

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

Promotion of Zero-Carbon Smart City through City-to-
City Collaboration between Ba Ria-Vung Tau Province
and Sakai City

Report

March 2023

Nippon Koei Co., Ltd.
Sakai City

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Zero-Carbon Society

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Table of Contents

	Page
CHAPTER 1 PROJECT BACKGROUND AND OBJECTIVES	1
1.1 BACKGROUND OF THE PROJECT.....	1
1.2 CITIES OF THE PROJECT	1
1.2.1 Sakai City.....	1
1.2.2 Ba Ria – Vung Tau Province	2
1.3 OBJECTIVE OF THE PROGRAM.....	3
1.4 IMPLEMENTATION STRUCTURE OF THE PROJECT	3
1.5 PROJECT SCHEDULE.....	4
CHAPTER 2 EFFORTS TO CONTRIBUTE TO CLIMATE CHANGE MEASURES IN PARTICIPATING CITIES	6
2.1 MEASURES BY SAKAI CITY ON CLIMATE CHANGE	6
2.1.1 Action Plan for Global Warming Countermeasures	6
2.1.2 Main Measures to Cope with Global Warming	6
2.1.3 Sakai Carbon Neutral Overseas Expansion Network.....	7
2.2 MEASURES BY VIETNAM AND BA RIA – VUNG TAU PROVINCE.....	7
2.2.1 National Policies in Vietnam	7
2.2.2 Policies and Measures of Ba Ria - Vung Tau Province	10
CHAPTER 3 CITY-TO-CITY COLLABORATION TO REALIZE NET ZERO CARBON SOCIETY	13
3.1 BACKGROUND AND OBJECTIVE OF THE CITY-TO-CITY COLLABORATION	13
3.1.1 Background.....	13
3.1.2 Objective of the Project.....	13
3.2 PROJECT APPROACH	13
3.3 PROJECT ACTIVITIES.....	14
3.4 RESULTS OF ACTIVITIES RELATED TO CITY-TO-CITY COLLABORATION	15
3.4.1 Outline of Activities.....	15
3.4.2 Activities of Support for Building Institutions.....	25
CHAPTER 4 PRELIMINARY STUDY FOR JCM MODEL PROJECT.....	32
4.1 DATA COLLECTION AND PRELIMINARY STUDY FOR DEVELOPMENT OF JCM MODEL PROJECTS.....	32

4.1.1	Data collection for identifying needs of renewable energy and energy saving in private sectors	32
4.1.2	Data Collection on Solid Waste Management	34
4.1.3	Information Collection on Smart Cities	37
4.2	PRELIMINARY STUDY FOR JCM MODEL PROJECT FOR ENERGY-SAVING EQUIPMENT (ONCE-THROUGH GAS BOILER): OSAKA GAS CO., LTD.	40
4.2.1	Outline of Study.....	40
4.2.2	Technology Expected to be Introduced.....	41
4.2.3	Draft Implementation Structure for JCM Model Project	42
4.3	PRELIMINARY STUDY FOR JCM MODEL PROJECT FOR BIOGAS GENERATION AND CO ₂ CAPTURE TECHNOLOGIES: AIR WATER INC.	42
4.3.1	Outline of Study.....	42
4.3.2	Technology Expected to be Introduced.....	43
4.3.3	Study Results	43
4.3.4	Project Plan and Feasibility.....	45
4.3.5	Draft Implementation Structure for JCM Model Project	45
4.3.6	MRV Plan	46
4.4	PRELIMINARY STUDY FOR JCM MODEL PROJECT FOR WASTE-TO-ENERGY : TAKUMA CO., LTD.	46
4.4.1	Outline of Study.....	46
4.4.1	Technology Expected to be Introduced.....	47
4.4.2	Study Results	47
4.4.3	Draft Implementation Structure for JCM Model Project	49
4.5	PRELIMINARY STUDY FOR JCM MODEL PROJECT FOR SOLAR POWER GENERATION SYSTEM: OSAKA GAS CO., LTD.	50
4.5.1	Outline of Study.....	50
4.5.2	Technology Expected to be Introduced.....	50
4.5.3	Draft Implementation Structure for JCM Model Project	51
4.5.4	MRV Plan	52
CHAPTER 5 FUTURE PLAN.....		53
5.1	ACHIEVEMENT AND CHALLENGES OF THE PROJECT ACTIVITIES IN FY2022 ..	53
5.1.1	Support for Building Institutions	53
5.1.2	Energy Conservation, Renewable Energy and Solid Waste Treatment	54
5.2	PROPOSAL FOR CITY-TO-CITY COLLABORATION PROJECT IN FY2023	55

List of Tables

Table 1-1	Overview of Sakai City	2
Table 1-2	Overview of Ba Ria – Vung Tau Province.....	3
Table 2-1	Major Global Warming Countermeasures in Sakai City.....	6
Table 2-2	Reduction Targets by Sector in Revised NDC	8
Table 2-3	National Policies for Climate Change and Energy Use in Vietnam.....	8
Table 2-4	List of Climate Change Tasks, Programs and Projects of Ba Ria - Vung Tau Province from 2021 to 2025.....	11
Table 2-5	List of Climate Change Tasks, Programs and Projects of Ba Ria – Vung Tau Province from 2026 to 2030.....	12
Table 3-1	List of Activities of the Project	15
Table 3-2	Results of the First On-site Survey.....	19
Table 3-3	Online Seminar Program	22
Table 3-4	Workshop Program.....	22
Table 3-5	Results of the Second On-site Survey	23
Table 4-1	Power Consumption by Business Category of Ba Ria– Vung Tau Province (2020)	32
Table 4-2	Daily Generation of Municipal Solid Waste in Ba Ria-Vung Tau Province.....	35
Table 4-3	Overview of Centralized Waste Treatment Areas in Ba Ria-Vung Tau Province	36
Table 4-4	Number of Waste Emission Companies in Phu My 3 Specialized Industrial Park	36
Table 4-5	Outline of Waste-to-Energy Facility to be Procured in Toc Tien Centralized Waste Treatment Area.....	37
Table 4-6	Advantages of High-efficiency Gas Once-through Boilers.....	41
Table 4-7	Potential Bioamss Energy Soure in Ba Ria – Vung Tau Province (1).....	44
Table 4-8	Potential Bioamss Energy Soure in Ba Ria – Vung Tau Province (2).....	44
Table 4-9	Result of the Interview with Industrial/Hazardous Waste Treatment Business	48
Table 4-10	Results of the Interview with Waste Collection and Transportation Company	49
Table 5-1	Draft Plan of Project Activities in FY2023	56

List of Figures

Figure 1-1	Location of Sakai City	2
Figure 1-2	Location of Ba Ria – Vung Tau Province	2
Figure 1-3	Photos of Ba Ria – Vung Tau Province	3
Figure 1-4	Implementation Structure of the Project	4
Figure 1-5	Schedule of the Project	5
Figure 3-1	Project Approach.....	14
Figure 3-2	The kick-off meeting with DONRE.....	18
Figure 3-3	Photos of the First On-site Survey	21
Figure 3-4	Photos of the Second On-site Survey.....	24
Figure 3-5	Example of VR Screen.....	25
Figure 3-6	Long-term Vision in the Environmental Field of Sakai City	27
Figure 3-7	Overview of Sakai Local Energy Production and Local Energy Consumption Project.....	27
Figure 3-8	Example of Promoting the Renewable Energy in Sakai City	29
Figure 3-9	Example of Promotion of Energy Conservation in Sakai City	30
Figure 3-10	Examples of Efforts of Sakai City in the Solid Waste Management Sector	31
Figure 4-1	Daily Generation of Municipal General Waste (tons/day) in Ba Ria-Vung Tau Province.....	35
Figure 4-2	Location of Industrial Parks in Ba Ria-Vung Tau Province	38
Figure 4-3	Smart City Monitoring Center in Ba Ria-Vung Tau Province (IOC)	40
Figure 4-4	Image of Gas Once-through Boiler	41
Figure 4-5	Image of Implementation Structure for JCM Model Project	42
Figure 4-6	Image of Implementation Structure for the JCM Model Project	46
Figure 4-7	Image of Waste-to-Energy System	47
Figure 4-8	Image of Implementation Structure for the JCM Model Project (Waste-to-Energy).....	50
Figure 4-9	Image of Solar Power Generation System in Industrial Parks	51
Figure 4-10	Image of Implementation Structure for JCM Model Project	51

List of Attachments

- | | |
|--------------|---|
| Attachment 1 | Presentation Material of Kick-off Meeting with DONRE in October 2022 |
| Attachment 2 | Presentation Materials of Online Seminar in December 2022 |
| Attachment 3 | Presentation Materials of Workshop in February 2023 |
| Attachment 4 | Presentation Material for the Zero Carbon City International Forum 2023 |

Abbreviations

ASEAN	Association of Southeast Asian Nations
BaU	Business-as-Usual
BIZA	Ba Ria - Vung Tau Industrial Zones Authority
COP26	The UN Climate Change Conference in Glasgow
DOFA	Department of Foreign Affairs
DOIT	Department of Industry and Trade
DONRE	Department of Natural Resources and Environment
DOST	Department of Science and Technology
DPI	Department of Planning and Investment
DX	Digital Transformation
EPA	Environmental Protection Agency
EPC	Engineering Procurement Construction
FS	Feasibility Study
GEC	Global Environment Centre Foundation
GGG	Green Growth Strategy
GHG	Greenhouse Gas
ICT	Information and Communications Technology
INDC	Intended Nationally Determined Contribution
IOC	Intelligent Operations Center for Smarter Cities
JCCH	Japanese Chamber of Commerce and Industry in Ho Chi Minh City
JCM	Joint Crediting Mechanism
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
LULUCF	Land use, land-use change, and forestry
MOU	Memorandum of understanding
MPI	Ministry of Planning and Investment
MRV	Measurement, Reporting and Verification
NDC	Nationally Determined Contribution
NKV	Nippon Koei Vietnam International Co., Ltd
PDP8	Power Development Planning VIII
PM3SIP	Phu My 3 Specialized Industrial Park
SNS	Social Networking Service
SOGEC	Sojitz Osaka Gas Energy Company Ltd.
UNIDO	United Nations Industrial Development Organization
VCCI	Vietnam Chamber of Commerce and Industry
VND	Vietnam Don
VR	Virtual Reality
XR	Extended Reality
ZEH	Net Zero Energy House

CHAPTER 1 PROJECT BACKGROUND AND OBJECTIVES

1.1 Background of the Project

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

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

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

The Project of Promotion of Zero-Carbon Smart City through City-to-City Collaboration between Ba Ria-Vung Tau Province and Sakai City (hereinafter referred to as the "Project") in FY2022 is positioned as the "first year" of the City-to-City Collaboration Project (three-year project) between Ba Ria-Vung Tau Province in Vietnam and Sakai City, which was launched this fiscal year. The project is designed to support the establishment of systems to create a zero-carbon city in Ba Ria-Vung Tau Province, and to reduce GHG emissions in the fields of energy conservation, renewable energy and solid waste treatment, as well as to form Joint Crediting Mechanism (JCM) model projects that contribute to reduce GHG emissions as well.

1.2 Cities of the project

1.2.1 Sakai City

Sakai City, which is the second largest city in Osaka Prefecture and has a population of approximately 820,000, is located in the central part of the Kinki region and the southern central part of Osaka Prefecture.

In ancient times, the Mozu-kofun Tumulus groups including the tomb of Emperor Nintoku was constructed, and in the medieval period, it prospered as a center of foreign trade and as a center of

Japanese economy. At present, exchanges with ASEAN countries, including Vietnam, are being continued through the hosting of Sakai-ASEAN Week and other activities.

In terms of industry, Sakai City is known as one of Japan’s leading industrial cities, with the largest number of manufactured goods shipped per inhabitant in government-designated cities nationwide. Especially in the coastal area, there are multiple oil refineries, thermal power plants, gas manufacturing plants, liquid hydrogen manufacturing plants, etc. and they become a large base which covers about 70% of the energy in Kansai region.

In the environmental field, the Sakai Environmental Strategy (March 2021) and the Sakai City Global Warming Prevention Action Plan (revised in November 2022) have positioned the promotion of international city-to-city cooperation in the environmental field from the viewpoint of contributing to the solution of global environmental problems beyond the municipal framework.

The outline of Sakai City statistics is shown in the table below.



Source: Nippon Koei Co., Ltd.

Figure 1-1 Location of Sakai City

Table 1-1 Overview of Sakai City

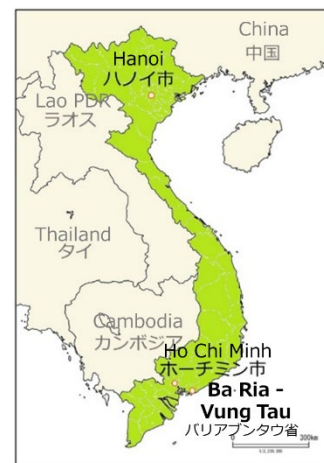
#	Item	Statistics
1	Area	149.83 [square kilometer] (as of December 1, 2022)
2	Total population	815,727 [persons] (as of December 1, 2022)
3	Population density	5444 [people per square kilometer] (as of December 1, 2022)
4	Number of households	369,921 [households] (as of December 1, 2022)
5	Number of private establishments	26,737 [facilities] (as of June 1, 2021)
6	Gross prefectural product (nominal)	3,299.5 [1 billion JPY] (as of 2019)

Source: Nippon Koei Co., Ltd. From Sakai City’s “Outline and Introduction of City” and Sakai City’s official HP

1.2.2 Ba Ria - Vung Tau Province

Ba Ria – Vung Tau Province, located in southeastern Vietnam, with a population of approximately 1,170,000 is designated as the Southern Economic Special Zone and has an international seaport, so it plays an economically important role as a major logistics base in the southeast region of Vietnam.

In the Ba Ria – Vung Tau Province, important manufacturing industries such as petrochemicals, electricity, iron and steel, fertilizer, and textiles have developed against the background of oil and natural gas reserves. A number of industrial parks are located in the province. In the large-scale industrial park “Phu My 3 Special Industrial Park” with 999 ha in particular, local enterprises and representative offices of foreign-



Source: Nippon Koei Co., Ltd.

Figure 1-2 Location of Ba Ria – Vung Tau Province

affiliated companies, including Japanese-affiliated companies, are occupied.

The outline of Ba Ria – Vung Tau Province is shown in the table below.

Table 1-2 Overview of Ba Ria – Vung Tau Province

#	Item	Statistics
1	Area	1982.6 [square kilometers] (as of December 31, 2020)
2	Total population	1,176.1 [thousand] (as of December 31, 2020)
3	Population density	593 [people per square kilometers] (as of December 31, 2020)
4	Number of households	Not available
5	Number of private establishments	111,393 [facilities] (as of December 31, 2021)
6	Gross domestic product(nominal)	390,293 [1 billion JPY] (as of 1992)

Source: Prepared by Nippon Koei based on statics of the General Statistics Office of Vietnam



Streets of Ba Ria – Vung Tau Province
Source: Ba Ria – Vung Tau Province website



Status of Ba Ria – Vung Tau province
Source: Website of Department of Natural Resource and Environment, Ba Ria – Vung Tau province

Figure 1-3 Photos of Ba Ria – Vung Tau Province

1.3 Objective of the Program

The objective of the Project is to conduct study and support for taking measures of overseas local government and introduction of facilities that contribute to the formation of carbon-free and low-carbon society by Japanese research institutes, private companies, universities, etc. with local government in Japan which have experience and know-how on carbon-free and low-carbon society formation.

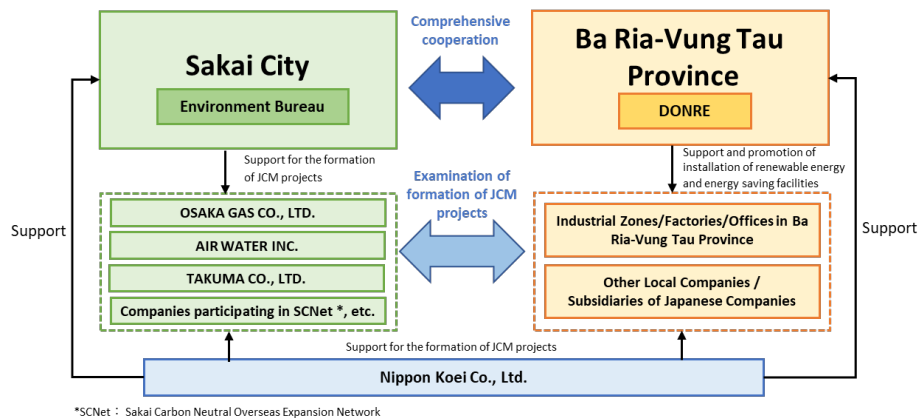
1.4 Implementation Structure of the Project

The Project supports the institutional development for creation of zero carbon city in Ba Ria – Vung Tau Province in the Socialist Republic of Vietnam, to reduce GHG emissions in the fields of energy conservation, renewable energy, and solid waste treatment and formulate the JCM model project. By sharing efforts for reduction of GHG reduction in Sakai City (action plans to prevent global warming, etc.), the implementation policies of Ba Ria – Vung Tau Province regarding climate change measures were discussed between two cities.

Regarding JCM model project formulation, the following were studied and proposed: Osaka Gas Co., Ltd., which has experience of representative company of JCM model projects and a track record of participating in the other City-to-City Collaboration Project in Ho Chi Minh City, and which is capable of developing photovoltaic power generation business and natural gas conversion and high-efficiency boilers utilizing local networks; Air Water Inc., which has many decarbonization-related technologies such as biomass utilization, CO₂ recovery, and hydrogen production; and Takuma Co., Ltd., which has the largest number of general waste treatment plants in Japan and has abundant domestic and overseas experience as well as experience of feasibility study (FS) in Vietnam. The three private companies, which participated in this project, worked for preliminary study for future application of JCM model projects.

Nippon Koei Co., Ltd. supported city-to-city collaboration activities as a representative business operator and carried out preliminary studies for the introduction of excellent decarbonization and environmental technology.

The implementation structure for the Project is shown below. In addition to the above three participating companies, project formulation for the JCM model project will be considered in cooperation with registered companies of the Sakai Carbon Neutral Overseas Expansion Network (abbreviated as SCNet) as necessary. SCNet is a network between Sakai City and companies in the city. The purpose is to contribute to the solution of global environmental problems and decarbonization, and to lead to further growth through overseas expansion of environmental businesses by forming and promoting decarbonization projects in overseas cities through public-private partnerships between Sakai City and companies in the city.



Source: Sakai City and Nippon Koei Co., Ltd.

Figure 1-4 Implementation Structure of the Project

1.5 Project Schedule

The implementation period of the Project is from August 27, 2022 to March 10, 2023. The Project schedule is shown in the figure below.

*FY2022 City-to-City Collaboration Programme for Zero-Carbon Society
Promotion of Zero-Carbon Smart City through City-to-City Collaboration
between Ba Ria-Vung Tau Province and Sakai City*

#	Contents	Items	2022						2023			
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1. City-to-City Collaboration Activities												
1)	Consultations on City-to-City Collaboration between the two cities online	Plan			▽			▽				▽
		Result			Kick-off			Progress Report				Final Report
2)	Exchange of opinions on collaborative fields (online)	Plan			▽			Kick-off	▽			▽
		Result			▽			▽				▽
3)	Discussions on city-to-city collaboration from the next fiscal year onwards	Plan									----->	
		Result									----->	
2. JCM Model Project Formulation												
1)	Consultation and Support with Stakeholders Involved in Potential JCM Applications for	Plan									----->	
		Result									----->	
2)	Web-based Consultations with Companies on JCM Formation and Information Collection in	Plan									----->	
		Result									----->	
3)	Information Collection Surveys Using Local Offices	Plan									----->	
		Result									----->	
4)	Preparation for the Formation of JCM Model Projects in the Next and Subsequent Years	Plan									----->	
		Result									----->	
3. The Workshop and Events												
1)	On-site Technical Workshop	Plan									▽	▽
		Result								Seminar	▽	Workshop
2)	Participate in seminars and introduce the projects (online)	Plan								Seminar		Workshop
		Result										▽
4. Regular Reporting and Final Report												
1)	Monthly Progress Report	Plan		▽	▽	▽	▽	▽	▽	▽	▽	▽
		Result			Progress Report			▽	▽	▽	▽	▽
2)	Briefing for MoEJ (Online)	Plan		▽	Kick-off						▽	▽
		Result				Progress Report 1					Progress Report 2	Final Report
3)	Consultation with Sakai City and companies (face-to-face or online)	Plan		▽		▽					▽	▽
		Result		▽		▽		▽	▽	▽	▽	Plant Report
4)	Final Report Preparation	Plan										----->
		Result									----->	▽(Submit)

Remarks: Dotted lines indicate remote domestic work (with some local work), solid lines indicate activities by local offices and local employees.

Source: Nippon Koei Co., Ltd.

Figure 1-5 Schedule of the Project

CHAPTER 2 EFFORTS TO CONTRIBUTE TO CLIMATE CHANGE MEASURES IN PARTICIPATING CITIES

2.1 Measures by Sakai City on Climate Change

2.1.1 Action Plan for Global Warming Countermeasures

In August 2017, the "Sakai City Action Plan for global warming countermeasures (Area Policy Edition)" was formulated, and not only "mitigation measures" to control GHG emissions, but also "adaptation measures" to prepare for the impact of climate change have been positioned and implemented. In November 2022, the action plan was revised to integrate plans for the promotion of heat island countermeasures, low-carbon public facilities, and energy conservation and energy creation in the municipal area, with the aim of integrated operation of climate change countermeasures.

2.1.2 Main Measures to Cope with Global Warming

Sakai City mainly implements and supports the following measures to combat global warming.

Table 2-1 Major Global Warming Countermeasures in Sakai City

#	Item	Activities
1	Initiatives for prefectural residents	1)Implementation of "Eco-diagnosis" 2)Promotion of COOL CHOICE 3)Implementation of subsidies for thermal insulation and renovation of houses and buildings 4)Implementation of reduction of property tax for houses that have undergone energy-saving improvements 5) Implementation of Sakai Eco-Life Point Project
2	Initiatives for Business Operators	1)Collaboration with enterprises under the Cool City Sakai Partner System 2) Implementation of the ESCO (Energy Service Company) project 3)Subsidization of project to support the introduction of energy-saving equipment for business establishments 4)Subsidization of project to support the introduction of high-efficiency air-conditioning equipment for business establishments 5)Dispatch of advisors and implementation of diagnosis projects for in-house equipment 6) Sakai Carbon Neutral Overseas Expansion Network
3	Smart House Initiatives	1)Provision of subsidies for projects to support the creation of smart houses in Sakai City 2)Subsidization of the Sakai City ZEH Support Project 3)Establishment of Sakai Eco-Bank, a CO2 emission reduction activity group, and its registration to J-Credit System 4)Grant of subsidy for solar power generation system for houses with no initial cost
4	Others	1)Dissemination activities by the Sakai City Environmental Action Design Team SEEDs 2)Preparation of the Sakai Environment Report 3) Establishment of Sakai City's Green Procurement Policy

Source: Sakai City Website (<https://www.city.sakai.lg.jp/kurashi/gomi/index.html>)

2.1.3 Sakai Carbon Neutral Overseas Expansion Network

The Sakai Carbon Neutral Overseas Expansion Network (SCNet) aims to contribute to solving global environmental problems, decarbonization, and further growth through overseas development of environmental businesses by forming and promoting decarbonization projects in overseas cities through public-private partnerships between Sakai City and companies in the city. The Network aims to contribute to the resolution and decarbonization of the world's environmental problems and further growth through the overseas expansion of environmental businesses.

The role of Sakai City is to disseminate information on the overseas development of environmental businesses and provide individual support to registered businesses, while the role of registered businesses is to formulate decarbonization projects in overseas cities in cooperation with Sakai City and related organizations.

2.2 Measures by Vietnam and Ba Ria – Vung Tau Province

2.2.1 National Policies in Vietnam

(1) Carbon neutral in 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 Nationally Determined Contribution (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 in draft submitted by the Ministry of Trade and Industry (MOIT) also indicates the policy of actively developing renewable energy and other projects.

(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 October 1, 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 based on the Green Growth Strategy is under preparation.

(3) 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 2-2 Reduction Targets by Sector in Revised NDC

Sector	Contribution with domestic resources		Contribution with international support		Total Contribution	
	Compared to BAU σχεσηαπο (%)	Reduction amount (Mil. tonnes of CO2eq)	Compared to BAU (%)	Reduction amount (Mil. tonnes of CO2eq)	Compared to BAU (%)	Reduction amount (Mil. tonnes of CO2eq)
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
Industrial process	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

*Abbreviation for LULUCF: Land Use, Land Use Change and Forestry

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 2-3 National Policies for Climate Change and Energy Use in Vietnam

Name of regulation (Date of enforcement)	Objectives
National Strategies on Climate Change (Decision 2139/QĐ-TTg of the Prime Minister) December 5, 2011	<u>Specific objectives</u> <ul style="list-style-type: none"> – 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.
National Target Program to Respond to Climate Change period 2012-2015 (Decision 1183/QĐ-TTg of the Prime Minister) August 30, 2012	<u>Specific objectives</u> <ul style="list-style-type: none"> – To gradually realize the National Strategy on climate change, – To increase awareness and capacity to adapt to climate change – To orient to reduce greenhouse gas emissions – To develop low-carbon economy, – To actively cooperate with international communities to protect the global climate system
Action Plan for Implementation of Paris Agreement on Climate Change (Decision 2053/QĐ-TTg of the Prime	<u>Overall objectives</u> To Identify and implement appropriate activities and solutions until 2020 and 2030 to gradually carry out all the provisions in the Paris Agreement applicable to Viet Nam. <u>Specific objectives</u> <ul style="list-style-type: none"> – To fulfil commitments in the Intended Nationally Determined Contribution (INDC) to mitigate GHG emissions

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

Source: Prepared by Nippon Koei based on each policy

2.2.2 Policies and Measures of Ba Ria - Vung Tau Province

(1) Action Plan for Socio-economic Development Plan of Ba Ria - Vung Tau Province

The action plan of Five-Year Socio-economic Development Plan (2021-2025) approved by People's Committee of Ba Ria - Vung Tau Province in July 2021 includes the following plans in relevant target areas.

1) Energy-related projects in the field of economic development

- Formulation and implementation of plans for economic and effective utilization of energy in 2021-2025
- Promotion of investment in large-scaled renewable energy (including wind power generation) and gas-fired thermal power generation

2) Solid waste and climate change-related plans in the field of Natural Resources and Environment

- Formulation and implementation of plans for solid waste management in the province and the separation of municipal solid waste at sources
- Completion of roadmap for application of incineration, recycling, and energy recovery technology for general solid waste treatment
- Investing in construction plan of waste-to-energy plant in a centralized waste disposal area in Toc Tien
- Review of the action plan in response to climate change in Ba Ria - Vung Tau Province in 2021-2030 toward the 2050 vision
- Development and deployment of smart environmental resource management services and utilities

(2) Action plan on climate change

The 2021-2030 Climate-Change Action Plan (Decision No.3070/QD-UBND, October 2021) of Ba Ria - Vung Tau Province provides targets and plans summarized below.

Vision

- Aim to become the representative province that responds actively and effectively to climate change by 2050. Specifically, the province provides low-carbon economies, environmental considerations, adaptation to climate change in coordination with communities, economic sectors, and ecosystems, and high resilience and adaptability to climate change impacts such as sea-level rise and urban flooding.

Individual goals

- Integration of climate change measures into the 2021-2030 provincial department master plan
- Improving resilience and adaptability of communities, economic sectors and ecosystems to climate change impacts

- Contributing to the implementation of the Paris Agreement and reducing total GHG emissions by 8%

Project list

- The following table lists the priority projects for 2021-2030 and 2026-2030 attached to the Climate Change Action Plan.

Table 2-4 List of Climate Change Tasks, Programs and Projects of Ba Ria - Vung Tau Province from 2021 to 2025

Priority	Project	Year of implementation
1	Project of planting, tending and protecting forests	2022
2	Project of upgrading and building new water reservoirs in the province : save water in the dry season and limit flooding in the rainy season, new construction of reservoirs in islands (Con Dao) etc.	2022
3	Strengthening the disease surveillance system to warn of the consequences of climate change and new outbreaks of diseases	2022
4	Investigate and assess the salinization of aquifers due to the impacts of climate change, sea level rise in coastal areas etc; propose solutions	2024
5	Strengthening the organization of communication campaigns on the impacts of climate change on human health in vulnerable areas	2022
6	Develop and implement the plan on economical and efficient use of energy in the province in the period of 2021 - 2025	2021
7	Deploying the application of new energy and renewable energy including the application of rooftop solar energy for self-use purposes, applying high-efficiency devices, intelligent control devices	2021
8	Strengthening the adaptability of coastal tourism activities in the context of climate change	2022
9	Project to raise awareness about climate change and improve adaptive capacity of communities and economic sectors	2022
10	Completing the network of hydrometeorological measurement stations in the province	2024
11	Assessment of the impact of climate change on flooding and action plan to respond to climate change on flooding in the province	2025
12	Action program to respond to coastal erosion, accretion and saltwater intrusion in coastal districts	2023
13	Planning and developing the seaport system taking into account climate change and climate change forecasting	2022
14	Developing and implementing policies to support, encourage, mechanisms and policies to support the development of public transport	2022
15	Communication program to raise awareness about energy saving and environmental protection to public	2023

Source: Summaized by Nippon Koei based on the 2021-2030 Climate Change Action Plan (Decision No.3070/QD-UBND, October 2021)

Table 2-5 List of Climate Change Tasks, Programs and Projects of Ba Ria – Vung Tau Province from 2026 to 2030

Priority	Project
1	Application of technology (GIS and remote sensing) in building a landslide monitoring system in riverside and coastal erosion areas
2	Implement greenhouse gas emission reduction program in the industry for energy saving
3	Mitigation of greenhouse gas emissions in the transport sector in order to realize NDC in accordance with the actual conditions (to further enhance public transport and control public and private transport)
4	Energy audit for key energy-using facilities
5	Building and implementing models of husbandry, aquaculture, and conversion of plant varieties to adapt to climate change
6	Building an information management system on climate change
7	Develop an action plan on air quality management
8	Develop an Action Plan on conservation and sustainable use of wetlands
9	Building a biodiversity database
10	Renovating and upgrading the drainage network of some urban areas that are frequently flooded in 2 cities of Ba Ria - Vung Tau
11	Planning to cope with sea level rise for important scenic spots, sea and island tourist areas
12	Project on training and changing jobs for coastal fishermen to other occupations
13	Develop plans to respond to types of natural disasters according to disaster risk levels

Source: Summaized by Nippon Koei based on the 2021-2030 Climate Change Action Plan (Decision No.3070/QD-UBND, October 2021)

CHAPTER 3 CITY-TO-CITY COLLABORATION TO REALIZE NET ZERO CARBON SOCIETY

3.1 Background and Objective of the City-to-City Collaboration

3.1.1 Background

In the Sakai Environment Strategy issued in March 2021, Sakai City announced to aim to realize an environmentally advanced and world-leading city, and clearly positioned "international city-to-city cooperation" as the direction of the policy. Based on this strategy, Sakai City conducted a study to promote international city-to-city cooperation. As a result, the City-to-City Collaboration Project with Ba Ria - Vung Tau Province was formulated based on the following background.

- Given the historical and cultural backgrounds of Sakai City, where international exchange projects with Southeast Asia, including Vietnam, are active, Ba Ria - Vung Tau province was selected as a candidate for a partner city because there are many common backgrounds between two cities for geographical and industrial characteristics with international ports and industrial parks.
- In November 2021, Sakai City held a seminar to promote overseas expansion in the environmental field. In addition, the need for City-to-City Collaboration Project in Ba Ria - Vung Tau Province was confirmed in questionnaires and interviews survey with enterprises regarding the possibility of overseas business expansion in the environmental field.
- Based on the above-mentioned examination, Sakai City proposed Ba Ria - Vung Tau provincial government to develop a cooperation between two cities through Japan Desk of Ba Ria - Vung Tau Province. In confirmation of a high level of interest from Ba Ria - Vung Tau provincial government, two cities hold an opinion exchange meeting in early April 2022.
- In a direct consultation between Environmental Bureau of Sakai City and Department of Natural Resources and Environment (DONRE) of Ba Ria - Vung Tau Province, it was agreed to prepare for city-to-city cooperation and formulation of City-to-City Collaboration Project, after confirming the target areas of cooperation for City-to-City Collaboration Project and candidate technologies for JCM model projects.

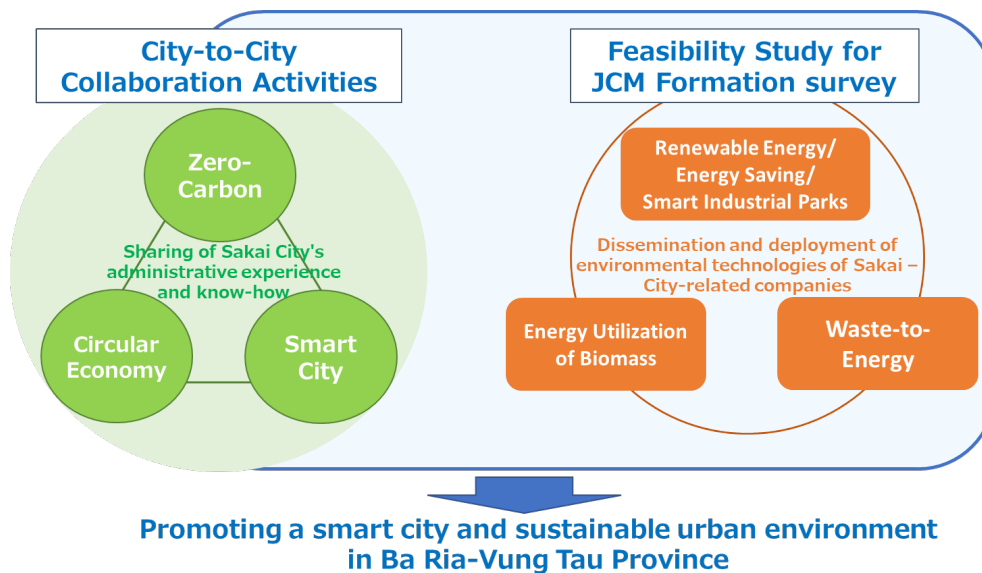
3.1.2 Objective of the Project

The objective of the Project is to support the institution establishment for being a zero-carbon city and to conduct a basic study for reducing GHG emissions in the energy conservation, renewable energy and waste treatment fields, as well as formulating JCM model projects that contribute to GHG emissions reduction, based on issues and needs in the environmental field of Ba Ria - Vung Tau Province.

3.2 Project Approach

The Project promotes the formation of a smart city and a sustainable urban environment of Ba Ria - Vung Tau Province by sharing the administrative experience of Sakai City, as an "environmental model city", and by disseminating and deploying advanced environmental technology.

Among the environmental fields covered by City-to-City Collaboration Program, the Project targets on the three main fields of cooperation (see the figure below) : zero-carbon, circular economy, and smart city (including smart industrial parks), where Sakai City has advantages, and which are required by Ba Ria - Vung Tau Province. Support is provided for comprehensive decarbonization of the urban environment of Ba Ria - Vung Tau Province by enhancing administrative know-hows, human resource development, and collaboration with private enterprises in the target fields through City-to-City Collaboration activities and basic study for JCM model projects.



Source: Sakai City and Nippon Koei Co., Ltd.

Figure 3-1 Project Approach

3.3 Project Activities

The activities of the Project are listed as follows.

<Support for Building Institutions>

- Share the measures of Sakai City for carbon neutrality such as the action plan for measures to combat global warming and discuss implementation policies on climate change measures of Ba Ria - Vung Tau Province, in order to conduct a study for being a zero-carbon city of Ba Ria - Vung Tau Province.
- Share the " Sakai Project for Local Energy Production and Local Energy Consumption" and other initiatives of Sakai City, as the “Decarbonization Leading Area,”.

<Energy Conservation and Renewable Energy>

- Share initiatives related to decarbonization in Sakai City, including the development of large-scaled photovoltaic power plants and eco-model towns
- Study the need for introducing energy-saving equipment in industrial parks
- Study for formulating JCM model projects of energy-saving and renewable energy facilities

- Study for formulating JCM projects of Smart Industrial Parks

<Solid Waste Treatment>

- Share Sakai City's knowledge and experience for a recycling-oriented society (including the effective use of waste energy)
- Study for formulating JCM model projects of Waste-to-Energy and utilization of biomass

3.4 Results of Activities related to City-to-City Collaboration

3.4.1 Outline of Activities

The surveys, meetings, and workshops conducted this year are shown in the table below. Materials for related meetings are shown in Attachment 1 – Attachment 4.

Table 3-1 List of Activities of the Project

Activity	Time of implementation	Overview
Meeting with Takuma Co., Ltd. (online)	July 8, 2022	- The following were confirmed: overall project plan, draft plan of activities by Takuma Co., Ltd. in this fiscal year, contents of subcontract work and project schedule.
Meeting with Sakai City (online)	July 22, 2022	- The outline of the project and the activity plan, etc. in this fiscal year were explained and discussed.
Meeting with Air Water Inc. (online)	July 26, 2022	- The outline of the Project in this fiscal year was presented. The activity plan and schedule of Air Water Inc. were explained. The contents of the subcontract work were confirmed.
Meeting with Osaka Gas Co., Ltd. (face-to-face/online)	July 29, 2022	- The outline of the Project and the activity plan, etc. in this fiscal year were explained and discussed. The future business promotion method for the introduction of equipment and system of Osaka Gas Co., Ltd. was confirmed.
Implementation of on-site information gathering surveys	August 8, 2022- February 28, 2023	- On-site survey conducted by Nippon Koei Vietnam International Co., Ltd. (NKV) - Relevant information on the environmental policies of Ba Ria-Vung Tau Province and facilities subject to JCM, etc was collected.
Meeting with the related organizations of Ba Ria – Vung Tau province (face-to-face and online)	August 29, 2022	- The meeting was held between Nippon Koei, NKV and related organizations (DONRE, BIZA, DOFA, DOST, DPI) of the Ba Ria – Vung Tau province. - The outline of the project and the procedures by the Ba Ria – Vung Tau Province for the future activity implementation with Sakai City were confirmed.
Meeting with the Ba Ria – Vung Tau Branch of Japanese Commerce and Industry of Ho Chi Minh City (online)	September 27, 2022	- JCM financing program was introduced to Ba Ria – Vung Tau Branch of Japanese Commerce and Industry of Ho Chi Minh City (JCCH-BRVT). - It was confirmed that JCCH-BRVT will cooperate with inviting member companies of JCCH-BRVT to a workshop of the Project.

Activity	Time of implementation	Overview
Implementation of the first on-site survey	October 2-7, 2022	<ul style="list-style-type: none"> - Field surveys were conducted by Sakai City, Nippon Koei and NKV. - In addition to city-to-city meeting with DONRE and other relevant agencies of the Ba Ria - Vung Tau Province, visits and discussions were held with other relevant organizations (PM3SIP, Air Water subsidiaries, Osaka Gas-related local subsidiaries, and companies introducing JCM subsidized facilities).
Kick-off meeting with the Ministry of the Environment (face-to-face/online)	October 14, 2022	<ul style="list-style-type: none"> - A kick-off meeting with the Ministry of the Environment was held to report and discuss progress and plans for the current fiscal year's activities.
Consultations with TAKUMA CO., LTD. regarding on-site surveys and project formation (telephone conference)	October 24, 2022	<ul style="list-style-type: none"> - Information was exchanged on the recent situation of city-to-city cooperation activities and sales activities in Vietnam. - The future study approach was discussed.
Meeting with Air Water Co., Ltd. (online)	November 7, 2022	<ul style="list-style-type: none"> - Information was exchanged on the latest status of city-to-city collaboration activities, and discussions were held on preparations for the technology introduction seminar in December and subsequent study approach.
Meeting with Osaka Gas Co., Ltd. (face-to-face/online)	November 25, 2022	<ul style="list-style-type: none"> - Information was exchanged on the latest status of city-to-city collaboration activities, and discussions were held on preparations for the technology introduction seminar in December and subsequent study.
Meeting with Sakai City (face-to-face/online)	December 6, 2022	<ul style="list-style-type: none"> - Information was exchanged on the recent situation of inter-city cooperation activities. - Consultations on technology introduction seminars on Wednesday, December 14, and consultations on city-to-city collaboration activities in the following fiscal year were held.
Technology Introduction Seminar (online)	December 14, 2022	<ul style="list-style-type: none"> - Technology introduction seminar was held for local Japanese companies (8 companies). - JCM financing program that can be used to introduce decarbonization technologies and Japanese environmental technologies (solar power generation, high-efficiency boilers, etc., biomass utilization, waste-to-energy) that contribute to low and decarbonization were introduced.
Meeting with new candidate for next year project (online)	December 21, 2022, February 10, 2023	<ul style="list-style-type: none"> - The meeting was held between Nippon Koei and the company which participated in the technology introduction seminar held on December 14 (Wednesday). In the seminar, they said that they would like to have consultations individually with Nippon Koei.

Activity	Time of implementation	Overview
		- Detailed discussions were made on the possibility of participation in this City-to-City Collaboration Project in the next fiscal year and the application methods of JCM financing program.
Progress Reporting Meeting with the Ministry of the Environment (online)	January 13, 2023	- Progress reporting meeting with the Ministry of the Environment was held to report and discuss progress, achievements and plans of activities in the current fiscal year, and plans for the next fiscal year.
Implementation of the second on-site survey	February 13 to 16, 2023	- Field surveys were conducted by Sakai City, companies participating in the Project, Nippon Koei and NKV. - In addition to interurban consultations with relevant agencies of Ba Ria – Vung Tau province, on-site technical workshop was held, and other relevant agencies (waste treatment companies, Osaka Gas subsidiary, Vietnam Chamber of Commerce and Industry) were visited and discussed.
On-site technical workshop (face-to-face, online)	February 14, 2023	- An on-site technical workshop was held in the PM3SIP. - Examples of JCM model project that can be used to introduce decarbonization technology and Japanese environmental technologies that contribute to low and decarbonization by companies participating in the Project (solar power generation, high-efficiency boilers, biomass utilization, waste power generation) was introduced.
Participation in and announcement of the Zero Carbon City International Forum 2023	March 1, 2023	- The effectiveness of City-to-City Collaboration was announced at the keynote speech of the Zero Carbon City International Forum 2023. And the outline of the Project was exhibited online.
Final Report Meeting with the Ministry of the Environment (online)	March 6, 2023	- The final report meeting with the Ministry of the Environment was held to report and discuss the results of activities for the current fiscal year and the schedule of activities for the next fiscal year.

Source: Nippon Koei Co., Ltd.

(1) Kick-off Meeting with DONRE

On October 4, 2022, a kick-off meeting was held with Sakai City, Nippon Koei, and related organizations (DONRE, BIZA, DOFA, DOST, DPI) of Ba Ria - Vung Tau Province. This meeting included information-sharing and exchanging views on the launch of the City-to-City Collaboration Project, confirming how to conclude a MOU, and consultations on holding a workshop.

[Overview]

Date and time: October 4, 2022 (Tuesday) 14:00-16:00 (Vietnam Standard Time)

Location: DONRE Conference Room in Ba Ria – Vung Tau Province

Participants:

- Ba Ria - Vung Tau Province

Mr. Dang Son Hai, Deputy Director of DONRE

Mr. Tran Thuong Tho, Director of EPA

Mr. Tran Anh Duc, Manager of EPA

Mr. Tran Chi Cong, Manager of DOFA

Mr. Pham Ngoc Thai, DOIT

Mr. Tran Van Ha, Management board of BIZA

- Japan Desk

Ms. Luong Nguyen Hoang Tram

- Sakai City

Mr. TOMITA Kenji, Environmental policy Division

Mr. MORI Takashi, Environmental Energy Division

Mr. TOKUNO Wataru, Environmental Facilities Division

- Nippon Koei Co, Ltd and Nippon Koei Vietnam International Co., Ltd.

Ms. BABA Aki, Mr. KOSHIGUCHI Ryuto, Mr. KATO Shota, Mr. Nguyen Truong Giang, Ms. Nguyen Thi Tu Oanh

- Interpreter

Ms. Pham Kim Hong



Source: Nippon Koei Co., Ltd.

Figure 3-2 The kick-off meeting with DONRE

(2) First On-site Survey

The first on-site survey was carried out for the purpose of face-to-face consultation with the staff of the Ba Ria - Vung Tau Province and the collection of information on the site facilities, etc. The main activities are summarized in Table 3-2

- Survey period: October 3, 2022 (Monday) - October 5, 2022 (Wednesday) * Excluding travel dates
- Participants: 3 officials from Sakai City, 3 staff from Nippon Koei, 2 staff from Nippon Koei Vietnam, and 1 local interpreter

Table 3-2 Results of the First On-site Survey

#	Activities	Results of Consultation and Investigation
1	Consultation with Phu My 3 Specialized Industrial Park (PM3SIP) management company	The following consultations were held with PM3SIP management company which cooperates with holding a workshop of the project and overseas business expansion of Japanese enterprises. 1) Preparations for consultation with DONRE 2) Preparation and confirmation of workshop 3) Necessity of MOU between Sakai City and Ba Ria – Vung Tau Province 4) Coordination with other international cooperation schemes, etc.
2	Site visit to PM3SIP wastewater treatment plant	<ul style="list-style-type: none"> • The wastewater treatment plant has a Class A wastewater treatment standard, and it conforms to the most stringent standard in Vietnam. • By the end of December 2022, all industrial parks in the province are required to meet Class A standards. There are no fines, but there is a request for improvement of the management method to meet the standards upon notification from the province. • Since Sakai City also has a coastal industrial complex, they decided to proceed with discussions while confirming common items with the activities of Ba Ria-Vung Tau Province, such as monitoring information on wastewater treatment.
3	Site visit to a food manufacturing factory	<ul style="list-style-type: none"> • Two biomass boilers were constructed with the assistance of JCM. • Since 100% of the steam is used for the biomass-fired boiler in the manufacturing and drying process, a significant reduction in GHG emissions can be achieved compared with the conventional gas-fired boiler. • The plant has realized Net zero through the introduction of biomass-boilers and other facilities.
4	Meeting with officials from Ba Ria-Vung Tau Province	The following were discussed with DONRE, DOFA and DOIT. 1) Procedures for commencing the city-to-city collaboration project. 2) Procedures for MOU conclusion and confirmation of target sectors. 3) Confirmation of workshop timing, approval, etc.

#	Activities	Results of Consultation and Investigation
5	Consultation and facility tour with Air Water Vietnam located in Phu My 1 Industrial Park	<ul style="list-style-type: none"> • Operation started in 2014. This plant manufactures industrial gas (physically separates oxygen, argon, and nitrogen from the atmosphere) for a wide range of applications, including semiconductors and medical applications. Oxygen is the main and other separated gases are released to the atmosphere. • It mainly sells gases to plants in PM1, but they also have a sales base in Hanoi. • The plant utilizes EVN grids over PM1. To reduce power consumption as much as possible, They are currently considering installing rooftop solar panels.

Source: Nippon Koei Co., Ltd.



Meeting with the PM3SIP management company



Meeting with related departments of Ba Ria - Vung Tau Province



PM3SIP: wastewater treatment facilities



Monitoring of the wastewater treatment facility



Phu My 1 Industrial Park: Air Water Vietnam Plant

Source: Nippon Koei Co., Ltd.

Figure 3-3 Photos of the First On-site Survey

(3) Online seminar

On December 14, 2022, an online seminar for introducing carbon-free technologies to local Japanese-affiliated companies was held to promote the decarbonization of the Ba Ria - Vung Tau Province. In this seminar, the following ideas were introduced: JCM financing program which can be utilized as a subsidy for the introduction of decarbonization technology, and Japanese environmental technologies (photovoltaic power generation, high-efficiency boiler, etc., biomass utilization, waste-to-energy) which contribute to low- or zero-carbon society.

[Overview]

- Date: Wednesday, December 14, 2022, 10:00-11:00 (Vietnam Standard Time)
- Location: Online (Zoom)
- Participants: 22 participants, including Japan Desk, Sakai City, Nippon Koei, and local Japanese-affiliated companies.

The contents of the program are as follows. See Attachment 2 for presentation materials.

Table 3-3 Online Seminar Program

#	Time (*)	Agenda	Speaker
1.	10:00-10:10	Opening Remarks	Sakai City, Japan Desk
2.	10:10-10:20	Introduction of JCM financing program that can be utilized for introduction of decarbonization	Nippon Koei Co., Ltd.
3.	10:20-10:50	Introduction of Japanese environmental technologies contributing to low- or Zero carbon society <ul style="list-style-type: none"> • Solar power generation, high-efficiency boilers, etc. • Utilization of Biomass • Waste power generation 	Osaka Gas Co., Ltd. AIR WATER INC. TAKUMA Co., Ltd.
4.	10:50-11:00	Questions and answers	Nippon Koei Co., Ltd.

Source: Nippon Koei Co., Ltd.

(4) Workshop

[Overview]

Date: Tuesday, February 14, 2023

Location: Phu My 3 Special Industrial Park and online (Zoom) hybrid format

Participants: About 56 people in total, including Sakai City, companies participating in this project, and local companies

The contents of the program are as follows. See Attachment 3 for explanatory materials.

Table 3-4 Workshop Program

#	Time (*)	Agenda	Speaker
1.	10:00-10:05	Opening Remarks	Environmental Bureau, Sakai City and PM3SIP
2.	10:05-10:15	Policies and actions of countermeasures against climate change in Sakai City	Environmental Bureau, Sakai City
3.	10:15-10:25	Introduction of city-to-city collaboration project and JCM(Joint Crediting Mechanism) Model Projects (Japanese subsidy program for facilities of renewable energy and energy saving)	Nippon Koei
4.	10:25-10:35	Introduction of good practice of JCM Model Project in Ba Ria – Vung Tau Province	Iguacu Vietnam Co., Ltd.
5.	10:35-11:20	Introductions of Japanese advances technologies <ul style="list-style-type: none"> • Solar PV and high-efficiency boiler • Utilization of biomass • Waste-To-Energy 	Osaka Gas Co., Ltd. AIR WATER INC. TAKUMA Co., Ltd.
6.	11:20-11:35	Q&A and discussion	Nippon Koei
7.	11:35-11:40	Closing Remarks	Consulate General of Vietnam in Osaka

Source: Nippon Koei Co., Ltd.

(5) Second On-site Survey

The second field survey was conducted for face-to-face discussions with officials from Ba Ria-Vung Tau Province and information collection on local facilities. An overview of the main activities is shown in Table 3-5.

Survey period: February 13, 2023 (Monday) to February 15, 2023 (Wednesday)

*Excluding travel days, etc.

Participants: 1 Sakai City official, 4 Nippon Koei employee, 2 NKV employee, 1 local interpreter

Table 3-5 Results of the Second On-site Survey

#	Activities	Results of Consultation and Investigation
1	Discussions with an industrial gas manufacturer	The following discussions were held. 1) Explanation of City-to-City Collaboration Project 2) Sharing information on the hydrogen field, etc.
2	Meeting with DOFA	DOFA and other relevant departments confirmed the flow toward the conclusion of the MOU in the future. The international cooperation schedule in the Ba Ria-Vung Tau Province Plan in 2023 (No.07/KH-UBND, February 1, 2023) includes a plan to conclude an MOU.
3	Meeting with VCCI Vung Tau	VCCI Vung Tau, Air Water Inc. and Nippon Koei Co., Ltd. held the following discussions. 1) Briefing on the organization of VCCI Vung Tau 2) Explanation of City-to-City Collaboration Project and JCM 3) Information sharing on biomass utilization 4) Plan for future cooperation, etc. It was confirmed that the decarbonization-related technologies of companies in Sakai City will be introduced, and JCM-related workshops will be held for companies belonging to VCCI Vung Tau in the future.
4	Consultations with industrial and hazardous waste disposal companies and facility tours	Interviews and facility tours were conducted with local companies that handle industrial and hazardous waste disposal. Information was collected on industrial and hazardous waste treatment methods and treatment capacity.
5	Meeting with DONRE	The content of the MOU and the flow of future conclusions were confirmed. It was confirmed that DONRE of Ba Ria-Vung Tau Province will collect comments from related organizations and report within the ministry toward the conclusion.
6	Discussions with waste collection and transportation companies/ Facility tours	Local waste collection and transportation companies, Takuma Co., Ltd., and Nippon Koei Co., Ltd. shared information on waste collection.
7	Meeting with the Consulate General of Japan in Ho Chi Minh City	After Sakai City and Nippon Koei explained the outline of the project, the progress including the results of the workshop was reported.



Meeting with DOFA



Meeting with VCCI Vung Tau



Facility tour of an industrial/hazardous waste disposal company (waste disposal plant)



Facility tour of an industrial/hazardous waste disposal company (wastewater treatment facility)

Source: Nippon Koei

Figure 3-4 Photos of the Second On-site Survey

(6) Presentations at International Forum designated by Ministry of the Environment

At “Zero Carbon City International Forum 2023” held on March 1, 2023, a presentation by Sakai City (See the Attachment 4) was delivered at the keynote speech, and an online exhibition of the Project outline was held. The presentation introduced the background and outline of the Project, and the environmental measures of Sakai City including the Decarbonization Leading Area, and good examples on carbon neutrality.

(7) Utilizing XR

At the time of the field survey in October 2022, DX (Digital Transformation) utilization in the Project was tried. For the purpose of introducing the building of PM3SIP management office, which was supposed to be a venue of workshop, still images were taken at multiple points using a 360° camera. Files of the form of JPEG, PDF, etc. are attached to the captured video, and detailed information can be accessed in the video. With this video content created in the trial, it is possible to grasp the situation in the facility in detail without traveling to the site. This time, for a simple trial, it was only to watch the

contents which recorded the screen operated beforehand. In the more advanced XR (Extended Reality) tool, viewers will wear VR (Virtual Reality) goggles and experience the metaverse as if they were actually in the space. In the future, it is expected to support the field survey, promote DX technology to the partner city, share the information in a workshop, and use it as a human resource development tool.



Source: Pocket Queries, Inc. and Nippon Koei Co., Ltd.

Figure 3-5 Example of VR Screen

3.4.2 Activities of Support for Building Institutions

The following two activities are involved in the field of support for building institutions

(1) City-to-City discussion for decarbonization of Ba Ria- Vung Tau province

In FY2022 as the first year of City-to-City Collaboration Program, the two cities deepened their mutual understanding of their efforts and issues toward the zero-carbon city and strengthened their cooperative relations toward the conclusion of the Memorandum of Understanding (MOU).

The activities and discussions are summarized as follows.

[Preparation for the MOU between two cities]

At the meeting between Environmental Bureau of Sakai City and DONRE of Ba Ria - Vung Tau Province in October 2022, it was confirmed that two cities will start preparation of MOU. After the prior consultation with the Consulate General of Vietnam in Osaka, the mayor of Sakai City submitted a draft MOU concerning carbon neutrality and other related environmental areas to the chairman of the People's Committee of Ba Ria - Vung Tau Province in November 2022. Department of Foreign Affairs (DOFA) of Ba Ria - Vung Tau Province and DONRE took procedures for concluding the MOU under the direction of the People's Committee. The concluding of MOU is scheduled in the Ba Ria – Vung Tau provincial plan of FY2023 and to be concluded soon after the finalization of MOU contents.

The proposed MOU includes the establishment of mutually beneficial cooperative relations mainly in the areas of decarbonization and related environmental issues, the sharing of administrative issues and experiences, the development of human resources, and the promotion of industry development and business-to-business exchange.

[Exchange of opinions on the decarbonization of Ba Ria - Vung Tau Province]

In exchanges of views with DONRE of Ba Ria - Vung Tau Province, the following measures and needs were identified as priority fields.

- The cooperation needs are confirmed for the fields of Waste-to-Energy, photovoltaic power generation and wind power generation etc. in Ba Ria - Vung Tau Province.
- Especially in the solid waste management field, the construction of Waste-to-Energy plant with a capacity of 1,000 tons/day in the province and an incineration plant with a capacity of 50 tons/day in the Con Dao district are planned. The province also promotes solid waste management including the waste separation.

In the industrial sector, the provincial government will conduct a study for smart industrial parks, eco-industrial parks, and industrial parks utilizing IT techniques. The cooperation in the following fields is expected.

- Introduction of Sakai City's technology and promotion methods for environmental management of industrial parks using advanced technologies such as monitoring system of environmental pollution
- Attracting manufacturers with low environmental impact and companies with environmentally friendly technologies
- Support Ba Ria - Vung Tau Province to establish an effective management and operation system with business operators in industrial parks, based on Sakai City's experience on sound environmental management for enterprises in industrial parks with regards to solid waste management, air pollution management and other related area.

In addition, it was confirmed that Ba Ria - Vung Tau Province will promote the management and utilization of environmental data with DX, such as promoting the disclosure of environmental data using the provincial website and SNS.

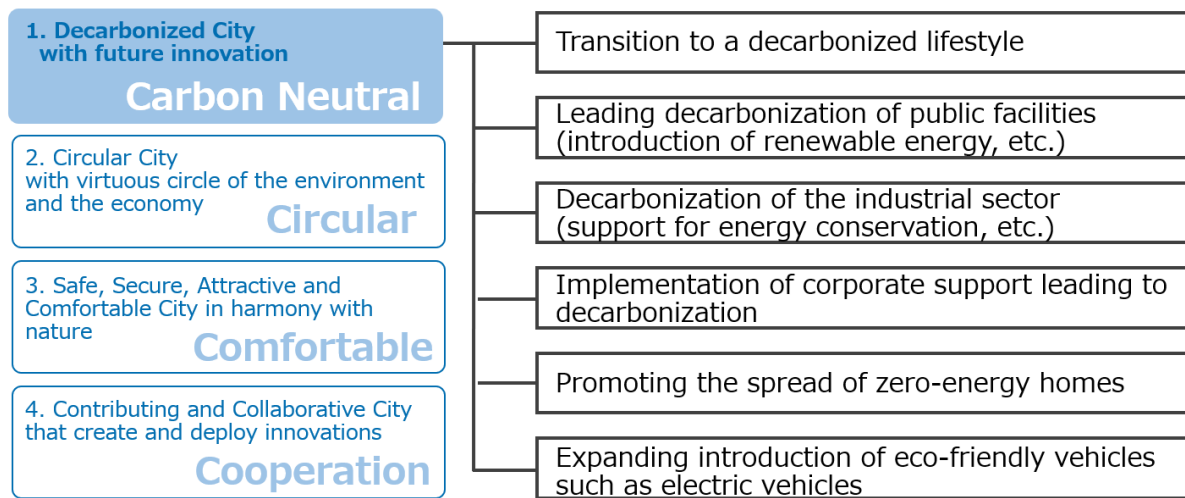
Further discussions of City-to-City Collaboration in the priority fields such as solid waste management will be held in the next fiscal year.

(2) Sharing of efforts for carbon neutrality in Sakai City

At the first on-site survey in October 2022, Environment Bureau of Sakai City introduced environmental efforts including decarbonization and solid waste management to relevant departments such as DONRE, BIZA, DOST of Ba Ria - Vung Tau Province, in response to the need for decarbonization and solid waste management in Ba Ria - Vung Tau Province. The outline of the activities in each field is shown below.

1) Long-term vision towards carbon neutrality in Sakai City

Sakai City aims to become a world-leading environmentally advanced city with four "C" (Carbon Neutral, Circular, Comfortable, Cooperation) as the keywords in Sakai Environment Strategy. As shown in Figure 3-6, measures are being taken in various related sectors, such as industrial, housing, and transportation, in order to realize a zero-carbon city.

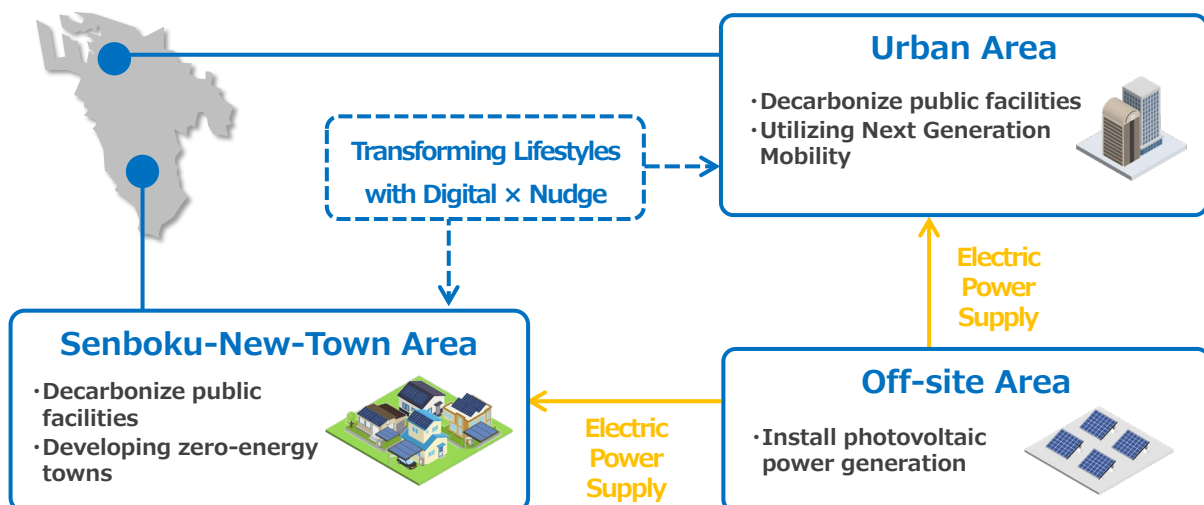


Source: Sakai City

Figure 3-6 Long-term Vision in the Environmental Field of Sakai City

2) Project for local energy production and local energy consumption (Decarbonization Leading Area Project)

In April 2022, Sakai City was selected by the Ministry of the Environment as a "Decarbonization Leading Area" as a nationwide model for realizing carbon neutrality in Japan by 2030. In the "Sakai Local Energy Production and Local Energy Consumption Project" as a Decarbonization Leading Area Project, the urban model of "Local Energy Production and Local Energy Consumption" is proposed. From FY2023 onward, City Hall and other public facilities are scheduled to be converted to zero-energy buildings and Zero Energy Towns will be built in line with the reconstruction of public rental housing in the new town area.



Source: Sakai City

Figure 3-7 Overview of Sakai Local Energy Production and Local Energy Consumption Project

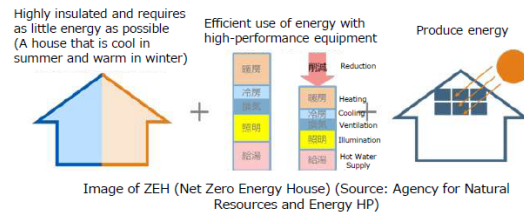
3) Sharing measures and knowledge of Sakai City in the field of energy conservation and renewable energy

GHG emissions in Sakai City have been decreasing year by year since peaking in FY 2014, but further reductions are required toward the target in 2030 (a reduction of 50% or more compared to FY2013). Sakai City is characterized by a high proportion of GHG emissions in industrial sector compared to the national average because of being an industrial city.

In addition to “Sakai Local Energy Production and Local Energy Consumption Project” described above, Sakai City has promoted advanced initiatives such as the installation of large-scaled solar power plants in 10 MW and the development of Eco Model Towns that have achieved net-zero energy in the whole town area.

Support for introduction of ZEH, etc.

- Part of the cost of introducing ZEH (Net Zero Energy House) equipment, such as a solar power generation system, is subsidized.



Creation of Harumidai Eco Model Town

- A residential area was developed using the site of an elementary school. The housing units in all 65 blocks are ZEHs, and the entire block has achieved a "Net Zero Energy Town (ZET)".



Harumidai Eco Model Town

Introduction of solar power generation system to municipal facilities

- In order to decarbonize municipal facilities, we are promoting the proactive introduction of photovoltaic power generation systems by utilizing private funds and leasing methods. As of the end of FY2021: 109 facilities with a total of 2,511 kW installed.



Installation in elementary school



Installation at a sewage treatment plant

Sakai Solar Power Plant

- A large-scale solar power plant is installed at the landfill site for industrial waste that has been completely filled.

[Area] About 21 hectares

[Power generation capacity]
 10 MW (about 4,000 ordinary households)

[Panel used]
 SHARP thin-film solar cells
 (approximately 74,000 sheets)

[Operation] From September 2011



Source: Sakai City

Figure 3-8 Example of Promoting the Renewable Energy in Sakai City

Support for the introduction of energy-saving equipment for business establishments

- In order to promote energy conservation at business sites, we subsidize part of the cost of updating equipment such as water heaters, boilers, refrigerators and freezers, and air compressors for business use (subsidy rate of 1/3 in FY2022, Up to 900,000 yen)

Dispatch of Energy Conservation Advisors

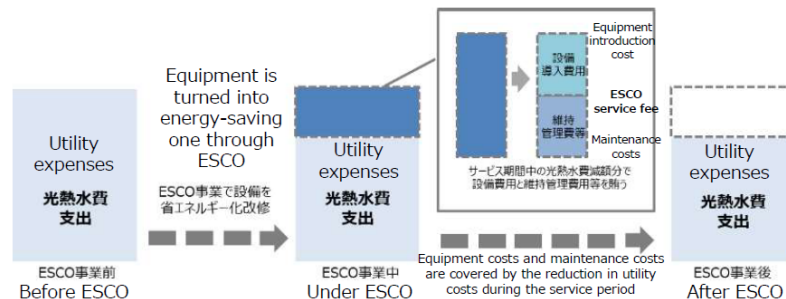
- We dispatch manufacturers' experts to business offices in the city to measure the usage status and load of equipment, and provide energy conservation advice based on the obtained data. We also provide equipment tuning upon request.



Energy-saving renovation of municipal facilities

- Through the ESCO (Energy Service Company) project, private sector funds and know-how are used to make energy-saving renovations to equipment, etc., to reduce the environmental impact and effectively reduce utility costs.

	Amount of reduction (compared to before the start of service)	
	Kita Ward Office	Higashi Ward Office
Annual greenhouse gas emissions	34%	40%
Annual utility bill	31%	39%



Source: Sakai City

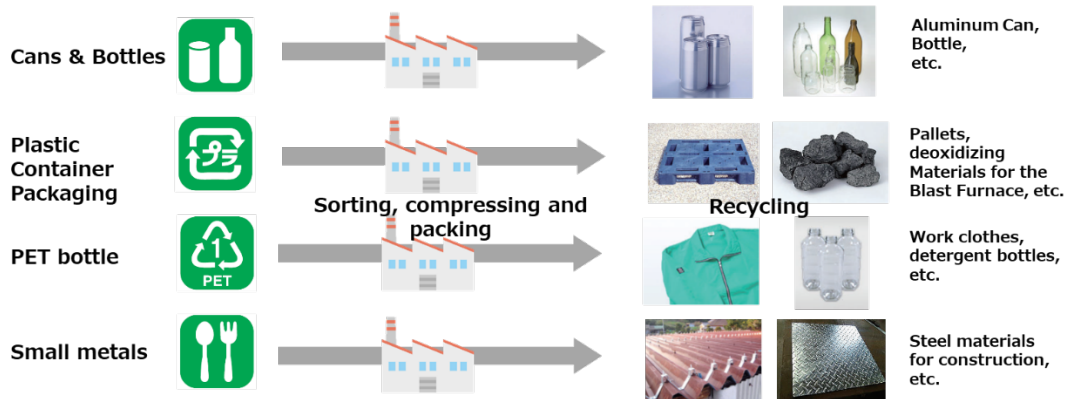
Figure 3-9 Example of Promotion of Energy Conservation in Sakai City

4) Sharing measures and knowledge of Sakai City in the waste disposal field

In the No.2 Plant of the Higashi Plant of Sakai City, a municipal waste treatment facility in Sakai City, steam and electric power are generated from the residual heat of waste incineration. The generated steam and electricity are utilized as a heat source and a power source in the plant. The surplus of steam and electricity is sold to neighboring private factories and sent to the city's fitness facilities for use as heat sources for hot water pools and bathing facilities and as power sources for air conditioning. In addition, local governments in Vietnam are urgently required to sort and promote recycling of municipal waste. Therefore, it is expected that more concrete examples of activities in Sakai City will be shared in the next fiscal year.

Separation and recycling of resources from households

- Among household solid waste, recyclable items such as plastics and metals are sorted and collected with the cooperation of citizens and reused for various purposes.



Incineration processing and waste to energy

- Collected garbage and other solid wastes are incinerated (melted down) at two waste incineration plants in the city.
- The surplus heat from waste disposal is used to generate electricity, and the surplus power and steam are sold to power company and neighbouring facilities to generate income.



Clean Center East Plant
 (Incineration processing and waste to energy)



Clean Center Waterfront Plant
 (Melting treatment* and waste to energy)
 * Solid waste is melted at high temperatures of 1,700 to 1,800 Degrees Celsius. Metallic waste is recycled as metal, and other waste is recycled as slag.

Source: Sakai City

Figure 3-10 Examples of Efforts of Sakai City in the Solid Waste Management Sector

CHAPTER 4 PRELIMINARY STUDY FOR JCM MODEL PROJECT

4.1 Data Collection and Preliminary Study for Development of JCM Model Projects

4.1.1 Data collection for identifying needs of renewable energy and energy saving in private sectors

As a part of preliminary study for formulating JCM model projects in private facilities of Ba Ria - Vung Tau Province, basic information on the need of renewable energy and energy saving facilities will be collected.

A total of 104 enterprises are listed as major consumers of electricity (Decision No: 1480/QD-TTg of Ba Ria – Vung Tau Province, 2021). The industrial sector consumes the most electricity, accounting for 96% of the total. The table below shows the list of organizations by business category. In the industrial sector, the steel-related enterprises (total 15 operators) consume the largest 449,340 TOE (petroleum equivalent tons) (28% of the total), followed by the oil and natural gas enterprises (total 2 operators) consuming 269,199 TOE (17% of the total). For these large-scale electric power consumers, potential needs for the installation or renewal of renewable energy and energy-saving facilities are considered high.

Table 4-1 Power Consumption by Business Category of Ba Ria– Vung Tau Province (2020)

Industry	Power Consumption (TOE)	Number of operators
Construction		
Other specialized wholesale not elsewhere classified	21,168	1
Hotels	8,608	2
Specialized design activities	4,643	1
Hospital activities	1,527	1
Non-specialized wholesale trade	901	1
Retail sale in supermarkets, shopping malls	901	1
Restaurants and mobile food service activities	575	1
Industry		
Manufacture of iron, steel and cast iron	449,340	15
Extraction of crude petroleum and natural gas	269,199	2
Electric power generation	251,555	4
Manufacture of non-alcoholic beverages	62,994	1
Manufacture of glass and glass products	57,228	2

Industry	Power Consumption (TOE)	Number of operators
Spinning of textile fibers	52,489	6
Manufacture of structural metal products	47,488	2
Manufacture of clay construction materials	35,402	4
Manufacture of refined petroleum product	32,004	3
Manufacture of basic chemicals	28,560	3
Manufacture of fertilizers and nitrogen compounds	26,231	2
Production of gas; distribution of gaseous fuels through mains	20,595	2
Other business support services not elsewhere classified	19,658	1
Manufacture of paper and paper products	16,827	1
Manufacture of plastics and synthetic rubber in primary forms	16,216	1
Manufacture of other basic chemicals	13,966	1
Other remaining business support service activities not elsewhere classified	12,234	3
Installation of industrial machinery and equipment	9,047	2
Manufacture of luggage, handbags and the like, saddlery and harness	7,355	1
Manufacture of concrete and articles of cement and plaster	7,018	2
Manufacture of machinery for food, beverage and tobacco processing	6,305	1
Milling and Manufacture of flours	6,111	2
Wholesale of solid, liquid and gaseous fuels and related products	5,989	1
Manufacture of vegetable and animal oils and fats	5,888	1
Manufacture of other fabricated metal products not elsewhere classified	5,725	1
Manufacture of metals	5,660	1
Manufacture of other porcelain and ceramic products	5,453	1
Manufacture of cement, lime and plaster	4,585	1
Operation and maintenance of petroleum and other industrial works	4,261	1
Manufacture of malt liquors and malt	3,981	1
Specialized design activities	3,790	1

Industry	Power Consumption (TOE)	Number of operators
Manufacture of starches and starch products	3,660	2
Other professional, scientific and technical activities not elsewhere classified	3,026	1
Tanning and dressing of leather; dressing and dyeing of fur	2,828	1
Processing and preserving of fisheries and fishery products	2,258	1
Manufacture of plastics products	2,131	1
Extraction and supply of freshwater	1,975	1
Manufacture of sporting and athletic goods	1,787	1
Geologic and water sources surveying activities	1,705	1
Retail sale of other household equipment in specialized stores	1,609	1
Building of ships and floating structures	1,505	1
Manufacture of other chemical products not elsewhere classified	1,354	1
Civil engineering	1,281	1
Manufacture of footwear	1,258	1
Manufacture of tanks, reservoirs and containers of metal	1,028	1
Transport		
Rail and Road transport and Transport via pipelines	13,918	7
Harbour cargo handling	8,306	1
Service activities incidental to water transportation	2,706	2
Other transportation support activities	1,162	1
Total	1,584,974	104

Source: Ba Ria – Vung Tau province, Decision No: 1480/QD-TTg, 2021

4.1.2 Data Collection on Solid Waste Management

(1) Solid waste management plan and status

1) National strategy and master plan

In Vietnam, Decision No. 491/QD-TTg, “the National Strategy to 2025 and the prospects for 2050 on General Management of Solid Waste”, was enacted in May 2018 with the goal of properly collecting, transporting, and disposing of all general solid waste and 85% of hazardous solid waste by 2025. On the other hand, in August 2013, Ba Ria-Vung Tau province established Decision No.1880/QD-UBND,

“the Master Plan by 2025 and the prospects for 2030 on Solid Waste Management”. Appropriate solid waste management is one of the top priorities for environmental protection and pollution control. By 2030, all solid wastes should be classified, collected, reused, recycled, and properly disposed by source, with the goal of minimizing the amount of waste transported into final disposal sites.

2) Waste generated

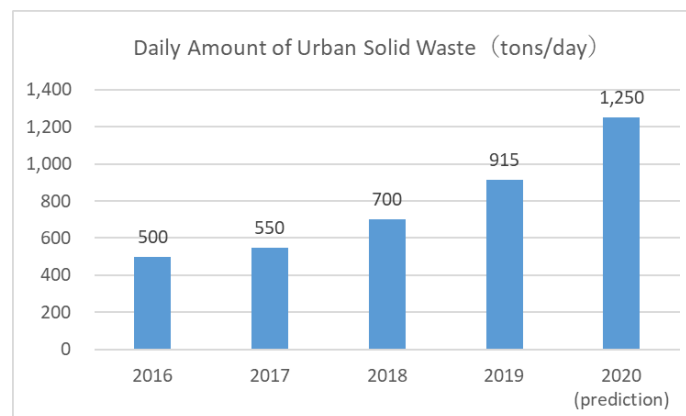
The following table shows the daily generation of municipal solid wastes in Ba Ria-Vung Tau Province. Municipal general waste is 915 tons/day, agricultural solid waste is 218 tons/day, ordinary industrial waste is 1,285 tons/day, hazardous industrial waste is 204 tons/day, and medical waste is 1.1 tons/day.

Table 4-2 Daily Generation of Municipal Solid Waste in Ba Ria-Vung Tau Province

No.	Category	Waste generated (tons/day)	Year
1	Municipal general waste	915	2019
2	Agricultural waste	218	2020
3	General industrial waste	1,285	2019
4	Hazardous industrial waste	204	2019
5	Medical waste	1.1	2019

Source: Summary Report of the Environmental Situation in Ba Ria Vung Tau Province 2016-2020

Municipal general waste and ordinary industrial waste account for the majority of total municipal solid waste. The following table shows trends in the amount of municipal general waste generated. The amount of waste has also increased with the development of cities since 2018, and it is predicted to increase to 1,250 tons/day in 2020.



Source: Summary Report of the Environmental Situation in Ba Ria Vung Tau Province 2016-2020

Figure 4-1 Daily Generation of Municipal General Waste (tons/day) in Ba Ria-Vung Tau Province

According to the Waste Management Master Plan (Decision No.1880/QD-UBND), the total amount of wastes generated should be reduced to approximately 8,420 tons/day (municipal general waste: 1,590 tons/day, industrial wastes (general and hazardous): 6,100 tons/day, medical wastes: 8.3 tons/day, construction wastes: 250 tons/day, and sewage sludge: 300 tons/day).

3) Centralized waste treatment area

The Master Plan of Ba Ria - Vung Tau Province has the construction plan of three centralized waste treatment areas. One is in operation, and the others are under planning. The outline of each treatment zone is shown in the table below.

Table 4-3 Overview of Centralized Waste Treatment Areas in Ba Ria-Vung Tau Province

	Toc Tien Centralized waste treatment area	Lang Dai Centralized waste treatment area	Phuoc Hoa Centralized waste treatment area
Construction site	Tan Thanh district	Dat Do district	Tan Thanh district
Site area	130 ha	20 ha	14.7 ha
Target area	All areas in Ba Ria-Vung Tau province	Vung Tau City, Long Dien and Dat Do districts	Ba Ria City, Tan Thanh and Chau Duc districts
Description of Businesses	<ul style="list-style-type: none"> - Management and final disposal of industrial waste (common and hazardous), and recycling. Landfill of wastes that cannot be treated in other treatment areas - Waste-to-Energy treatment and final disposal of general solid waste. 	<ul style="list-style-type: none"> - Treatment and Final Disposal of municipal solid waste by Waste-to-Energy 	<ul style="list-style-type: none"> - Treatment and final disposal of municipal solid waste by composting
Operational status	Operating (Currently, most municipal solid wastes in the province are accepted. However, Waste-to-Energy treatment has not yet been introduced.)	Under planning	Under planning

Source: Decision No.1880/QD-UBND

(2) Waste Emission Enterprises in Phu My 3 Specialized Industrial Park

A survey was carried out on the waste discharge business in Phu My 3 Specialized Industrial Park. The number of enterprises surveyed was 18, and the respective business categories are shown in the table below. A wide variety of 12 types of projects were implemented, mainly in manufacturing and processing.

Table 4-4 Number of Waste Emission Companies in Phu My 3 Specialized Industrial Park

Category	Number of Operators
Gas production line	2
leather products	1
Food processing industry	2
Furniture manufacturer	1
Steel manufacturers	1
Electronic component maker	1
Building materials manufacturer	2
Non-ferrous metal processing industry	2

Category	Number of Operators
Petroleum product manufacturers	1
Chemical manufacturers	3
Paper processing industry	1
Plastics processing industry	1
Total	18

Source: Phu My 3 Specilized Industrial Park Website (Browsed on January 13, 2023: "<http://www.phumy3sip.com/ja-JP/Default.aspx>")

(3) Current procurement status of Waste-to-Energy plant

1) Preferential treatment system in Vietnam

In Vietnam, various preferential systems for Waste-to-Energy projects have been established in accordance with the "Measures to Support the Development of Waste-to-Energy Projects in Vietnam (Decision No. 31/2014/QĐ-TTg)" decided by the Prime Minister in May 2014. The feed-in tariff (FIT) is established in this decision. The electricity sales price is 2,114 VND/kWh (\approx 10.05 US cents/kWh for direct incineration and 1,532 VND/kWh (\approx 7.28 US cents/kWh for burnt gases recovered from landfill sites. In addition, land use lease payments related to power transmission can be reduced or exempted, and the People's Commission is responsible for compensating and subsidizing the expropriation of land.

2) Status of Waste-to-Energy Project in Ba Ria-Vung Tau Province

In May 2021, the People's Committee of Ba Ria-Vung Tau Province announced Decision 463/QĐ-UBND for the selection of a Waste-to-Energy facility for Toc Tien centralized waste treatment area. A summary of the requirements is given in the table below.

Table 4-5 Outline of Waste-to-Energy Facility to be Procured in Toc Tien Centralized Waste Treatment Area

Item	Content
Installation site	Toc Tien centralized waste treatment area
Site area	5 ha or less
Treatment capacity	500 tons/day
Target waste	Municipal solid waste in Ba Ria-Vung Tau province
Business method	BOO (Build Own Operate)
Project operating period	49 years or less
Tipping fee	572,415 VND/ton

Source: Decision 463/QĐ-UBND

4.1.3 Information Collection on Smart Cities

(1) Information on industrial parks in Ba Ria-Vung Tan Province

Ba Ria-Vung Tau Province is the largest industrial district in southern Vietnam, and has abundant natural resources (oil, natural gas, building materials) and the Cai Mep Port, which is the entrance to the sea. The province has been making efforts to attract Japanese companies. In addition to Ho Chi Minh City, the neighborhood includes Binh Duong Province, Dong Nai Province, Tay Ninh Province, Long An Province, Vinh Phuc Province, and Tien Giang Province, and the Southern Key Economic

Region is required to concentrate the development of industrial parks and smart urban areas in the context of the projected inflow of foreign investment into Vietnam in the near future. Since Ba Ria-Vung Tau Province has heavy and petrochemical industries in the Southern Economic Region, the supply chain of southern Vietnam is formed by supplying products to the light industrialized regions of neighboring Dong Nai Province, Binh Duong Province, Longan Province, and Ho Chi Minh City.

At present, 15 industrial parks have been constructed in Ba Ria-Vung Tau Province as shown in the map below. Under the management of Ba Ria-Vung Tau Industrial Zones Authority (BIZA), all developments and operations are conducted by private developers. Most of them are located along the western Thi Vai River or in the coastal area, but the three parks of Chau Duc, Dabak, and Dat Do are inland.



Source: Support for expansion into Ba Ria-Vung Tau Province Japan Office HP (<https://jp.BaRia-Vungtau.gov.vn/wps/portal/industry>)

Figure 4-2 Location of Industrial Parks in Ba Ria-Vung Tau Province

(2) Measures and trends for the introduction of smart cities in Vietnam

In August 2018, the Vietnamese Government promulgated the Prime Minister's Decision 950/QĐ-TTg to endorse the Vietnamese Sustainable Smart City Development Project from 2018 to 2025 and the Vietnamese Policy to 2030 to provide guidance for the development of Smart Cities. The decision states that ICT should be used to effectively manage urban governments, make efficient use of natural resources such as land and energy, improve the quality of life, and promote socio-economic development. Currently, more than 30 cities nationwide in Vietnam have adopted a policy on smart cities, and each has formulated a master plan for smart city construction. Among them, smart cities

networks centered around Hanoi City, Da Nang City, Ho Chi Minh City, and Can Tho City have been formed.

Between 2014 and 2019, the United Nations Industrial Development Organization (UNIDO) and the Vietnamese Ministry of Planning and Investment (MPI) undertook pilot projects in industrial parks in Ninh Binh Province, Da Nang and Can Tho City and were forced to switch to eco-industrial parks in industrial areas. Consequently, in May 2018, "Cabinet Order 82/2018/ND-CP No. (hereinafter, Cabinet Order No. 82)" was promulgated as a policy on smart management parks (eco-industrial parks), and "Cabinet Order 35/2022/ND-CP No. (hereinafter, Cabinet Order No. 35)," which revised Cabinet Order No. 82, was promulgated in May 2022, to promote IT utilization in industrial parks. In addition to IT utilization, this revision promoted eco-friendliness of industrial parks (reduction of pollution sources, recycling-based production, and decarbonization), and developed soil for urban development centered on industrial parks. Policy formulation for the promotion of the Eco-Industrial Park Policy was clearly described as the responsibility of each province.

(3) Measures and trends for the introduction of smart cities in Ba Ria-Vung Tau province

In the Ba Ria-Vung Tau Province, in response to the Vietnamese government's "Vietnam's Sustainable Smart City Development Plan from 2018 to 2025 and the Policy for 2030", in December 2019, the People's Council resolved the "Smart City Development Project from 2020 to 2022, Direction for 2025, and Vision for 2030" (No.112/NQ-HDND). Under the provincial project, smart cities are formed by applying information and communication technology in six fields: management, economic, transportation, environment, citizens, and lifestyles.

In April 2022, the Smart City Monitoring Center (IOC) was established, which began operation of a system in which data on 10 fields of (1) socio-economic, (2) administration, (3) proposed reflection systems, (4) healthcare, (5) education, (6) tourism, (7) natural resource and environmental, (8) social networks, (9) information security, (10) security cameras and transportation are collected on IOC and displayed visually on the system.

From the above, the improvement of the service in residents and industrial field by utilizing the data in Ba Ria-Vung Tau Province is expected in future.



Source: Vietnam Posts and Telecommunications Group HP (<https://vnpt.com.vn/>)

Figure 4-3 Smart City Monitoring Center in Ba Ria-Vung Tau Province (IOC)

4.2 Preliminary Study for JCM Model Project for Energy-Saving Equipment (Once-through Gas Boiler): OSAKA GAS CO., LTD.

4.2.1 Outline of Study

This study examined the feasibility of fuel conversion from fuel oil to natural gas and the introduction of gas once-through boilers for several industrial park operators and tenant factories in Ba Ria - Vung Tau Province. The preliminary study focused on collecting information and introducing decarbonization technologies and case studies at the workshop as the activity of the first fiscal year of the Project. In addition, specifications and implementation structure for the target equipment are summarized based on experience of the ongoing JCM model project in the other areas of Vietnam.

4.2.2 Technology Expected to be Introduced

In this study, it is assumed that a once-through gas boiler from a Japanese boiler manufacturer, Miura Co., Ltd will be introduced. This type of boiler has already been adopted in the JCM model project in Vietnam and the requirements for JCM financing program were already confirmed.



Source: Miura Co., Ltd.

Figure 4-4 Image of Gas Once-through Boiler

The high-efficiency gas once-through boiler pushes boiler water into the boiler from one end of the water pipe and converts it into steam without circulating it. This type of boiler has excellent start-up performance due to the low water-holding capacity. It is compact, space-saving, and does not take up much space. The once-through boiler is a technology that has been developed and introduced mainly in Japan and has features such as low noise and low NOx emissions. The advantages over other the boilers are shown in the table below.

Table 4-6 Advantages of High-efficiency Gas Once-through Boilers

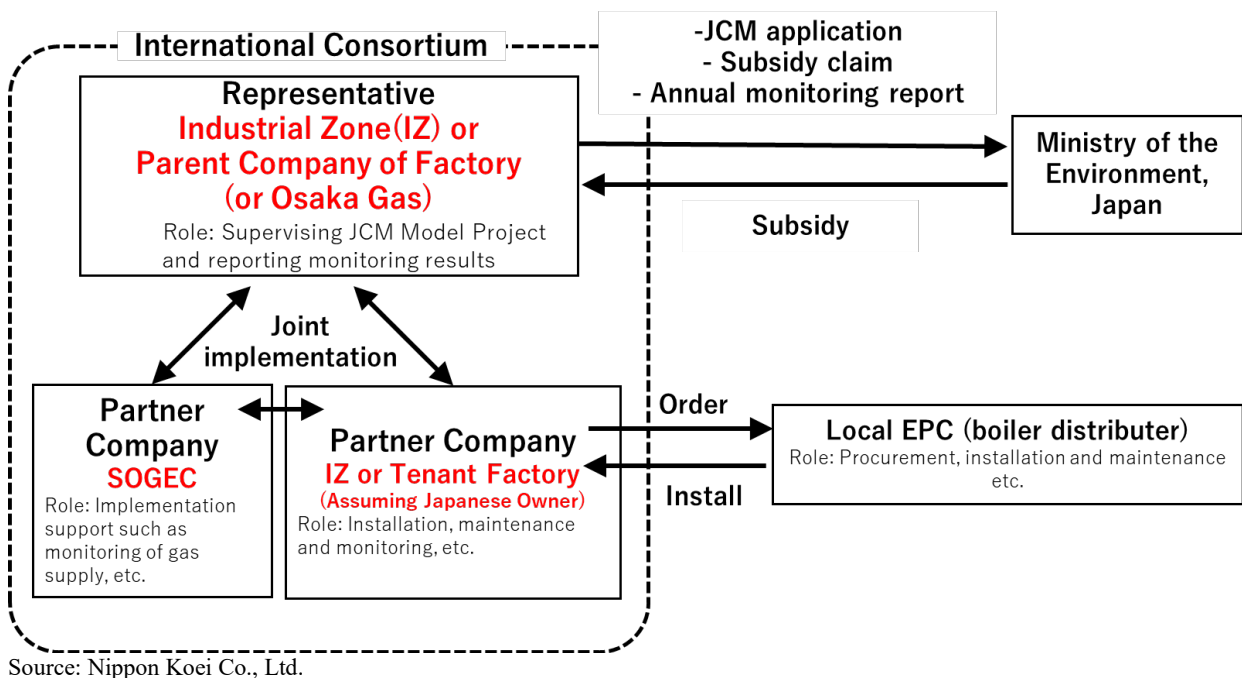
Advantages	Overview
Through-flow boiler with high mobility, load-following capability, and advanced control	Unlike the water tube boiler, in which water is pushed in from one end of the pipe and circulated, water is converted to steam inside the pipe, resulting in superior startup and load-following performance and enabling rapid startup. Advanced control is used to stabilize steam volume and steam temperature.
Space saving	Small boiler with small space requirement (approx. 60% of other types)
High efficiency in low-load operation	High efficiency and low carbon emissions are possible due to control that follows load changes and enables high-efficiency operation over a wide range of heat loads.
Recovery of exhaust combustion gases by economizer	High efficiency is achieved by recovering residual heat from discharged fuel gas with a feed water preheater (economizer) and preheating water pressurized by a feed water pump.
Low NOx and CO emissions	Excellent low emission characteristics. Reduces NOx and CO values in the full load combustion range.

Source: Nippon Koei Co., Ltd.

4.2.3 Draft Implementation Structure for JCM Model Project

The international consortium structure for JCM model project is assumed to be as follows. Osaka Gas Co., Ltd. (hereinafter referred to as "Osaka Gas") is a participating company in the project and has a track record as a representative company in several JCM model projects.

Sojitz Osaka Gas Energy Company Ltd. (SOGEC) is a joint venture established by Sojitz Corporation, Sojitz Vietnam, and Osaka Gas Singapore Pte. Ltd. which is wholly owned subsidiary of Osaka Gas. Osaka Gas and SOGEC are ready to participate in a JCM model project as an international consortium with a company that will install a facility, to provide continuous support for the gas supply business during the project implementation period.



**Figure 4-5 Image of Implementation Structure for JCM Model Project
(Once-through Gas Boiler)**

4.3 Preliminary Study for JCM Model Project for Biogas Generation and CO₂ Capture Technologies: AIR WATER INC.

4.3.1 Outline of Study

The possibility of GHG emission reduction by introduction of biogas production (wet methane fermentation system) and CO₂ recovery equipment which are developed by AIR WATER Inc. (hereafter referred to as “Air Water”), was investigated in the Project.

Study method and items are shown below.

- Study method: Collection of waste-related public information and data, and on-site hearing survey

- Study subjects: local government officials, industrial parks, tenant companies, waste disposal companies, etc.
- Survey items: Procedures and issues for waste treatment in industrial parks and plants, potential needs for biomass and biogas utilization

4.3.2 Technology Expected to be Introduced

(1) Waste-derived biogas generation and utilization system

Air Water is conducting demonstration experiments on biogas generation technology using food residues in Japan. The amount of treatment is assumed to be 1 ton/day, and the amount of biogas generated is assumed to be about 120 Nm³/ days (methane : carbon dioxide = 6:4). As a business model, Air Water aims to contribute to a local community by receiving waste from a region and developing a "Quatro Generation System" in a methane fermentation plant, which sells green CO₂ as power generation or dry ice etc., as well as heat and fertilizer sales.

The full-scale capacity of commercially sized plant which will be operated in Matsumoto City, Nagano Prefecture in 2024 is assumed to be 30 tons/day. The similar-sized plant will be proposed to municipalities and local companies in Ba Ria - Vung Tau Province.

(2) CO₂ recovery technology

Using CO₂ recovery technology that is under development by Air Water, it is proposed to consider developing a carbon dioxide-supplying businesses in Ba Ria – Vung Tau Province. The main specifications are as follows.

- Dry ice production capacity: 100 kg/ day
- Size of facility: 40 ft container size
- Technical features: CO₂ in various exhaust gases can be removed and collected as gas, liquid, or dry ice. The purity of recovered CO₂ can be adjusted to less than 99%. The entire process from exhaust gas to CO₂ generation can be completed in a single unit of compact container-sized facility.
- Type of exhaust gas: Exhaust gas from a biogas boiler using wood chips, etc. are assumed.
- How to utilize CO₂: Additive to concrete material, dry ice blast cleaning for metal/semiconductor, neutralizer for wastewater treatment, etc.
- Reduced GHG emissions: Because GHG emissions from biomass-derived exhaust gases is not counted, the expected GHG emissions reduction is estimated to be 36.5 tons/year. This calculation is derived from the assumed operating hours of 365 days/year, multiplied by the emission rate of 0.1 CO₂ tons/day.

4.3.3 Study Results

(1) Waste-derived biogas generation and utilization system

Based on the statistical data of Ba Ria - Vung Tau Province (2020), a survey was conducted on the potential of biomass energy sources. The results are shown in Table 4-7 and Table 4-8. There are 48,992

head of cattle and 344,918 head of pigs being raised, which produce wastes which are suitable as feedstock for wet methane fermentation systems, and the estimated biogas generation potential is about 140,000 Nm³/day. In addition, food residues are also useful as feedstock for methane fermentation, and interviews with food wholesale market in Ho Chi Minh City are scheduled to be conducted in the next fiscal year.

In addition, a survey of energy consumption of 100 companies in Ba Ria - Vung Tau Province was conducted to investigate the potential of biogas utilization. From these companies, a food processing factory (Company I) with high potential for methane fermentation was selected to conduct an interview. The company manufactures coffee and has already installed a biomass boiler using woodchips and rice husks as fuel in the factory. Company I is currently considering the use of coffee bean residues. The supplemental interview will be carried out to obtain further information for introducing a methane fermentation plant and a biogas boiler.

Table 4-7 Potential Bioamss Energy Soure in Ba Ria – Vung Tau Province (1)

Cultivation	Planted area (ha)			Production (ton)		
	2018	2019	2020	2018	2019	2020
Paddy Crop	25,004	24,605	24,368	129,757	136,130	130,965
Corn	13,544	13,596	13,177	70,227	70,579	73,211
Sweet Potatoes	292.9	293.3	22.1	1,258	1,261	96
Cassava	7,239	7,520	7,201	175,778	185,427	186,859
Sugar-cane	309	313	299	14,002	14,627	14,052
Perennial crops	58,066	61,036	59,734	129,815	147,391	157,627

Source: Ba Ria – Vung Tau statistic book, 2020

Table 4-8 Potential Bioamss Energy Soure in Ba Ria – Vung Tau Province (2)

Livestock	Number (head)		
	2018	2019	2020
Buffaloes	466	461	464
Cattles	47,440	48,699	48,992
Pig	356,595	335,086	344,918
Horse	16	14	13
Goat	64,325	85,487	88,481
Sheep	487	477	384
Poultry	4,689	5,125	5,702

Source: Ba Ria – Vung Tau statistic book, 2020

(2) CO₂ Capture Technology

The interview survey was conducted on raw material sources and demand for CO₂ in the south-central area of Vietnam. Cassava ethanol plants are the most common source of CO, and other sources include molasses ethanol plants, methanol plants and fertilizer plants. The price of CO₂ production depends on cassava production.

The purity of liquefied carbon dioxide (LCO₂) distributed in Vietnam is generally 99.9% or higher. The quality of LCO₂ for food additives is also subject to the same global standards.

Regarding demand, it was confirmed that liquefied carbon dioxide gas for food additives and carbon dioxide gas cylinders for welding are the mainstream, and dry ice is not widely distributed. In particular, dry ice for low-temperature transportation for food distribution, which is in high demand in Japan, does not match the Vietnamese culture and is not expected to be in current demand. On the other hand, AIR WATER Inc. is developing a container-type CO₂ recovery system with a product with 99% of CO₂ purity. The demand survey in Vietnam needs to target on applications for blast cleaning.

4.3.4 Project Plan and Feasibility

(1) Biogas production from waste

The examination for installation of one treatment plant in Ba Ria - Vung Tau Province will be carried out on the assumption of 30 tons/day of treatment amount. The schedule for formulating the project plan is as follows, and concrete project plan will be drafted in the next fiscal year and beyond. The feasibility of introduction in Ba Ria - Vung Tau Province will be examined referring to the business feasibility assessment of the demonstration plant in Japan which is scheduled to start operation in 2024.

Year 1: Information collection, on-site needs survey (FY2022)

Year 2: Selection of candidate companies, hearing, and preparation of draft business plan

Year 3: Preparation of application for JCM financing program

(2) CO₂ recovery technology

Since CO₂ recovery/generation quantity is decided by the standard of one equipment unit, the feed quantity can be simply calculated according to the quantity of facilities to be introduced. Currently, the technology is under development, and the manufacturing and business potential will be examined in the next fiscal year and beyond in line with the following schedule.

Work schedule

Year 1: Information collection and local needs survey

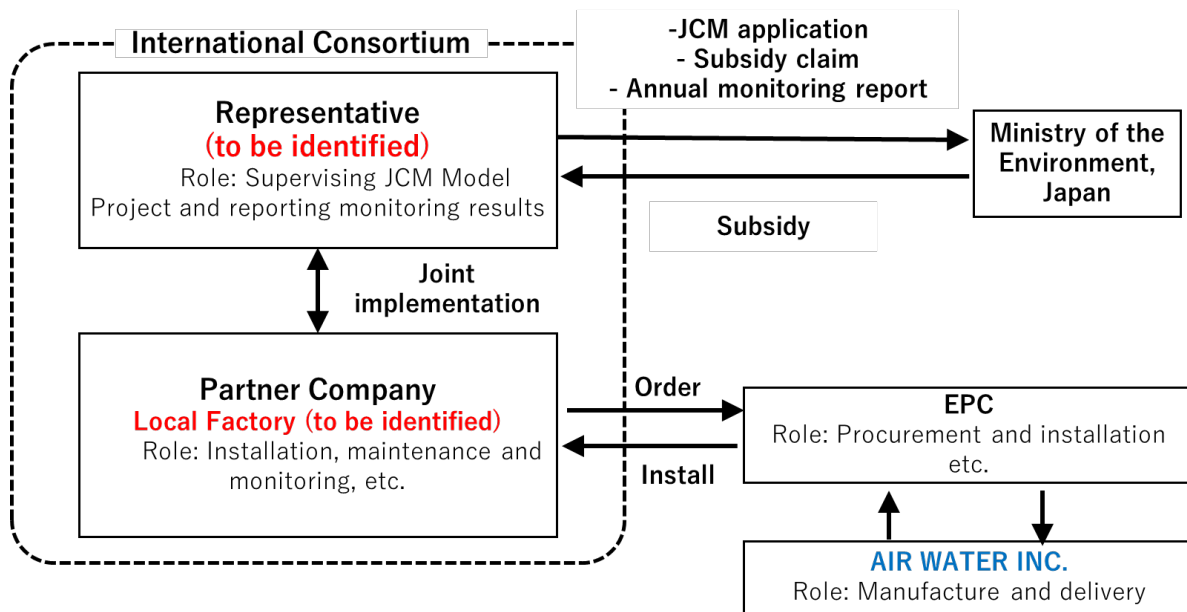
Year 2: Selection of candidate companies, hearing, and technical proposals

Year 3: Sales contract

4.3.5 Draft Implementation Structure for JCM Model Project

(1) Biogas production from waste

The draft implementation structure for JCM model project for introducing this technology is shown in the following figure. In the upcoming fiscal year, candidate facilities (plants, etc.) that are highly likely to be installed will be selected. The implementation structure will be elaborated through discussions with a local company and EPC which will be a member of international consortium or key business partner.



Source: Nippon Koei Co., Ltd.

Figure 4-6 Image of Implementation Structure for the JCM Model Project (AIR WATER INC.)

(2) CO2 recovery technology

As this technology aims to be introduced to local companies as BtoB sales, the implementation structure for JCM model project is not currently anticipated. However, if the use of biomass-derived exhaust gas is to be considered, GHG emission reduction will be estimated and an application for JCM financing scheme will be considered.

4.3.6 MRV Plan

In this fiscal year, the site status and needs survey are mainly conducted. Therefore, a MRV (Measurement, Reporting and Verification) plan will be prepared after a target facility and candidate of partner company are identified in the following fiscal year.

4.4 Preliminary Study for JCM Model Project for Waste-to-Energy : TAKUMA CO., LTD.

4.4.1 Outline of Study

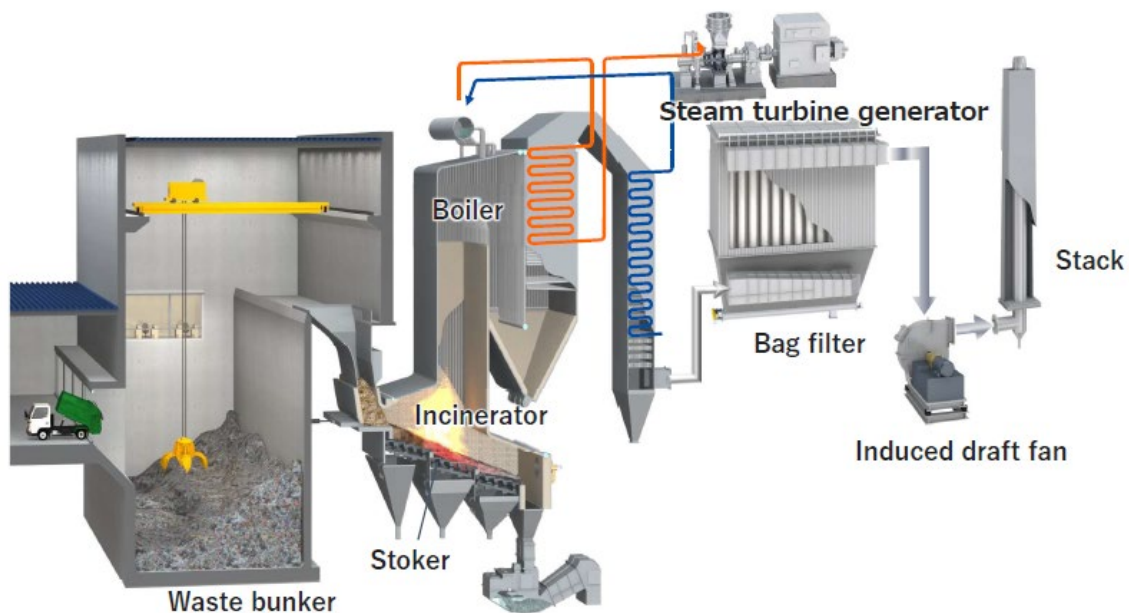
Based on the results of the aforementioned waste survey in Ba Ria - Vung Tau Province, the feasibility of introducing a waste-to-energy project in the province was examined. This year's survey focused on collecting and organizing local information, including the province's waste-to-energy project plan, examining specifications for the equipment to be introduced, and conducting interviews with waste treatment companies and other parties.

4.4.1 Technology Expected to be Introduced

Currently, waste treatment method in Ba Ria - Vung Tau Province is limited to landfill only, but the optimal scale and specifications for the future introduction of an incineration and power generation facility were studied. As shown below, a stoker-type incinerator is assumed to be capable of stably incinerating and generating electricity from a large volume of waste with diverse properties.

Features and advantages of a stoker-type incinerator

1. No pre-treatment is required. The waste is fed directly from a waste pit.
2. Stable combustion is possible for mixed combustion of various types of waste.
3. Easy operation control due to slow combustion.
4. High reliability with a proven track record.



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Source: TAKUMA CO., LTD.

Figure 4-7 Image of Waste-to-Energy System

4.4.2 Study Results

Interviews were conducted with an industrial/hazardous waste treatment company and a collection/transportation company in Ba Ria - Vung Tau Province to investigate the business activities of local waste-related businesses.

The table below shows the results of interview with industrial/hazardous waste treatment company. The company is located in the Toc Tien centralized waste treatment area and has been responsible for the treatment of over 500 types of industrial/hazardous waste since 2018, mainly waste from industrial parks in Ba Ria - Vung Tau Province.

Additional interviews for detailed waste volume and waste quality of industrial/hazardous waste generated in the province will be planned in order to examine the feasibility of a waste-to-energy facility as needed.

Table 4-9 Result of the Interview with Industrial/Hazardous Waste Treatment Business

Date and Time	February 15, 2023, 9:00-11:00 a.m.	
Facility location	Toc Tien centralized waste treatment area	
Site area	15,000 m ² (solid waste treatment facility) 28,000 m ² (wastewater treatment facility)	
Year of commencement of business	2018	
Business	<ul style="list-style-type: none"> -Collection, transportation, treatment, recycling, and storage of industrial/hazardous waste and wastewater -The company has treated more than 500 types of waste as stipulated in the province. -The company mainly processes waste generated from industrial parks in the province and is responsible for processing approximately 80% of the waste generated from the Long Son Industrial Park and PM3 Specialized Industrial Park. 	
Business scheme	<ul style="list-style-type: none"> -The company is 100% owned and operated by itself -The land rent is paid by the company to the province. -Disposal costs are contracted individually with each waste generator. 	
Current Facilities		
(1) Industrial/Hazardous waste incineration Facility	Processing capacity: 500 kg/hour/incinerator Incinerators: 2 lines	
(2) Wastewater treatment facility	Processing capacity: 200 m ³ /day Function: Treatment of wastewater generated onsite and industrial wastewater	
(3) Fluorescent lamp treatment system	Processing capacity: 0.16 ton/day	
(4) Electronic spare parts treatment system	Processing capacity: 0.2 ton/day	
(5) Rinsing packaging, drums system	Processing capacity: 0.5 ton/day Function: Cleaning containers and other equipment used for storage and transportation.	
(6) Solidification system	Processing capacity: 0.2 ton/day Function: Recycling of ash and sludge generated onsite into concrete blocks for construction	
(7) Cocooning tank	Volume: 500 m ³ /tank Quantity: 4 tanks Function: Isolation and storage of non-treatable hazardous waste	
(8) Treatment of impurities from waste (scrap land, steel rolling scales, iron powder)	Processing capacity: 140 ton/day Function: Separation of valuable materials such as metals and plastics from mixed wastes	

(9) Aluminium recycling facility	Processing capacity: 20 ton/day
----------------------------------	---------------------------------

Source: Nippon Koei Co., Ltd.

The table below shows the results of interviews with waste collection and transportation company. Since 2018, the company has been responsible for the collection and transportation of general household waste in Phu My Town, Ba Ria - Vung Tau Province, and general waste from business activities of tenant companies in industrial parks located in the area. In addition to this company, there are several other collection and transportation companies in the province. Additional interviews with other companies and final disposal sites for detailed waste volume and waste quality of general waste generated in the province will be planned in order to examine the feasibility of a waste-to-energy facility as needed.

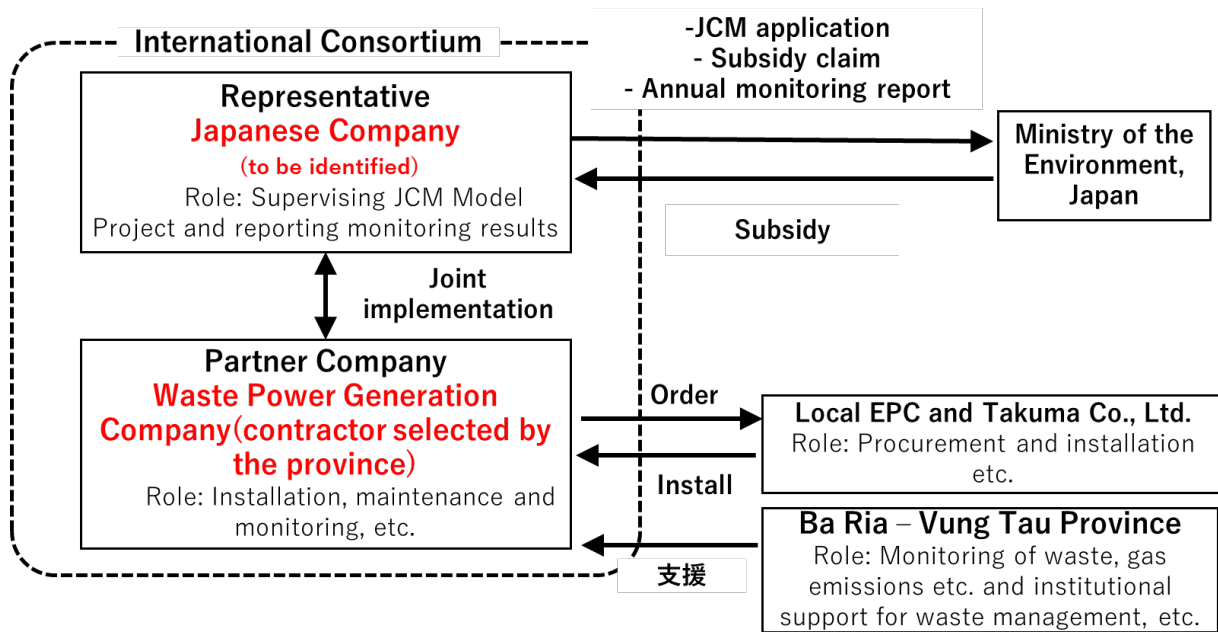
Table 4-10 Results of the Interview with Waste Collection and Transportation Company

Date and Time	February 15, 2023, 13:30-14:30
Facility location	Phu My Town
Year of commencement of business	2018
Business	Collection and transportation of household and commercial general solid waste
Business Scheme	-Household waste: tipping fee is stipulated in the regulation of Ba Ria- Vung Tau province (Decision No. 26/2019) and contracted with the People's Committee of Phu My Town. -Business waste: Transportation costs are set by each company.
Collection area	Phu My Town (3/5 District and 3/5 Commune) Phu My 1,2,3 Industrial Park and My Xuan Industrial Park (of which 130 companies)
Waste transportation destination	Toc Tien centralized waste treatment area
Volume of waste collected	2,100 ton/month
Vehicles owned	-10 m ³ Packer truck -15 m ³ Packer truck -Three-wheeled motorcycle with 1-ton container *Packer truck bodies are made in Japan, containers are made in Vietnam

Source: Nippon Koei Co., Ltd.

4.4.3 Draft Implementation Structure for JCM Model Project

Preliminary idea on the implementation structure for applying for a JCM financing program is shown below. However, at this point, since there have been no discussions on the target site, scale, or how to cooperate with Ba Ria - Vung Tau Province, the specific implementation structure will be considered in the upcoming stage of study.



Source: Nippon Koei Co., Ltd.

Figure 4-8 Image of Implementation Structure for the JCM Model Project (Waste-to-Energy)

4.5 Preliminary Study for JCM Model Project for Solar Power Generation System: OSAKA GAS CO., LTD.

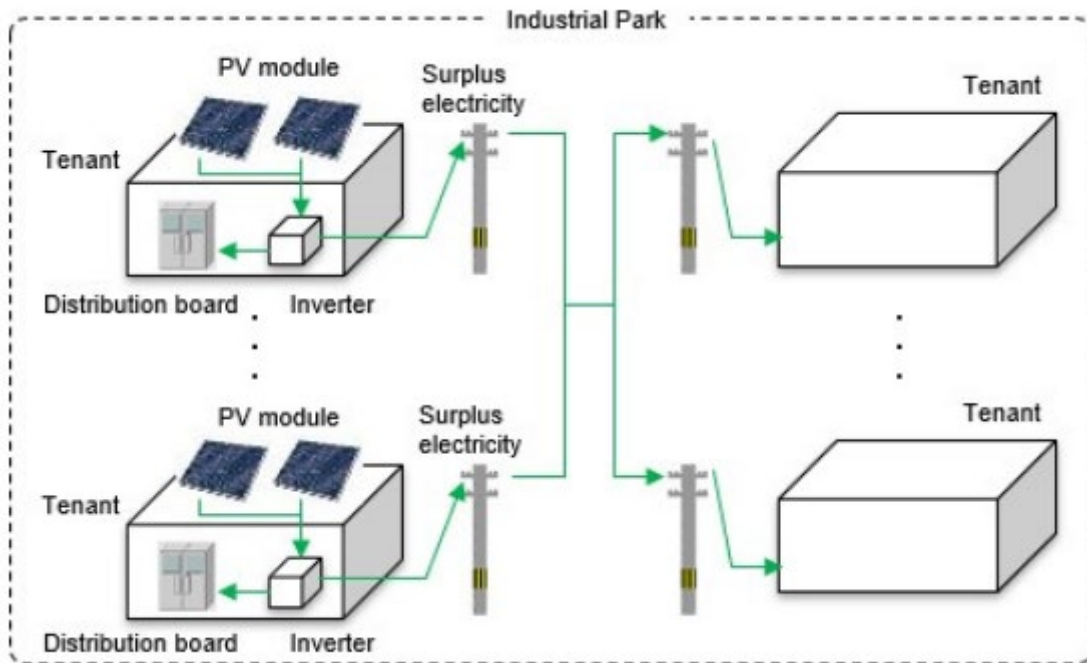
4.5.1 Outline of Study

Regarding a roof-top solar power system, the outline of system and model cases of JCM model projects will be introduced to industrial parks and tenant factories in Ba Ria- Vung Tau Province through the on-site workshop. The individual proposals will be delivered to companies which are interested in introducing. Several target factories that meet the requirements to apply for JCM model project will be identified in the forthcoming fiscal year and beyond.

4.5.2 Technology Expected to be Introduced

In Vietnam, there have been several cases of roof-top solar power system adopted as JCM model projects. Among them, Osaka Gas has been selected as the representative company for the "Installation of 9.8 MW roof-top solar power generation system in the industrial park (FY2021)". This project experience is expected to be horizontally deployed in Ba Ria - Vung Tau Province, referring to the specification and scale.

The system is characterized by its ability to generate electricity at multiple tenant factories that can install roof-top solar panels, and to flexibly distribute the surplus power to other factories in the same industrial park.

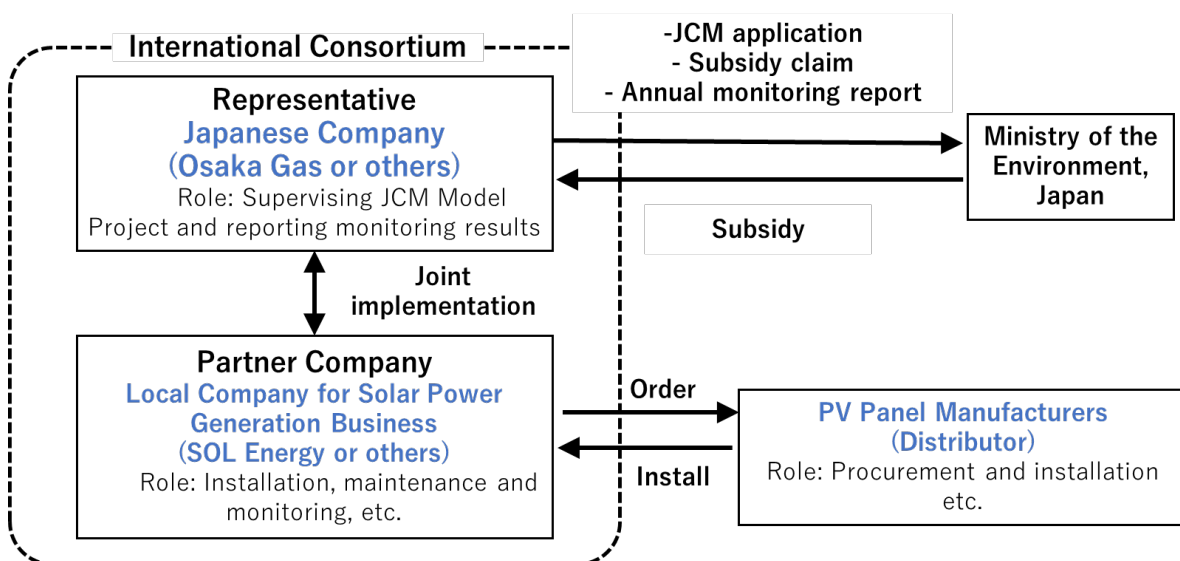


Source: GEC Website: https://gec.jp/jcm/projects/21pro_vnm_06/

Figure 4-9 Image of Solar Power Generation System in Industrial Parks

4.5.3 Draft Implementation Structure for JCM Model Project

The following implementation structure is assumed in the case of applying for a JCM model project, with reference to the other project case in Vietnam. The tenant factory only provides the roof and enters into a contract to purchase the electricity generated and does not participate as a member of international consortium. The partner company is assumed to be SOL Energy Company Limited (SOL Energy) which is a joint venture company of SOGEC and Loop Inc.



Source: Nippon Koei Co., Ltd.

Figure 4-10 Image of Implementation Structure for JCM Model Project (Solar Power Generation System)

4.5.4 MRV Plan

At present, it is presumed that MRV shall be executed according to the endorsed methodology for photovoltaic power generation. The study in FY2022 focused on the site investigation and needs survey. The MRV plan will be drafted following the identification of target facility and possible partner company in the forthcoming fiscal year and beyond.

CHAPTER 5 FUTURE PLAN

5.1 Achievement and Challenges of the Project Activities in FY2022

The achievements and challenges of the Project activities in FY2022 are identified as follows to consider the activity plan of the Project for the next fiscal year.

5.1.1 Support for Building Institutions

(1) Promote dialogue to conclude MOU

The Project was initiated this year as the first city-to-city cooperation in the environmental and carbon neutrality field for both Sakai City and Ba Ria - Vung Tau Province. Since both cities had no experience in City-to-City Collaboration Program, the Project required some time and process to initiate smoothly. Through a series of opportunities for dialogue, mutual understanding was promoted step by step, and an acknowledgement was formed for an MOU in carbon neutrality and other related area. The initial plan was to conclude the MOU by the end of 2022, but it took more time than expected for Ba Ria-Vung Tau Province to complete specified provincial procedures. Even under such circumstances, the Japan Desk at DPI of Ba Ria - Vung Tau Province and other related organizations provided intermediary and logistical support for coordination between the two cities, which helped to ensure smooth implementation of the project. The MOU between the two cities will be signed shortly after administrative coordination.

(2) Sharing of administrative experience and know-hows of Sakai City

While progress was made in preparations for the conclusion of the MOU, the exchange of views between the two cities was limited to a general introduction of decarbonization-related measures. In the next fiscal year, Sakai City plans to share knowledge and case studies from Sakai City in response to individual issues in related fields in Ba Ria - Vung Tau Province. In particular, regarding solid waste management, which has been a priority issue in the environmental sector of Vietnam in recent years, Sakai City's extensive administrative experience in similar fields is expected to be utilized to address separate collection of solid waste in Ba Ria - Vung Tau Province and to implement plans for the Waste-to-Energy project. Other collaborative activities for decarbonization with relevant departments of Ba Ria - Vung Tau Province other than DONRE, which were not pursued in FY2022, will be also planned in the next fiscal year. Considering the industrial characteristics of Ba Ria-Vung Tau, it would be of great significance to advance the province's decarbonization efforts by enhancing City-to-City Collaboration activities, particularly with BIZA and DOIT, to bolster initiatives aimed at introducing energy efficiency and renewable energy in the province's industrial parks and enterprises.

(3) Coordination and collaboration with related stakeholders

Ba Ria-Vung Tau Province is currently preparing to execute a new technical cooperation project with the Japan International Cooperation Agency (JICA), titled "Project for Strengthening Management and Capacity of Eco Industrial Parks with Environmental Consideration and IT Utilization in Ba Ria - Vung

Tau Province, Vietnam". Discussions between Sakai City and JICA officials were held twice during the current fiscal year, at the commencement and closing stages. The officials in charge of from Ministry of the Environment and JICA have confirmed their basic policies towards collaborating with each other's projects. In February 2023, the Ministry of Environment and JICA jointly launched the Clean City Partnership Program (C2P2). It is anticipated that this initiative will facilitate synchronized support for urban issues in Ba Ria - Vung Tau Province, together with JICA projects, in the upcoming fiscal year. The project is further expected to bolster the synchronized support for urban issues in Ba Ria-Vung Tau Province in the following fiscal year and beyond.

5.1.2 Energy Conservation, Renewable Energy and Solid Waste Treatment

(1) Networking with local industrial parks, and the Chambers of Commerce and Industry, etc.

In Ba Ria - Vung Tau Province, an industrial city, it is crucial to reduce GHG emissions in the industrial parks. In this fiscal year, the Project collaborated with companies that operate and manage representative industrial parks in the province. Among others, Phu My 3 Specialized Industrial Park, a Japanese-affiliated industrial park, and Chau Duc Industrial Park, a locally capitalized industrial park, are showing growing enthusiasm for transitioning into eco-industrial parks. The formation of JCM model project is expected to bolster efforts towards carbon neutrality, not only by tenant companies in the industrial parks but also for the entire area of industrial parks. The seminar and workshop of the Project were held for local Japanese affiliated companies, with the cooperation of Ba Ria - Vung Tau Branch of Japanese Chamber of Commerce and Industry in Ho Chi Minh City (JCCH-BRVT). It was highly effective to introduce the JCM financing program and Japanese technology to more than half of the member companies of JCCH-BRVT. Although the activities this year were primarily aimed at Japanese-affiliated companies, the other companies such as non-Japanese local companies and other sectors including hotels and resort facilities will be targeted in the next fiscal year through VCCI Vung Tau and other local networks.

(2) Identification of candidates for JCM model projects

This year, the JCM financing program and available technologies of the participating companies in the Project were introduced to local companies through the online technical seminar and workshop. Through these events, five local companies interested in installing energy-saving and renewable energy facilities were identified and individual discussions were held. Among them, the Project will continue on-site surveys and discussions with local Japanese affiliated company which plans to invest in solar power generation facilities of 2 to 3 MW in order to apply for JCM financing program in the next fiscal year. In this way, the local sales network of the participating company in the Project, which has experience in implementing JCM model projects, is functioning efficiently with regard to the consideration of the introduction of solar power generation.

On the other hand, for the introduction of biogas generation and CO₂ capture technologies, the Project focused on identifying technologies that could be applied locally and understanding their needs. In the next fiscal year, it is expected to examine a candidate site to develop a JCM model project and elaborate a business model.

In addition, for the study of introducing Waste-to-Energy, it is necessary to increase the possibility of participation in the provincial project through more studies on waste quality, waste volume, and profitability, in addition to the basic information on solid waste transportation and collection which was obtained this fiscal year.

(3) Identification of prospective new participant for the upcoming fiscal year

A Sakai-City-based company showed interest in the City-to-City Collaboration Project after participating in the online seminar in December 2022. Subsequent to the seminar, several discussions were held to explore the possibility of the company's participation in the Project. The company has expressed interest in deploying its decarbonization combustion technology overseas in industrial furnaces and is hopeful to participate in the project in the coming year. In order to introduce high-efficiency industrial burners and carbon-free hydrogen and ammonia in industrial furnaces, candidates of potential sites in Ba Ria-Vung Tau Province have been identified, including Japanese affiliated companies such as steel companies. During the upcoming fiscal year, the proposed activities of the Project will encompass gathering relevant information and scrutinizing issues for the introduction of the target technologies. Additionally, the specifications and implementation structure for developing JCM model project will be discussed.

5.2 Proposal for City-to-City Collaboration Project in FY2023

Based on the results and challenges encountered this year, the following activities are proposed and summarized in the table presented below for the Project in FY2023.

Table 5-1 Draft Plan of Project Activities in FY2023

Area/Approach	Item	Plan
Support for institutional building/City-to-City Collaboration Activities	Collaboration between the two cities to combat climate change	Following the sharing of Sakai City's overall efforts in the area of decarbonization in the current fiscal year, a series of in-depth discussions focused on sub-areas that correspond to priority issues in Ba Ria - Vung Tau Province will be planned as a means of exchanging views, building momentum, and promoting specific activities towards the province's decarbonization. Specific themes will include measures to promote renewable energy and energy efficiency, waste sorting and recycling, etc. Based on the MOU to be signed soon, cross-sectoral collaboration will be promoted involving related departments such as DOIT, BIZA, and DOT, in addition to DONRE.
Energy saving, renewable energy, solid waste treatment/Basic study for development of JCM model project	Introduction of energy-saving equipment (once-through gas boiler)	Conduct a feasibility study for replacement of energy-saving equipment, specifically targeting outdated boilers in industrial facilities located in the province.
	Study on introduction of biogas generation technology	A candidate project site will be selected in collaboration with DONRE, targeting sources of organic waste generation, including a public sector, such as public markets in the province.
	Study on introduction of CO ₂ capture technology	Select a target factory of emission sources of exhaust gas as raw material for carbon dioxide gas and candidate suppliers of carbon dioxide gas to formulate a business model.
	Study on introduction of Waste-to-Energy	Examine a business model, which includes the waste collection and sorting system, the cost of disposal, and profitability
	Study on introduction of solar power generation	Prepare for JCM model project applications at Japanese-affiliated companies in the province which plans to install the equipment. Also continue to identify other candidate sites in the same way as this fiscal year.
	Study on introduction of hydrogen combustion technology, etc. in industrial furnaces	Efforts will be undertaken to identify suitable locations for the installation of high-efficiency and hydrogen burners, with the participation of a new company in the Project that specializes in decarbonization combustion technologies for industrial furnaces. Gather and examine relevant information on issues related to the supply of hydrogen gas and other factors that need to be addressed to successfully implement the technology.

Source: Nippon Koei Co., Ltd.