reduced their use by 50%.

Targeting 2030, by using non-degradable plastic bags in packaging and storing products for customers., the city minimizes the use of single-use plastic products.

Regulations and activities at the central level

At the central level, the government has set up regulations and policies to reduce plastic waste, including restricting single-use plastics.

- Law No. 72/2020/QH14 dated November 17, 2020, Law on Environmental Protection: Article 73. Reduction, reuse, recycling, and treatment of plastic waste, preventing and controlling ocean plastic waste pollution.
- Decree No. 08/2022/ND-CP dated January 10, 2022. Article 64. Roadmap for restricting production and import of single-use plastic products, non-biodegradable plastic packaging, and products and goods containing microplastics

Regulations and activities at the municipality level

At the municipality level, Ho Chi Minh City has taken steps to increase public awareness of plastic waste management through education and outreach programs and the development of recycling facilities and collection systems.

- Action plan for Ocean Plastic Waste Management of the fishing industry for the period of 2020 - 2030 in Ho Chi Minh City (Attached to Decision No. 4306/QD-UBND dated December 24, 2021, of the City People's Committee)
- Plan for increase Plastic Waste Management, reduction, reuse, recycling, and treatment in Ho Chi Minh City, period of 2022 - 2025, vision 2030 (Attached to Decision No. 1667/QD-UBND dated May 19, 2022, of the City People's Committee)

Regulations and activities at the community level

At the community level, various initiatives, such as community-based recycling programs and public-private partnerships, are underway to encourage residents to participate in plastic bottle collection and recycling. Some communities also offer incentives, such as discounts on utility bills, for those who regularly recycle. Several documents has been prepared related to propaganda and classification of domestic solid waste, such as a guidelines for sorting, collecting, transporting and handling solid waste management, leaflets and posters on classification of daily-life solid waste.

It is worth noting that despite these efforts, plastic waste management continues to be a challenge in Ho Chi Minh City, and there is a need for further action to collect and recycle plastic bottles effectively.

(4) MOT Action Plan for Climate Change (2021-2025)

The Ministry of Transport (MOT) formulated the Action Plan for active response to climate change, enhancement of natural resources management and environmental protection pursuant to Resolution No. 452/QD-BGTVT approved on 24 March 2021. The Action Plan is a 5-year plan from 2021 to 2025 and to specify implementation of the guidelines, policies and instructions by the Government on the natural resources, environment work in the transport sector for development of transport in a sustainable and environmentally friendly manner.

The Action Plan shows the following solutions to the challenges of the transportation sector.

- i. Improvement of awareness of organizations and individuals in response to climate change
- ii. Improvement of resilience to climate change for the transport infrastructure
- iii. Improvement of management capability of GHG emission
- iv. Strengthening economical and efficient energy use
- v. Efficient management and utilization of natural resources
- vi. Reinforcement of environmental protection in development and maintenance of transportation infrastructure
- vii. Controlling emission of the exhaust gas by transportation
- viii. Promotion of green transportation in the private sector

Regarding item iv, the Action Plan describes in detail the strategy for decarbonization. For example, it plans to improve the capacity and service quality of public passenger transport in the cities; to accelerate investment into highway transport such as Mass Rapid Transit (MRT) and Bus Rapid Transit (BRT) in Hanoi and Ho Chi Minh City; to prioritize investment and operation of energy-saving and environmental-friendly buses and taxis, such as hybrid vehicles, vehicles using Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LPG); electric vehicles, etc. and e) to strengthen application of renewable energy, energy-saving technologies such as solar battery and LED light for lighting and traffic signals in the transport infrastructure investment projects and maintenance works.

(5) Power Development Plan 8

The Power development Plan 8 (PDP8) is being formulated under the initiative of MPI, but according to the information as of February 2023, PDP8 is still revising in the Ministry to present best option based on the important issues "power supply", "power load", "transmission and distribution", "highly efficient use of power" and "electricity rates". After government approval, it plans to review the contents of the plan and consider the consistency and cooperation with the City-to-City collaboration activities.

(6) Nationally Determined Contribution (NDC)

Vietnamese Government originally submitted Nationally Determined Contribution (NDC) in November 2016 and then revised it in September 2020 and November 2022. To achieve the long-term targets of Vietnam's National Climate Change Strategy to 2050, the latest version of the NDC (2022) significantly increases the GHG reduction targets from the previous update (2020). Compared to the previous NDC (2020), the GHG reduction targets in the latest NDC (2022) have been updated to 15.8% unconditional and to 43.5% conditional by 2030 compared with Business-as-Usual (BaU) scenario. The target GHG reduction reductions by 2030 for each sector are shown in Table 2-3.

Table 2-3 Reduction targets by sector in revised NDC (2022)

Sector	Contribution with domestic resources		Contribution with international support		Total contribution with both domestic resources and international support	
	Compared to BAU scenario (%)	Reduction amount (Mil. tonnes of CO _{2eq})	Compared to BAU scenario (%)	Reduction amount (Mil. tonnes of CO _{2eq})	Compared to BAU scenario (%)	Reduction amount (Mil. tonnes of CO _{2eq})
Energy	5.5	51.5	11.2	104.3	16.7	155.8
Agriculture	0.7	6.8	2.8	25.8	3.5	32.6
LULUCF*	1.0	9.3	1.3	11.9	2.3	21.2
Waste	1.0	9.1	2.6	24.0	3.6	33.1
IP	0.8	7.2	0.1	0.8	0.9	8.0
Total	9.0	83.9	18.0	166.8	27.0	250.8

Note (): increase in GHGs sequestration*

Source: Updated Nationally Determined Contribution (NDC), The Socialist public of Vietnam

Based on the targets of NDC, Vietnamese Government has been implementing various policies. Under the national policies, each municipality is carrying out individual policies. Main national policies are shown in Table 2-4.

Table 2-4 National Policies for Climate Change and Energy use in Viet Nam

Name of regulation (Date of enforcement)	Objectives
<p>National Climate Change Strategy to 2050 (Decision 896/QD-TTg of the Prime Minister) 07 March, 2022</p>	<p><u>Specific objectives</u></p> <ul style="list-style-type: none"> - Adaptation to climate change: To reduce vulnerability and risks to the impacts of climate change through improved resilience and the adaptability of natural, economic and social systems, minimizing losses harm caused by natural disasters and climate extremes increased due to climate change Reduce greenhouse gas emissions: To meet emissions targets net zero by 2050, actively contributing responsibly to the national community protecting the Earth's climate system; improve the quality of growth and competitiveness picture of the economy
<p>National Target Program to Respond to Climate Change period 2012-2015 (Decision 1183/QD-TTg of the Prime Minister) 30 August, 2012</p>	<p><u>Specific objectives</u></p> <ul style="list-style-type: none"> - To gradually realize the National Strategy on climate change, - To increase awareness and capacity to adapt to climate change - To orient to reduce greenhouse gas emissions - To develop low-carbon economy, - To actively cooperate with international communities to protect the global climate system
<p>Action Plan for Implementation of Paris Agreement on Climate Change (Decision 2053/QD-</p>	<p><u>Overall objectives</u> To Identify and implement appropriate activities and solutions until 2020 and 2030 to gradually carry out all the provisions in the Paris Agreement applicable to Viet Nam.</p> <p><u>Specific objectives</u></p> <ul style="list-style-type: none"> - To fulfil commitments in the Intended Nationally Determined

Name of regulation (Date of enforcement)	Objectives
<p>TTg of the Prime Minister)</p> <p>28 October, 2016</p>	<p>Contribution (INDC) to mitigate GHG emissions</p> <ul style="list-style-type: none"> - To fulfil commitments in the Intended Nationally Determined Contribution to adapt to climate change - To prepare human, technical and financial resources to fulfil commitments in the Intended Nationally Determined Contribution and contribute to the transition to a low-carbon, highly resilient economy - To establish and operate the transparency system (MRV system) to monitor and assess the implementation of adaptation, mitigation, and resource preparation - To revise institutions and policies to establish a favourable environment and focus national efforts to respond to climate change;
<p>National Strategies on Green Growth 2011-2020 with a vision by 2050 (Decision 1393/QD-TTg of the Prime Minister)</p> <p>25 September, 2012</p>	<p><u>Overall objectives</u> Green growth, towards the low-carbon economy, natural capital enrichment has become a decisive tendency in sustainable economic development; reduction in emissions and increase in the possibility to absorb greenhouse gases is becoming mandatory and important targets in socio-economic development.</p>
<p>National Program on Economical and Efficient Use of Energy for the period 2019 – 2030 (Decision 280/QD-TTg of the Prime Minister)</p> <p>13 March, 2019</p>	<p><u>Overall objectives</u> "National program on economical and efficient use of energy in the period of 2019 - 2030" is the implementation step to concretize the energy development strategy, an important element in the National Sustainable Development Strategy, with the aim to turn Viet Nam into a country using energy saving and efficiency.</p> <p><u>Specific objectives</u></p> <ul style="list-style-type: none"> - To mobilize all the national and international resources for stimulating economical and efficient use of energy through the synchronous implementation of assignments and solutions of State management, technical assistance, science and technology research and product development, market transition, human resource training and development, and also utilization of support from the international community in the field of economical and efficient use of energy. - To formulate the habit of using energy economically and effectively in all social activities; to reduce intensive use of energy in a variety of economic sectors and industries; energy efficiency becomes a regular activity in key energy users and key economic sectors that consume a lot of energy, with an aim at green growth and sustainable development.

Source: Prepared by Nippon Koei based on each policy.

2.2.2 Policies in Hanoi City

(1) Green Growth Strategy (GGS)

In July 2020, Hanoi City People's Committee ("PC") issued Action No. 149/KH-UBND on "Green growth action of Hanoi City to 2025, orientation to 2030". The overall object of this strategy is to develop the economy rapidly and sustainably, improve the efficiency of the use of resources, and reduce GHG emissions. Specifically, the targets include reducing GHG emission, green production, greening lifestyles, and sustainable consumption. To achieve these targets, necessary projects and task are listed below.

Reducing GHG emissions:

- 1) By 2025, GHG emission will be reduced by 12.14% compared to emission of 2025 without measures to reduce GHG emissions (approx. 6.68 million tons of CO₂)
- 2) By 2030, GHG emissions will be reduced by 18.71% compared to the 2030 level in the absence of measures to reduce GHG emissions (approx. 13.76 million tons of CO₂)

Green production: The rate of increase of products labeled green and eco is 15%/year. Newly built buildings meet the standards of the National Technical Regulation on "Buildings using energy efficiently" - QCVN 09:2017/BXD (offices, hotels, hospitals, schools, commercial and service zones, apartment buildings, industrial parks, export processing zones, industrial clusters) by 2025 is 100%.

Green lifestyle: Increase the average green tree area per capita, reaching 7.8m² to 8.1m² by 2025 and 13m² to 15m² by 2030. The rate of public procurement for green/ ecological products reaches 100%, the rate of public passenger transport will reach 30-35 % by 2025 and 40-45% by 2030, the rate of domestic wastewater treatment in urban areas will reach 45-50% by 2025 and 60% by 2030.

Sustainable consumption: level of reduction in consumption of non-biodegradable packaging in supermarkets, trade centers and by 2025 from 70 to 75%; 85% by 2030 and 65 to 70% in markets by 2025, 80% by 2030. Public procurement rate of green and ecological products, for goods on the market with labeled products Green/ Eco is 100%.

In addition, in July 2021, Hanoi City issued Plan No. 172/KH-UBND on measuring emissions of motorcycles and motorbikes in the city, because the exhaust gas from motorcycles and motorbikes are one of the major sources of GHG emissions. From September 2021 to June 2022, the emission tests of major motorcycles such as Honda and Yamaha will be implemented to analyze the impact for social economy when the city regulates exhaust gas. Based on the result of analysis, the city will propose solutions to improve air quality, including a subsidy for a replacement purchase from old motorbikes.

(2) Climate Change Action Plan (CCAP)

DONRE in Hanoi City are currently drafting “Action Plan to respond to Climate Change for the period 2021-2030 for Hanoi City”.

So, Hanoi City still follows “Plan for Implementation of the Paris Agreement on Climate Change in Hanoi City” issued in November 2017. The plan describes concrete issues on mitigation and adaptation to climate change, and divided approaches to solve them into two phases: 2018-2020 and 2021-2030.

- 1) To carry out the task of mitigating greenhouse gas emissions, Hanoi City will develop and implement proposals to reduce greenhouse gas emissions and green growth in accordance with national conditions for the country for the sectors of industry, transportation, construction, agriculture, and rural development.
- 2) For the task of climate change adaptation, Hanoi City will update its contribution on climate change adaptation; develop a national adaptation plan under the guidance of the Ministry of Natural Resources and Environment, Viet Nam (MONRE); review existing information and data on climate change adaptation, loss and damage; Proposing information, additional research and methods of data management and sharing to facilitate the development and updating of national contribution reports on climate change adaptation

(3) SDGs

In December 2017, Hanoi City PC issued Plan No. 242/KH-UBND on Action Plan of Hanoi City to implement the 2030 Agenda for Sustainable Development. The action plan, which takes SDGs into consideration, sets goals for sustainable development by 2030, and these attachment documents show concrete action plan for achieving the goals and the responsible agencies for implementing actions (Table 2-5).

Table 2-5 Goals for Sustainable Development in Hanoi City

#	Goals
1	End all forms of poverty in the area.
2	Ensure food security, improve nutrition and promote sustainable agricultural development.
3	Ensure healthy lives and promote well-being for people of all ages.
4	Ensure quality, equitable, and inclusive education and promote lifelong learning opportunities for all.
5	Achieve gender equality; empowering and creating opportunities for women and girls.
6	Ensure adequate and sustainable management of water resources and sanitation for all.
7	Ensure access to affordable, reliable and sustainable energy for all.
8	Ensuring sustainable, comprehensive and continuous economic growth; full employment, productivity and decent work for all.
9	Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
10	Reduce inequality in society.
11	Sustainable and resilient urban and rural development; ensure a safe living and working environment; reasonable distribution of population and labor by region.
12	Ensure sustainable production and consumption.
13	Timely and effective response to climate change and natural disasters.
14	Protect and develop forests sustainably, conserve biodiversity, develop ecosystem services, combat desertification, prevent degradation and restore land resources.
15	Promoting a peaceful, democratic, fair, equal and civilized society for sustainable development, creating access to justice for all; building effective, accountable and participatory institutions at all levels.
16	Strengthening implementation and promoting a global partnership for sustainable development.

Source: Created Nippon Koei based on Plan No. 242/KH-UBND on Action Plan of Hanoi City to implement the 2030 Agenda for Sustainable Development.

CHAPTER 3 THE CITY-TO-CITY COLLABORATION FOR ZERO-CARBON SOCIETY

3.1 Background and Objective

3.1.1 Background of the City-to-City Collaboration

Fukuoka Prefecture mentions the promotion of international environmental cooperation in Asian regions widely in "Fukuoka Prefecture Comprehensive Plan" and "Fukuoka Prefecture Environmental Comprehensive Vision." Fukuoka Prefecture has made a lot of good relationship with several overseas cities inclusive of Hanoi City and implemented activities by cooperating with them for the environment. Especially in Hanoi City, Fukuoka Prefecture has supported on waste management and countermeasure to air pollution etc. by organizing workshops or providing technical support. Because of these previous collaborations, the both cities have started the City-to-City Collaboration financed by Ministry of the Environment, Japan (MOEJ) on "climate change and decarbonization" as new cooperation fields, therefore, the City-to-City Collaboration Project started from FY2021.

The previous achievements of the collaboration between the cities are shown in Table 3-1.

Table 3-1 Major achievements of support from Fukuoka Prefecture

#	Fiscal year	Outline
1	FY2006 - Ongoing	International Environment HR development Training Invited Hanoi trainees to Fukuoka, 31 participants in total
2	FY2011 - FY2020	Support on introduction of Fukuoka method landfill Field study, Design, construction, O&M
3	FY2010 - FY2012	Environmental Education Environmental Seminar, Training for invited stakeholders
4	FY2014 - FY2016	Water environment improvement Pilot project stage was completed.
5	FY2020 – on-going	Start discussion for improvement of environment and decarbonization in Hanoi City





Source: Prepared by Nippon Koei based on information of Fukuoka Prefecture

As the table above shows, based on good relationship between the cities in the past, both cities agreed with starting the City-to-City Collaboration for realizing zero-carbon society, after several online discussion between DONRE and Fukuoka Prefecture officers.

3.2 Approach of the City-to-City Collaboration

The Project implemented several activities focusing on 4 goals out of 17 SDGs between Hanoi City and Fukuoka Prefecture. In the future, new environmental issues or fields that should involve collaboration between the cities will be added as the main activities of the Project in/ after FY2022 if necessary (Table 3-2).

Table 3-2 Image of approach of the City-to-City Collaboration (Achievements in FY2021 and plan in FY2022)

SDGs	Field of collaboration	Activity achievement of last year (1st year)	Activity plan for this year (2nd year)
	Introduction of “energy-saving” & “renewable energy” technologies	<ul style="list-style-type: none"> introduced solar sharing technology at a workshop and assisted in identifying local data and partner companies for commercialization (ongoing) 	<ul style="list-style-type: none"> establish a cooperative relationship with the Department of Agriculture (DARD) and farmers through the Department of Natural Resources and Environment (DONRE) provide opportunities to introduce technical information (through local workshops, etc.)
	Proposal of multiple technologies as “decarbonization” & “air pollution” countermeasures	<ul style="list-style-type: none"> introduced case studies of technologies for combating open burning and factory-derived exhaust gases (VOCs) at the request of Hanoi City (ongoing) 	<ul style="list-style-type: none"> provide opportunities to share information on Japanese decarbonization technologies and initiatives regarding the use of biomass such as rice straw and rice husks, which are the target of field burning (through local workshops, etc.)
	Information sharing and human resource (HR) development by technical training on hydrogen	<ul style="list-style-type: none"> introduced hydrogen technologies (fuel cells, etc.) to Hanoi City at a local workshop with the cooperation of researchers from Kyushu University (ongoing) 	<ul style="list-style-type: none"> provide opportunities to share information to promote understanding of hydrogen technology in Hanoi City (local workshops, etc.) consider the need to identify Japanese companies with hydrogen technology
	Information sharing and continuous support in the waste management sector	<ul style="list-style-type: none"> introduced technologies and provided information materials for waste sorting/collection and waste PV panel treatment requested by Hanoi City (ongoing) 	<ul style="list-style-type: none"> support training/human resource development planned by Hanoi City by providing lecturers, technical materials, etc. identify needs for sharing information on the Fukuoka method repository, which has proven results, and for the utilization of waste-derived biogas, etc.

Source: Prepared by Nippon Koei

3.3 Achievements of the City-to-City Collaboration

3.3.1 Overview of each activity

In FY2022, the meetings of the City-to-City Collaboration activities with MOE were conducted three times during the project period as shown in Table 3-3.

Table 3-3 Activities of the City-to-City Collaboration in FY2021

Content	Date	Description
MOE kick-off meeting (online)	13 Sep 2022	<ul style="list-style-type: none"> reported the plans and progress of this year's activities, as well as plans for field survey exchanged opinions on potential third-country

Content	Date	Description
		collaboration and the collaboration methods
MOE progress report meeting (online)	16 Dec 2022	<ul style="list-style-type: none"> • reported the results of the field work and the workshop • proposed candidate cities for third-country collaboration
MOE final report meeting (hybrid)	2 Mar 2023	<ul style="list-style-type: none"> • reported the results of this year's activities and proposed activity plan for the next fiscal year • reported the results of study on City-to-City Collaboration Project in third country

Source: Prepared by Nippon Koei

3.3.2 Activities related to Institutional support

Activities in the field of institutional development support for this fiscal year were carried out based on the following policies.

- 1) To develop plans and human resources for climate change countermeasures in Hanoi City, Fukuoka Prefecture's efforts (action plans for global warming countermeasures, efforts for prefectural residents, etc.) were shared, and implementation policies were discussed.
- 2) Supported Hanoi City's efforts to study the introduction of decarbonization technologies (including hydrogen and CCS) to improve the environment, to improve the current system and structure, and to achieve the SDGs.

In this fiscal year, the relaxation of travel restrictions due to the spread of the COVID-19 infection enabled face-to-face city-to-city consultations between Fukuoka Prefecture and Hanoi City to be held in November 2022. During the discussions, the two cities exchanged opinions on specific urban issues and how to proceed with future city-to-city collaboration. The main contents of the discussions are as follows (Table 3-4).

Table 3-4 Discussion under the City-to-City Collaboration Project in FY2022

Content	Date	Description
Joint kick-off meeting between Fukuoka Prefecture and participating companies (online)	13 Jul. 2022	<p>The meeting included a meeting of all Japanese participants and confirmation of activities and schedule for this year.</p> <p>The participants introduced the technologies of their respective companies and established a framework for cooperation between Fukuoka Prefecture and the partner companies.</p> <p>Information on JCM and available funding schemes was shared.</p> <p>It was requested that each company will introduce their technologies at the on-site workshop scheduled to be held by the end of this year, and obtained their approval.</p>
Kick-off meeting between Fukuoka Prefecture and Hanoi City (online)	2 Aug. 2022	<p>The participants shared the activity plan for the current fiscal year and confirmed the collaboration method and schedule.</p> <p>The participants exchanged opinions on issues such as</p>

Content	Date	Description
		waste management, which had been discussed since the previous fiscal year. DONRE provided information on related JICA, World Bank, and other support schemes. It was requested DONRE to share the contents and proposals of this activity to other departments (DOIT, etc.) and to confirm their opinions.
Meeting between Fukuoka Prefecture and JICA Vietnam Office (a waste expert) to gather information on waste management in Hanoi City (online)	22 Sep. 2022	The current status of waste management in Vietnam was reviewed. The contents of JICA's support for waste management and the results of activities in the field of city-to-city collaboration from the previous year were shared. Information was exchanged on issues/needs in Hanoi City.
Face-to-face meeting between Fukuoka Prefecture and Hanoi City DONRE	17 Nov. 2022	The participants reviewed the workshop and confirmed the division of roles for the next year. Hanoi City requested to share knowledge on waste separation and to support the preparation of a master plan for waste management.
Wrap-up meeting between Fukuoka Prefecture and Hanoi City (hybrid)	21 Feb. 2023	The participants discussed the proposed activities and schedule for the next (third) year, and exchanged opinions on specific support details and collaboration methods, particularly with regard to on-site workshop and waste management.

Source: Prepared by Nippon Koei



Online meeting



Face-to-face meeting

Source: Photos taken by Nippon Koei

Figure 3-1 Photos of discussion under the City-to-City Collaboration

3.3.3 Field Survey

Field surveys (three times) were conducted during this year's City-to-City Collaboration Project. A summary is provided below (Table 3-5).

Table 3-5 Summary of each field work

Content	Date	Description
1 st field work	27 Sep – 1 Oct 2022	<ul style="list-style-type: none"> gathered information on regulations and Hanoi City's plans for energy conservation in face-to-face discussions with Hanoi DONRE and the Department

Content	Date	Description
		of Industry and Trade (DOIT) respectively • prepared for the local workshop
2 nd field work	14 Nov – 19 Nov 2022	• traveled with Fukuoka Prefecture officers • collected information and exchanged opinions with the participants by holding a workshop • gained information on environmental issues (garbage separation, etc.) from DONRE, Hanoi, and necessary support was confirmed • inspected a waste-to-energy facility in Hanoi City
3 rd field work	19 Feb – 21 Feb 2023	• confirmed details of business matching methods and joint-holding of local workshops through City-to-city Collaboration projects in the next fiscal year in face-to-face discussions with Hanoi DONRE and the headquarters of the Vietnam Chamber of Commerce and Industry (VCCI) in Hanoi

Source: Prepared by Nippon Koei

3.3.4 Technical Workshop in Hanoi City (Hybrid)

The technical workshop was held by DONRE of Hanoi City and the Environmental Policies Division of Fukuoka Prefecture on 16th November 2022. The workshop was held at a hotel in Hanoi and in a hybrid format using Zoom, with about 85 participants from Hanoi City government officials, Fukuoka Prefecture, private companies, etc.

In the workshop, Fukuoka Prefecture and Nippon Koei introduced the progress of the project and an overview of the JCM subsidy scheme, DONRE of Hanoi City introduced plans and measures related to climate change mitigation and adaptation measures in Hanoi City, DOIT of Hanoi City explained the implementation status of energy conservation measures in the industrial sector in Hanoi and points to note when introducing overseas technology due to revision of related laws and regulations. In addition, VINA HYDROGEN Co., Ltd. reported the results of collecting information on renewable energy and hydrogen energy, Seibu Giken Co., Ltd. introduced their heat exchange technology and exhaust treatment technology in factories, Agritree Co., Ltd. introduced solar sharing system in agricultural land, RIAMWIND Co., Ltd. introduced small wind power generation technology, Kanematsu KGK Vietnam Co., Ltd. gave a presentation about a JCM model project introducing renewable energy, WEATHERNEWS INC. made a presentation on disaster prediction using high-precision weather forecast technology as one of the climate change adaptation measures.

DONRE stated that they hope to produce results in the city's environmental improvement and climate change countermeasures by utilizing the JCM. In the closing remarks by Fukuoka Prefecture, they said that they would like to work together with companies with advanced environmental technologies to make this project a success.

The contents of the agenda are as follows. See Attachment for presentation materials.

Table 3-5 Agenda of the Technical Workshop

#	Agenda	Speaker
	Opening remarks and guest introduction	Hanoi DONRE
1.	Progress of City-to-City Collaboration and outline of JCM scheme	Environmental Policies Division of Fukuoka Prefecture, Nippon Koei
2.	Plan for Climate change Mitigation and Adaptation in Hanoi	Hanoi DONRE
3.	Demands of energy saving technologies at factories and buildings in Hanoi	Hanoi DOIT
4.	Report of data collection survey related to renewable energy/hydrogen	VINA HYDROGEN
5.	Technological introduction by Japanese companies 1) Heat exchange and exhaust treatment in factories 2) Solar sharing system in agricultural land 3) Micro wind power turbine 4) Introduction of JCM project (renewable energy) 5) Risk management using a high-quality weather forecast	1) Seibu Giken 2) Agritree 3) Riamwind 4) Kanematsu KGK Vietnam 5) Weathernews
6.	Closing remark	Environmental Policies Division of Fukuoka Prefecture

Source: Nippon Koei



Presentation by Fukuoka Prefecture



Presentation by Nippon Koei



Presentation by DOIT



Presentation by WEATHERNEWS INC.



Technical workshop venue

Source: Photos taken by Nippon Koei



Group photo after the workshop

Figure 3-2 Photos of the Technical Workshop in Hanoi City

In addition, after the technical workshop was held, DONRE, Fukuoka Prefecture, and Nippon Koei held three-way discussions and agreed on the following improvements regarding the planning and implementation system for the next fiscal year.

- Focus on technical presentations and secure question-and-answer time for business matching.
- Discussions on city-to-city collaboration between local governments will be held at a separate meeting.
- DONRE will be proactively involved from the venue arrangement and agenda review stage.
- In cooperation with VCCI, prepare a system to invite many local companies.

3.3.5 JCM Seminar for Industrial Park in Hanoi City (Hybrid)

Since factories with high energy and fuel consumption have high potential for decarbonization, the following side events were held for tenant companies in Japanese industrial parks near Hanoi.

Purpose: Introduction of schemes for JCM equipment subsidy projects, decarbonization technologies and business matching between presenting companies and participating companies.

Date: Friday, December 16, 2022

Venue: Thang Long Industrial Park 1 conference room + Zoom (hybrid format)

Participants: Tenant companies in the industrial park (mainly Japanese companies), presentation companies, Nippon Koei (secretariat)

Number of participants (excluding secretariat and presenting companies): 12 people (online: 10 people, venue: 2 people)

Table 3-6 Outline of JCM Seminar for Industrial Parks

#	Agenda	Speaker
	Environmental regulations in Vietnam and introduction of JCM scheme	Nippon Koei
1.	Environmental technologies and services for efforts toward zero-carbon in factories 1) Energy saving consultant 2) Scale control for cooling system of air conditioner and energy saving by water reforming method 3) High efficiency heat exchanger and VOC concentrator (SEIBU GIKEN)	3 companies
2.	Q&A and supplementary explanation · Points to note regarding application timing and procurement timing for JCM equipment subsidy projects · International consortium requirements for JCM equipment subsidy projects, etc.	Nippon Koei

Source: Nippon Koei



Source: Official Website of Thang Long Industrial Park (<https://tlip1.com>)

Figure 3-3 Thang Long industrial park office



Source: Nippon Koei

Figure 3-4 JCM seminar venue

3.3.6 Promotion of Third Country Collaboration

Fukuoka Prefecture and India's Delhi Territory concluded a friendship agreement in March 2006, and were candidates for a third-country partnership. This year, in individual discussion with Delhi Territory, the information of City-to-City Collaboration Project being implemented in Hanoi City was provided and hearings on the Delhi Territory's needs related to decarbonization and the level of interest in the technologies to be introduced were held. In addition, Fukuoka Prefecture has conducted a questionnaire survey of companies in the prefecture regarding business development in India, and has identified several companies that are interested. In the next fiscal year (the third year), it is planned to materialize the content of information dissemination through this City-to-City Collaboration Project and strengthen third-country partnership with the Delhi Territory.

3.3.7 Consideration of Digital Transformation (DX)

Although the introduction of DX-specific technologies was not considered this year, superior monitoring systems, energy management, and other technologies were considered in the

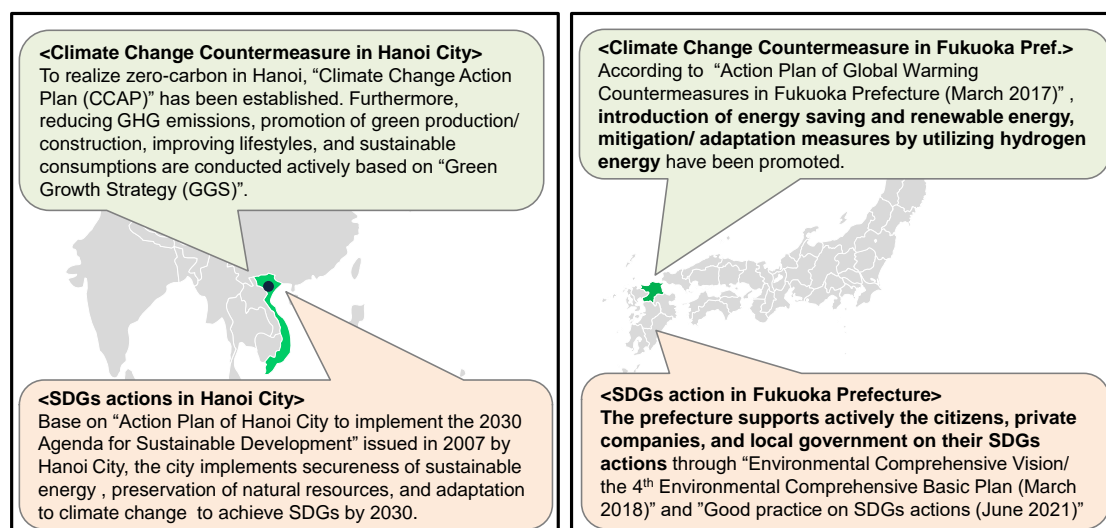
formation of projects for the JCM Model Project. In addition, DX technology was expected to contribute to the utilization of meteorological observation and forecasting technology for renewable energy and energy conservation projects this year. In addition, there is a possibility of introducing DX technology in the optimal operation of garbage sorting and collection planned by Hanoi City, and it is planned to make the proposal.

3.3.8 The Second International Forum organized by MOEJ

MOEJ together with the Office of the Special Presidential Envoy for Climate (SPEC), U.S. State Department organized the Forum as a part of the “Global Subnational Zero Carbon Initiative” launched by the in the Side Event at Japan Pavilion of the COP26. The achievements of this city-to-city collaboration project between Osaka City and Hanoi City were submitted as report materials (in Japanese and English) as shown below, and posted during the Forum (Figure 3-5 and Figure 3-6).

City-to-City Collaboration between Hanoi City and Fukuoka Prefecture

Fukuoka Prefecture and Hanoi City has started friendship relation since 2008 and conducted various activities such as a training for environmental officers of Hanoi City and an environmental education seminar under the environmental cooperation agreement since 2010. In this City-to-City Collaboration, to solve environmental issues in Hanoi City, support on **(1) human resources development and information sharing on the promotion of zero-carbon** and **(2) consideration for introducing zero-carbon technologies by Japanese companies** were implemented thorough online workshops, field survey, and discussion with the relevant persons/organizations.



Source: Prepared by Fukuoka Prefecture and Nippon Koei

Figure 3-5 Draft materials of introducing the Project (1/2)

City-to-City Collaboration between Hanoi City and Fukuoka Prefecture

【Implementation Structure】

The diagram shows the implementation structure for the City-to-City Collaboration. At the top, Hanoi City People's Committee (Chairman DONRE) and Fukuoka Prefecture (Governor, Environment Bureau) are connected by a 'City to City Collaboration' arrow. Below them, Nippon Koei provides 'Policy Support' to both. A 'Support for JCM project' arrow points from Nippon Koei to both sides. In the center, 'JCM Project Formulation' is supported by 'Technical support' from various entities. On the left, 'Local governments' (Gov. owned enterprise, Private Companies, Kanomatsu KGK Vietnam) provide support. On the right, 'SeibuGiken(Energy Saving)', 'Riamwind(Lens windmill)', 'Agritree (Solar sharing)', 'Weathernews (weather Forecasting)', and 'University in Fukuoka Pref.' provide technical support.

Activities/ Achievements

<City-to-City Collaboration Activity>

- Discussion between Hanoi and Fukuoka Pref.: 3 times
- Technical workshop and JCM seminar: 2 times

<Activity of partner companies and academic institute>

- Field survey (review on policies, meetings with local companies, collecting information on factories/buildings in Hanoi City)
- Introduction of zero-carbon measurement and Japanese zero-carbon technologies at the technical workshop
- Preparation of MOU with Vietnamese university for introducing of solar sharing system as a pilot project
- Implementation of site inspection and selection for introduction of the small wind power system in Vietnam

Achievement:

- (1) Information sharing on environmental technologies by Fukuoka Prefecture (Prevention of open burning and utilization of biomass derived from agriculture sector)
- (2) Recommendation of applicable technologies for JCM
 - Solar sharing
 - High-efficiency small wind turbine systems (Lens windmills)
 - Building energy saving system (heat exchangers)
 - Fuel conversion technology (VOC concentrator for factories)
- (3) Adaption of one JCM model project in 2022 based on City-to-City collaboration Project between Hanoi and Fukuoka Pref. "16MW Mini Hydro Power Plant Project in Binh Thuan Province Representative Participant" in FY2022

【Photos】

Face-to-face discussion at Hanoi DONRE office

Technical workshop in Hanoi City

Source: Prepared by Fukuoka Prefecture and Nippon Koei

Figure 3-6 Draft materials of introducing the Project (2/2)

CHAPTER 4 JCM MODEL PROJECT FORMULATION

4.1 Information Collection Survey

In order to support Hanoi City's decarbonization and environmental measures, information gathering survey was conducted using local mercenaries in the following technical fields (Table 4-1). The fields involved in JCM project formulation are 2) through 4).

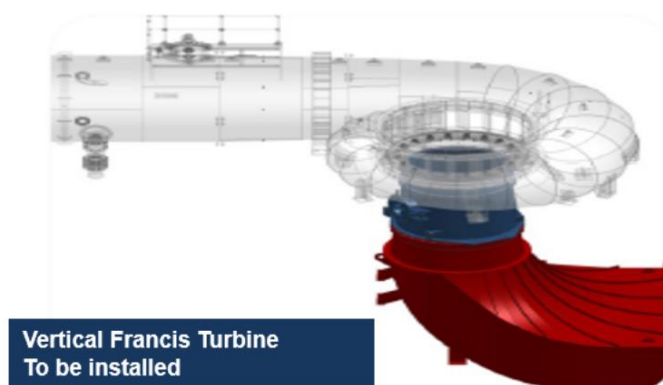
Table 4-1 Fields covered this year and overview of work

Target field	Overview of work
1) Support for institution building (described in Chapter 3)	<ol style="list-style-type: none"> 1. Conducting city-to-city meetings to decarbonize Hanoi City and achieve the SDGs 2. Support for institutional development and human resource development in the field of climate change and environment by Hanoi City
2) Energy saving	<ol style="list-style-type: none"> 1. Support for business matching with local stakeholders in public and private facilities 2. Examine the possibility of launching the JCM model project by introducing energy-saving technologies in public and private facilities
3) Renewable energy	<ol style="list-style-type: none"> 1. Examine the possibility of launching the JCM model project by introducing solar sharing and support the implementation of stakeholder consultations 2. Examine the possibility of launching the JCM model project by introducing small wind power generation and support the implementation of stakeholder consultations 3. Support for studying the use of meteorological data for the introduction of renewable energy technologies 4. Support for project formation and business matching for large-scale renewable energy projects
4) New technologies (hydrogen, CCS, etc.)	<ol style="list-style-type: none"> 1. Collect information on highly innovative decarbonization technologies (hydrogen, CCS, etc.) and share it with Hanoi City 2. Identify the needs for innovative decarbonization technologies (hydrogen, CCS, etc.) in Vietnam

Source: Prepared by Nippon Koei

4.2 Achievement of JCM project formulation through City-to-City collaboration in FY2022

Through the research activities of this City-to-City Collaboration Project to date, projects have been formed, and one JCM Model Project was adopted by the Ministry of the Environment this fiscal year. Kanematsu KGK Corp., which is the parent company of Kanematsu KGK Vietnam, will serve as the representative participant of this project, which will implement a renewable energy project to install a 16 MW small-scale hydroelectric power generation facility in Binh Thuan Province in southern Vietnam. The project will not only contribute to the stable power supply and economic development of the region by selling electricity to EVN, but also to the achievement of Vietnam's GHG reduction target. The installed facilities are shown in Figure 4-1.



Source: Global Environment Centre Foundation (GEC) HP: https://gec.jp/jcm/projects/22pro_vnm_02/

Figure 4-1 Image of hydropower turbine

4.3 Consideration of JCM Model Project Formulation by installing building Energy Saving technology into public facilities: High Efficiency Total Heat Exchanger and VOC Concentrator (Seibu Giken)

4.3.1 Overview of the study

Seibu Giken Co., Ltd. (hereinafter called “Seibu Giken”), an environmental conservation equipment manufacturer company established in 1962 in Fukuoka Prefecture, produces and sells various equipment centered on the honeycomb structure, which is their unique technology. In the study, installing total heat exchanger of general air conditioning system and VOC (Volatile Organic Compounds) concentrator which are technologies developed by Seibu Giken was continued to be considered for formulating a project from the previous fiscal year.



Seibu Giken Innovation Center



Core technology: Honeycomb structure

Figure 4-2 Photos of Innovation Center and Core technology in Seibu Giken

Hanoi City, a capital city of Vietnam, is a big city which the population is over 8 million, and there are many public facilities, buildings, hotels, and large shopping malls such as Japanese AEON mall and Vincom owned by VIN group that is Vietnamese big conglomerate company.

Therefore, energy demand of electricity, fuel and so on in Hanoi City is very large. Furthermore, several industrial parks are located near the city and Japanese companies have already expanded their business in these areas.

In addition, the National Programme on Economical and Efficient Use of Energy (VNEEP) was established in 2006, and has been working on energy conservation as a nation.(Table 4-2)

Table 4-2 Overview of VNEEP

VNEEP	Date of issue	Overview
VNEEP1 (2006-2010)	14 Apr 2006	Achieved energy savings of 3.4% (equivalent to 4.9 million TOE)
VNEEP2 (2012-2015)	2 Oct 2012	Achieved energy savings of 5.65% (equivalent to 11.2 million TOE)
VNEEP3 (2019-2030)	13 Mar 2019	Set quantitative targets for the period to 2025 and 2030

Source: Provided by Nippon Koei based on the documents of Seibu Giken

Moreover, "Decision on Issuance of List of Designated Energy Users of 2019 (Government Decision No.1577 / QD-TTg)" was announced in 12 October 2020 in Vietnam, and also the list of main facilities which consume a lot of energy in the country was created. In Hanoi City, the announcement (No. 3700 / QD-UBND) of implementation plan of VNEEP was issued in 21 August 2020, this plan sets specific target from 2021 to 2025. Furthermore, in the government decree "1577/QD-TTg", large commercial facilities, buildings, and factories in Hanoi City are also included as target facilities, so the needs of installing energy saving technologies into these facilities are increasing.

In the study, for considering of installing a total heat exchanger of general air conditioning system into public facilities, large commercial facilities, buildings, hotels, mainly installing VOC concentrator into chemical factories, the following survey items were conducted in order to confirm needs and also formulate a JCM model project (Table 4-3).

Table 4-3 Overview of the study to installing Total Heat Exchanger and VOC Concentrator

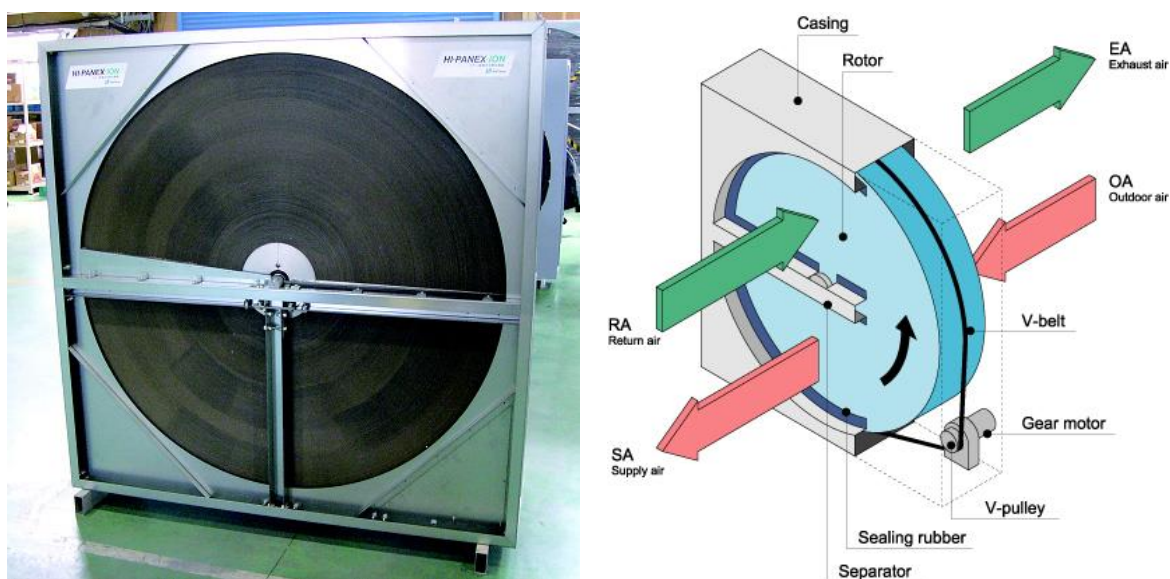
#	Survey item	Overview
1	Collecting information on local public facilities, large-scale commercial facilities, buildings, hotels, and factories	The survey was conducted with local staffs to collect information on local public facilities, large-scale commercial facilities, buildings, hotels, and factories in Hanoi City.
2	Consideration of specification of a technology to be installed	Specification of the technology to be installed was considered.
3	Business plan and feasibility evaluation	The effect of energy saving and the amount of CO ₂ emission reduction were tentatively calculated.
4	Consideration of international consortium	International consortium and implementation structure were considered for applying to JCM model project.

Source: Provided by Nippon Koei

4.3.2 Specification of the technology expected to be installed

(1) Total Heat Exchanger for general air conditioning system

Seibu Giken's ion adsorption types total heat exchanger for general air conditioning (trade name: HI-PANEX-ION), which is expected to be installed in Hanoi City, is a unit to exchange heat by absorbing and releasing a total heat (heat or humidity) of return air from rooms and air from outside by using rotary rotor (Figure 4-3). This technology is expected to contribute to reduce GHG emissions by reducing the amount of electricity consumption of air conditioning system.



Source: Seibu Giken

Figure 4-3 Total Heat Exchanger for general air conditioning system (HI-PANEX-ION) (left) and its sketch (right)

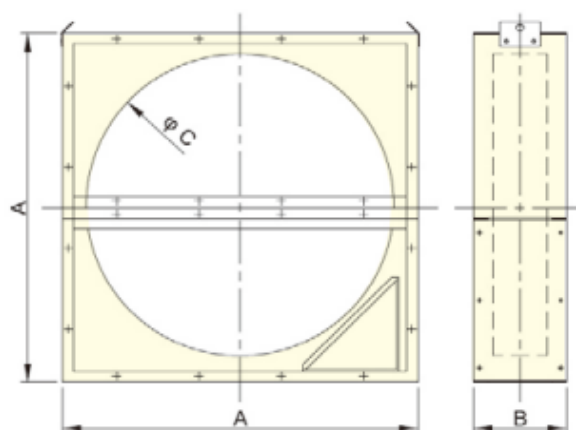
Specification of the technologies expected to be installed is shown in Table 4-4 and Figure 4-4.

Table 4-4 Specification of Total Heat Exchanger for general air conditioning system

Items		Expected Specification (PAU-FP950T)
Air flow*1 (m ³ /h)		1,810~5,450
Motor*2 (kW)		0.1
Weight (kg)		135
Dimension (mm)	A	1,200
	B	340
	C	950

*1: Face velocity (1.5~4.5 m/s)

*2: 3 φ /380~415V, 50Hz/60Hz



Source: Seibu Giken

Figure 4-4 Size of HI-PANEX-ION

An advantage of HI-PANEX-ION is shown in Table 4-5.

Table 4-5 Advantage of HI-PANEX-ION

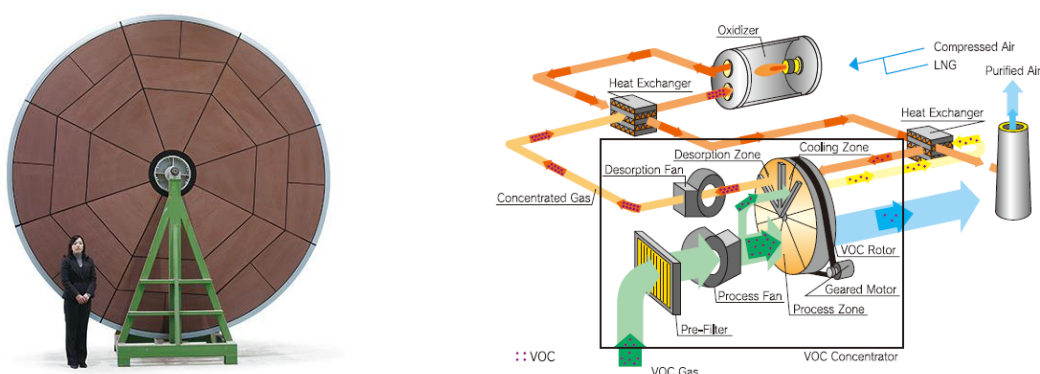
#	Advantage	Overview
1	Excellent energy saving effect	Since it is a rotor rotation countercurrent system, it is highly efficient and exhibits excellent energy-saving effects.
2	Prevention of odor transfer	The world's first ion exchange resin polymer adsorbent that does not easily adsorb odors is used as the adsorbent for latent heat exchange, and odor transfer and accumulation are extremely small compared with conventional products that use silica gel etc.
3	Antibacterial and fungicidal agent	By using a polymer adsorbent and Antibacterial and fungicidal agent, the IAQ (air quality) is thoroughly improved.

Source: Provided by Nippon Koei based on the documents of Seibu Giken

HI-PANEX-ION has already been installed into various areas such as hotels, hospitals, and airports not only in Japan but also Asian countries like Singapore as an energy saving technology for large facilities. Particularly, South-east Asian countries have a large need of air conditioners, so it is expected to install the technology more there.

(2) VOC Concentrator

Seibu Giken's VOC concentrator (trade name: SKY-SAVE) which is expected to be installed in Hanoi City and industrial parks near the city, is a device that concentrates an exhaust gas containing low-concentration VOC exhausted from printer dryers and painting booths to high concentration and a small amount of air, and then detoxifies by oxidative decomposition by burning (Figure 4-5). In general countermeasures to exhausted gas, an exhaust gas containing low-concentration VOC are burned by using fuels like LNG, however, the technology can burn shortly and efficiently by increasing VOC's concentration. As a result, it contributes to reduce GHG emissions by reducing the amount of fuel consumption. But, it is necessary to consider electricity consumption of a rotor.



Source: Seibu Giken

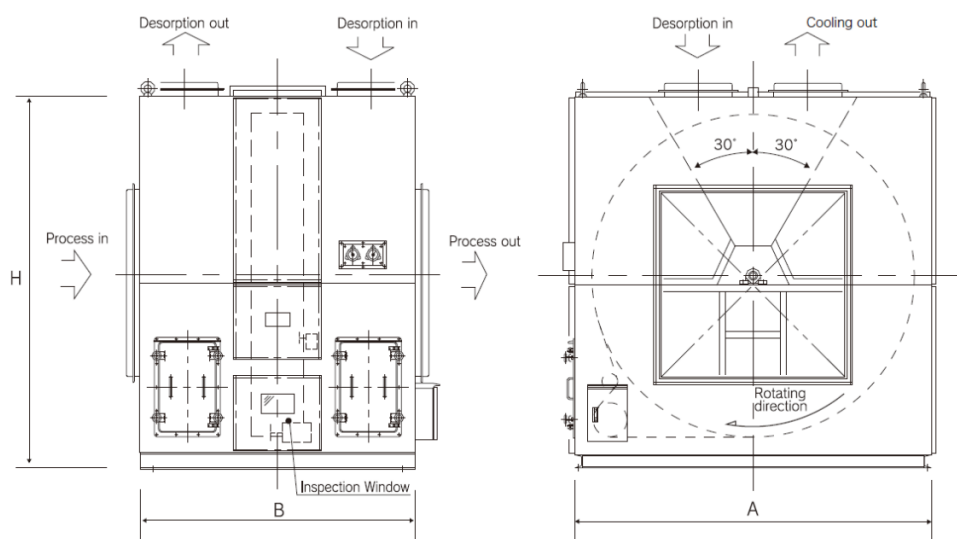
Figure 4-5 VOC Concentration Rotor (left) and VOC Concentrator (right)

Specification of the technologies expected to be installed shown in Table 4-6.

Table 4-6 Specification of Total Heat Exchanger for VOC Concentrator

Items		Expected Specification (VMU III-4250V40)
Process flow rate * (Nm ³ /h)/ (Scfm)		135,000/ 85,200
Rotor driver output (kW)		0.4
Weight (kg)		6,950
Dimension (mm)	Width A	4,700
	Length B	2,000
	Height C	4,850

*The amount of gas is 2.0 Nm³/s in front of the rotor, zone division 10: 1: 1, when concentrated 10 times.



Source: Seibu Giken

Figure 4-6 Size of SKY-SAVE

Advantage of SKY-SAVE are shown in Table 4-7.

Table 4-7 Advantages of SKY-SAVE

#	Advantage	Overview
1	High performance and high efficiency	Hydrophobic zeolite with excellent adsorption performance is used as an adsorbent, and it can be handled with a wide range of VOC types and different operating conditions.
2	High boiling point solvent can be processed	High boiling point VOC can be treated because it can be regenerated at high temperature by utilizing the characteristics of hydrophobic zeolite such as nonflammability and high heat resistance.
3	Inexpensive maintenance	Inexpensive maintenance is possible due to the rotor structure.

Source: Provided by Nippon Koei based on the documents of Seibu Giken

SKY-SAVE has already been installed as exhaust gas treatment equipment at printing company or painting company in not only Japan but also over 30 countries in the world. A regulation of exhaust gas has been gradually increased in South-east Asian countries as a countermeasure to air pollution. In addition, this technology can contribute to decarbonization as well, so it is expected to install it into factories where manufacture eco-friendly chemical products.

4.3.3 The Result of Study

In the study, for selecting facilities in Hanoi City to install total heat exchanger for general air conditioning system (HI-PANEX-ION) and VOC concentrator (SKY-SAVE), collecting

information about factories and buildings that have large energy consumption was conducted. Table 4-8 shows the survey items for the target facilities.

Table 4-8 List of survey items for Target facilities

#	List
1	Facility name
2	Address
3	Manufacturing industry
4	Energy equivalent consumption (TOE)
5	Company URL
6	Type of capital
7	Age of facility (or year of construction)
8	Business content (product, service, etc.)
9	Factory/Building area (m ²)
10	Number of floors
11	Contact person (name, position, e-mail, etc.)
12	Interest in CO2 reduction
13	Photo (Interior/Exterior of facility)

Source: Provided by Nippon Koei based on “Decision on THE ISSUANCE OF THE LIST OF DESIGNATED ENERGY USERS OF 2019”

4.3.4 Draft Project Plan and Feasibility Evaluation

(1) Total Heat Exchanger for general air conditioning system

The effect to GHG emission reduction by installing HI-PANEX-ION in Hanoi City was estimated with a reference to a case in Japan. As shown in the table below, assuming that the air conditioning load by human per one floor is 3,375 m³/h and a building has 10 floors, it is expected that GHG emissions will be reduced by about 308 t- CO2 per year. These values will be calculated again after confirming the target places of projects.

Table 4-9 Estimation of GHG Emission Reduction by Installing HI-PANEX-ION

#	Item	Value	Unit	Remarks
a	Electricity consumption (Reference)	50.04	MWh/year	<ul style="list-style-type: none"> - 1 Floor = 3,375 m³/h - Cooling loads (in summer): 12.3 kW - Heating loads (in winter): 3.9 kW
b	Electricity consumption (Introducing HI-PANEX-ION)	13.54	MWh/year	Total heat efficiency (74% recovery) <ul style="list-style-type: none"> - Cooling loads (in summer): 3.3 kW - Heating loads (in winter): 1.1 kW
c	Emission factor	0.8458	tCO2/MWh	R3 JCM model project (Vietnam, Energy saving)
d	Annual GHG reduction/floor	30.87	tCO2/year	= (a-b) × c
e	Floors	10	Floors	
f	Annual GHG reduction	308.7	tCO2/year	= d×e

#	Item	Value	Unit	Remarks
g	Design lifetime	15	Year	Statutory durable years of Japan
h	Total GHG reduction	4,631	t CO ₂	= f×g

Source: Provided by Nippon Koei based on the document by Seibu Giken

Even if a subsidy amount of JCM model project is 50% (maximum percentage of subsidy), the cost-effectiveness of this project is 4,000 JPY/t CO₂ or less.

(2) VOC Concentrator

The effect to GHG emission reduction by installing SKY-SAVE in Hanoi City was estimated as a reference. As shown in the table below, assuming that 400 mg/Nm³ of VOC (ex. xylene) is processed in an automobile painting booth, it is expected that GHG emissions will be reduced by about 5,900 t-CO₂ per year. These values will be calculated again after confirming the target places of projects.

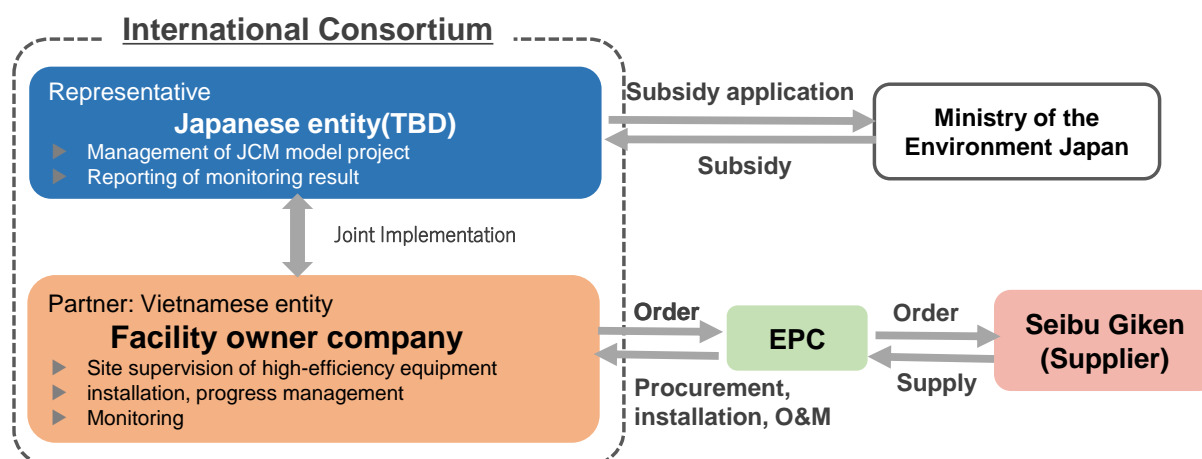
Table 4-10 Estimation of GHG Emission Reduction by Installing SKY-SAVE

#	Item	Value	Unit	Remarks
				<u>General Conditions</u> – Xylene: 400 mg/Nm ³ – Operating time: 8,500 h/year – Processing Air Volume: 140,000Nm ³ /h
a	Fuel consumption (Reference)	5,911	tCO ₂ /year	– Annual fuel consumption: 2,142 (t/year) – Net calorific value of fuel: 44.8 (GJ/ t) – Emission factor: 0.0616 (tCO ₂ /GJ)
b	Fuel consumption (Introducing SKY-SAVE)	3	tCO ₂ /year	– Annual fuel consumption: 0.0 (t/year) – Electricity consumption: 3.23 (MWh/year) – Emission factor 0.8458 (tCO ₂ /MWh)
d	Annual GHG reduction	5,908	t CO ₂ /year	= a-b
e	Design lifetime	15	Year	Statutory durable years of Japan
f	Total GHG reduction	88,620	t CO ₂ /15year	= d×e

Source: Provided by Nippon Koei based on the document by Seibu Giken.

4.3.5 Consideration of International Consortium for applying to JCM Model Project

An expected international consortium and implementation structure are shown in the following figure. Since target places of JCM model project have not been decided at the moment, a representative participant and partner participant will be selected in next fiscal year. Seibu Giken plans to join as a supplier, but it is necessary to find a reliable local EPC company to maintain because the technology/ equipment is quite unique.



Source: Provided by Nippon Koei

Figure 4-7 Image of International Consortium (Seibu Giken)

4.3.6 MRV plan

In Vietnam, there have been no JCM model projects related to fuel conversion technologies by total heat exchangers and VOC concentrator. Therefore, it is necessary to develop a methodology for these technologies.

As for the MRV of total heat exchangers, electricity consumption calculated by simulation of normal air conditioning load expects to be a reference scenario, and it also is necessary to measure actual electricity consumption after installing the total heat exchangers. In addition, setting meters in total heat exchangers and air conditioning to monitor their electricity consumption, and installing a monitoring system to keep measurement data are necessary.

Regarding the MRV of VOC concentrator, the amount of fuel consumption and electricity consumption by the equipment will be mainly monitored since the reduction amount of fossil fuel usage by exhaust gas combustion is counted as GHG emission reduction amount. So, it is necessary to set a fuel meter and an electric meter, and install a monitoring system to keep measurement data.

After confirming target areas of JCM model projects, the MRV plan will be considered in detail.

4.3.7 Future Plan for dissemination of the technology

In FY2022, the technical workshops and JCM seminars for industrial parks were held to introduce energy saving technology and confirmed interest from several participants companies through the result of questionnaire. In the next fiscal year, the detailed surveys of target facilities and face-to-face business negotiations with Vietnamese companies will be conducted to find new businesses.

4.4 Consideration of JCM Model Project Formulation by Installing Renewable Energy in Farmlands near the City: Solar Sharing (Agritree)

4.4.1 Overview of the Study

In the study, as a renewable energy for farmlands near the city, installing solar sharing technology which was developed by Agritree Co., Ltd. (hereinafter called “Agritree) located in Fukuoka Prefecture was considered for JCM model project formulation.

Agritree has been trying to develop and promote solar sharing technology since 2018 and has over 10 cases of installing this technology in Japan. Furthermore, through the Project, the company is considering to expand their business to overseas targeting on farmlands near Hanoi City in Vietnam.

Solar sharing is an efficient system that realizes agriculture and power generation using solar power by setting narrow solar panels at intervals on a high frame installed in farmlands. The services provided by Agritree have the following merits (Figure 4-8).

- Reducing GHG emission by using solar power generation
- Getting power generation income while continuing farming (in the case of selling electricity)
- Reducing significantly the electricity charges that have been purchased so far (in the case of electricity self-generation)
- Getting technical supports on agricultural management and solar sharing
- Contribution to restraint in new land development and environmental conservation because solar sharing utilizes existing farmlands. etc.



Source: Agritree (Guidebook on Technologies of Environment-Related Corporations in Fukuoka Prefecture)

Figure 4-8 Image of installing Solar Sharing (the example in Japan)

In Vietnam, Feed-in Tariff (FIT) to large scale solar power generation projects was completed in 2021. Therefore, solar sharing of small scale less than 1MW for self-generation was

considered, not selling power to an electric power company via a grid. Specifically, collecting information on Vietnamese agricultural situation, farmer’s technical or budgetary issues, and the needs about solar sharing were conducted through interview survey with Hanoi City government, local companies, and university as follows (Table 4-11).

Table 4-11 Survey items and its Overview for installing Solar Sharing

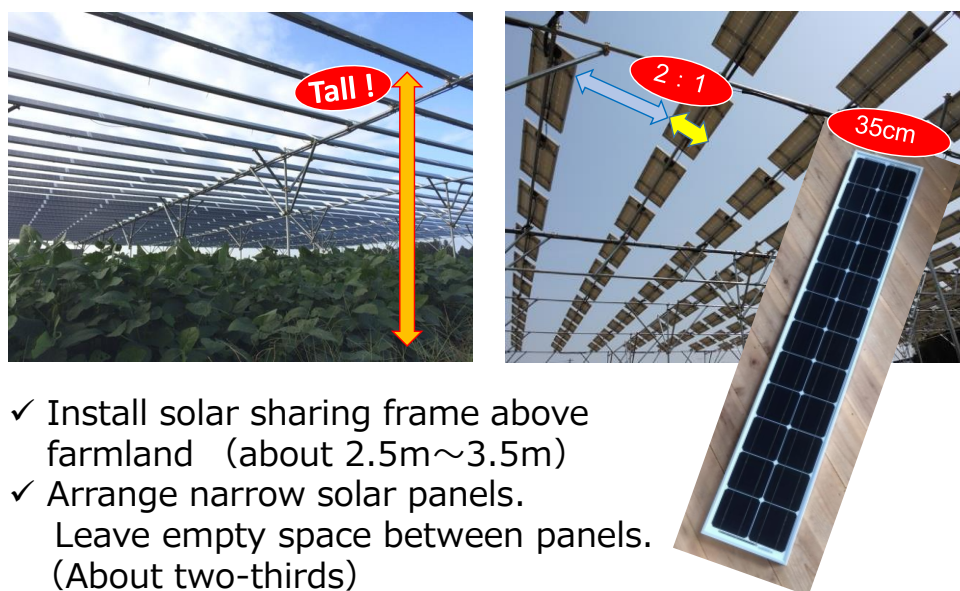
Interviewee	Overview
Agricultural companies	Status of greenhouse installation in Vietnam, market trends of value-added crops such as fruits, exchange opinions of installing solar sharing.
Agricultural university	Possibility of installing solar sharing in Vietnam, candidate crops, possibility of implementing demonstration project in the university

Source: Provided by Nippon Koei

4.4.2 Specification of the technology expected to be installed

Solar sharing uses narrow panels to avoid them from interfering with growing crops and working on the farms, which is different from general solar power generation system, and the panels are installed at a height of 2.5 to 3.5m. As the photos(Figure 4-9) below shows, the amount of solar power generation per area is lower than the usual one since the panels are installed at 2:1 interval.

However, by using a double-sided type of panel, the light reflected on the ground can also be efficiently utilized for power generation.



- ✓ Install solar sharing frame above farmland (about 2.5m~3.5m)
- ✓ Arrange narrow solar panels. Leave empty space between panels. (About two-thirds)

Source: Agritree’s presentation material

Figure 4-9 Technology to be installed (Solar Panel)

The electricity generated by solar sharing should be utilized effectively for self-consumption at farmers with the aim to realize a grid alternative/ fuel conversion. To improve the quality of agricultural management and increase added value of crops, it is essential to connect to a facility that can consume the generated electricity without waste. Table 4-12 shows an ancillary

equipment expected to be installed which will be investigated and considered continuously in the next fiscal year.

Table 4-12 Survey items of an ancillary equipment to Solar Sharing

Target	Survey item
Agricultural machinery	Local standards, general specifications, power consumption (electric agricultural machines), fuel consumption (normal agricultural machines), international standards, selling prices, manufacturers, frequency of use, etc.
Storage battery	Local standards, specifications, manufacturers
Water distribution and irrigation system	Current equipment specifications, power consumption
Houses, factories and equipment adjacent to farmland	Electricity consumption, fuel consumption, presence or absence of air conditioning/drying equipment, etc.

Source: Provided by Nippon Koei

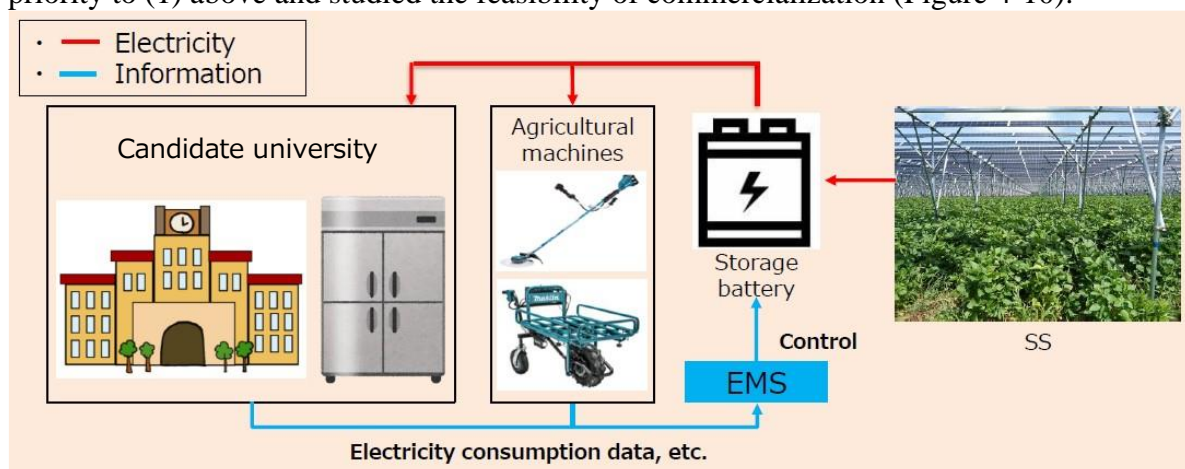
4.4.3 Result of the Study

Through this year's field survey and discussions with relevant parties, it was confirmed that it is possible to obtain cooperation for the pilot introduction of solar sharing using a field in a local university. Since Hanoi City is located in the northern part of Vietnam, where solar radiation is relatively low, discussions were also held with agricultural businesses and research institutions in southern Vietnam, where there are many large areas of farmland, and it was confirmed that there is potential for full-scale business development here.

The results of the survey showed that there is potential for commercialization in each of the two regions according to their weather characteristics and needs.

(1) Northern Vietnam (Hanoi City): Study on the introduction of solar sharing as a demonstration project

(2) Southern Vietnam (Can Tho City): Studying the spread of solar sharing as an agribusiness
 Since there are no examples of solar sharing projects in Vietnam, the company decided to give priority to (1) above and studied the feasibility of commercialization (Figure 4-10).

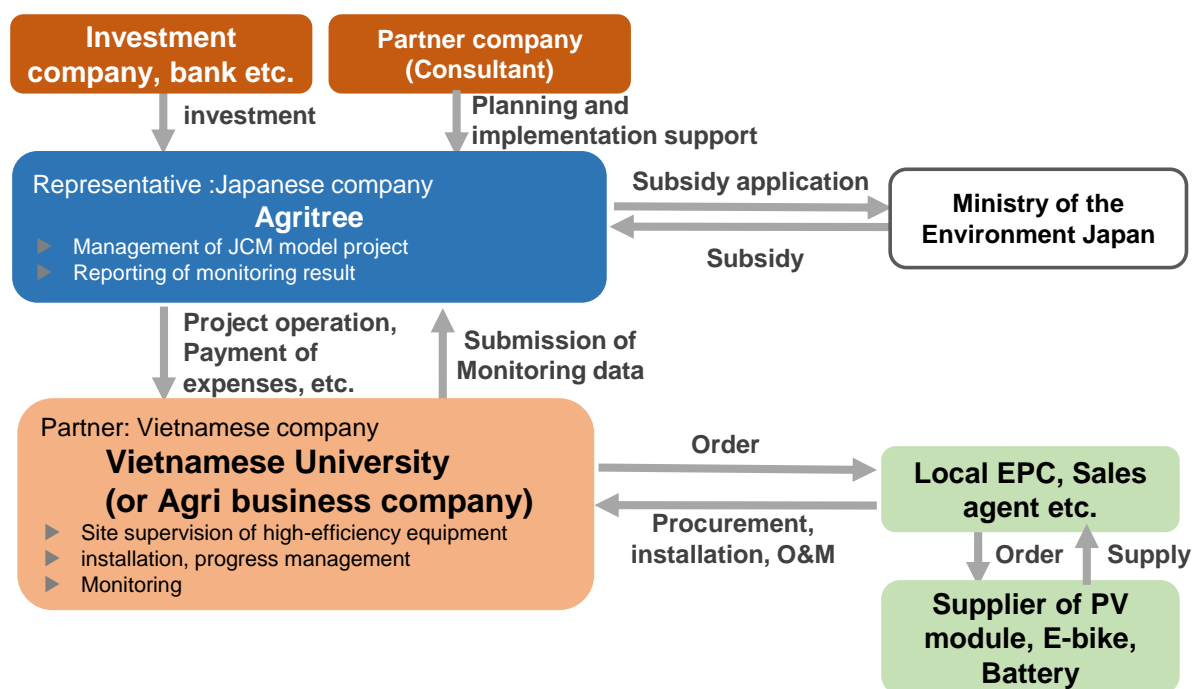


Source: Provided by Agritree (Partially edited by Nippon Koei)

Figure 4-10 Image of Business Plan (Agritree)

4.4.4 Draft Project Plan and Feasibility Evaluation

As a scheme for the demonstration project, an implementation system that assumes the use of the Ministry of the Environment's Co-Innovation Project was considered. It is envisioned that this will be linked to the JCM Model Project in the future (Figure 4-11). Since the technologies to be introduced and the project cost have not been decided at this point, the cooperating organizations and companies will be decided at the time of application for the Co-Innovation Project in the next fiscal year.



Source: Prepared by Nippon Koei

Figure 4-11 Image of International Consortium (Agritree)

4.4.5 MRV plan

With reference to the existing methodology for a project in Vietnam (VN_AM007), it is assumed that the monitoring of electricity generation by panels and solar radiation is necessary for solar power generation project by solar sharing system. At present, it is not decided the type of equipment utilizes generated power, however, it is needed to install a system can synchronize the electricity usage in each equipment in real time. In order to prevent power loss, it is also necessary to develop a new methodology including more complicated mechanisms such as the introduction of storage batteries.

4.4.6 Further Plan

After signing a memorandum of understanding with a local university, it will be planned to proceed to formulate a detailed implementation structure, financing, identification of equipment to be introduced, and business plan, assuming application for the Ministry of Environment's Co-Innovation Project (demonstration project) in the following fiscal year. If the Co-Innovation Project is realized, after sorting out the applicable conditions and institutional constraints for the spread of solar sharing in Vietnam, the project is expected to be developed into JCM Model Project targeting the southern part of the country, where solar radiation is abundant, with a major local agricultural corporation as a joint venture partner.

4.5 Consideration of JCM Model Project Formulation by installing Renewable Energy in Hanoi City: Small Wind Turbine Systems (RIAMWIND)

4.5.1 Overview of the study

In the Project, installing of small wind turbine systems using “Wind-Lens Technologies” developed by RIAMWIND Co., Ltd. (hereinafter called “RIAMWIND”) located in Fukuoka Prefecture was considered for JCM model project formulation in Hanoi City and neighboring areas. Collecting information and consideration of project formulation were conducted targeting the whole area of Vietnam, not only consideration of using this technology as self-consumption in commercial buildings/ factories or an emergency power source in public facilities but also expanding it to the coast areas and southern Mekong Delta where the wind conditions are good other than northern area of Vietnam inclusive of Hanoi City.

In the study of this fiscal year, comparison of the amount of power generation at northern, central and southern Vietnam locations by using wind simulation was implemented, and information of the amount of power generation and its cost in the country was collected.

4.5.2 Specification of the technology expected to be installed

“Wind-Lens Technologies” is a windmill with a ring (wind-lens) around its blades, and has the following features (quoted from RIAMWIND’s website, Figure 4-12).

High efficiency: Two-threefold increase in output power compared to conventional wind turbines due to the concentration of wind energy (“wind-lens” technology)

Very quiet: Since the vortices generated from the blade tips are considerably suppressed through the interference with the boundary layer within the diffuser shroud, the aerodynamic noise is reduced substantially

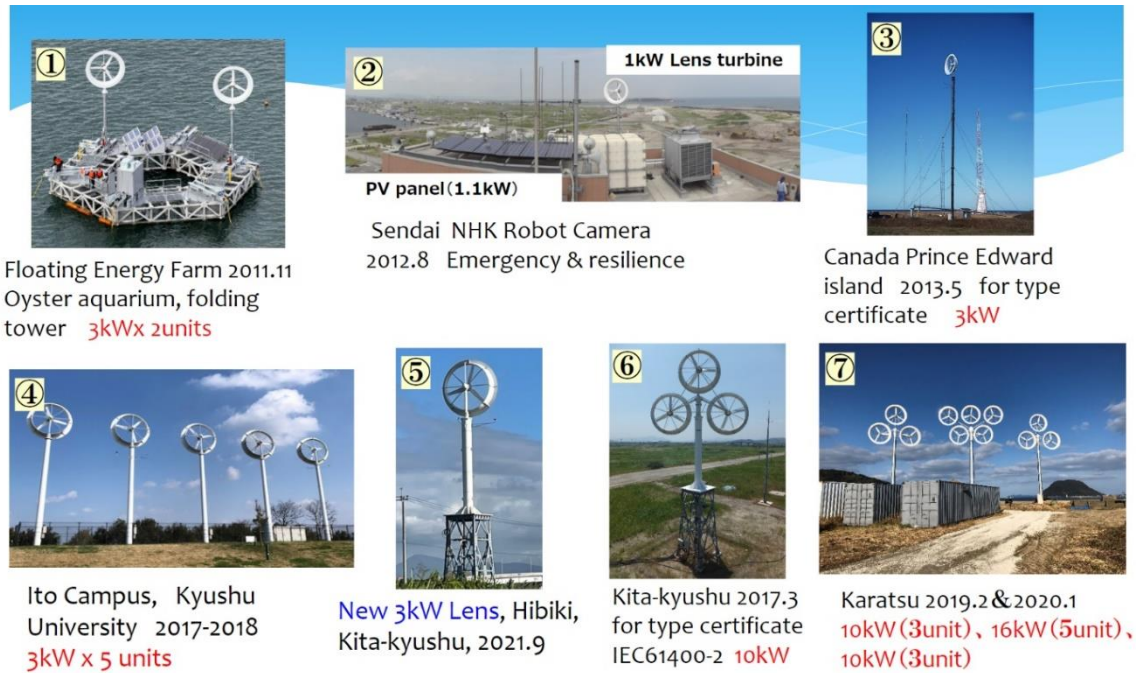
Adaptable to surrounding: Wind-lens is safe and has a beauty that blends into the surrounding landscape.



Source: Extracts form RIAMWIND’s documents

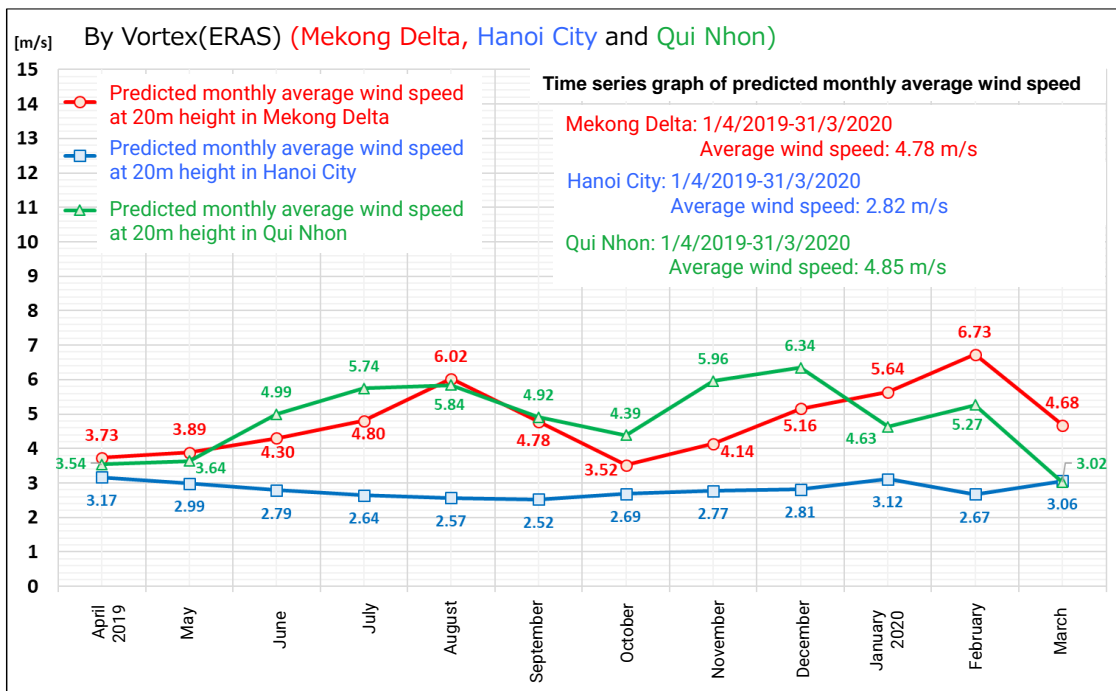
Figure 4-12 Image Lens-Wind (Left : Single, Right:Multi Lens)

In Japan, RIANWIND has around 30 installations of this technology as of February 2022(Figure 4-13), inclusive of demonstration projects. Another advantage of RIAMWIND’s technology is that it is possible to design appropriately the size, number, and height of pillars of wind-lens turbine according to the location condition with the aim of maximizing the amount of power generation (Figure 4-14, Table 4-13).



Source: Extracts form RIANWIND’s documents

Figure 4-13 On-going project of Wind-Lens Technology in Japan



Source: RIANWIND

Figure 4-14 Result of wind simulation based on data of VORTEX

Table 4-13 Estimated annual power generation at three locations in Viet nam

1. Estimated annual wind power generation 9kW (independent type) x2unit

Location	Average annual wind	Annual average power generation (9kW)	Unit	Total annual power generation
Mekong Delta	4.78 m/s	15.5 MWh/年	2台	31.0 MWh/年
Hanoi City	2.82 m/s	4.3 MWh/年未滿※1	2台	8.6 MWh/年未滿
Qui Nhon	4.85 m/s	16.0 MWh/年	2台	32.0 MWh/年

2. Estimated annual wind power generation 15kW (independent type) x1unit

Location	Average annual wind	Annual average power generation (15kW)	Unit	Total annual power generation
Mekong Delta	4.78 m/s	25.9 MWh/y	1台	25.9 MWh/y
Hanoi City	2.82 m/s	Less than 7.1 MWh/y※	1台	7.1 MWh/y
Qui Nhon	4.85 m/s	26.7 MWh/y	1台	26.7 MWh/y

※Estimation of power generation used 3.0m/s, because there is a lower limit of the wind strength in the simulation.

This estimation is based on the simulated data, it not guarantee the actual amount of power generation.

Source: RIAMWIND

4.5.3 The Result of Study

In response to a purchase request from a private company in this fiscal year, a field survey was conducted to confirm the current situation of the candidate site and the implementation procedure, and examined the possibility of introducing 3kW wind turbine. It was confirmed that the tower, storage battery, and electrical system equipment except wind turbine (core technology) can be produced and procured in partnership with a local construction company. However, the introduction cost of this technology is not very effective against the current electricity bill, and it was difficult to approach the price range where wind turbines can be sold in Viet Nam.

On the other hand, regarding power generation system using technology applied Wind-lens at the exhaust, from the results of interviews with local companies and the results of inspections of industrial park in Viet Nam, it was confirmed that there is a high potential for introduction of the technology.

4.5.4 Further Plan

According to the results of the study above, additional consideration of new business in Viet Nam regarding the power generation technology using exhaust wind was conducted. This technology can generate power more than the power used for exhaust, it use regeneration energy to install the wind turbine at the exhaust ports in the existing factory and commercial facilities as shown below (Figure 4-15). Although the power generation capacity of a single location is very small, there is the potential to introduce hundreds or even thousands of units in

an industrial park because a typical factory has dozens of exhaust outlets. In addition, technically speaking, it can be installed as an addition to existing facilities, and since additional equipment other than blades and turbines is not required, it can be produced at low cost, which is highly likely to lead to new business. Currently, a pilot project to introduce this system has been implemented in Japan, and since there are prospects for practical application, it is assumed to introduce it to Vietnamese company that has interested in this technology and field surveys will be conducted in FY2023.

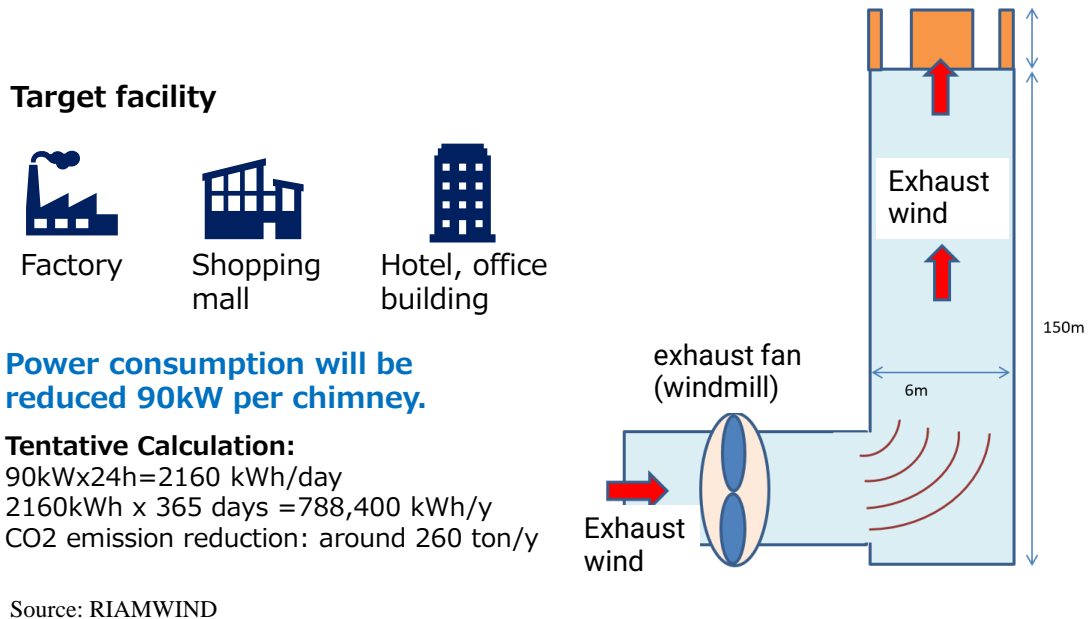


Figure 4-15 Renewable Energy technology using exhaust wind (RIAMWIND)

4.6 Consideration of JCM Model Project Formulation by installing Large-Scale Renewable Energy (Kanematsu KGK Vietnam)

4.6.1 Outline of the Study

In order to formulate renewable energy projects using JCM scheme, current trends in large-scale renewable energy projects and information of on-going and/or planned major projects were collected in this fiscal year. Through the discussion with Hanoi City and information sharing with participating companies of the technical workshop, the large-scale renewable energy projects (solar power, small hydropower, waste to energy, etc.) for the purpose of selling electricity were considered.

4.6.2 Results of the Study

To confirm recent trend of renewable energy project, the related information for the past five years in Viet Nam as follows (Table 4-14 to Table 4-17). Regarding planned project, it will be continued to collect details such as the project schedule and implementation system because it has some possibilities of considering formulation of JCM model project.

Table 4-14 List of large-scale Renewable Energy project in Viet Nam (Solar Power)

#	Project Site (category)	Capacity	Progress of the project
1	Ninh Thuan Province	150 MW	Operation start: January 2021
2	Binh Thuan Province	50 MW	Operation start: January 2021
3	Quang Binh Province	47.6 MW	Operation start: 2022
4	Thuan Thien-Hue Province	50 MW	Operation start: December 2020
5	Binh Dinh Province	50 MW	Operation start: 2020
6	Binh Dinh Province	50 MW	Operation start: 2020
7	Ninh Thuan Province	150 MW	Under construction
8	Long An Province	49 MW	Under construction
9	Gia Lai Province	14.8 MW	Planning
10	Gia Lai Province	49 MW	Planning
11	Gia Lai Province	500 MW	Planning
12	Tay Ninh Province	450 MW	Planning
13	Binh Phuoc Province	30 MW	Planning
14	Khanh Hoa Province	40 MW	Planning

Source: Prepared by Nippon Koei

Table 4-15 List of large-scale Renewable Energy project in Viet Nam (Hydropower)

#	Project Site (category)	Capacity	Progress of the project
1	Hoa Binh Province	480 MW	Under construction
2	Kon Tum Province	360 MW	Under construction
3	Nghe An Province	27 MW	Under construction
4	Thanh Hoa Province	102 MW	Under construction
5	Dong Nai Province	200 MW	Planning
6	Dong Nai Province	93 MW	Planning

Source: Prepared by Nippon Koei

Table 4-16 List of large-scale Renewable Energy project in Viet Nam (Wind Power)

#	Project Site (category)	Capacity	Progress of the project
1	Bac Lieu Province	80 MW	Operation start:2022
2	Gia Lai Province	50 MW	Operation start: 2021
3	Ninh Thuan Province	50 MW	Operation start: 2021
4	Quang Tri Province	48 MW	Operation start: 2021
5	Soc Trang Province	30 MW	Operation start: January 2021
6	Quang Binh Province	109 MW	Operation start: 2021
7	Dak Nong Province	49 MW	Operation start: 2021
8	Binh Thuan Province	50 MW	Operation start: October 2021
9	Tien Giang Province	100 MW	Under construction
10	Soc Trang Province	50 MW	Under construction
11	Ben Tre Province	30 MW	Under construction
12	Ben Tre Province	128 MW	Under construction
13	Ninh Thuan Province	88 MW	Planning
14	Tra Vinh Province	200 MW	Planning
15	Binh Thuan Province	3400 MW	Planning
16	Binh Thuan Province	3500 MW	Planning
17	Lam Dong Province	98 MW	Planning
18	Vung Tau Province 省	102.6 MW	Planning
19	Quang Tri Province 省	30 MW	Planning
20	Binh Dinh Province	2000 MW	Planning

Source: Prepared by Nippon Koei

Table 4-17 List of large-scale Renewable Energy project in Viet Nam (Others)

#	Project Site (category)	Capacity	Progress of the project
1	Tuyen Quang Province(Biomass)	25 MW	Operation start: 2019
2	Gia Lai Province(Biomass)	95 MW	Operation start: 2018
3	Hau Giang Province(Biomass)	20 MW	Under construction
4	Tra Vinh Province(Biomass)	25 MW	Planning
5	Quang Binh Province(Biomass)	50 MW	Planning
6	Soc Son, Hanoi City(WtE)	15 MW	Operation start: July 2022
7	Son Tay, Hanoi City(WtE)	37 MW	Under construction
8	Bac Ninh Province(WtE)	11.6 MW	Under construction
9	Dong Nai Province(WtE)	30 MW	Planning
10	Thanh Hoa Province(WtE)	18 MW	Planning
11	HCMC City(WtE)	40 MW	Planning
12	HCMC City(WtE)	No info.	Planning
13	Quang Tri Province(Geothermal)	25 MW	Planning

Source: Prepared by Nippon Koei

4.6.3 Consideration of International Consortium for applying to JCM Model Project

The International consortium of large-scale renewable energy projects such as JCM model project is shown in Figure 4-16. It is assumed that Kanematsu KGK and local power company will form an international consortium. Kanematsu KGK Vietnam as a subsidiary company of Kanematsu KGK will support the operation of partner local company and MRV activities in order to achieve stable project operations and achieve GHG emission reduction plans,

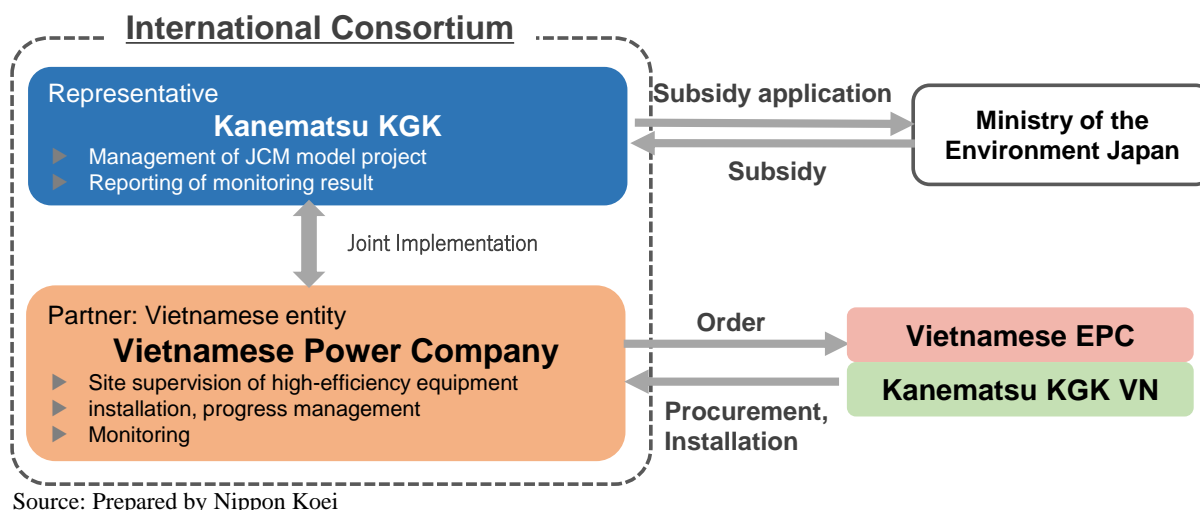


Figure 4-16 Image of International Consortium (Kanematsu KGK Vietnam)

4.6.4 Future Plan

Kanematsu KGK Vietnam has been participating in the large-scale solar power project as JCM model project in Viet Nam. The first micro hydropower project using JCM subsidy scheme in Viet Nam has also been applied by this company and adopted by MOEJ in FY2022. In the next fiscal year, based on these abundant experiences, it plans to continue for formulating one JCM model project annually through the finding of Vietnamese company which has been considering investment and implement of renewable energy.

4.7 Examination of the use of weather observation and forecasting technology: Weathernews

4.7.1 Overview of the Research

In this project, weather observation and forecasting technology by Weathernews Inc., a participating company in this City-to-City Collaboration Project, was studied for use in Hanoi City and surrounding areas. Although renewable energy generation is unstable and easily affected by weather conditions, the introduction of this technology is expected to contribute to supplying stable electricity to specific facilities (e.g., factories) and the region concerned. In addition, from the perspective of climate change adaptation measures, weather forecasting can be used as a tool for disaster prevention and forecasting flooding and inundation damage in urban areas, and is therefore expected to be highly needed in Hanoi City, the capital of Vietnam.

4.7.2 Assumed equipment to be installed

In collaboration with the Vietnam General Department of Meteorology and Hydrology, the company has installed and begun test operation of a new type of high-frequency observation compact meteorological radar in Hanoi City in November 2022, which will be able to observe 50 km around it in 30 seconds in three dimensions. The radar is capable of capturing the development of cumulonimbus clouds within a radius of 50 km in near real time, enabling a more accurate understanding of local weather phenomena such as torrential rains, gusty winds, and hailstorms. The installation of the radar enables the early detection of flood risks and issuance of warnings in Hanoi City establishing reference information. Thus, it is expected to strengthen local disaster prevention functions. (Source: Weathernews Inc. press release (27 Apr 2022) partially quoted from: <https://jp.weathernews.com/news/39889/>)

4.7.3 Results of the Research and Future Development

As part of the research for this project, Weathernews Inc. presented the latest weather forecasting technology and application examples at the technical workshop (Hanoi City, October 2022). A post-workshop questionnaire confirmed that Hanoi municipal government officials and local companies are highly interested in the technology.

In the next year's City-to-City Collaboration Project, we plan to propose ways to utilize the meteorological data acquired for renewable energy projects and local companies planning the introduction of rooftop solar power generation to study the possibility of forecasting the amount of electricity by renewable energy generation. For this purpose, as mentioned above, information on large-scale renewable energy projects (under implementation or planned) in Vietnam was collected and listed (Table 4-14 to Table 4-17).

In addition, since it was confirmed that this weather forecasting technology is of great interest from the perspective of urban disaster prevention for Hanoi City, where flood damage during the rainy season is prominent, information on applicable international support schemes will be collected and considered for project formulation in parallel with City-to-City Collaboration project.

CHAPTER 5 FUTURE PLAN

5.1 Achievement of Activities and Analysis of the Issues in FY2022

To consider a plan of the City-to-City Collaboration in the next fiscal year, the achievements of main activities (renewable energy/ energy saving, institutional support) and the issues in FY2021 were analyzed and summarized as follows.

5.1.1 Institutional Supports

(1) Intercity discussion for achieving Zero-carbon and SDGs

In this fiscal year, issues and plan of garbage separation and technology introduction of WtE were raised at the City-to-City Collaboration meeting between Hanoi City and Fukuoka Pref. Hanoi City, in particular, has been preparing a guideline of garbage separation with support from JICA expert is aiming to develop its own master plan for waste management in the future. Fukuoka Pref. does not manage the garbage separation directly, but it is able to consider the support such as human resource and training in the field of waste management. There are also several companies in the prefecture with advanced technology of waste treatment. Therefore, in the next fiscal year, it plans to support implementation continuously with summarized support menu under the City-to-City Collaboration project based on the specific demands from Hanoi City.

(2) JCM Model Project Formulation supported by City-to-City Collaboration

In this fiscal year, the technical workshop with co-hosted by Hanoi City, Fukuoka Pref. and Nippon Koei was held in hybrid (See chapter 3.3.4). It is one of achievements of support activity for JCM project formulation in private sector under the city-to-city collaboration.

Sharing zero-carbon activities of both cities and introducing the detailed JCM scheme, results of feasibility study of project formulation and some JCM project examples were conducted to the relevant local government officers and private companies in the city through the workshop.

In addition, there were several individual inquiries from Vietnamese and Japanese companies regarding the materials distributed at the workshop and seminars, confirming that the advertising effect was high. At the next technical workshop in the next fiscal year, it was planned to analyze achievements and points for improvement, and proceed with discussions to lead to project formation together with Hanoi city.

5.1.2 Consideration of JCM Project Formulation

(1) Consideration of JCM Project Formulation with Energy Saving technology

Information was disseminated to local governments and local private companies in Hanoi that own facilities with high energy consumption in the city through the presentation at the technical workshop in Hanoi City.

The total heat recovery system developed by Seibu Giken can promote energy saving for buildings and factories in Hanoi City, additional seminar focus on building energy saving to the industrial park and tenant companies was conducted in this fiscal year. It was able to increase interest in the zero-carbon technology to the local companies which has not consider and conduct countermeasure yet.

(2) Consideration of JCM Project Formulation in the agriculture land with Solar Sharing System

Agritree was able to proceed consideration Co-Innovation project (pilot project scheme under the JCM) in next fiscal year through the face-to-face meeting with Vietnamese university and conduct field survey. For further application of the project next fiscal year, both party plans to have MOU, then the specific equipment, duration, capacity and cost allocation etc. will be considered. It will be supported the negotiations and detailed surveys of both sides, aiming for adoption and implementation under the Cit-to-City collaboration in the next fiscal year.

(3) Consideration of JCM Project Formulation with Small Wind Power technology

Based on the result of study and simulation of wind power generation in the last fiscal year, it was confirmed that the wind strength of Hanoi City located in the northern part of Vietnam is less than along the central coast and in the south of the country. It means there are not suitable weather conditions to introduce small wind power generation system (Wind-lens) in Hanoi City. However, it was confirmed that the technology applied from Wind-lens which recovers the energy from wind of exhaust ports in the factories could be high potential of business in Viet Nam because of low price and easy installation compare with other technology. Therefore, it plans to consider the formulation of small wind power project in the southern part of Vietnam and to propose the power generation system to introduce the exhaust ports for industrial park in Hanoi City in parallel.

(4) Consideration of JCM Project Formulation with large-scale Renewable Energy

Although in the other province, in this fiscal year, the partner company of this City-to-City Collaboration company adopted one JCM model project by MOEJ which is the first small hydropower project in Viet Nam. In FY2023, the consideration of project formulation in Hanoi City and surrounding area to solve the energy issues continuously, and propose large-scale renewable energy project using JCM subsidy scheme and other supporting scheme.

(5) Consideration of business using new technology (Hydrogen, CCS etc.)

Through technology presentations at technical workshops, green hydrogen derived from renewable energy and CCS technology under development by Japanese companies in Fukuoka Pref. are being introduced, but the number of companies that can use these technologies in Viet Nam is extremely limited. Therefore, it plans to focus on information dissemination under the City-to-City Collaboration and continue consideration of business to introduce these new technologies.

5.2 Proposal of City-to-City Collaboration in FY2022

The following table shows the proposal of next fiscal year’s activities based on the achievements and issues of this fiscal year (Table5-1).

Table 5-1 Proposal of activities in FY2023

Activity	Technology	Overview
The formulation of JCM model project and pilot project	Introduction of energy saving facilities	In order to discover Vietnamese companies, it plans to hold individual seminars with the cooperation of VCCI. In addition, field surveys will be conducted to increase opportunities for companies to propose their unique technologies in FY2023.
	Introduction of solar sharing system	1) Conclude MOU with Vietnamese University in Hanoi city and promote formulation of Co-Innovation project (pilot project) continually 2) Consider formulation of new business with Vietnamese company in the souse Viet Nam.
	Introduction of small wind power generation system	Promote to introducing the applied wind power technology to the exhaust ports mainly in the industrial park and commercial buildings and Wind-lens to Vietnamese company in parallel.
	Introduction of large-scale renewable energy technologies (solar power, wind power)	It plans to conduct information collection of large-scale renewable projects under planning in Viet Nam and promote formulation of JCM model project.
	Introduction of weather observation and forecasting technology	It plans to consider introduction of meteorological observation and forecasting technology to apply renewable energy project and adaptation countermeasure in Hanoi City through technical workshop
City-to-City Collaboration for	Implementation of activities for on climate	1)Providing advice on feasible measures and initiatives for climate change policy and energy

Activity	Technology	Overview
realization of zero-carbon city	change countermeasures under City-to-City collaboration	policy in Hanoi City (particularly promoting the introduction of energy-saving technology) and support on human resource development activity. 2)Planning/Co-sponsorship of technical workshop. 3)Support on formulation of master plan for waste management (garbage separation) in Hanoi City such as data collection.

Source: Provided by Nippon Koei