FY2021 Project for Ministry of the Environment Japan

FY2021
City-to-City Collaboration Programme for Zero-Carbon Society

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

Report

March 2022

Nippon Koei Co., Ltd.
Fukuoka Prefecture

FY2021
City-to-City Collaboration Programme for Zero-Carbon Society

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Report

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Abbreviations

BaU	Business-as-Usual
BRT	Bus Rapid Transit
CCAP	Climate Change Action Plan
CNG	Compressed Natural Gas
COP	United Nations Climate Change conference
DONRE	Department of Natural Resources and Environment
EMS	Eco-drive Management System
EPC	Engineering Procurement Construction
EVN	Vietnam Electricity
GBS Vietnam	Green Building Solutions Vietnam
GEC	Global Environment Centre Foundation
GGS	Green Growth Strategy
GHG	Greenhouse Gas
IMHEN	Vietnam Institute of Meteorology, Hydrology and Climate Change
INDC	Intended Nationally Determined Contribution
JCM	Joint Crediting Mechanism
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MOEJ	Ministry of the Environment, Japan
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
RCEE-NIRAS	Research Center for Energy and Environment-NIRAS
SDGs	Sustainable Development Goals
SS	Solar Sharing
TOE	Tonne of Oil Equivalent
VNEEP	The National Target Energy Efficiency Program
VOC	Volatile Organic Compounds

CHAPTER 1 BACKGROUND AND OBJECTIVE

1.1 Background of the Programme

Paris Agreement which was entered into force in November 2016 and to implementation stage from 2020, mentions not only central governments but non-governmental actors including local governments and cities that need to accelerate their countermeasures to climate change. Also, in "Ministerial meeting of the "Online Platform" on a Sustainable and Resilient Recovery from COVID-19" held in September 2020, confirmed the necessity of zero-carbon policies of local governments leading directly to communities and of the importance of developing of an approach by initiatives of local communities. In Japan, the Government declared that Japan is aiming to become a zero-carbon society by achieving zero emission of overall greenhouse gas (GHG) by 2050 and more than 300 local governments declared net zero emissions.

Roles of cities and local governments are becoming more important to consider for implementing climate change countermeasures and projects in each region. Toward realization of zero-carbon society in the entire globe, it is necessary to accelerate movements to sustainable and zero-carbon society especially in Asia where economic growth is remarkable. Thus, international support for city activities has been implemented for realization of zero/low-carbon society where supporting activities for development of society and economy.

Also, under current situation of COVID-19 pandemic, while tackling issues related to the pandemic, cities are required to re-coordinate and consider new policies to achieve sustainable development. From these perspectives, it is important to develop new measures and cities by collaboration between cities.

In this Programme, by cooperating with Japanese cities with experiences and know-how for development of low-/zero-carbon society, Japanese research institutes, private companies and universities and study for introduction of equipment to contribute to development of low-/zero-carbon society in foreign cities and realization of decarbonization domino.

In FY2021, the project for Zero-Carbon Society between Hanoi City and Fukuoka Prefecture (hereafter "the Project") is positioned as the first 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 at

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.

Furthermore, Fukuoka Prefecture has promoted an 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.

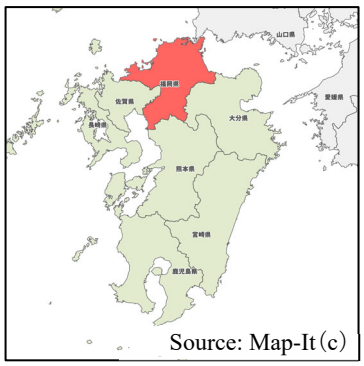


Figure 1-1 Location of Fukuoka Prefecture

As for Hanoi City, the friendship alliance has been concluded 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, by 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 big achievements for improving environmental problems in Vietnam.

Statistical overview of Fukuoka Prefecture is shown in the following table.

Table 1-1 The Overview of Fukuoka Prefecture

#	Item	Statistics
1	Area	4,987 [km^2] (as of 2019)
2	Population	5,138,891 [population] (as of 1 October 2020)
3	Population density	1,031 [population /km^2] (as of 1 October 2020)
4	Num. of household	2,316 [thousand households] (as of 1 October 2020)
5	Num. of private enterprise offices	223,008 [offices] (as of 1 June 2016)
6	GDP (nominal)	19.8 [trillion JPY] (as of March 2018)

Source: Prepared by Nippon Koei base on "FY2021 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

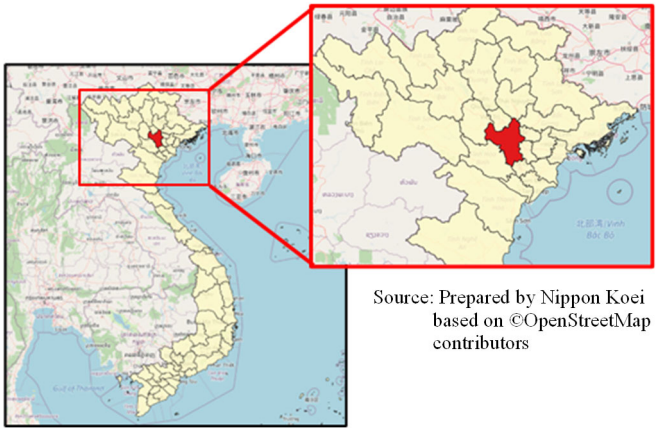


Figure 1-2 Location of Hanoi City

subsidiaries and representative offices of many foreign-affiliated companies.

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 as follows.

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.

Cityscape of Hanoi City
（Web site of Fukuoka Prefecture）

Traffic condition in Hanoi City

Figure 1-3 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 GHG emission reduction by introducing high efficiency equipment/renewable energy technology 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 by. Through the following activities, human resources development and information sharing and also a consideration for introduction of advanced technologies were implemented.

1) Implementation of intercity discussion for realizing decarbonization and SDGs

2) Support for JCM model project formulation in public sector

3) Implementation of online workshop on promoting hydrogen technology

1.4.2 Promotion of Renewable Energy and Energy Saving Equipment

In addition, there are major issues for energy shortage and air pollution due to economic activities in Hanoi City. So, through the City-to-City Collaboration, JCM model project formulation have been considered in wide sectors such as energy saving in factory or building, renewable energy (wind power or solar power generation) in surrounding city area and agricultural area, and utilization of hydrogen technology which Fukuoka Prefecture has been promoting for a long time.

1）Installing building energy saving technologies in public facilities etc.

2）Installing renewable energy in farmlands near Hanoi City

3）Installing renewable energy in Hanoi City

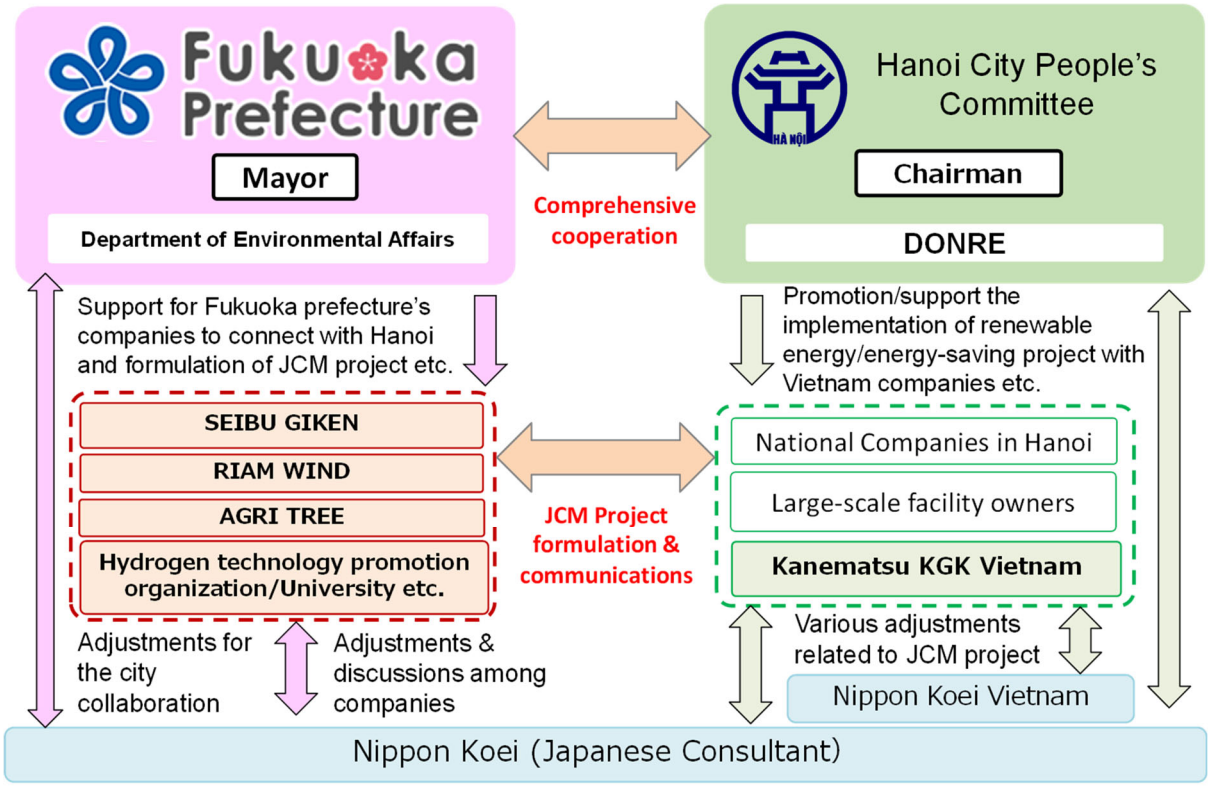
1.4.3 Implementation Structure

Furthermore, studies for formulation of JCM model project were 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 with 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.

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.

As business trips were limited due to COVID-19 pandemic, information collection and consideration of target local companies were implemented through online meetings with Nippon Koei Vietnam (NKV, local subsidiary of Nippon Koei) and Japanese staff of local offices of Japanese companies.

The implementation structure of this project is as follows.



Source: Prepared by Nippon Koei

Figure 1-4 Implementation Structure

1.5 Project Schedule

The project period is from 27 August 2021 to 10 March 2022. The schedule is shown below.

FY2021 Hanoi-Fukuoka City-to-City Collaboration project schedule

#	Contents	Items	2021 Aug	Sep	Oct	Nov	Dec	2022 Jan	Feb	Mar
1. City-to-City Collaboration activities										
1)	Consultations on City-to-City Collaboration between the two cities / policy dialogue	Plan		▽		▽			▽	
		Result		▽ ▽				▽		▽
2)	Information sharing and online training on hydrogen technology	Plan		⇢	⇢	⇢ ▽		⇢	⇢	
		Result		⇢	⇢	⇢	⇢	⇢	⇢	⇢ ▽
3)	Exchange the opinion on related themes (SDGs, etc.)	Plan				▽			▽	
		Result								
4)	Discussions regarding City-to-City Collaboration for the next and subsequent years	Plan				▼		⇢	⇢	
		Result						⇢	⇢	▽
2. JCM model project fomulation			⟷ (The public offering period for the JCM model project in FY2021)							
1)	Consultation and support with stakeholders involved in potential JCM applications forFY2021	Plan		⇢	⇢					
		Result		⇢	⇢					
2)	Web-based consultations with companies on JCM formation and information collection in Japan	Plan		⇢	⇢	⇢	⇢	⇢		
		Result		⇢	⇢	⇢	⇢	⇢		
3)	Information collection surveys using local offices and local staffs	Plan		⟶	⟶	⟶	⟶	⟶		
		Result		⟶	⟶	⟶	⟶	⟶	⟶	
4)	Preparation for the formation of JCM model projects in the next and subsequent years	Plan					⇢	⇢	⇢	
		Result					⇢	⇢	⇢	
3. Events										
1)	Online workshop	Plan			▽				▽	
		Result			▽					▽
2)	Participate in seminars and introduce the projects (online)	Plan								▽
		Result					▽			
4. Regular Reporting and Final report										
1)	Monthly progress report	Plan			▽	▽	▽	▽	▽	▽
		Result			▽	▽	▽	▽	▽	
2)	Briefing for MoEJ (Online)	Plan		▽			▽		▽	
		Result		▽			▽			▽
3)	Consultation with Fukuoka Prefecture and companies (face-to-face or online)	Plan			▽		▽		▽	
		Result		▽ ▽	▽▽	▽▽	▽	▽▽		
4)	Final report preparation	Plan							⇢	▽
		Result					⇢	⇢	⇢	▽

▼ : In Vietnam (Plan) ▽ : In Japan (Plan) ▼ : In Vietnam(Plan) ▽ : In Japan (Result)

⇢ Plan ⇢ Result

Source: Prepared by Nippon Koei

Figure 1-5 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 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

#	Items	Activities
		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.

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.

Source: Fukuoka Prefecture homepage

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. After COP26, the National Power Development Plan has been reviewed, and it is expected that Vietnam will develop a roadmap for carbon neutrality.

(2) Green Growth Strategy 2021-2030

The Ministry of Planning and Investment (MPI) updated the "Green Growth Strategy" formulated in 2012, and it was approved on 1st October 2021. The Green Growth Strategy has set a goal to reduce GHG emissions by 15% by 2030 and 30% by 2050 compared to 2014.

The Strategy is in line with the Socio-Economic Development Strategy 2021-2030, which was developed by MPI. The Green Growth Action Plan will be developed within 1 year after the Strategy is approved.

(3) MOT Action Plan for Climate Change

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 taxies, 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.

(4) Nationally Determined Contribution (NDC)

Vietnamese Government firstly submitted Nationally Determined Contribution (NDC) in November 2016 and then revised it in September 2020. While NDC of 2016 targeted 8% of GHG emission reduction unconditionally and 25% with enough international cooperation by 2030 compared with Business-as-Usual (BaU) scenario, the target of revised NDC is unconditionally 9% reduction and 27% reduction with international cooperation. Reduction targets by sector are listed below.

Table 2-3 Reduction targets by sector in revised NDC

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 and under the national policies, each municipality is carrying out individual policies. The main national policies are as shown below.

Table 2-4 National policies for climate change and energy use in Vietnam

Name of regulation (Date of enforcement)	Objectives
National Strategies on Climate Change (Decision 2139/QD-TTg of the Prime Minister) 05 December, 2011	<u>Specific objectives</u> - To raise national capacity and to carry out simultaneously measures of climate change adaptation and GHG emission reduction to assure safety for people and properties for the sustainable development goals. - To strengthen human and natural system resilience to climate change, develop a low-carbon economy to protect and enhance quality of life, ensure national security and sustainable development in the context of global climate change, and actively join the international community to protect the earth's climate system.

Name of regulation (Date of enforcement)	Objectives
National Target Program to Respond to Climate Change period 2012-2015 (Decision 1183/QD-TTg of the Prime Minister) 30 August, 2012	Specific objectives - 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
Action Plan for Implementation of Paris Agreement on Climate Change **(**Decision 2053/QD-TTg of the Prime Minister) 28 October, 2016	Overall objectives 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. Specific objectives - To fulfil commitments in the Intended Nationally Determined Contribution (INDC) to mitigate GHG emissions - 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;
National Strategies on Green Growth 2011-2020 with a vision by 2050 (Decision 1393/QD-TTg of the Prime Minister) 25 September, 2012	Overall objectives 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.
National Program on Economical and Efficient Use of Energy for the period 2019 – 2030 (Decision 280/QD-TTg of the Prime Minister) 13 March, 2019	Overall objectives "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 Vietnam into a country using energy saving and efficiency. Specific objectives − 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

Name of regulation (Date of enforcement)	Objectives
	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 (hereafter "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 7.8m^2 to 8.1m^2 by 2025 and 13m^2 to 15m^2 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 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: Creared 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 workshop 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.

The previous achievements of the collaboration between the cities are as follows.

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	Start discussion for improvement of environment and decarbonization in Hanoi City

Source: Prepared by Nippon Koei based on infomation 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.

3.1.2 Objective of the City-to-City Collaboration

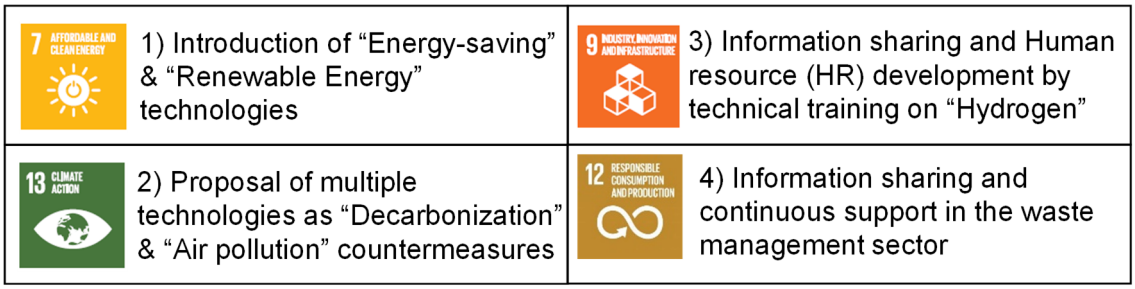
For solving environmental issues in Hanoi City, the Project aimed to conduct collecting and analyze information in order to support on human resources development related to promotion

of zero-carbon and introduction of advanced technologies based on the environmental policies of both cities and basic policies such as SDGs.

In Hanoi City, there are major issues of energy shortage and air pollution due to economic activities. Through the City-to-City collaboration, JCM model project formulation and other activity have been considered in many sectors such as energy saving in building, renewable energy in surrounding city area and agricultural area, and utilization of hydrogen technology which Fukuoka Prefecture has been promoting for long time.

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.



Source: Prepared by Nippon Koei

Figure 3-1 Image of approach of the City-to-City Collaboration

3.3 Achievements of the City-to-City Collaboration

3.3.1 Overview of each activity

Results of the City-to-City Collaboration activities conducted during the Project are presented in the following table.

Table 3-2 Activities of the City-to-City Collaboration in FY2021

Content	Schedule	Description
Kick-off meeting between Fukuoka Prefecture and Hanoi City (online)	1 Sep 2021	-The kick-off meeting among Hanoi City, Fukuoka Prefecture, and Nippon Koei was held via online. Self-introduction each other and confirmation of the project overview were implemented. -In addition, Hanoi City's needs for the workshop was confirmed. -Hanoi City's reference documents related to environmental issues were reviewed.

Content	Schedule	Description
Field survey	6 Sep 2021 ~ 20 Feb 2022	-NKV conducted field surveys, and collected information on the environmental policies of Hanoi City and target facilities/areas for JCM model project.
Kick-off meeting with MOEJ (online)	16 Sep 2021	-Project overview, progress of each activities, and future plan were explained to MOEJ. -MOEJ shared information on Viet Nam-Japan Environmental Week.
Meeting between Fukuoka Prefecture and Hanoi City (online)	28 Sep 2021	-The online meeting among Hanoi City, Fukuoka Prefecture, and Nippon Koei was held. -The project overview was explained, and confirmed agenda contents and schedule of workshop. -Progress of each activity were reported.
The first online workshop	27 Oct 2021	-The participants from DONRE gathered in a conference in Hanoi City, and the participants from other entities inclusive of Japanese project members and private companies in both Hanoi City and Japan joined from each place via online (It took for 2 hours half and total approx. 70 people participated in the workshop). -Energy trend and green building were introduced by Hanoi City. -Four Japanese companies and Kyusyu University introduced technologies regarding renewable energy, energy saving, and hydrogen. -DONRE officers mentioned that it is welcome to consider suitable technologies and technical proposals actively which are considered the environmental issues and circumstance of Hanoi City.
Survey in Japan	1 ~ 5 Nov 2021	-To follow up the online workshop, Nippon Koei visited Fukuoka Prefecture and had meetings with private companies and university from 1 to 5 November 2021.
Participation in Viet Nam – Japan Environmental Week	14 ~ 27 Dec 2021	-Kanematsu KGK Vietnam and Seibu Giken exhibited their booths at "virtual business matching and exhibition", one of the events of Viet Nam – Japan Environmental Week. -Nippon Koei supported as an interpreter for Seibu Giken to introduce their technologies from 15 to 17 December.
Participation in JCM seminar	17 Dec 2021	- "Webinar on the Joint Crediting Mechanism (JCM) Implementation in Viet Nam 2021 – Innovation for Carbon Neutrality through the JCM –" was held during "Viet Nam – Japan Environmental Week", and Nippon Koei gave a presentation on the Project.
Progress meeting to MOEJ (online)	20 Dec 2021	-MOEJ, Fukuoka Prefecture, and Nippon Koei conducted a progress online meeting. According to MOEJ , the achievements of the project will be reported to MONRE after the project -MOEJ informed that "International Forum" to be held in mid-March in 2022.
Final meeting to MOEJ (online)	4 Mar 2022	MOEJ, Fukuoka Prefecture, and Nippon Koei conducted a progress report meeting via online. Report on the status of JCM model projects and co-

Content	Schedule	Description
		innovation projects in City-to-City Collaboration this fiscal year, and activity plans for the next fiscal year.

Source: Prepared by Nippon Koei

3.3.2 Activities related to Institutional support

Activities related to institutional support in FY2021 had mainly three themes, and each has achievements as discussed below. (Attachment-1)

(1) Implementation of intercity discussion for realizing decarbonization and SDGs

<Countermeasures against open burning at farmlands>

One of the urgent environment problems in Hanoi City is air pollution caused by open burning of rice straw at farmlands (paddy) in/ near the city. To solve this problem, Fukuoka Prefecture collected and summarized valuable information about use of rice straw for useful activities in Japan, and shared this information with Hanoi City in the following materials. These materials were translated into Vietnamese so that they could be shared with not only Hanoi City officers but also local farmers.

Countermeasures against Open Burning of Rice Straw Shared by Fukuoka Prefecture

1. **Use of rice straw in Japan**
   - Annual production: approx. 8.2 mil. ton/year, Import: approx. 0.2 mil. ton/year
   - Japanese government has promoted the further utilization of domestic rice straw recently.
   - Approx. 0.7 mil. ton/year is used as livestock feed and the remaining amount is plowed into soil or used as fertilizer.
2. **Regulations of open burning in Japan**
   - Open burning is banned by Waste Disposal Act in Japan.
   - The penalty is a five-year imprisonment or a fine below ten million JPY (approx. 2 billion VND).
   - The exception is allowed for unavoidable cases for farming, incineration at disaster site, religious ceremony and minor open fire.
3. **Issues on open burning in Fukuoka Prefecture**
   - Open burnings are sometimes occurred in Fukuoka Pref., as exceptional cases.
   - There are concerns about the impact of bad odour and smoke nuisance in surrounding area and the occurrence of fires and traffic obstacles caused by open burning.
4. **Measures by Fukuoka Prefecture**
   - "Plowing into soil with rice straws " is recommended to farmers in Fukuoka. It is able to increase organic substances in soil and improve soil quality. To promote and disseminate this activity, a leaflet on "good practice of soil cultivation" (see Case 1 in the next slide) was prepared by Fukuoka Prefecture.
   - Saga Prefecture where is next to Fukuoka, has subsidized for agricultural land that introduced plowing using rice straw.
   - Other good practices for utilization of rice straw;
     -Collection and sales of rice straw conducted by livestock feed farmers (see Case 2 in the next slide), and
     -Spreading rice straw on agricultural fields at the time of planting (see Case 3 in the next slide)

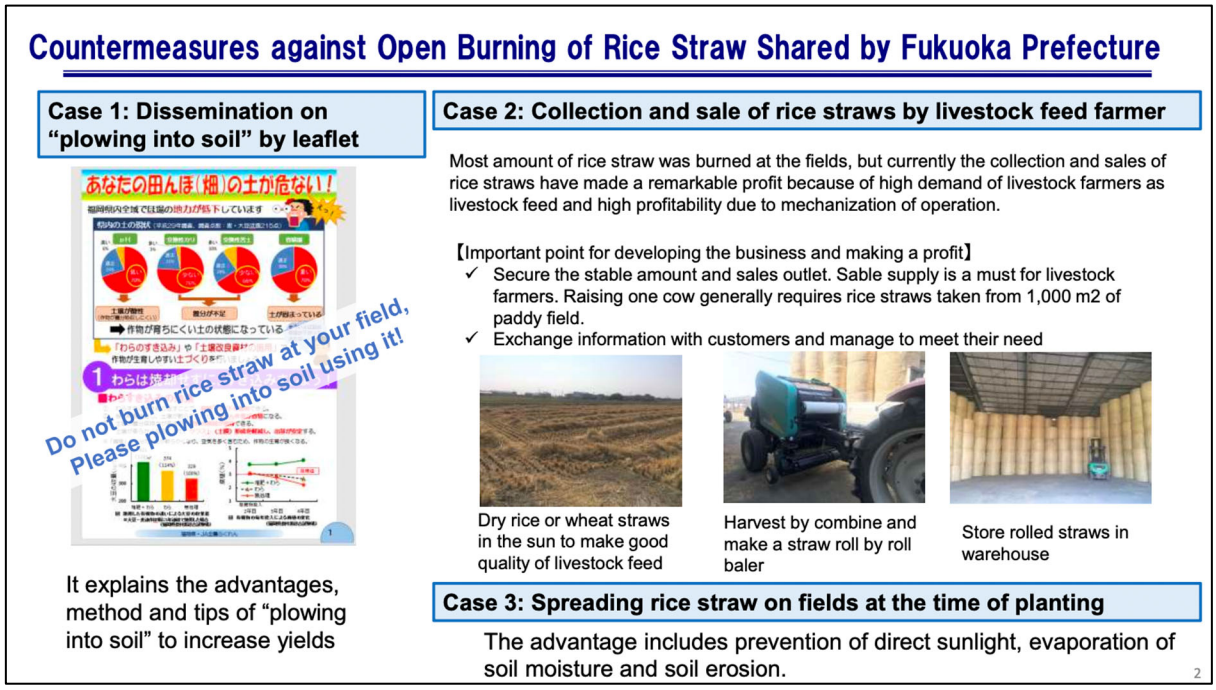
Sourc: Prepared by Fukuoka Prefecture and Nippon Koei

Figure 3-2 Countermeature against Open Burning (1/2)

Fukuoka Prefecture has had the same issues and created a leaflet that explains a practical use of rice straw as the following figure. It is possible that Fukuoka Prefecture share their know-how on it with Hanoi City if they are interested in these methods or technologies. Furthermore,

the case of promotion of plowing into soil using rice straw, an added value of using rice straw as livestock feed, and an effectiveness of spreading rice straw on fields at the time of planting can be introduced by Fukuoka Prefecture to Hanoi City.

After FY2022, it is expected to share a more detailed information and solve this environmental issue through the intercity collaboration.



Source: Prepared by Fukuoka Prefecture and Nippon Koei

Figure 3-3 Countermeature against Open Burning (2/2)

<Smart collection system of solar panel waste in Fukuoka Prefecture>

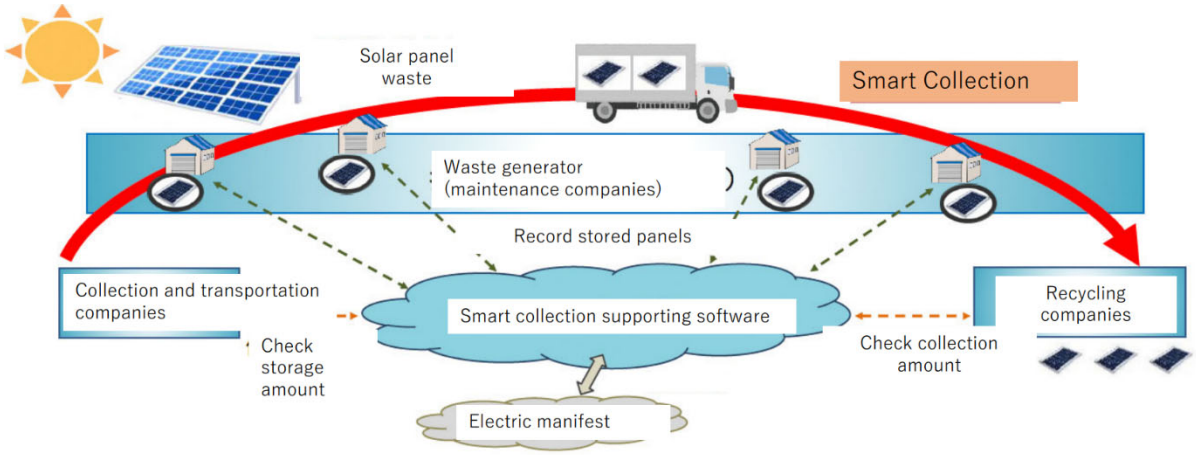
In the Project, Japanese company' s technologies regarding solar power generation, which is described later, was introduced and the study for JCM model project formulation on solar sharing (SS) was conducted. Several facilities in Hanoi City have already installed solar power generation, and it is expected that management of used solar panels will be new environmental issues in the future. So, in parallel with JCM model project formulation, Fukuoka prefecture shared their know-how and policies with Hanoi City about PV panels waste management.

Concretely, the current situation in Japan regarding disposal and recycling of PC panels was summarized as well as relevant guidelines on these topics. In addition, "smart collection system of solar panel waste" developed by Fukuoka Prefecture and treatment/ recycling technology of solar panel waste by private companies in Fukuoka Prefecture were explained to Hanoi City.

In the system "smart collection system of solar panel waste" developed by Fukuoka Prefecture and Fukuoka Research Commercialization Center for Recycling Systems, maintenance, transportation, and PV recycling companies share PV panel information (storage amount, location, type), scheduled collection date, amount. Etc. on the cloud server, and efficiently collect waste PV panels scattered through the prefecture.

Furthermore, Shinryo Corporation located in Fukuoka Prefecture owns a technology which the material recycling rate is 82% (the total recovery rate including heat recovery is 99% or more), and this is the first recycling technology in Japan to recover glass, silver, and copper with almost 100% purity.

In addition, Hanoi City has shown interest in waste management of battery attached in solar power generation facilities, so it is expected to share information relevant Japanese technologies and policies through intercity discussion in FY2022.



Source: Circulation Society Promotion Division, Fukuoka Prefecture

Figure 3-4 Smart collection system of solar panel waste in Fukuoka prefecture

<Information of waste collection system and samples in Japan>

Due to the request form Hanoi City, information of the current collect waste system in Japan and Fukuoka Prefecture were summarized as described below.

In Japan, municipalities collect general waste (household, business garbage, and human waste), and the sorting method varies from municipality to municipality. About 80% of municipalities in Japan have sorted household waste into more than 10 types. (2016)

Example of types for garbage separation: Combustible garbage, non-combustible garbage, paper such as waste paper, metals such as empty cans, glass such as bottles, resource garbage such as plastic bottles and clothing, large bulky garbage such as furniture and bicycles, etc.

The total cost for collection and disposal of general waste in Japan is about 19.6 billion JPY (about 3,872.8 billion VND). The average cost per person per year is 15,300 JPY (about 3.02 million VND). Most of the expenses are covered by taxes, but about 80% of municipalities in Japan collect collection fees which is paid for garbage bags by residents.

Measures to promote waste separation and waste reduction

[Regulatory Approach] - Mandatory of recycling of home appliances and automobiles

[Economic Approach]

- Introduction of fee-based designated garbage bags (increased from around the 1990s)
- Charging for plastic shopping bags (from July 2020)

- 38 local governments out of 60 in Fukuoka prefecture introduced a subsidy system for purchasing garbage disposer.

Awareness raising of sorting method: Posting on website, creating educational videos and posters, distributing pamphlets, wards for excellent business operators and activity groups, briefing meeting for residents, etc.

In Fukuoka prefecture (consisting of 60 municipalities), all municipalities except one have introduced designated paid garbage bags. The fee of designated paid garbage bags of municipalities in Fukuoka Pref. is shown in the below table. Residents purchase garbage bags at designated stores in residential municipalities.

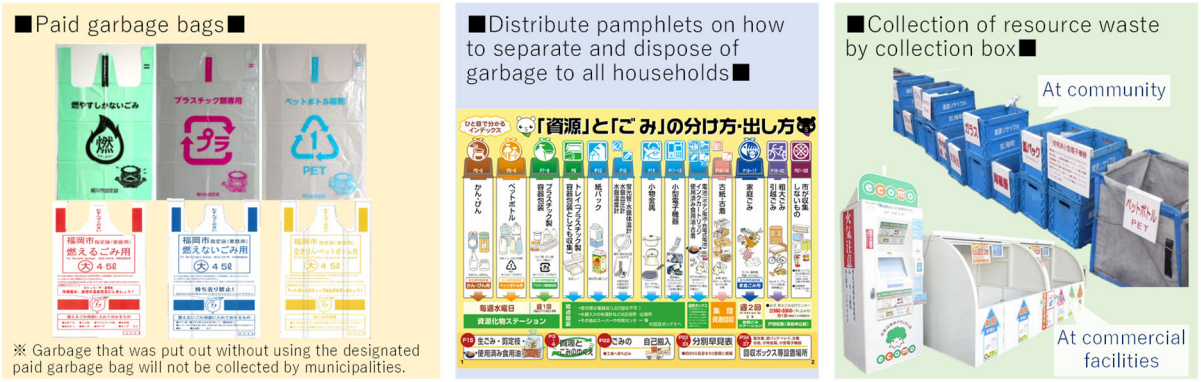


Figure 3-5 Sample of waste collecting system in Fukuoka

(2) Support for JCM model project formulation in public sector

In public sector, Hanoi City's city hall, education facilities such as schools, hospitals, public transportation system, and industrial parks managed by the national government can be target areas for JCM model project. In FY2021, to grasp a potential of zero-carbon in public sector, a mechanism of JCM scheme and relevant technologies were introduced to Hanoi City. In addition, to confirm needs of a building energy saving and renewable energy in Hanoi City, it was requested to local government (inclusive of person in charge of each district in Hanoi City) to share information at the online meeting or the online workshop.

In next fiscal year, it is planned to summarize and analysis the collected data, consider GHG emission reduction amount, an implementation structure, and budget acquisition for JCM model project formulation.

(3) Implementation of online workshop on promoting hydrogen technology

According to the result of discussion with Hanoi City, it was judged that a holding a workshop on prompting hydrogen technology was premature itself because relevant knowledge sharing or introduction of hydrogen technologies hadn't been included in the past activities. Therefore, at online workshop, basic information and use case of hydrogen usage were shared with the participants from Vietnam as a first step, for considering the utilization of renewable energy (solar energy / wind power) and agricultural land-derived biogas. The details of hydrogen technologies which were shared in the workshop are described in the next section.

3.3.3 The first workshop (online)

The first online workshop was held by DONRE of Hanoi City and the Environmental Policies Division of Fukuoka Prefecture on 27 October 2021. The participants from DONRE gathered in a conference in Hanoi City, and the participants from other entities inclusive of Japanese project members and private companies in both Hanoi City and Japan joined from each place via online. Total approx. 70 people participated in the workshop.

In the workshop, Nippon Koei gave an overview of the Project, RCEE-NIRAS explained energy trends in Hanoi City, and finally GBS Vietnam introduced their activities on green building. After that, Seibu Giken Co., Ltd. introduced their technologies related to building energy saving and factory's exhaust management, Agritree Co., Ltd. introduced solar sharing (SS), RIAMWIND Co., Ltd. introduced wind turbine systems using "Wind-Lens Technology", and Kanematsu KGK Vietnam gave a presentation about a project of large-scale PV panel as the case of JCM model project. In addition, Kyusyu University explained about hydrogen technologies by using biomass in order to share a basic knowledge on hydrogen.

DONRE officers mentioned that it welcomes to consider suitable technologies and technical proposals actively which are considered the environmental issues and circumstance of Hanoi City. In the closing remarks from Fukuoka prefecture, it was shown that they are positive to make their efforts toward decarbonization for improving environment in Hanoi City through intercity collaboration.

The agenda of the workshop is as follows, and the presentation materials are attached as Attachment-2.

Table 3-3 Agenda of the first online workshop

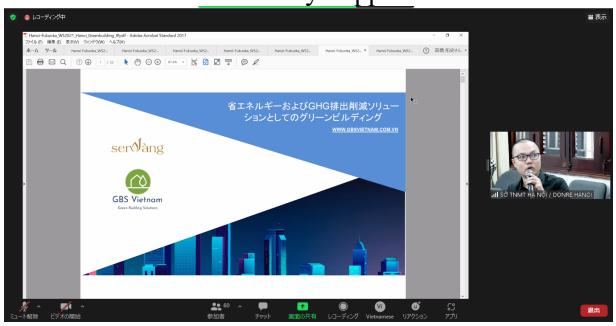
#	Time (VST)	Agenda	Speaker
1.	13:00-13:10	Opening remark and guest introduction	Ms. Luu Thi Thanh Chi, Hanoi DONRE
2.	13:10-13:20	Outline of City-to-City Collaboration and JCM subsidy scheme	Ms. Aki Baba, Nippon Koei Co., Ltd.
3.	13:20-13:35	Current situation about energy usage in Hanoi city	Mr. Nguyen Trong Nghia, RCEE-NIRAS
4.	13:35-13:50	Green infrastructures – Solutions to save resources and reduce greenhouse gas emissions	Mr. Trinh Tung Bach, GBS Vietnam
5.	13:50-14:30	Technological introduction by Japanese companies 1) Seibu Giken: Energy save for buildings + Factory exhaust treatment 2) Agritree: Solar sharing 3) Riamwind: Small size wind power 4) Kanematsu KGK Vietnam: Large scale PV projects	1) Ms. Kanako Sugi, Seibu GikenCo., Ltd. 2) Mr. Koji Nishi, Agritree Co., Ltd. 3) Mr. Wakaki Tominaga, Riamwind Co., Ltd. 4) Mr. Shuhei Morita and Ms. Dinh Thi Ha Quynh, Kanematsu KGK Vietnam Co., Ltd.

#	Time (VST)	Agenda	Speaker
6.	14:30-14:40	Introduction of hydrogen energy derived from biomass and renewable energy	Mr. Yusuke Shiratori, Associate Professor of Kyushu University
7.	14:40-14:55	Q & A	
8.	14:55-15:00	Closing remark	Ms. Seiko Shiroishi, Section manager of Fukuoka Prefecture

Source: Prepared by Nippon Koei

Presentation by Nippon Koei

Presentation by RCEE-NIRAS



Presentation by GBS Vietnam

Presentation by Japanese company

3.3.4 Viet Nam-Japan Environmental Week

MOEJ and MONRE jointly organized a virtual event "Viet Nam-Japan Environmental Week" on from 14 to 27 December 2021. In this event, thematic seminars related to environmental infrastructure and technology was held in order to discuss needs and seeds on the latest environmental policies, market trends, and solutions (e.g. environmental technologies) for private companies or administrative officers in both countries. In addition, virtual business matching and exhibition were also organized aiming to create an opportunity of discussing new business or deals among participants from both countries that were interested in environmental solutions. Seibu Giken Co., Ltd. and Kanematsu KGK Vietnam, they are the partner companies for the Project, also participated in the virtual business matching and exhibition to introduce their technologies.

During the period of this event, "Webinar on the Joint Crediting Mechanism (JCM) Implementation in Viet Nam 2021 – Innovation for Carbon Neutrality through the JCM –" was held by MOEJ, Global Environment Centre Foundation (GEC), and MONRE, and Nippon Koei gave a presentation to introduce the Project at the webinar.

The schedule of the event is shown below, and the presentation material presented by Nippon Koei at the webinar is shown in Attachment-3.

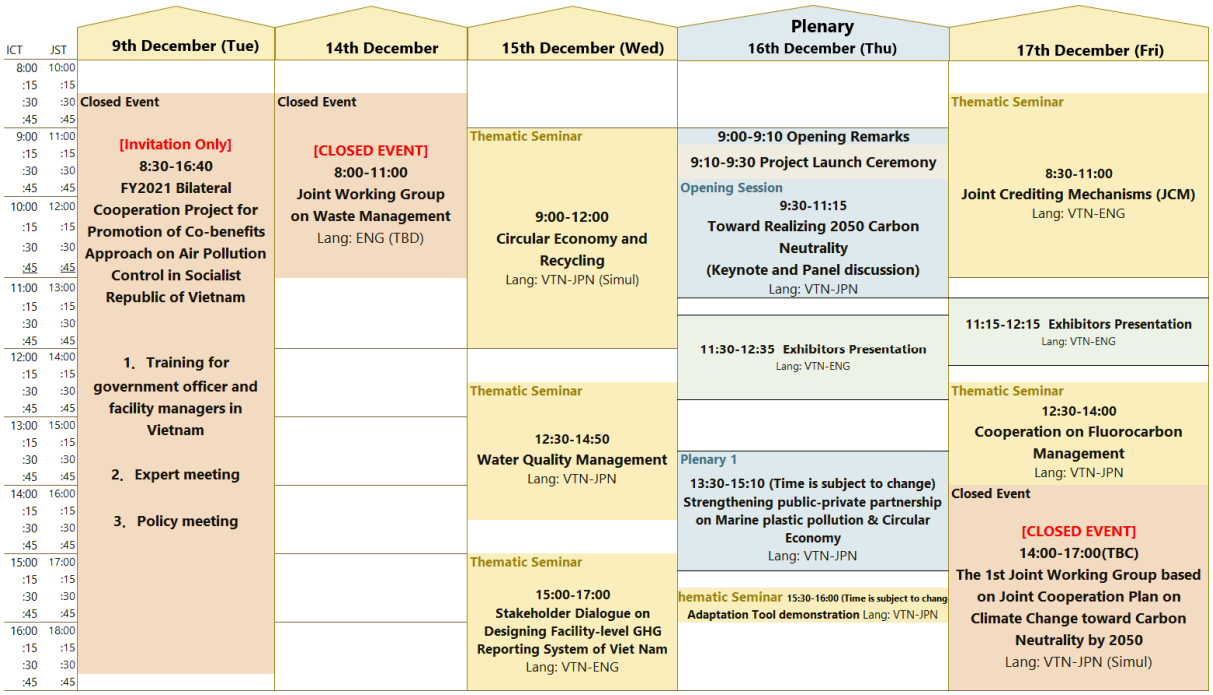


Figure 3-6 Schedule of Viet Nam-Japan Environmental Week

Source: Website of Viet Nam – Japan Environmental Week（https://www.jprsi.go.jp/ew2021vn/event_jp.html）

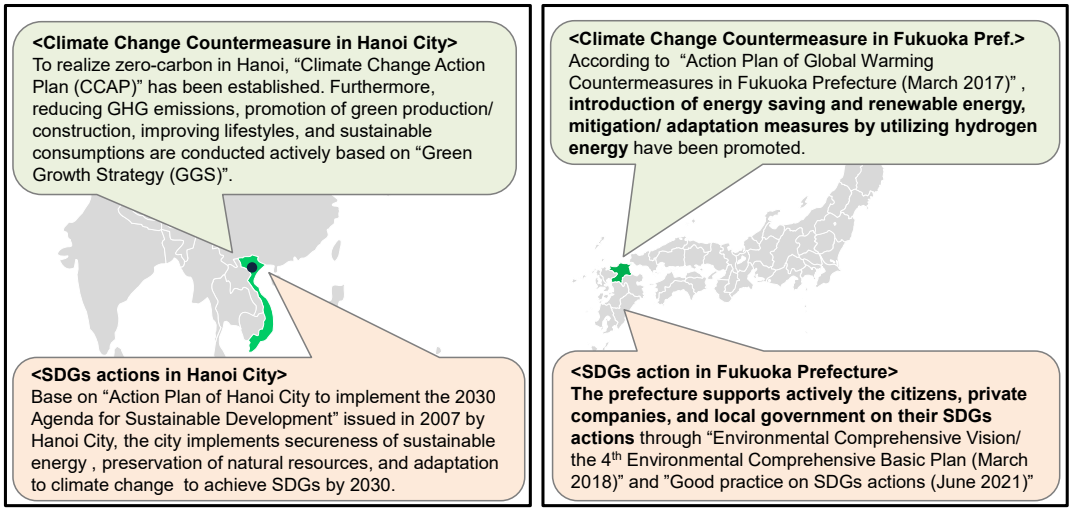
3.3.5 The Second International Forum organized by MOEJ

The online city-to-city collaboration seminar originally scheduled for this year was integrated into the Second Zero Carbon City International Forum hosted by MOEJ on 9-10 March 2022. 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.

In the Forum, leading subnational climate policies and actions and city-to-city collaborations to expanding "Decarbonization Domino Effect" ware shared. The activities of this city-to-city collaboration project between Hanoi City and Fukuoka Prefecture were submitted as results report documents (Japanese and English PPT)as below, and posted during the Forum.

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

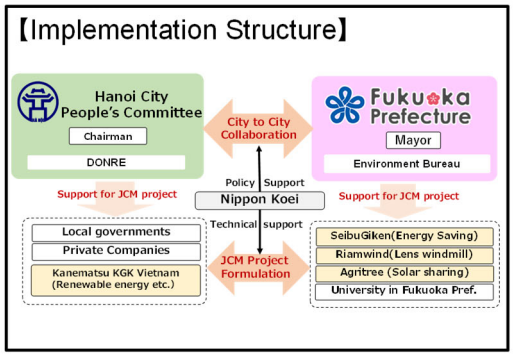
Fukuoka Prefecture and Hanoi City has started friendship relation since 2008 and conducted various activities such as a training for environmental officers of Hanoi City and an environmental education seminar under the environmental cooperation agreement since 2010. In this City-to-City Collaboration, 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 3-7 Draft Materials of introducing the Project (1/2)

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



Activities/ Achievements
<Local government>
- Intercity discussion via online: 3 times
- Online workshop: twice

<Private companies/ university>
-Field survey (review on policies, meetings with local companies, collecting information on factories/buildings in Hanoi City)
- Introduction of zero-carbon technologies at the Vietnam JCM seminar
- Introduction of zero-carbon technologies at the online workshop
- Creation of presentation contents in Vietnamese and movie materials
- Implementation of wind condition simulations

Achievement:
(1) Information sharing on environmental technologies by Fukuoka Prefecture
- Smart collection system of solar panel waste
- Countermeasures against open burning (utilization of agricultural-derived biomass)
- Japan's garbage separation and collection system, and the relevant efforts

(2) Suggestion of applicable technologies to JCM
- Solar sharing
- High-efficiency small wind turbine systems (Lens windmills)
- Building energy saving system (heat exchangers)
- Fuel conversion technology (VOC concentrator for factories)
- Biomass-derived hydrogen technology (fuel cell)

(3) Formulation of the Co-Innovation project (one candidate project)

Source: Prepared by Fukuoka Prefecture and Nippon Koei

Figure 3-8 Draft Materials of introducing the Project (2/2)

CHAPTER 4 JCM MODEL PROJECT FORMULATION

4.1 Collecting Information for Project Formulation and the Result of Study

In this fiscal year, the following three themes was considered for formulating JCM model project.

1） Installing building energy saving technologies in public facilities etc.
2） Installing renewable energy in farmlands near Hanoi City
3） Installing renewable energy in Hanoi City

In addition, regarding the above three themes, a field survey in Japan and an online survey in Hanoi City were implemented to summarize information to ensure realization of project formulation in next fiscal year.

4.1.1 The Result of Field Survey in Japan

A field survey related to the following areas was conducted to support decarbonization and improving environmental problems in Hanoi City.

1) Information collection about countermeasures to open burning and utilization of rice straw
As section 3.3.2 shows, information on countermeasures to open burning and utilization of rice straw in Fukuoka Prefecture was collected and interview surveys with relevant stakeholders were conducted as well. The documents summarized these results was shared with Hanoi City, and the city became interested in a brochure for farmers published by Fukuoka Prefecture in order to use a reference document. So, as a content of this intercity collaboration, Fukuoka Prefecture will give some advice about workshop contents and introduce professionals about this field in an online workshop.

2）Information collection about collecting and recycling of PV panels waste
As section 3.3.2, information on the cases of wasted PV panel's collecting/ recycling system in Fukuoka Prefecture was collected and interview surveys with relevant stakeholders were conducted. Hanoi City has very high interests in these technologies because they have an apprehension of big environmental problem in the future due to solar panel waste from the areas where currently they installed or planned to install solar power technology.
The summary document was explained at the 2nd workshop to share the information with local government and private companies. Not only formulating projects regarding solar power generation which is considered in the Project, but also support on technology transfer related to solar panel waste collection/ recycling system in Hanoi City which is expected in the future.

3）Information collection on garbage separation
According to Hanoi City, it was cleared that the city is going to establish a policy and a plan regarding garbage separation within 2022 and submit them to the national government. So,

information about relevant systems and policies in Japan and Fukuoka Prefecture was shared with Hanoi City.

In Hanoi City, a project called "Implementation support for 3R INITIATIVE of Hanoi City for Cyclical Society" from 2006 to 2009 was implemented by JICA, so it seems that the city has basic knowledge about garbage separation and collection. Therefore, in the City-to-City Collaboration in the next fiscal year, a consideration of applicable technologies and providing know-how or information to encourage citizens to contribute decarbonization are expected to be implemented.

4) Information collection on technologies of participant companies in Japan

Technical information was collected by visiting facilities of RIAMWIND Co., Ltd. and Seibu Giken Co., Ltd. (these two companies are participant companies of the Project) and a hydrogen station owned by Kyusyu University. In Hanoi City, installing renewable technologies which are applicable to urban area such as small wind power and solar power at farmlands, and also energy saving technologies in commercial building or factories are especially expected. Based on this situation, by understanding more deeply these technologies, the probability of realizing project formulation is expected to be high. These collected information will be utilized to formulate JCM model project in the next fiscal year.

4.1.2 The Result of Online Survey in Hanoi City

The study was conducted with the following survey items to consider JCM model project formulation in both this and next fiscal year, and also utilize them as reference information for technology transfer and implementing the policies. The approaches of the study were interview survey with the people concerned about these items, information collection by local staffs, a review of relevant documents, and field survey.

Table 4-1 Overview of the online survey in Hanoi City

Survey items	Overview
1) Collecting information and review on current environmental policies and climate change countermeasure in Vietnam and Hanoi City	Information on current policies and activities related to Hanoi City such as Green Growth Strategy, CCAP, and SDGs was collected. And the overview of the national government's climate change countermeasure and the Zero Carbon Declaration after COP26 held in November 2021 were reviewed.
2) Collecting information and interview survey on large commercial facilities and factories in Hanoi City	Collecting information on large commercial facilities and factories which emit a lot of GHG in Hanoi City and the making a list of these facilities were conducted. Furthermore, contact information, photos of facilities, and building age was additionally collected based on the information from local companies which consume huge energy in Hanoi City in order to consider JCM model project formulation.
3) Collecting information and interview survey on exhausted gas regulation in Vietnam	To confirm potential of installing VOC concentrator developed by Seibu Giken Co., Ltd., collecting information on exhausted gas regulation in Vietnam

Survey items	Overview
	and interview survey to local companies were implemented.
4) Collecting information and field survey on transportation sector in Hanoi City	To consider installing zero-carbon technologies in the logistics and transportation sectors in the future, field survey was conducted in major roads in Hanoi City. In the survey, information on traffic situation and the installation situation of LED streetlights were mainly collected.

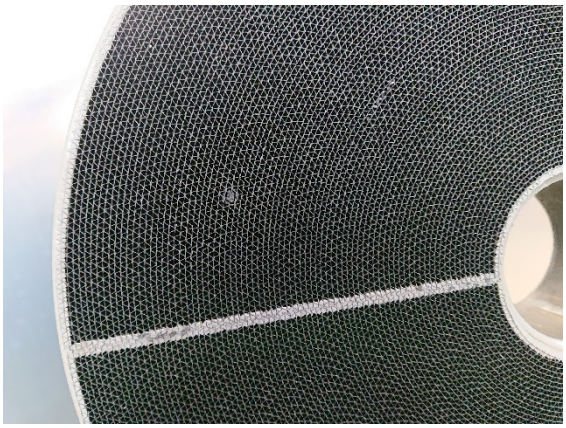
Source: Provide by Nippon Koei

4.2 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)

4.2.1 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 considered for formulating a project.

Seibu Giken Innovation Center



Core technology: Honeycomb structure

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 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 energy a lot 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.

Hotel in Hanoi City
Sourse: Website of Sofitel Legend Metropole Hà Nội. (**https://www.sofitel-legend-metropole-hanoi.com/vi/**)

Shopping mall in Hanoi City
Source: website of Vincom (https://vincom.com.vn/vincom-center-ba-trieu)

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 Overview of the Study to Installing Total Heat Exchanger and VOC Concentrator

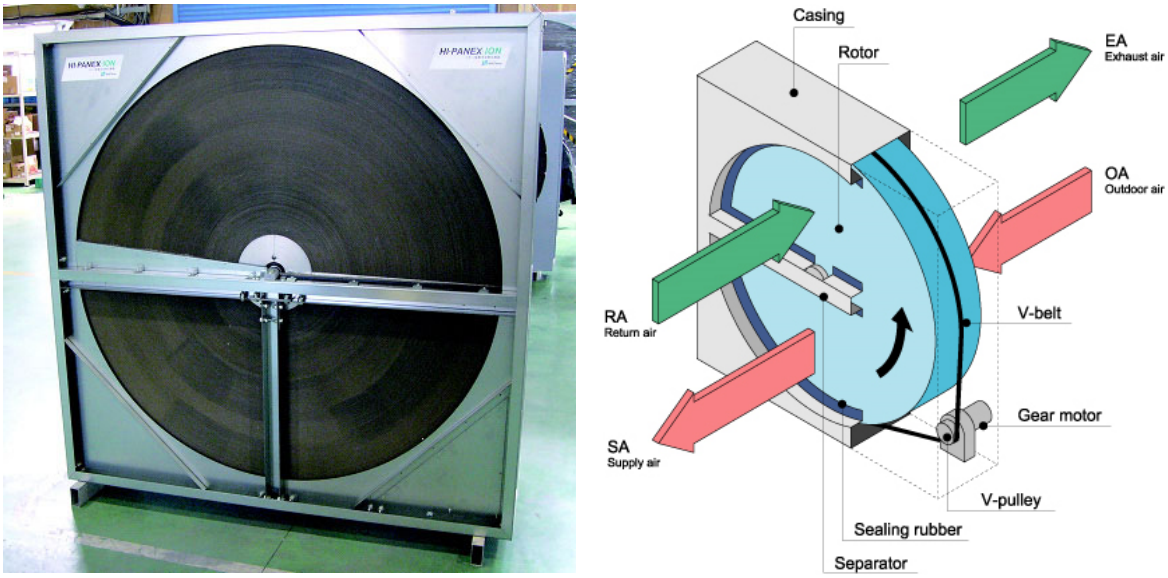
#	Survey item	Overview
1	Collecting information on local public facilities, large-scale commercial facilities, buildings, hotels, and factories	The survey was conducted with local staffs to collect information on local public facilities, large-scale commercial facilities, buildings, hotels, and factories 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 CO2 emission reduction were tentatively calculated.
4	Consideration of international consortium	International consortium and implementation structure were considered for applying to JCM model project.
5	Site visit in the Seibu Giken Innovation Center	Site visit to Seibu Giken Innovation Center was conducted, where is a research institute of the company and where also implement research on honeycomb filter, core technology of Seibu Giken. (November 2021).

Source: Provided by Nippon Koei

4.2.2 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 an equipment 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. This technology is expected to contribute to reduce GHG emissions by reducing the amount of electricity consumption of air conditioning system.



Source: Seibu Giken

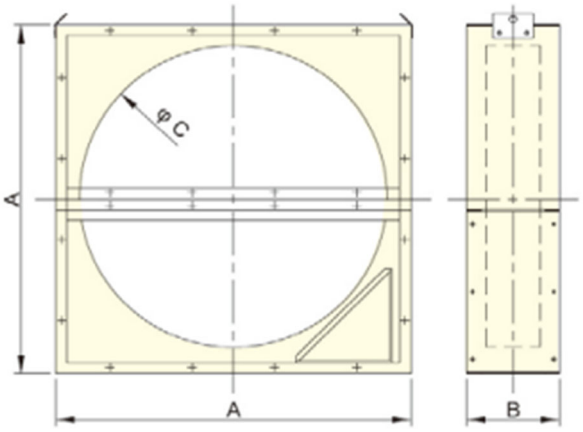
Figure 4-1 Total heat exchanger for general air conditioning system (HI-PANEX-ION) (left) and its sketch (right)

Specification of the technologies expected to be installed is as follows.

Table 4-4 Specification of total heat exchanger for general air conditioning system

Items		Expected Specification (PAU-FP950T)
Air flow*1 (㎥/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 4-2 Size of HI-PANEX-ION

An advantage of HI-PANEX-ION is shown in the table below.

Table 4-5 Advantage of HI-PANEX-ION

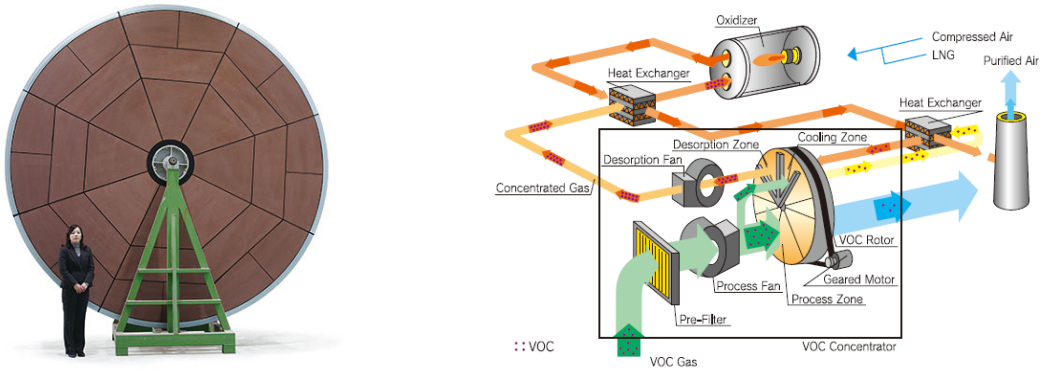
#	Advantage	Overview
1	Excellent energy saving effect	Since it is a rotor rotation countercurrent system, it is highly efficient and exhibits excellent energy-saving effects.
2	Prevention of odor transfer	The world's first ion exchange resin polymer absorbent that does not easily adsorb odors is used 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 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. 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

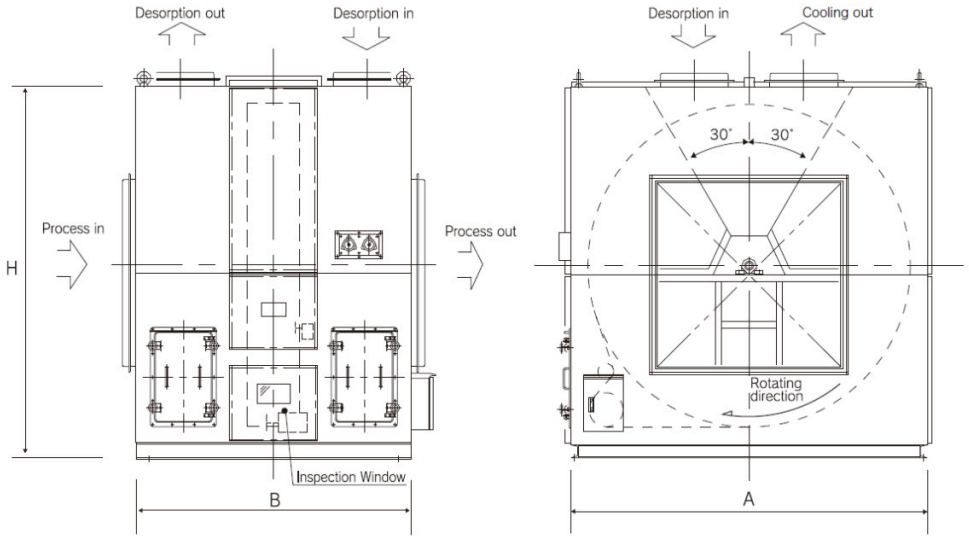
Figure 4-3 VOC Concentration Rotor (left) and VOC Concentrator (right)

Specification of the technologies expected to be installed is as follows.

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

Items		Expected Specification (VMUⅢ-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 Nm/s in front of the rotor, zone division 10: 1: 1, when concentrated 10 times.



Source: Seibu Giken

Figure 4-4 Size of SKY-SAVE

Advantage of SKY-SAVE are shown in the table below.

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 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.

4.2.3 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 consume energy a lot was conducted. As a result,

information of approx. 40 facilities was collected and summarized. The following table shows the survey items for the target facilities. Based on this information, interview survey to local companies will be implemented in the next fiscal year.

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 CO_2 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"

4.2.4 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 the case in Japan. As shown in the table below, assuming that the air conditioning load by human per one floor is 3,375 m^3/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	− 1 Floor = 3,375 m^3/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) − 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	

#	Item	Value	Unit	Remarks
f	Annual GHG reduction	308.7	tCO2/year	= d×e
g	Design lifetime	15	Year	Statutory durable years of Japan
h	Total GHG reduction	4,631	tCO2	= 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/tCO2 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/Nm^3 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.

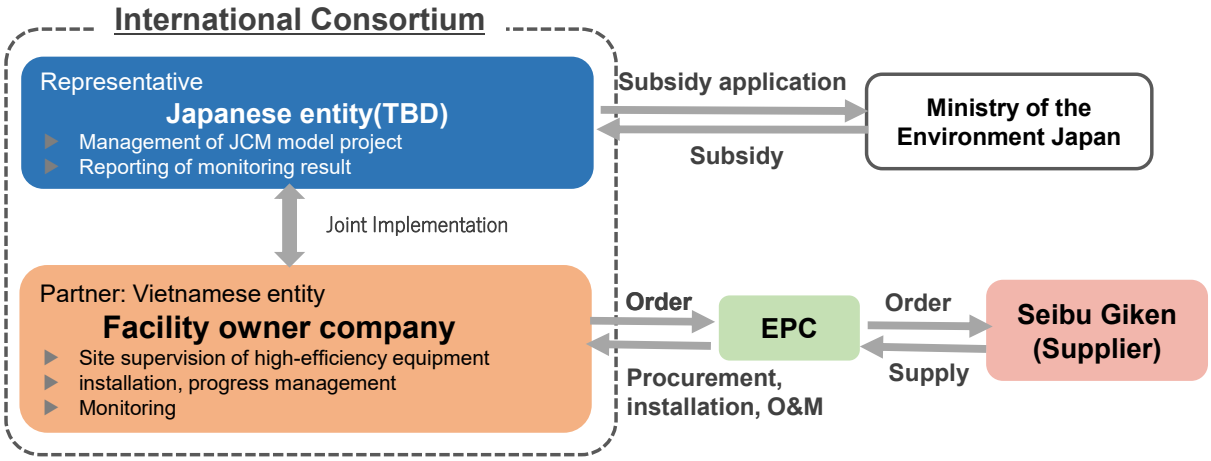
Table 4-10 Estimation of GHG Emission Reduction by Installing SKY-SAVE

#	Item	Value	Unit	Remarks
				General Conditions – Xylene: 400 mg/Nm^3 – Operating time: 8,500 h/year – Processing Air Volume: 140,000Nm^3/h
a	Fuel consumption (Reference)	5,911	tCO2/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	tCO2/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	tCO2/year	= a-b
e	Design lifetime	15	Year	Statutory durable years of Japan
f	Total GHG reduction	88,620	tCO2/15year	= d×e

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

4.2.5 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 4-5 Image of International Consortium (Seibu Giken)

4.2.6 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 consumptions, 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, MRV plan will be considered in detail.

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

4.3.1 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.

- 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 4-6 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.

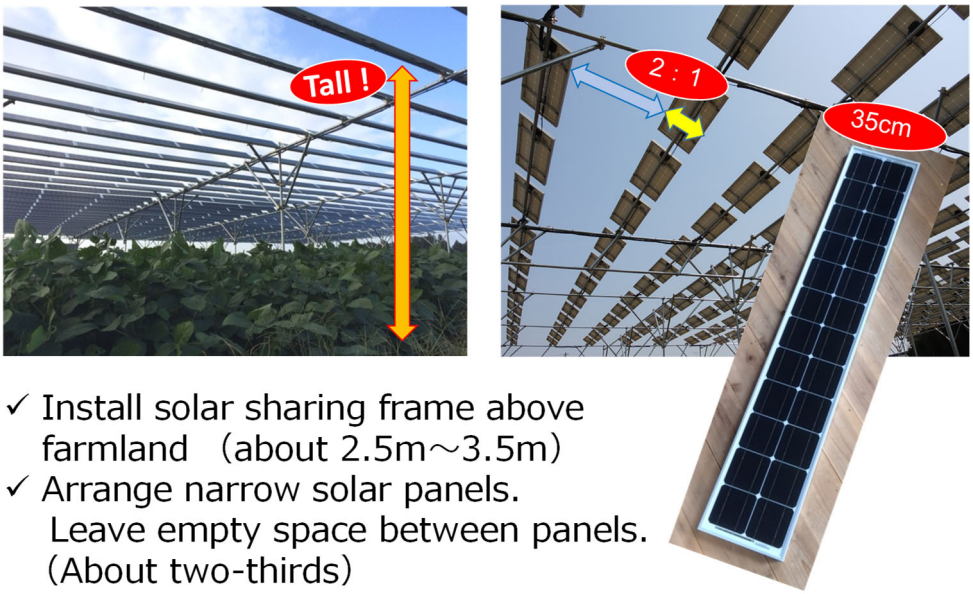
Table 4-11 Survey Items and its Overview for installing Solar Sharing

Interviewee	Overview
Hanoi City, DONRE	Farmland's condition near Hanoi City, situation of energy usage, and governmental supports for farmers by Hanoi City etc.
Agricultural companies	Status of greenhouse installation in Vietnam, market trends of value-added crops such as fruits, exchange opinions of installing solar sharing etc.
Agricultural university	Possibility of installing solar sharing in Vietnam, candidate crops, possibility of implementing demonstration project in the university

Source: Provided by Nippon Koei

4.3.2 Specification of the technology expected to be installed

Solar sharing uses narrow panels to avoid them from 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 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.



Source: Agritree's presentation material

Figure 4-7 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 values of crops, it is essential to connect to a

facility that can consume the generated electricity without waste. As follows, an ancillary equipment expected to be installed 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

4.3.3 Overview of the study

Through the above interview survey, it was confirmed that Hanoi City has a serious air pollution due to open burning in farmlands near the city and there is a possibility to install solar sharing into cultivated field, paddy and green house such as strawberries.
According to Hanoi City, the main reason of continuing open burning is that agricultural waste (mainly rice straw) has not been properly managed and treated, and extensive and inexpensive methods are being continued. In addition, indirect reasons may be the low income of farmers and the lack of knowledge and skills regarding current environmental regulations and farming. Since the installing of solar sharing is expected to improve agricultural management (income), it is also expected that farmers will be able to manage the cost for appropriate management of agricultural waste disposal.

Through several online discussions with people to concerned in agricultural university in Hanoi City, it was decided to consider concrete way of implementation of solar sharing project inclusive of applying to “Financing Programme to Demonstrate Decarbonization Technology for Realizing Co-Innovation (hereinafter called “Co-Innovation Project”) funded by MOEJ in the next fiscal year.

4.3.4 Draft project plan and feasibility evaluation

In the Project, it was not possible to grasp the actual situation of the farmlands due to the spread of COVID-19 infection, so the business plan was considered based on the information and advice from the local universities at candidate target farmlands and applicable multiple crops to those lands.

The draft design and tentative calculation of the amount of power generation when solar sharing system is installed were considered with the two fields of paddy and farmland as a candidate areas of demonstration project.

Table 4-13 Estimation of GHG emission reduction of Solar Sharing

Items	results	Remarks
Estimated annual power generation	150-200kW	Paddy field and crop land
GHG emission factor	0.533 tCO2/MWh	Vietnam, Renewable energy, based on GEC material.
Total GHG emissions reduction	To be considered in FY2022	
Rate of subsidy	To be considered in FY2022	
Cost efficiency	To be considered in FY2022	Cost effectiveness for the subsidy
Project cost	Depend on the installing location, the project cost will be different. (To be considered in FY2022)	Equipment cost and installation cost (without civil work)

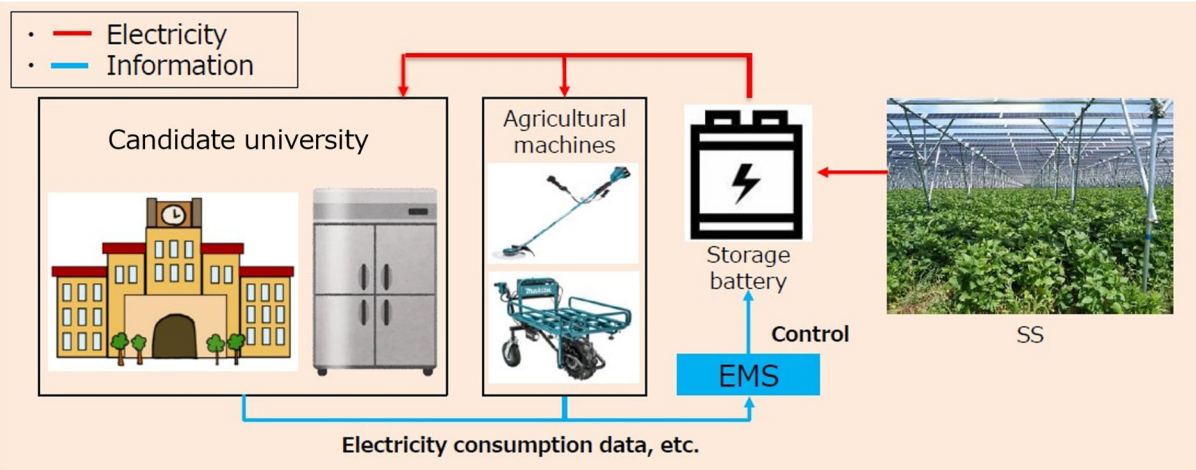
Source: Provided by Nippon Koei

Source: Editing and processing photos provided by Google Maps and local universities

Figure 4-8 Field in the university (candidate farmland)

Source: Editing and processing photos provided by Google Maps and local universities

Figure 4-9 Field in the university (candidate paddyx)



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

Figure 4-10 Image of business plan (Agritree)

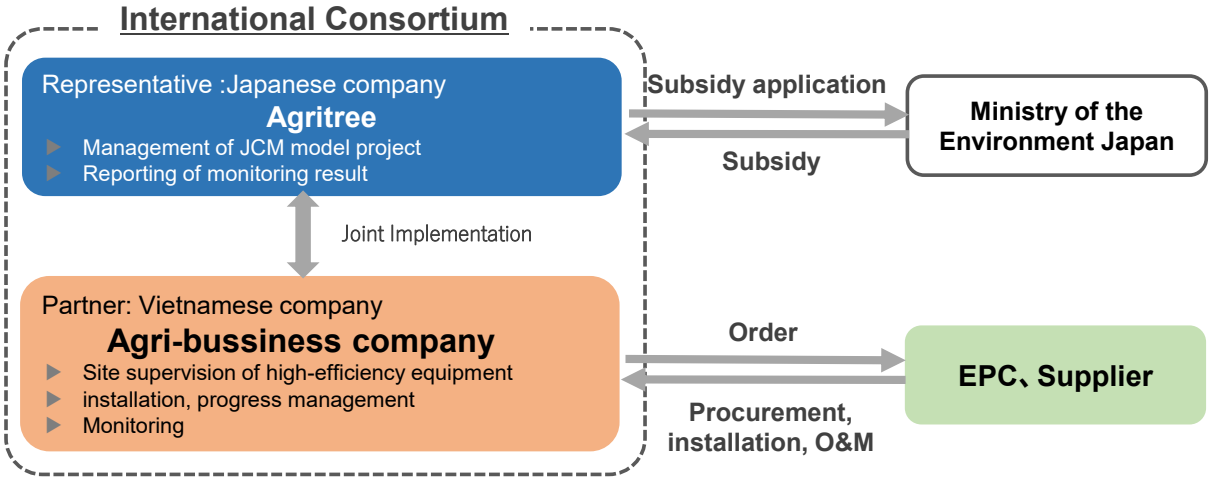
4.3.5 Consideration of implementation structure for applying to Co-Innovation Project

In the Co-Innovation Project, Agritree plans to be a representative participant, and local agricultural university and Japanese university involved in the project, and local EPC company

will cooperate to implement the project. In this fiscal year, basic agreement with the universities was completed online, however, it is necessary to discuss in detail the roles of each stakeholder and project cost for formulating implementation structure from now on.

4.3.6 Consideration of international consortium for applying to JCM mode project

In this fiscal year, the possibility of installing solar sharing in Hanoi City on trial was considered, however, it is expected to install them in southern areas of the country in the future where they have high solar radiation, fertile land and there are companies that implement large-scale agriculture management.
In the case of installing solar sharing in a farmland with a single crop and self-consumption, it is necessary to consider developing an international consortium to apply to JCM model project as follows.



Source: Provide by Nippon Koei

Figure 4-11 Image of International Consortium (Agritree)

4.3.7 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 Consideration of JCM model project formulation by installing renewable energy in Hanoi city: Small wind turbine systems (RIAMWIND)

4.4.1 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.

4.4.2 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).

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

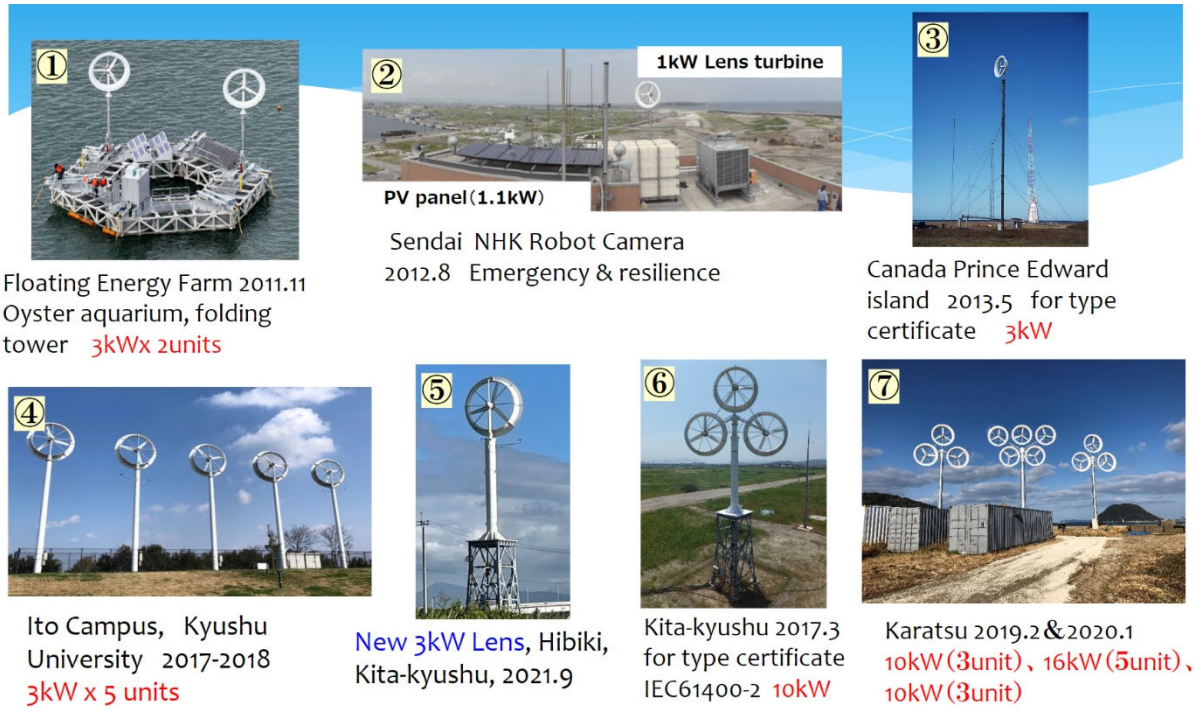
Very quiet: Since the vortices generated from the blade tips are considerably suppressed through the interference with the boundary layer within the diffuser shroud, the aerodynamic noise is reduced substantially

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 cases of installing this technology as of February 2022, 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.



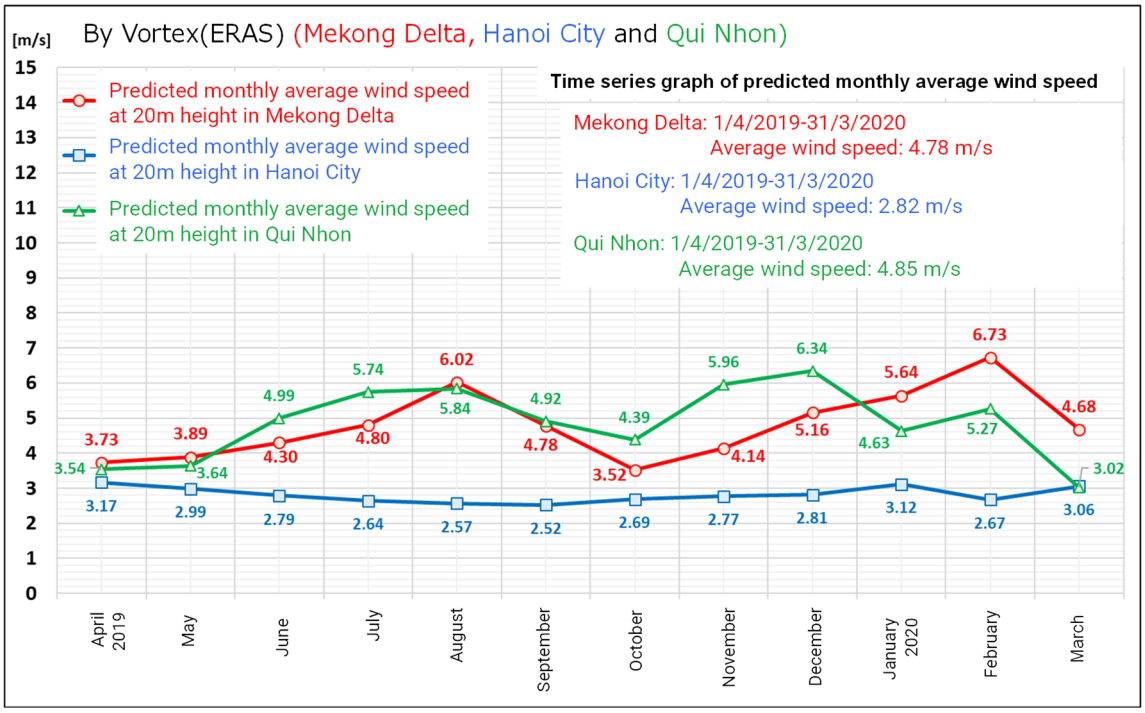
Source: Extracts form RIAMWIND's documents

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

4.4.3 The result of study

Although sharing the weather data of Vietnam was requested to Vietnam Institute of Meteorology, Hydrology and Climate Change (IMHEN), MONRE's subordinate organization, through DONRE of Hanoi City, it was difficult to obtain it from them during the Project's period. Therefore, wind simulations was implemented by using Vortex's open data.

As same as Japan, Vietnam's land is vertically long and the wind conditions vary greatly depending on the location. So, the estimated amount of power generation was calculated at three locations: (1) central area of Hanoi City, (2) Central Quy Nhon, and (3) Southern Mekong Delta.



Source: RIAMWIND

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

4.4.4 Draft project plan and feasibility evaluation

Based on the result of wind simulation, annual generation for 9kW/15kW(Independ power supply type) at three location were estimated as below.

Table 4-14 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/年未満※1	2台	8.6 MWh/年未満
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

Since the project area has not been decided yet at this time, the feasibility evaluation was conducted in the case of installing two wind-lends turbine (9kW) in central area of Hanoi City.

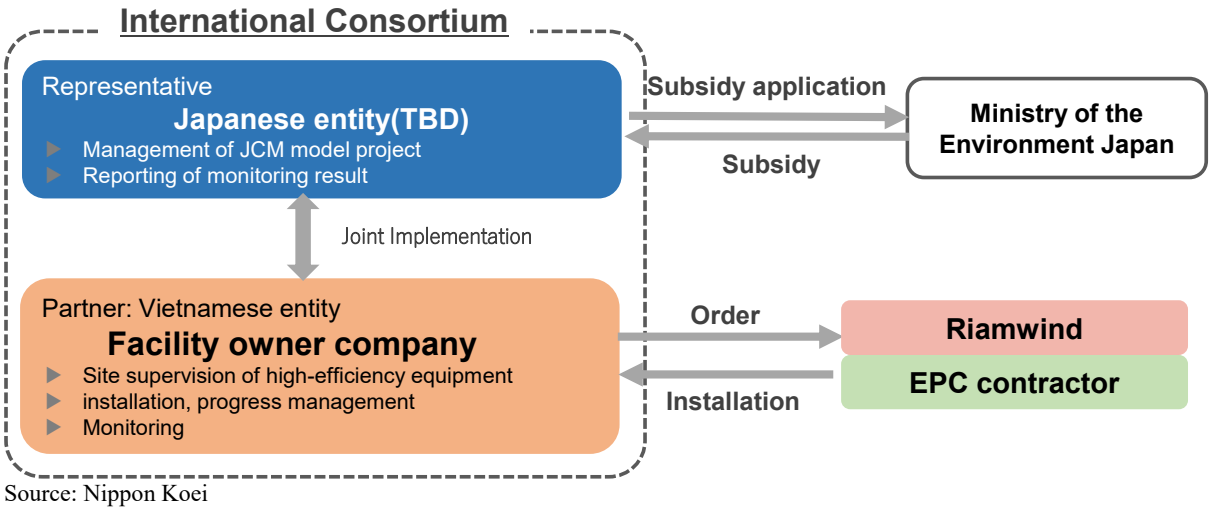
Table 4-15 Estimation of GHG Emissions Reduction of wind-lends

Items	results	Remarks
Estimated annual power generation	8.6MWh/year	In Hanoi City
GHG emission factor	0.533 tCO2/MWh	Vietnam, Renewable energy, based on GEC material.
Total GHG emissions reduction	To be considered in FY2022	project year depends on the usage of facility which use the generated electricity
Rate of subsidy	To be considered in FY2022	Target of the subsidy is equipment and installation cost
Cost efficiency	To be considered in FY2022	Cost effectiveness for the subsidy
Project cost	Depend on the installing location, the project cost will be different. (To be considered in FY2022)	Equipment cost and installation cost (without civil work)
Payback period	To be considered in FY2022	Not including Operation and Maintenance cost

Source: Nippon Koei

4.4.5 Consideration of international consortium for applying to JCM mode project

In this fiscal year, since the consideration of installing wind-lens turbine in Hanoi City and whole Vietnam was conducted mainly focusing on technical aspects, the project implementation areas have not been decided yet. For applying to JCM model project, an international consortium is expected as follows. RIAMWIND plan to provide their technology and instruct an appropriate way of installing facilities and maintain them as well as design of wind turbines. As for a representative participant, it plans to discuss with a Japanese company (machinery trading company, leasing company, etc.) that are familiar with renewable energy project in Vietnam.



Source: Nippon Koei

Figure 4-15 Image of International Consortium (Riamwind)

4.4.6 MRV plan

There is only one wind power generation project (in Philippines) among all JCM partner countries, and the methodology has not been developed yet. However, it must be at least requested to monitor the amount of power generation. In addition, regarding monitoring system attached to an equipment which utilize a power by self-generation, it is necessary to install a system which can monitor energy consumption in real time, and also design a system not to count the power loss as GHG emission reduction.

The detailed system of meters will be considered in the next fiscal year when a project area is decided.

CHAPTER 5 IMPACT OF COVID-19 AND INGENUITY FOR IMPLEMENTING STUDY

Due to the expansion of COVID-19 infection since January 2019, the usual main activities such as field surveys, discussion between the cities, workshops, and a City-to-City Collaboration seminar were totally held online, and it means that all activities of this fiscal year were implemented under various restrictions. However, even under this pandemic situation, several activities could be carried out with ingenuity, some activities were transferred to alternative ones, and others plan to be implemented in/ after the next fiscal year as follows.

5.1 Impact of the Spread of COVID-19 in Viet Nam

In Vietnam, the spread of infection had been suppressed for a long time by promoting thorough immigration restrictions and infection control, but because infection has spread since July 2021, lockdown was carried out in the big cities such as Hanoi City and Ho Chi Minh City where the population is concentrated. Although the impact was relatively small in Vietnam's main industry such as agriculture, forestry and fisheries, the economic damage is expected to be serious in the mining/ construction industry and service industry (restaurant etc.). Due to the economic slowdown in Vietnam, local companies may be refraining from capital investment. Therefore, to promote installing energy saving technologies and renewable energy, it is necessary to explain more carefully about the economic merits of utilizing subsidy of JCM model project.

5.2 Ingenuity for Implementing Study Smoothly

Improvement of internet environment in Hanoi City:

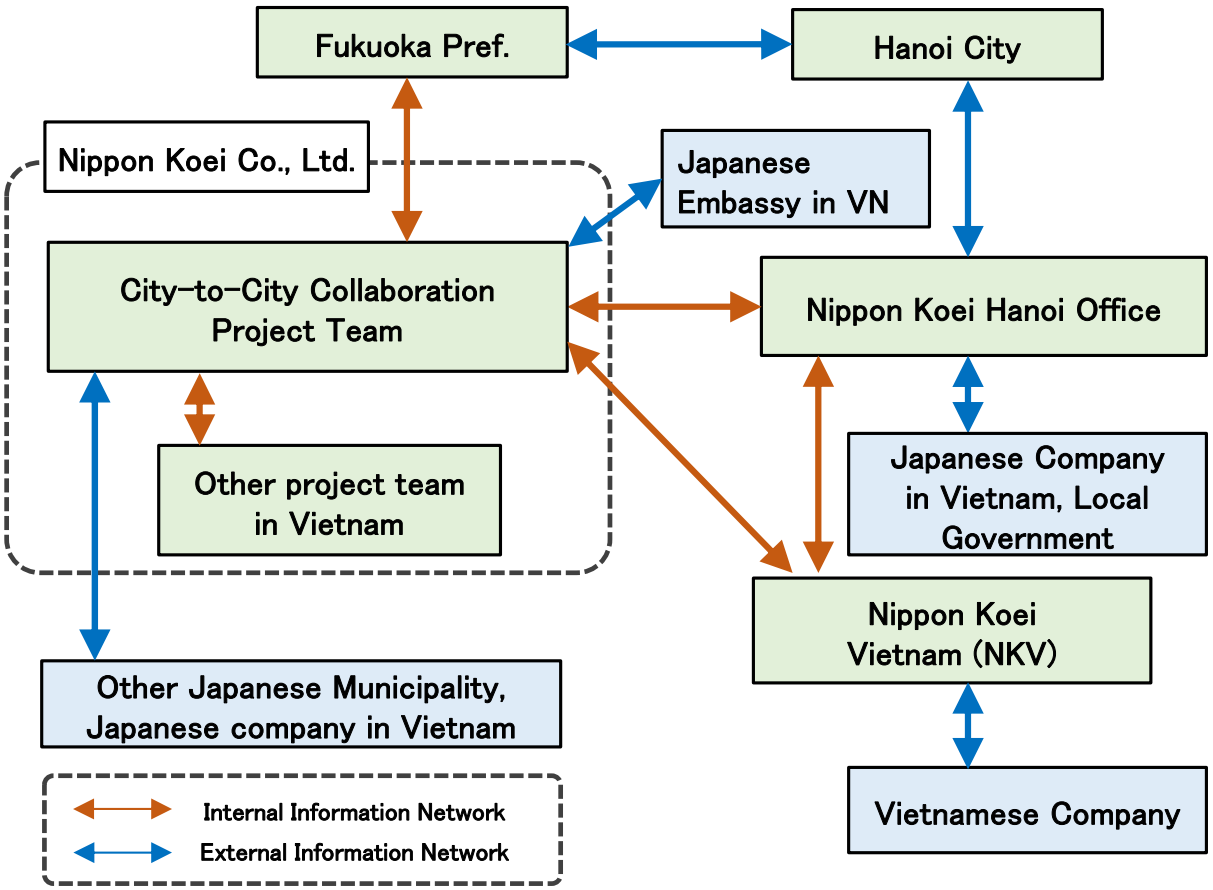
Communication with Hanoi City was carried out via e-mail and local staffs. Although there were some restrictions on network environment of online meetings, the content of the meetings was almost the same as face-to-face meetings. In addition, when the online workshop was held, DONRE rented and installed an equipment for smooth online conference in their office so that the workshop could be held without any problems about internet connection.

Smooth communication through interpreters and translated materials:

In response to the requests from the participants of conferences and workshops, providing as much support and preparation as possible such as arranging interpreters for Japanese/English/Vietnamese, and translating presentation materials were implemented. These supports helped communication smoothly between the cities within the limited time via online.

Implementation of efficient surveys utilizing local offices:

By cooperating with Nippon Koei's Hanoi office and local subsidiary (NKV), collecting information and analysis regarding City-to-City Collaboration activities and JCM model project formulation could be conducted efficiently (see as following figure).



Source: Provided by Nippon Koei

Figure 5-1 Internal/External Information Collection Network and Division of Roles in the COVID-19 Pandemic

CHAPTER 6 FUTURE PLAN

6.1 Achievement of Activities and Analysis of the Issues in FY2021

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.

6.1.1 Renewable Energy/Energy Saving

(1) Consideration of installing energy saving equipment in public facilities for JCM model project formulation

Through the presentation on technology at the online workshop, Hanoi City shared information on public and private companies which have facilities consuming large energy in the city. Based on the study, it was cleared that several companies had interests in energy saving and renewable energy technologies. In the next fiscal year, they are expected to consider JCM model project formulation concretely.

When arranging a meeting with local companies or organizations, it was sometimes not smooth to do so because they requested to receive a letter for making the meeting. Based on this experience, it is necessary to make an environment that Japanese companies can contact and discuss with local companies or organizations easily by preparing a common letter form and meeting and explaining the materials of the Project.

In addition, preparing presentation materials in Vietnamese and interpreters for the online workshop was very effective since it was needed to explain complicated technologies in easy to understand language within the limited time.

(2) Consideration of installing renewable energy technologies in farmlands near Hanoi city

Since the agricultural university in Hanoi City expressed their big interests in solar sharing technology by Agritree through the online discussion, an initial consideration for developing a project was conducted based on collected information.

Because a field survey at the candidate farmlands in this fiscal year could not be conducted, it was difficult to calculate cost with high accuracy and to design. However, with the supports of the university, consideration of a project formulation plan to be continued as joint research in the next fiscal year. In the future, based on the result of implementing Co-Innovation Project which is one of the subsidy scheme of MOEJ, it is supposed to expand solar sharing technology to large-scale farmlands as a JCM model project.

In addition, whereas solar sharing is a comprehensive and attractive service in terms of economical benefit and capacity building for farmers, which are not found in a general solar power generation project, Vietnamese people hardly don’t recognize the technology. So, it is necessary to make opportunities for widely promoting this technology to both large scale

agricultural companies and individual farmers through the City-to-City Collaboration in the future.

(3) Consideration of installing renewable energy technology in Hanoi City

Hanoi City has a low amount of solar radiation and wind compared with the southern areas of Vietnam, so their weather condition is not suitable for installing large size of renewable energy technology. On the other hand, there are possibilities to utilize organic waste (biomass) from farmlands, wastewater, sludge, waste from the urban areas. Although exchanging basic information and providing technologies on open burning and garbage collection were main activities in this fiscal year as one of the countermeasures to environmental issues, it plans to implement discussion in detail related to decarbonization in the next fiscal year.

6.1.2 Institutional Supports

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

In the discussion between two cities in this fiscal year, Hanoi City raised their current environmental problems they face such as air pollution due to open burning, waste disposal, and energy. Fukuoka Prefecture introduced the existing environmental policies, the case of raising public awareness, and Japanese companies' technologies etc., and then consequently the two cities had an effective discussion and expanded their cooperation activities.
The reason why the cities could communicate smoothly despite the spread of COVID-19 infection is that the cities built already reliable relationship as a friendship city for a long time. Another reason is that this is the first year of the City-to-City Collaboration project and working on new themes and technical fields such as "zero-carbon" for both cities made high awareness and motivation of the person in charge of the Project.
As the issues, all discussions between Hanoi City and Fukuoka Prefecture were implemented via online in this fiscal year, but it was sometimes difficult to contact timely with Hanoi City due to their weak internet connection. In addition, it took a long time to find concrete issues and identify necessary technologies for consideration of installing equipment since there was no opportunity to see technologies and exchange opinions directly.
From the next fiscal year, assuming traveling overseas can be resumed, working on activities for achieving zero-carbon and improvement of environmental issues with the local government and private companies will be conducted related to Hanoi City's environmental issues, by utilizing online discussion as well.

(2) Supports for JCM model project formulation at public sectors

In this fiscal year, only introduction of JCM financial scheme and some project examples to Hanoi City and the relevant local government officers in the city through the online workshop was conducted. There are needs for energy saving and renewable energy in public sector as well, however, sufficient opinions and information could not be collected to propose along their administrative procedures, timing of budgeting, and their current policies. From the next

fiscal year, it is necessary to concretely discuss the possibilities of JCM model project formulation in Hanoi City with supports from Fukuoka Prefecture through the City-to-City Collaboration.

(3) Organizing online workshop for promoting a hydrogen technology

Since it was a first year to share information on hydrogen technology, the introduction of the technology was included in the contents of the online workshop. In Hanoi City, it seems that the concern to advanced hydrogen technologies will be increasing rapidly because of the central government's declaration for carbon neutrality.
Furthermore, it will be effective to involve not only DONRE but also other relevant administrative organizations (energy, transportation, agricultural sectors etc.), private companies, and local universities in the activities for promoting hydrogen technology.

6.2 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.

Table 6-1 Proposal of activities in FY2022

Activity	Technology	Overview
The study for JCM model project and Co-Innovation Project formulation	Installing energy saving facilities (Total heat exchanger)	Interview survey and introduction of the technology to local factories and large-scale commercial facilities which the collecting information via online was done in FY2021 will be implemented, and partner companies will be decided for JCM model project.
	Installing energy saving facilities (VOC abatement system)	
	Installing solar sharing	Under the collaboration with the local universities, consideration of formulating "**Co-Innovation Project"** will be continued. Depending on a project scale and a type of technology to be installed which will be concretely decided, it might be considered to apply to JCM model project or other financial schemes.
	Installing small wind power generation system	**<u>In Hanoi City / neighboring areas:</u>** Installing the technology in public facilities as a backup power source in the event of disaster/ blackout situation will be considered. And installing it in private companies' factories or large-scale commercial facilities as self-generation system will be considered as well. (It will be BtoB model because it is small-scale

Activity	Technology	Overview
		technology) **<u>The southern areas / coastal areas:</u>** Installing it in coastal areas or mountainous areas where have good wind condition to utilize as a micro-grid will be considered. Depending on the number and scale of the technology to be installed, JCM model project formulation will be considered.
	Installing large-scale renewable energy technologies (solar power, wind power)	As a renewable energy project not depending on FIT, project formulation of solar power generation and wind power generation at large-scale industrial parks and commercial facilities will be continuously considered with the assumption of self-power-generation. If the bid is needed, the project plans to be formed on a BtoB model.
City-to-City Collaboration for realization of zero-carbon city	Implementation of activities for on climate change countermeasures under City-to-City collaboration	Based on the environmental technologies/ policies/ systems shared with Hanoi city by Fukuoka Prefecture in FY2021, the activities that can be implemented in Hanoi City will be concreted. Regarding the promotion of climate change countermeasures, SDGs and decarbonization of the city, the actions related to current environmental problems in Hanoi City was conducted in FY2021. In FY2022, it plans to support more effective activities to match the goal for a carbon neutral in Vietnam (such as workshop and seminar).

Source: Provided by Nippon Koei