

FY2023
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

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Nippon Koei Co., Ltd.
Sakai City

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List of Attachments

Attachment 1: Presentation Materials of the C2P2 Seminar at COP28 Japan Pavilion

Attachment 2: Presentation Materials of the Technical Workshop

Abbreviations

BESS	Battery Energy Storage System
BIZA	Ba Ria - Vung Tau Industrial Zones Authority
BRVT	Ba Ria - Vung Tau
COP26	The UN Climate Change Conference in Glasgow
C2P2	Clean City Partnership Program
C3P	City-to-City Collaboration Program for Zero Carbon Society
DARD	Department of Agriculture and Rural Development
DO	Diesel Oil
DOFA	Department of Foreign Affairs
DOIT	Department of Industry and Trade
DONRE	Department of Natural Resources and Environment
DPI	Department of Planning and Investment
DX	Digital Transformation
EAFD	Electric Arc Furnace Dust
EPC	Engineering Procurement Construction
EPR	Extended Producer Responsibility
FIDC	Formosa International Diabolo Competition
FIT	Feed in Tariff
FS	Feasibility Study
GEC	Global Environment Centre Foundation
GHG	Greenhouse Gas
HUST	Hanoi University of Science and Technology
IDICO	Vietnam Urban and Industrial Zone Development Investment Corporation
IoT	Internet of Things
IT	Information Technology
IZICO	Phu My 1 and Dong Xuan Industrial Zone Infrastructure Investment and Operation Company
JCCH	Japanese Chamber of Commerce and Industry in HCMC
JCCI	JICA Clean City Initiative
JCM	Joint Crediting Mechanism
JETP	Just Energy Transition Partnership
JICA	Japan International Cooperation Agency
LEP	Laws on Environmental Protection
LNG	Liquefied Natural Gas
MONRE	Ministry of Natural Resources and Environment
MOIT	Ministry of Industry and Trade
MOU	Memorandum of Understanding
NGO	Non-Governmental Organization
NKV	Nippon Koei Vietnam International Co., Ltd
PDP8	Power Development Planning VIII
PPC	Provincial People's Committee
SAF	Sustainable Aviation Fuel
SCNet	Sakai Carbon Neutral Overseas Deployment Network
SOGEC	Sojitz Osaka Gas Energy Company Ltd.

UAE	United Arab Emirates
VCCI	Vietnam Chamber of Commerce and Industry
VND	Vietnam Don
V2H	Vehicle to Home
WtE	Waste to Energy
ZEH	Net Zero Energy House
ZET	Net Zero Energy Town

CHAPTER 1 PROJECT BACKGROUND AND OBJECTIVES

1.1 Background of the Project

According to the Intergovernmental Panel on Climate Change (IPCC)'s Working Group III Sixth Assessment Report published in 2022, approximately 70% of the world's Greenhouse Gas (GHG) emissions come from cities. Accelerating climate action in cities is essential to achieving the 1.5 degree target set by the Paris Agreement. In Japan, the country and cities are working together to create more than 100 Decarbonization Leading Areas under the regional decarbonization roadmap drawn up in June 2021, with the aim of realizing zero carbon cities.

In order to realize a zero-carbon society throughout the world, it is necessary to accelerate the movement toward building a sustainable decarbonized society, especially in Asia, where economic growth is rapid. There is a growing movement internationally to support cities in their efforts to decarbonize cities, which are the sites of activities that support social and economic development .

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 FY2023 is positioned as the "second year" of the City-to-City Collaboration Project (three-year project) between Ba Ria-Vung Tau Province in Vietnam and Sakai City in Japan, which was launched in 2022. 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, hydrogen energy and solid waste treatment, as well as to form Join 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



Figure 1.1 Location of Sakai City

Source: Nippon Koei Co., Ltd.

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.

Table 1.1 Overview of Sakai City

#	Item	Statistics
1	Area	149.83 [square kilometer] (as of January 1, 2023)
2	Total population	815,235 [persons] (as of January 1, 2023)
3	Population density	5,441 [people per square kilometer] (as of January 1, 2023)
4	Number of households	369,874 [households] (as of January 1, 2023)
5	Number of private establishments	30,471 [facilities] (as of January 1, 2023)
6	Gross prefectural product (nominal)	3,480.7 [billion JPY] (as of 2020)

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 1,180,000 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-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



Figure 1.2 Location of Ba Ria – Vung Tau Province

Source: Nippon Koei Co., Ltd.



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, hydrogen energy and solid waste treatment and formulate the JCM Model Project. Environment Bureau of Sakai City and Department of Natural Resources and Environment (DONRE) of Ba Ria-Vung Tau Province served as the points of contact respectively and held discussions regarding the City-to-City Collaboration.

Regarding the JCM Model Project formulation, the following companies participated in the Project: OSAKA GAS CO., LTD. (hereinafter “Osaka Gas”) and AIR WATER INC. (hereinafter “Air Water”), both of which continued to participate from FY2022; Chugai Ro Co., Ltd. (hereinafter referred to as “Chugai Ro”) developing decarbonization technologies of industrial furnace and Kubota Corporation (hereinafter referred to as “Kubota”) having a track record of waste power generation projects in Sakai City and other areas, both of which started to participate from FY2023. They implemented studies to introduce each proposed technologies aiming to apply for the JCM Model Project. The business fields of each company are shown in the table below.

Table 1.3 Technical Field of Participating Companies

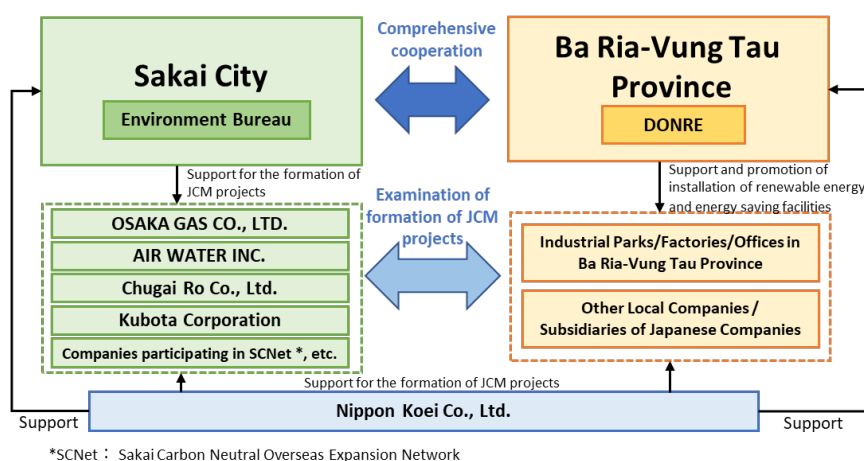
Company Name	Technologies to be Introduced	Features
OSAKA GAS CO., LTD.	Solar power generation, high efficiency boilers, smart industrial parks	Expanding business based on the project experience as representative company of other JCM Model Projects and sales networks of local affiliates, SOGEC and SOL

		Energy.
AIR WATER INC.	Utilization of biomass energy	Having many decarbonization-related technologies such as biomass utilization, CO ₂ capture, and hydrogen production.
Chugai Ro Co., Ltd.	Hydrogen/ammonia combustion technology	Developing decarbonizing combustion technology in industrial furnaces, including the world's first general-purpose hydrogen burner.
Kubota Corporation	Utilizing waste for energy	Having a large track record of contracting for domestic waste treatment and recycling projects, including the waste power generation facility in Sakai City.

Source: Nippon Koei

The implementation structure for the Project is shown below. In addition to the above four 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.

Nippon Koei Co., Ltd., as a representative company of the Project, supported all activities under the Project, and carried out preliminary studies to introduce advanced decarbonization and environmental technologies.



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 June 22, 2023 to March 8, 2024. The Project schedule is shown in the figure below.

*FY2023 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*

#	investigation	2023						2024			
		Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. City-to-City Collaboration activities											
1)	Discussions on City-to-City Collaboration between two cities			▽			▽		▽		
2)	Sharing information and exchanging opinions regarding collaborative fields			▽			▽		▽		
3)	Discussions on activities in FY2024								→		
2. JCM Model Project formation											
1)	Discussion with relevant parties who could be involved in candidate JCM Model Project	→									
2)	Discussions and surveys related to JCM model project formation	→									
3)	Information collection survey			→							
4)	Preparations for forming JCM projects from next year onwards							→			
3. Workshops/Events											
1)	On-site workshop								▽		
2)	Presentation or coordination at event related to Ministry of the Environment							▽ (COP28 C2P2/UAE)	(City-to-city collaboration seminar)	▽	
4. Meeting/Deliverables											
1)	Monthly report to Ministry of the Environment			▽	▽	▽	▽	▽	▽	▽	▽
2)	Meeting with Ministry of the Environment		▽				▽			▽	
3)	Meeting with Sakai City and Japanese companies	▽	▽	▽	▽	▽		▽	▽	▽	
4)	Reporting work									→ ▽	

Source: Nippon Koei Co., Ltd.

Figure 1.5 Schedule of the Project

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

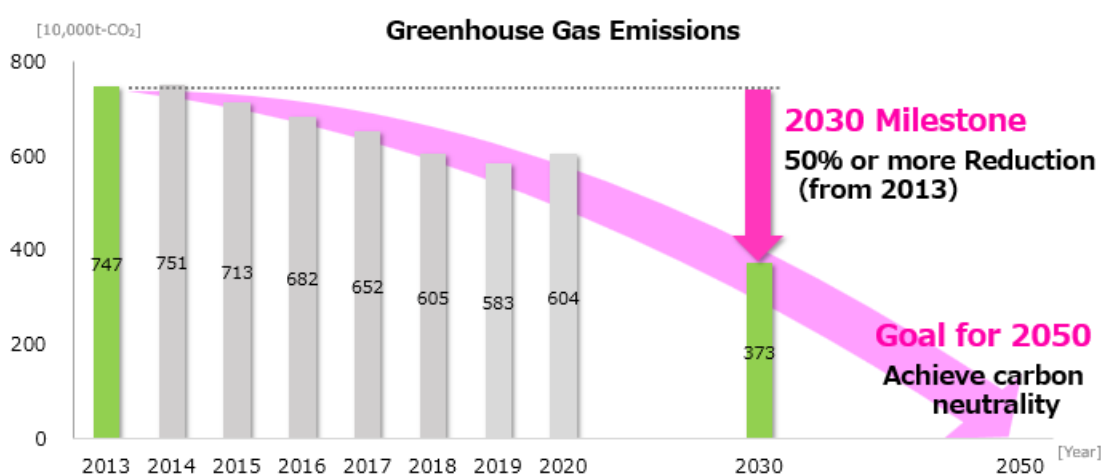
2.1 Initiatives by Sakai City to Combat Climate Change

2.1.1 Sakai City Global Warming Countermeasures Implementation Plan

In order to comprehensively and systematically promote global warming countermeasures, Sakai City has revised the "Sakai City Global Warming Countermeasures Implementation Plan" based on Article 21 of the Act on Promotion of Global Warming Countermeasures in November 2022. It aims to promote climate change countermeasures through both "mitigation measures" and "adaptation measures." Representative initiatives and achievements are described below. For the overall overview of global warming countermeasures, refer to the FY2020 Project report.

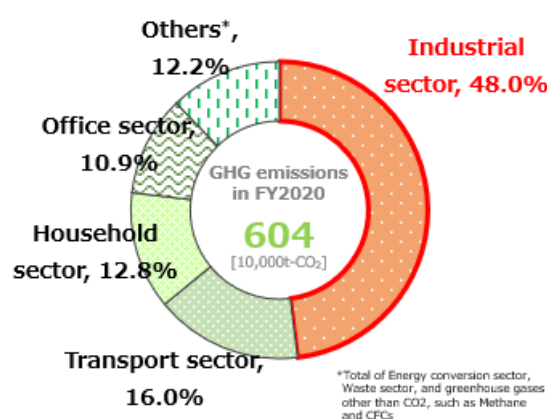
2.1.2 Goals for GHG Reduction

Greenhouse Gas (GHG) emissions in the Sakai city area were 6.04 million t-CO₂ as of 2020, and are on the decline as shown in Figure 2.1. Because of industrial city, it is characterized by a higher proportion of emissions from the industrial sector than the national average (See Figure 2.2.). Sakai city is aiming for further reductions toward its goal of 50% or more reduction (compared to 2013) in 2030.



Source: Sakai City

Figure 2.1 Changes in Greenhouse Gas Emissions in the Sakai City Area



Source: Sakai City

Figure 2.2 GHG Emission by Sector in Sakai City Area (in FY2020)

2.1.3 Examples of Initiatives Aimed at Reducing GHG in Sakai City

In order to promote GHG reduction in public facilities, businesses and homes, Sakai City is working to expand the introduction of renewable energy, promote energy conservation and promote the use of new energy. The results of typical efforts in recent years are shown in the figures below.

- As the leading role, actively promoting the installation photovoltaic power generation in city public facilities such as elementary school, sewage treatment plant, etc.



Total 119 facilities, 2,918.7kW
(as of the end of FY2022)

- Subsidizing the installation of photovoltaic power generation, vehicle-to-home system, ZEH (net zero energy house) components, etc. in households.



Number : 279 in total
Amount : 19,610,000 yen in total
(Approx. 140 thousand dollars)
(in FY2022)

Source: Sakai City

Figure 2.3 Example of Sakai City's Efforts toward Decarbonization (1)

- Subsidizing a portion of the cost for factories in the city to replace existing equipment with energy-saving equipment.



Number : 10 in total
(in FY2022)

- Sakai City, Osaka City, and Osaka Prefecture have jointly formulated “H2 Osaka Vision” and are working to expand the use of hydrogen, which is considered a key technology for achieving carbon neutrality.



Fuel cell truck test ride



Christmas tree lighting demonstration
by using FCV power supply



Experiment to utilize FCV as a power source
for work in the event of a disaster

Source: Sakai City

Figure 2.4 Example of Sakai City’s Efforts toward Decarbonization (2)

2.2 Initiatives by Vietnam and Ba Ria-Vung Tau Province

2.2.1 National Policies in Vietnam

Among Vietnamese domestic policy trends related to decarbonization, the main items updated this year are shown below.

(1) National Power Development Plan VIII (PDP8)

The National Power Development Plan VIII (PDP8), which is the power development guideline for 2021 to 2030, was finalized in Prime Minister’s Decision No. 500 in May 2023, two and a half years later than originally planned, and took effect immediately. The Vietnamese government predicts real GDP growth rate to average 7% per year between 2021 and 2030, and has set plans for the same period to provide the electricity necessary for economic growth. The plan calls for increasing power generation capacity to 150,489 MW by 2030. Considering that the installed capacity as of the end of 2022 is 80,704 MW, the installed capacity will need to be increased by nearly 9,000 MW every year. In addition, it presents a long-term vision for achieving net zero GHG emissions by 2050. The table below shows the targets for 2030 and 2050 in PDP8.

Table 2.1 2030 and 2050 Targets in PDP8

Item		2030 Target	2050 Target
Power generation capacity		150,489MW	490,529 -573,129 MW
Electricity generated		567 billion kWh	1,224.3 billion to 1,378.7 billion kWh
Coal-fired power		20%	0% (completely abolished)
Natural gas		9.9%	0%
LNG		14.9%	2.9%
Hydrogen		0% (no track record)	4.7%
Renewable energy	Solar power	8.5%	32.0%
	Wind power	18.6%	28.5%
Investment amount		\$134.7 billion	\$399.2 billion to \$523.1 billion

Source: Nippon Koei summarized from PDP8

(2) COP-related Trends in Vietnam

At COP26 which was held in 2021, Pham Minh Chinh, Prime Minister of Vietnam announced the goal of achieving carbon neutrality by 2050.

At COP28 which was held in 2023, no new commitments were announced, but instead the countries emphasized the need for the international community to work together to address the issue of climate change. Furthermore, in his speech, Prime Minister Pham Minh Chinh introduced the following three measures that have been implemented since COP26 to date to achieve carbon neutrality by 2050.

- 1) Development of plans for national climate change strategy, green growth strategy, PDP8, renewable energy development, etc.
- 2) Announcement of funding plan for the Just Energy Transition Partnership (JETP)
- 3) Establishment of legal systems related to oil and gas, land and electricity

JETP has decided to disburse an initial amount of USD 15.5 billion (JPY 2.15 trillion) from public and private funds over the next three to five years to support Vietnam's green transition. The aim is to provide development support and improve the investment environment in fields such as wind power, solar power, power transmission, energy efficiency, power storage, electric vehicles (EVs), and human resource development.

Furthermore, the Vietnamese government has announced its participation in the Global Cooling Pledge announced at COP28. The pledge, which has been endorsed by 63 countries including Japan, aims to reduce GHG emissions from air conditioning equipment by at least 68% by 2050 compared to 2022.

(3) Domestic Carbon Market Trends in Vietnam

The Vietnamese government announced the Decree on Mitigation of GHG Emissions and Protection of Ozone Layer (Decree No. 06/2022/ND-CP) on January 7, 2022, which includes articles on development of domestic carbon market. This Decree stipulates the management and operation of carbon markets. The government aims to begin trial operation of carbon credit exchanges by 2025 and to officially operate them in 2028.

(4) Regulations Regarding the Formation and Implementation of JCM Projects

At the 8th Japan-Vietnam Environmental Policy Dialogue held in January 2024, it was confirmed that the two countries will continue to cooperate in various related fields, including climate change countermeasures, through JCM and other mechanisms. Meanwhile, in Vietnam, the Ministry of Natural Resources and Environment (MONRE) has issued Circular No. 17 (Circular No. 17/2015/TTBTNMT, April 6, 2015) stipulating the development and implementation of projects under the JCM in the framework of cooperation between Vietnam and Japan. MONRE is in the process of revising the notification, and the draft notification as of 2023 includes revised matters regarding the evaluation method of baseline emissions, extension of the JCM credit period and others. It is necessary to continue to monitor future revisions to the Circular based on the discussion between the two countries.

(5) Regulations Regarding Solar Power Generation

In response to the PDP8 setting out a plan to increase the amount of solar power generation to 12,836MW by 2030, preparations are underway for a Decree to implement this plan. The Ministry of Industry and Trade (MOIT)'s draft Decree to as of December 2023 specifies two ways to install rooftop solar power generation: self-consumption type and connection to the national power grid. PDP8 prioritizes self-consumption type solar power generation (consumed only on-site without selling electricity). On the other hand, under the proposed decree, when connecting to the national power grid, surplus electricity cannot be sold to others and no income can be earned from selling electricity. Additionally, in order to minimize the load on the grid, it is necessary to install equipment such as BESS (Battery Energy Storage System), which combines storage batteries and power control systems. In order to promote the introduction of solar power generation in Vietnam, early finalization and approval of the draft Decree is awaited.

2.2.2 Policies in Ba Ria-Vung Tau Province

The representative higher-level plans on the Project-related field approved by Ba Ria-Vung Tau Province government in 2023 are shown below. For the Action Plan for the 5 Year Socio-Economic Development Plan (2021-2025) (July 2021) and the Climate Change Action Plan for 2021-2030 (October 2021), which were formulated in previous years, refer to the FY2021 Project report. Individual measures in the field of environment and climate change are shown in 3.4.2 (3).

(1) Master Plan for 2021-2030 towards 2050

The 2021-2030 master plan for Ba Ria-Vung Tau Province towards 2050 was approved by Prime Minister Decision No. 1628/QĐ-TTg on December 16, 2023. The outline of urban development is as follows.

- Develop green and smart urban systems that are adaptable to climate change. Develop cities with an urban system with modern infrastructure (including surface, underground and elevated transportation), ensure connectivity of urban areas within the province with other urban areas, and also protect the natural ecosystem.

- By 2030, aim to play the role of an important development center in the urban system of the southeastern region of Vietnam. It is expected that the urban development areas of Vung Tau, Ba Ria, Phu My, Long Dien, and Long Hai will meet the standards of Class-1 urban area.
- In the development and modernization of satellite cities, aim to lead the development of suburban, coastal and rural areas and create a ripple effect.
- By 2050, Ba Ria - Vung Tau aims to become the main gateway to the southeastern sea area and develop as the center of the national maritime economy, along with the development of the urban areas of Vung Tau - Phu My - Ba Ria - Long Dien - Long Hai. The central urban area will be connected by a modern urban transport system (road system, metro and monorail) and coexist with satellite metropolitan areas of appropriate size, ensuring a green quality of living environment.

The master plan also establishes specific economic and social growth goals until 2030. In the environmental field, the province aims to protect the environment, ensure a balance with the ecosystem, avoid making trade-offs with the environment for economic benefits in the development process, promote a green economy and low-carbon economy, and contribute to achieve Vietnam's net-zero target by 2050. Some of the specific goals in the environment and energy fields are excerpted in the table below.

Table 2.2 Provincial Development Goals by 2030 (excerpts from environment and energy fields only)

Item	Overview
Specific development goals by 2030 (excerpts from related urban environment fields only)	<ul style="list-style-type: none"> - 100% of hazardous solid waste (including medical solid waste) is collected, transported and treated in accordance with regulations. - The collection rate of household solid waste in urban and rural areas will be 100%, and the main processing methods will be recycling, export of fertilizers, processing using combustion power generation technology, and circular economy model. - By 2030, household solid waste will basically not be disposed of in landfills, and the recycling rate of organic waste will be 100%. - Achieve 100% elimination of single-use plastic products and non-biodegradable plastic bags in shopping centers, supermarkets, hotels, tourist spots, etc. - The proportion of industrial parks and industrial clusters with centralized wastewater treatment systems that meet environmental technical standards will be 100%. - The proportion of urban wastewater treated to meet prescribed standards and regulations shall be at least 50% in Class 1 and 2 cities and 30% or more in Class 3 to 5 cities.
Electricity supply network development plan (only relevant items are excerpted)	<ul style="list-style-type: none"> - New development of biomass power plant - Development of investments in wind power projects for electricity export and new energy production
Waste treatment plant development plan (only relevant items are excerpted)	<ul style="list-style-type: none"> - Construction of household solid waste treatment plants using combustion technology in Toc Tien, Dat Doi Industrial Park and Vung Tau City

Source: Excerpt from the 2021-2030 Master Plan for 2050 of Ba Ria-Vung Tau Province

(2) Green Growth, Smart and Sustainable Urban Development Plan by 2030

The Urban Development Plan for green growth, smart and sustainable development cities in Ba Ria – Vung Tau Province until 2030 was approved as Plan No. 246/KH-UBND in October 2023. Promote the transformation of urban economic growth models towards green growth, improve competitiveness, ensure rapid, effective and sustainable economic development in urban areas, create jobs, reduce poverty, and improve people's physical and mental health. It was published with the aim of contributing to the improvement of people's lives. By 2030, Ba Ria-Vung Tau Province will strive to coordinate urban comprehensive plans approved before 2015 with newly approved urban comprehensive plans to integrate specific goals on green growth and addressing climate change. The specific priority tasks include reviewing and adjusting urban planning and urban development programs for green growth and addressing climate change and investing to build green growth urban development through resource utilization and the application of science and technology.

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 Environmental Strategy formulated in March 2021, Sakai City declared its aim to become a world-leading environmentally advanced city, and clearly positioned "international city cooperation" as the direction of its measures. Based on this strategy, Sakai city is promoting city-to-city cooperation with Ba Ria-Vung Tau Province, and have been implementing city-to-city collaboration project for decarbonization of Ba Ria-Vung Tau Province since FY2022.

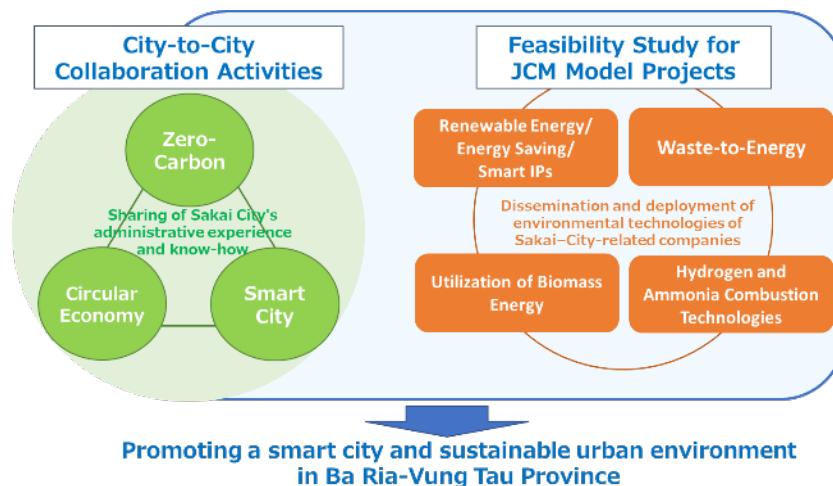
3.1.2 Objective of the Project

The objective of the Project is to support the institutional development for being a zero-carbon city and to conduct a basic study for reducing GHG emissions in the energy conservation, renewable energy, hydrogen energy and waste treatment fields, as well as formulating JCM Model Projects that contribute to GHG emissions reduction, based on challenges 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 has been selected as a "Decarbonization Leading Area," and by disseminating and deploying advanced environmental technology. It promotes the creation of a sustainable urban environment.

Among the environmental fields covered by City-to-City Collaboration Programme, 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 in FY2023 are listed as follows.

<Support for Institutional Development>

- 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 Saving/Renewable Energy Field>

- Share Sakai City's decarbonization initiatives, such as large-scale solar power plant and eco-model town development.
- Study for introduction of energy saving/renewable energy technology for JCM Model Project formation

<Hydrogen Energy Field>

- Information gathering and needs survey regarding the utilization of hydrogen energy
- Study for introduction of hydrogen energy technology in industrial furnaces for JCM Model Project formation

<Waste Treatment Field>

- Gather information on waste treatment
- Study for introducing waste treatment technology for JCM Model Project formation

Regarding the above activities, based on the results of FY2022, the Project has set the following policy for the second year.

<Support for Institutional Development>

- Exchange of opinions and knowledge sharing in individual areas that address the issues of the province, such as strengthening initiatives related to energy saving and introduction of renewable energy in industrial parks and enterprises, and promoting waste separation, recycling, and effective use.
- Conclusion of an intercity Memorandum of Understanding (MOU) and based on it, promotion of cross-departmental collaboration involving related departments such as DONRE, DOIT (Department of Commerce and Industry), and BIZA (Ba Ria – Vung Tau Industrial Zone Authority)
- Support for eco-industrial park development in the province in collaboration with JICA technical cooperation project

<Energy Saving/Renewable Energy/Waste Treatment Field>

- In addition to involving Japanese-related industrial parks and Chambers of Commerce that the Project approached in FY2022, the activities will be expanded involving business match with non-Japanese local companies and other sectors through local industrial parks and the Vietnam Chamber of Commerce and Industry(VCCI).
- Elaboration of plans for forming JCM Model Project for business models and candidate sites considered in FY2022
- Gathering information for the introduction of hydrogen/ammonia combustion technology, and coordinating among related parties for project development

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 and Attachment 2.

Table 3.1 List of Activities of the Project

Item	Implementation period	Overview
Kick-off meeting with the Ministry of the Environment, Japan	July 5, 2023	- The activity plan of the Project was explained and discussed by Ministry of the Environment, Sakai City and Nippon Koei.
Kick-off meeting with Sakai City and participating company (online)	July 10, 2023	- The activity plan of the Project in this fiscal year was explained. Business overviews of each participating company were presented by the representatives of those companies.

Meeting with Sakai City (online)	July 10, 2023	- The preparing for MOU conclusion with Ba Ria - Vung Tau Province was discussed.
Meeting with Chugai Ro Co., Ltd.	July 10, 2023	- The activity plan of Chugai Ro Co., Ltd. was discussed and confirmed.
Discussion between Air Water Inc. and KUBOTA CORPORATION. (online)	July 25, 2023	- Decarbonization technologies and overseas business of each company were introduced. Possibility of collaboration between those companies was discussed.
Meeting with Sakai City (online)	August 1, 2023	- Preparation for MOU conclusion with Ba Ria - Vung Tau Province and the first on-site survey were discussed.
Meeting with HUST (online)	August 18, 2023	- Discussion with a professor specializing fuel engineering in HUST (Hanoi University of Science and Technology) was conducted. - Technology of Chugai Ro Co., Ltd. was introduced, and the current situation of hydrogen field was discussed.
Implementation of the first on-site survey	August 20-25, 2023	- Field surveys were conducted by Sakai City, Nippon Koei and Nippon Koei Vietnam International Co., Ltd (NKV). - In addition to city-to-city meeting with DONRE and DOFA of the Ba Ria - Vung Tau Province, visits and discussions were held with other relevant organizations (PM3SIP, VCCI, steel companies, industrial park, JICA office Ho Chi Minh City Branch, Air Water subsidiaries, Osaka Gas-related local subsidiaries, and other local companies).
Meeting with Chugai Ro Co., Ltd. (face-to-face)	October 12, 2023	- Approach to potential local introductions and confirmation and discussion for the second on-site survey were conducted.
Meeting with Air Water Inc. (face-to-face)	October 13, 2023	- Plan of the second on-site survey and the plan for future investigation were discussed.
Meeting with Sakai City (face-to-face)	October 13, 2023	- MOU conclusion with Ba Ria - Vung Tau Province and the second on-site survey were discussed.
Meeting with Air Water Inc. and local agricultural company (online)	October 19, 2023	- The online meeting about biomass usage was held between Air Water Inc. and local agricultural company. - Usage of food and agricultural waste in Ba Ria - Vung Tau Province was discussed.
Implementation of the second on-site survey	November 1-3, 2023	- Field surveys were conducted by Sakai City, Nippon Koei and NKV. - In addition to city-to-city meeting with DONRE and DOFA of the Ba Ria - Vung Tau Province, visits and discussions were held with other relevant organizations (VCCI, local agricultural company, steel companies and other local companies).
Meeting with local waste management company (online)	November 6, 2023	- The outline of the project and the technologies of participating company were explained. Information was exchanged on the latest status of waste management field in Ba Ria - Vung Tau Province and discussions were held.
Progress Reporting Meeting with Ministry of	November 16, 2023	- Progress reporting meeting with the Ministry of the Environment was held.

Environment, Japan (face-to-face/online)		<ul style="list-style-type: none"> - Results of the second on-site survey was reported. Plan for MOU conclusion with Ba Ria - Vung Tau Province and third on-site survey were discussed.
Meeting with Air Water Inc. and local environmental analysis company	November 17, 2023	<ul style="list-style-type: none"> - The online meeting about biomass usage was held between Air Water Inc. and local environmental analysis company. - Potential collaboration of those companies in a pilot analysis for usage of food and agricultural waste in Ba Ria - Vung Tau Province was discussed.
Site Visit to Chugai Ro's Thermal Technology Creation Center (face-to-face)	November 22, 2023	<ul style="list-style-type: none"> - The site visit to Thermal Technology Creation Center (opened in November 2023) of Chugai Ro was held. - Chugai Ro introduced the equipment related to the development of carbon-free and energy-saving combustion technologies.
Pre-travel meeting with DONRE of Ba Ria-Vung Tau Province	December 1, 2023	<ul style="list-style-type: none"> - A meeting was held for DONRE of Ba Ria-Vung Tau Province and Nippon Koei to travel to Dubai. - The logistics-related matters are confirmed and the final confirmations regarding the MOU signing ceremony was discussed.
Presentation at COP28/C2P2 seminar/MOU signing ceremony	December 6, 2023	<ul style="list-style-type: none"> - Sakai City and Nippon Koei travelled to UAE to participate in the COP28/C2P2 seminar. - At the same seminar, an MOU signing ceremony between Ba Ria-Vung Tau Province and Sakai City was held.
Meeting with Osaka Gas Co., Ltd.	December 18, 2023	<ul style="list-style-type: none"> - The content of presentations during the technical workshop during the third trip was discussed.
3rd field survey	January 15th to 19th, 2024	<ul style="list-style-type: none"> - A field survey was conducted by Sakai City officials, participating companies (Air Water INC, Kubota Corporation.), Nippon Koei and NKV. - In addition to a courtesy call to Provincial People's Committee (PPC) of Ba Ria-Vung Tau Province and intercity discussions with DONRE and other related departments, meeting with other related organizations (VCCI, agricultural company, steel-related companies, waste-related companies, other local companies, etc.) were carried out. - Based on the results of the intercity discussions, the activity plan between the two cities for next year is to be prepared.
Technical workshops (hybrid)	January 19, 2024	<ul style="list-style-type: none"> - The technical workshop was held in a hybrid format (in principle, conducted face-to-face; some presentations were presented online). - The MOU signing ceremony, the policy for future cooperation between the two cities, and the decarbonization technologies of participating companies were introduced.
Meeting with IDICO	January 22, 2024	<ul style="list-style-type: none"> - A face-to-face meeting was held with IDICO (Phu My 2 industrial park management company). - Nippon Koei provided explanations on City-to-City Collaboration Project and JCM Model Project.
Final Report Meeting with Ministry of Environment, Japan	February 13, 2024	<ul style="list-style-type: none"> - The final report was conducted face-to-face with the Ministry of the Environment, Japan. - The MOU ceremony between Ba Ria-Vung Tau Province and Sakai City and the results of the third field survey were reported.

Meeting with Sakai City officials (face-to-face)	February 13, 2024	- A face-to-face meeting was held with Sakai City. Discussions were held regarding the seminar on City-to-City Collaboration(C3P) scheduled for the end of February and the next year's activity plan.
Meeting with Air Water INC. (face-to-face)	February 16, 2024	- Nippon Koei and Air Water discussed the site visit to a resource circulation model demonstration facility using locally produced and locally consumed energy in Matsumoto City, scheduled for the end of February.
Meeting with DONRE of Ba Ria-Vung Tau Province (online)	February 20, 2024	- A meeting was held online with DONRE, Sakai City Environment Bureau, and Nippon Koei. They discussed the revision of the draft action plan, etc.
C3P seminar/site visit	February 26-27, 2024	- One DONRE official from the BRVT Province was invited to Japan. The C3P seminar was held on the 26 th Feb., and a field trip was conducted on the 27 th Feb.
Site visit to Matsumoto City and Sakai City, Japan	February 28-29, 2024	- Site visits to the decarbonization-related facilities of the participating companies in the Project were conducted.

Source: Nippon Koei Co., Ltd.

(1) First On-site Survey

The first on-site survey was carried out for the purpose of face-to-face consultation with the officials 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: August 20, 2023 (Sunday) to August 25, 2023 (Friday)
*Excluding travel days, etc.
- Participants: 2 Sakai City officials, 2 Nippon Koei employees, 2 Nippon Koei Vietnam (NKV) employees, 1 local interpreter

Table 3.2 Results of the First On-site Survey

#	Activity Content	Consultation and Investigation Results
1	Discussion with Phu My 3 Specialized Industrial Park	Information was exchanged regarding decarbonization-related trends of local companies.
2	Discussion with DOFA/DONRE	Discussions were held regarding the conclusion of the MOU and City-to-City collaboration activities.
3	Discussion with VCCI Vung Tau	A business matching with VCCI member companies was conducted. 12 people from 5 companies participated from VCCI Vung Tau. One of the companies that expressed interest in hydrogen burners asked Nippon Koei to have another individual meeting at a later date. It was confirmed that the City-to-City Collaboration Project and VCCI will continue to collaborate in promoting decarbonization technology and business matching.
4	Discussions with local steel companies	A meeting was conducted on project formulation for JCM Model Project.
5	Discussion with local industrial park	Nippon Koei explained the JCM model project, and discussed about it with the industrial park representative.

6	Discussion with JICA Ho Chi Minh Branch	Nippon Koei explained the City-to-City collaboration project and exchanged opinions on C2P2 collaboration.
7	Discussion with SOGEC	Nippon Koei explained the JCM model project, and discussed about it with SOGEC.
8	Discussion with local steel company	Nippon Koei explained the JCM model project, and discussed about it with the steel company.
9	Discussion with local chemical manufacturer.	Information was exchanged regarding the possibility of using hydrogen.

Source: Nippon Koei Co., Ltd.



Discussion with BRVT DOFA/DONRE



Discussion with VCCI Vung Tau

Figure 3.2 Discussion during the First On-site Survey

(2) Second On-site Survey

The second survey was conducted to hold face-to-face discussions with officials from Ba Ria-Vung Tau Province and gather information on local facilities. The summary of the main activities is shown in the table below.

- Survey period: November 1, 2023 (Wednesday) to November 3, 2023 (Friday)
*Excluding travel days, etc.
- Participants: 1 Sakai City officials, 2 Chugai Ro employees, 2 Nippon Koei employees, 1 Nippon Koei Vietnam (NKV) employees, 1 local interpreter

Table 3.3 Results of the Second On-site Survey

#	Activity Content	Consultation and Investigation Results
1	Discussion with BRVT DOFA/DONRE	Discussions were held regarding the conclusion of the MOU.
2	Discussion with agricultural companies	They exchanged information on biomass utilization and visited farms.
3	Discussion with VCCI Vung Tau	Discussions were held regarding business matching with member companies (implementation of needs assessment questionnaires) and holding workshops.
4	Discussion with local steel companies (1)	Nippon Koei consulted on project formulation for the JCM Model Project and conducted factory tours.

5	Discussion with local steel companies (2)	Nippon Koei consulted on project formulation for the JCM Model Project and conducted factory tours.
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Source: Nippon Koei Co., Ltd.



Discussion with BRVT DOFA/DONRE



Site Visit to a Farmland

Figure 3.3 Photos of the Second On-site Survey

(3) Third On-site Survey

The third on-site survey was conducted in order to hold face-to-face discussions with relevant parties in Ba Ria-Vung Tau Province, collect information on local facilities, etc., and hold a technical workshop. The summary of the main activities is shown in the table below.

- Survey period: January 15, 2024 (Monday) to January 19, 2024 (Friday)
*Excluding travel days, etc.
- Participants: 3 Sakai City officials, 1 Air Water INC. employees, 2 Kubota Corporation employees, 4 Nippon Koei employees, 2 Nippon Koei Vietnam (NKV) employees, 1 local interpreter

Table 3.4 Results of the Third On-site Survey

#	Activity Content	Consultation and Investigation Results
1	Discussion with BRVT DOFA/DONRE	Discussions were held regarding the conclusion of the MOU and future activity plans based on it.
2	PPC courtesy visit	Sakai City officials and Nippon Koei paid a courtesy visit to Ba Ria-Vung Tau PPC and exchanged opinions regarding the concluded MOU and future activity plans based on it.
3	Site visit to a recycling facility	Guided by DONRE, site visit to a recycling facility within the province was held.
4	Discussion with local analysis organization	Discussions regarding analysis and confirmation of equipment were held in preparation for on-site testing of biomass utilization.
5	Discussions with local food companies	The conclusion of the MOU was reported and the site visit to a biomass boiler was conducted.
6	Discussion with SOGEC	Nippon Koei reported on the conclusion of the MOU and consulted on project formulation for the JCM Model Project.
7	Discussion with JCCH	Nippon Koei provided an overview of the City-to-City Collaboration Project, reported on the conclusion of the MOU, and discussed future cooperation with JCCH.

8	Visit to the Consulate General of Japan in Ho Chi Minh	Nippon Koei provided an overview of the City-to-City Collaboration Project, reported on the conclusion of the MOU, and exchanged other opinions.
9	Discussions with local agricultural companies	Nippon Koei provided consultation on project formulation for the JCM Model Project and toured farms and factories.
10	Tour of waste energy recycling facility	Guided by DONRE, Sakai City officials, Kubota and Nippon Koei and toured a typical waste-to-energy recycling facility in the province.
11	Discussions with waste treatment-related companies	The opinion exchange was held with the waste treatment companies on the waste treatment field.
12	Visit to Vung Tau sewage treatment plant	The site visit to the Vung Tau sewage treatment plant was conducted.
13	Discussion with VCCI Vung Tau	Nippon Koei reported on the conclusion of the MOU, discussed future activity policies based on the MOU, and exchanged opinions on biomass utilization in Ba Ria-Vung Tau Province.
14	Discussions with local steel company	Nippon Koei discussed the project formulation for JCM Model Project with a local steel company.
15	Technical workshop	A local workshop was held to report on the conclusion of the MOU and introduce the decarbonization technologies of participating companies.

Source: Nippon Koei Co., Ltd.



Discussion with BRVT DOFA/DONRE



PPC Courtesy Call



Site Visit to the Farmland



Discussion with SOGEC



Sewage Treatment Plant



Discussion with VCCI Vung Tau

Figure 3.4 Photos of the Third On-site Survey

(4) Technical Workshop

The technical workshop was held in a hybrid format. The MOU signing ceremony, the direction for future cooperation between the two cities, and the decarbonization technologies of participating companies were introduced.

[Event overview]

Date and time: January 19, 2024 (Friday) 9:30-11:50

Location: Conference room on the 2nd floor of the Ibis Styles Hotel Vung Tau

Participants: Approximately 42 people in total, including Sakai City, Ba Ria Vung Tau Province, companies participating in the Project, and local companies.

The contents of the program are as follows. Also, see Attachment 2 for presentation materials.

Table 3.5 Program of the Technical Workshop

#	Time	Agenda	Speakers
1.	9:00 - 9:30	Registration	
2.	9:30 - 9:40	Opening speech	Sakai City, BRVT DONRE
3.	9:40 - 9:55	Measures for decarbonization in Ba Ria-Vung Tau province	BRVT DONRE
4.	9:55 - 10:20	Measures for decarbonization in Sakai City	Sakai City Environment Bureau
5.	10:20 - 10:30	Introducing the city-to-city collaboration program and the JCM subsidy program for introducing renewable energy and energy-saving equipment	Nippon Koei Co., Ltd.
6.	10:30 - 10:40	Break	
7.	10:40 - 11:30	Introduction of the Japanese environmental technology of the participating companies <ul style="list-style-type: none"> • Solar power generation/high efficiency boiler (Osaka Gas Co., Ltd.) (online) • Biomass utilization (Air Water INC.) • Hydrogen combustion technology (CHUGAI RO CO., LTD.) (online) 	Osaka Gas Co., Ltd. Air Water INC. CHUGAI RO CO., LTD. Kubota Corporation Nippon Koei Co., Ltd.

		<ul style="list-style-type: none"> Waste power generation (Kubota Corporation) Promoting Eco-and Smart-IPs by introducing an integrated data platform (Nippon Koei Co., Ltd.) 	
8.	11:30 - 11:45	Q&A/opinion exchange	All participants
9.	11:45 - 11:50	Closing remarks	Sakai City
10.	11:50 -	Lunch	All participants

Source: Nippon Koei Co., Ltd.

(5) Presentations at Meetings Designated by the Ministry of the Environment: C2P2 Seminar

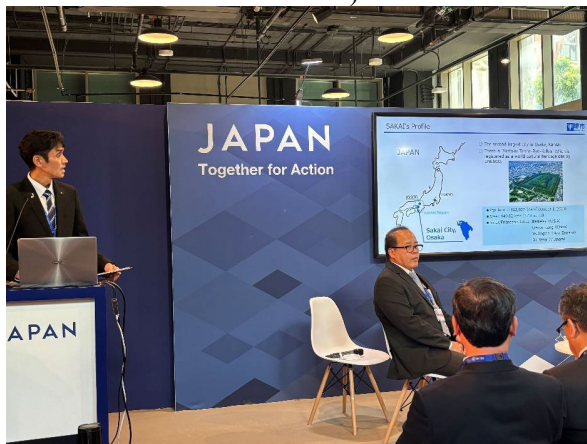
The representatives from both cities attended at "Clean City Partnership Program (C2P2) Seminar: Urban Agenda on Climate Change, Pollution and Biodiversity Loss" held as a side event of the Japan Pavilion at the 28th Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change in Dubai, UAE. At the seminar, Mr. Masahiko Tsujio, Director of Carbon Neutrality Promotion Department, Environment Bureau, Sakai City and Mr. Dang Son Hai, Deputy Director of DONRE, Ba Ria-Vung Tau Province, each took the stage to introduce the Project outline and announce efforts toward decarbonization in each city. DONRE of Ba Ria-Vung Tau Province introduced the outline of JICA Eco-IP technical cooperation project in Ba Ria-Vung Tau Province, which was launched in October 2023 as one of the efforts in collaboration with the JICA Clean City Initiative (JCCI). At the end of the seminar, the MOU signing ceremony (see 3.6.2 (1)) was held to strengthen and promote cooperation between the two cities in the environmental field, including decarbonization. Speeches by Mr. Hideki Nagafuji, Mayor of Sakai City and Mr. Nguyen Cong Vinh, Vice Chairman of Ba Ria-Vung Tau PPC, focused on contributing to the further development of friendly relations between Japan and Vietnam, which marks the 50th anniversary of the establishment of diplomatic relations, and on building the carbon city. Each of them expressed their hopes for further cooperation between the two cities towards the future.



Speech by Mayor of Sakai City (video attendance)



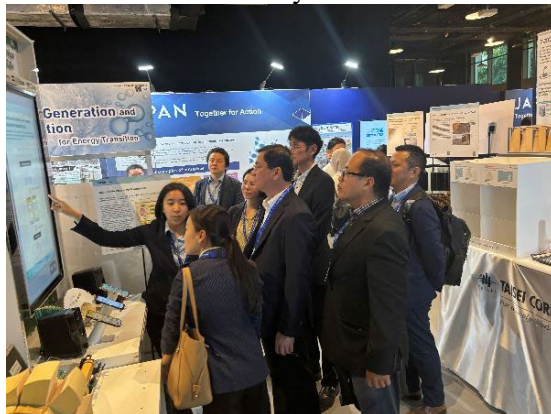
Speech by Vice Chairman of BRVT PPC



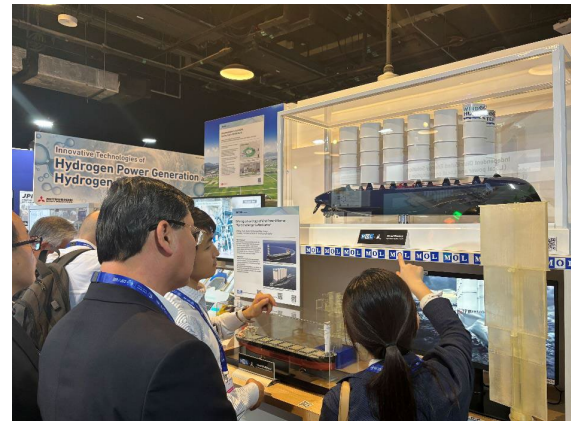
Presentation by Environment Bureau of Sakai City



Presentation by DONRE of Ba Ria-Vung Tau Province



Japan Pavilion Exhibition Tour (1)
Photo: Nippon Koei



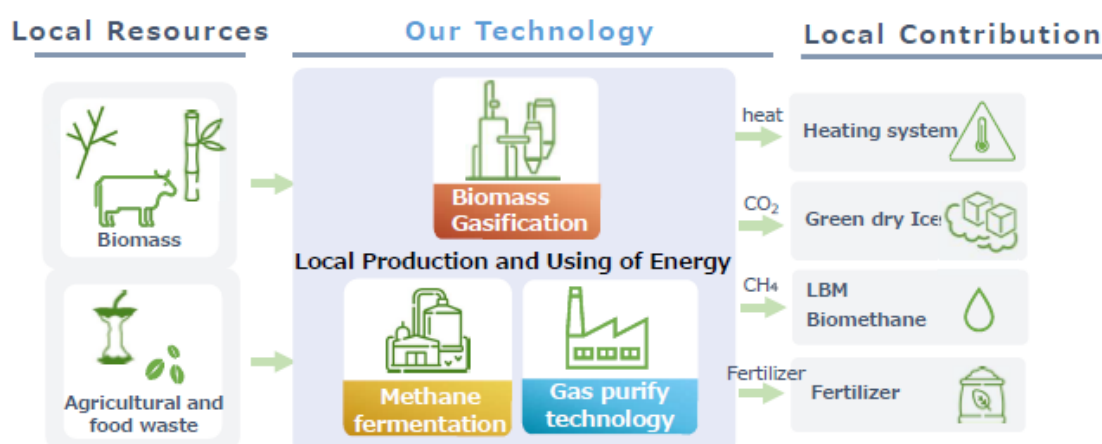
Japan Pavilion Exhibition Tour (2)

Figure 3.5 Attendance at C2P2 Seminar

(6) Presentations at meetings designated by the Ministry of the Environment: C3P Seminar

On February 26th and 27th, 2024, as part of the "Climate Change and Zero Carbon City Week" sponsored by the Ministry of the Environment, one official from BRVT DONRE involved in City-to-City collaboration was invited to participate in the "Seminar on City-to-City Collaboration for Zero Carbon Society."

In addition to participating in the above seminar, on the 28th (Wednesday) Feb., the site visit to Chikyu no Megumi Farm Matsumoto", a development facility for a resource circulation model using locally produced and locally consumed energy by Air Water was conducted. In addition, on the 29th (Thursday) Feb. in Sakai City, site visit to the Clean Center East Factory (waste treatment facility (including WtE) (constructed by Kubota)), and Chugai Ro's Thermal Technology Creative Center.



Source: Air Water INC.

Figure 3.6 Resource Circulation Model Using Locally Produced Energy for Local Consumption

Table 3.6 R&D Focus Areas and Major Equipment of the Thermal Technology Creative Center

#	Name of Facility	R&D Focus Areas and Major Equipment
1	Thermal Technology Creative Center	Composed of the Combustion Zone, designed to strengthen the development of decarbonizing and energy-saving combustion technologies, the Functional Materials Zone, dedicated to the development of high-profile material processing such as all-solid-state battery electrolytes, and the Co-creation Space, aimed at cultivating new ideas through the introduction of the latest digital equipment
2	Metal Heat Treatment Technology Laboratory	Equipped with a gas carburizing furnace that meets all the requirements for carbon neutrality
3	Zero Emission Technology Laboratory	Responsible for developing resource recycling-related technology, technology for reducing environmental impact, and technology for heating and cooling high performance materials
4	Vacuum Carburizing Technology Laboratory	Equipped with the latest vacuum carburizing furnaces, for which there is a growing need
5	Converting Technology Laboratory	Responsible for developing high-performance thin-film coating technology aimed at widespread use in semiconductor manufacturing

Source: Chugai Ro Co., Ltd.

Table 3.7 Overview of the C3P Seminar and Site Visits

Date and Time	Overview
February 26th (Monday), Iino Hall & Conference Center	
10:00 - 11:30	Seminar on City-to-City Collaboration for Zero Carbon Society (High-level session, hybrid) Participants: Persons involved in City-to-City Collaboration Projects Contents: Announcements from the Ministry of the Environment and local governments in Japan and abroad regarding project overviews and results.
13:30 - 17:00	Mutual learning on local decarbonization initiatives (Closed to the public) Participants: People involved in City-to-City Collaboration Projects Content: Introduction of support menus from the Japanese government such as the Ministry of the Environment and JICA Sharing the outline and results of City-to-City Collaboration Projects Information exchange through group discussions
17:30 - 19:00	Reception
February 27th (Tuesday), Yokohama City	
8:00 – 13:00	Site visit to the Decarbonization Leading areas (Excursion) Participants: Invited people from overseas cities Content: Participants deepened their understanding by learning about advanced examples of local decarbonization implemented by the City of Yokohama through site visits.
February 28th (Wednesday), Matsumoto City	
9:00 - 12:00	Site visit to Chikyu no Megumi Farm Matsumoto
13:00 - 15:00	Site visit to methane fermentation facility
February 29th (Thursday), Sakai City	
Morning	Site visit to Clean Center East Factory
Afternoon	Visit to Thermal Technology Creative Center

Source: Nippon Koei

3.4.2 Activities in the Field of Support for Institutional Development

(1) Signing of MOU for Decarbonization in Ba Ria-Vung Tau Province

Based on last year's City-to-City Collaboration Activities, both cities proceeded with preparations for the conclusion of the MOU between cities. The MOU was finally concluded at C2P2 seminar, side event at the Japan Pavilion of COP28 on December 6, 2023 (see Figure 3.7).

The MOU aims to strengthen and promote cooperative relationships in the field of decarbonization and related environmental fields, with the aim of building a decarbonized city and circular economy and forming JCM Model Projects. Sharing of administrative experience and challenges, human resource development and exchanges between industries and companies in these fields will be promoted.



Photography: Nippon Koei

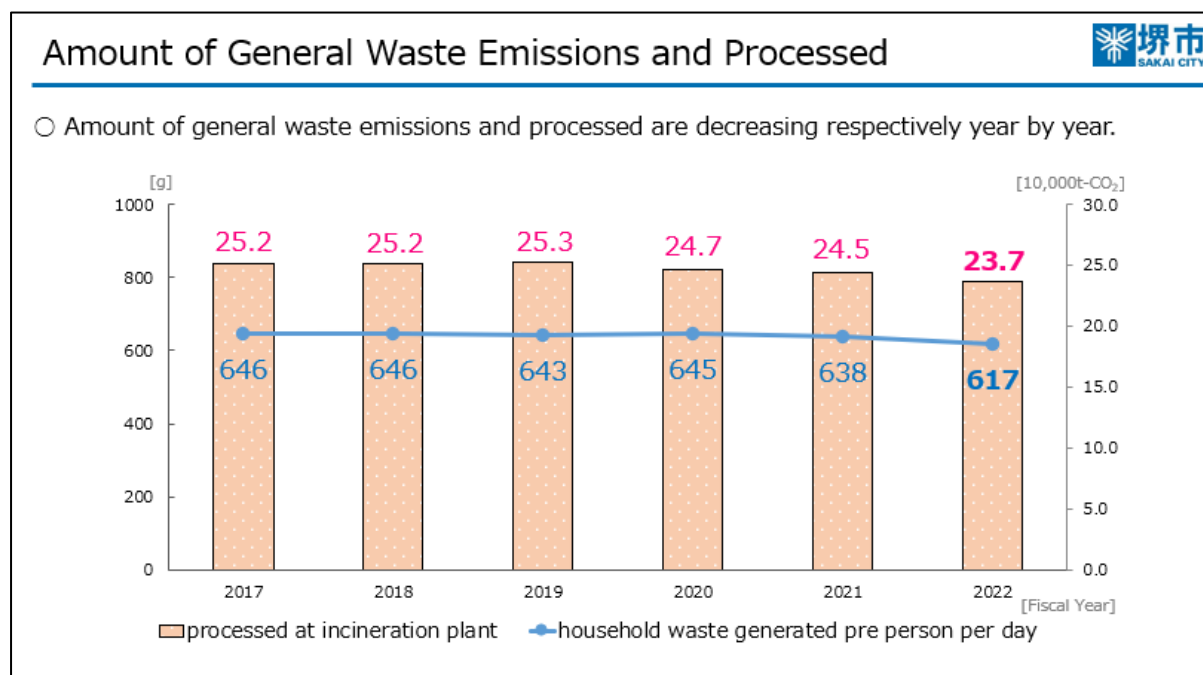
Figure 3.7 MOU Conclusion Ceremony

(2) Sharing Sakai City's Decarbonization Initiatives

Sakai City's initiatives in the environmental field, including decarbonization was shared with DONRE and related departments of Ba Ria-Vung Tau Province. An overview of initiatives in each field is shown below.

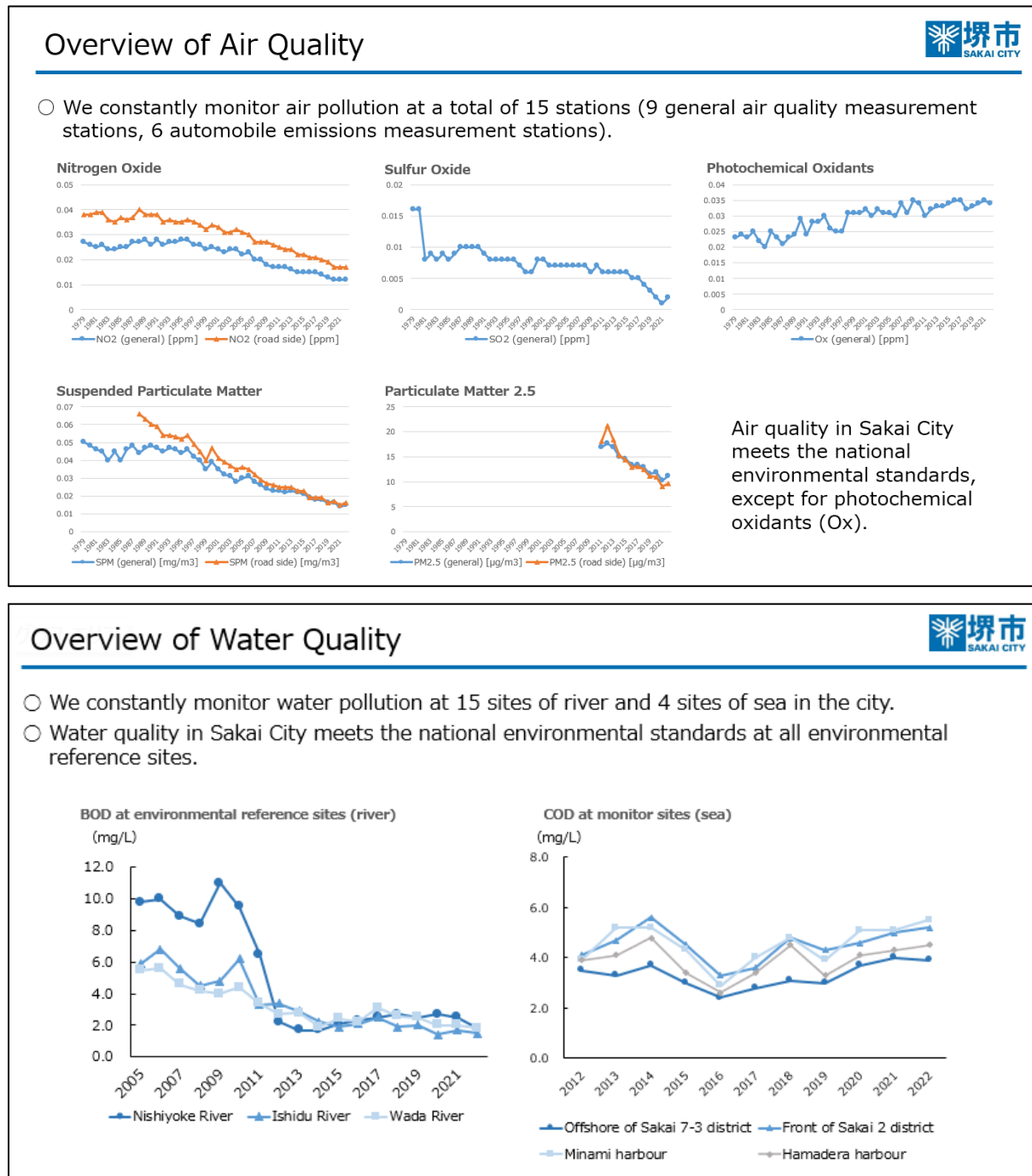
1) Waste/Air Quality/Water Quality

In response to the interest of Ba Ria Vung Tau Province, the management status of general solid waste, and air and water quality in Sakai City was introduced.



Source: Sakai City

Figure 3.8 Status of Waste, Air Quality, and Water Quality in Sakai City (1)



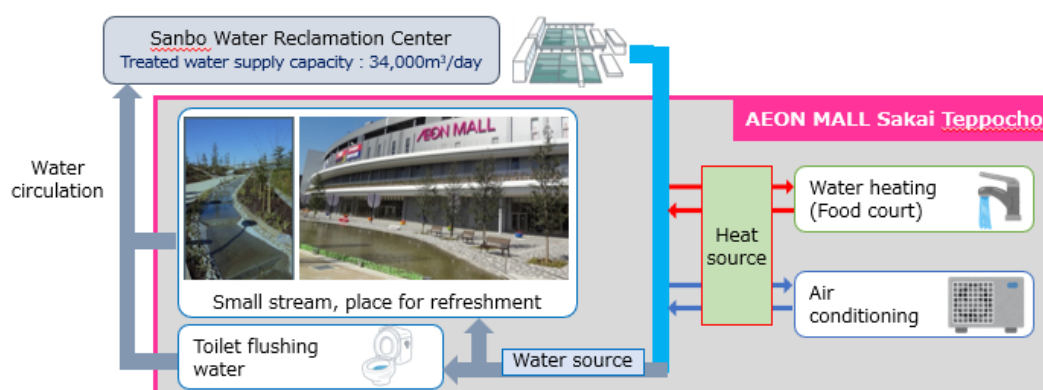
Source: Sakai City

Figure 3.9 Status of Waste, Air Quality, and Water Quality in Sakai City (2)

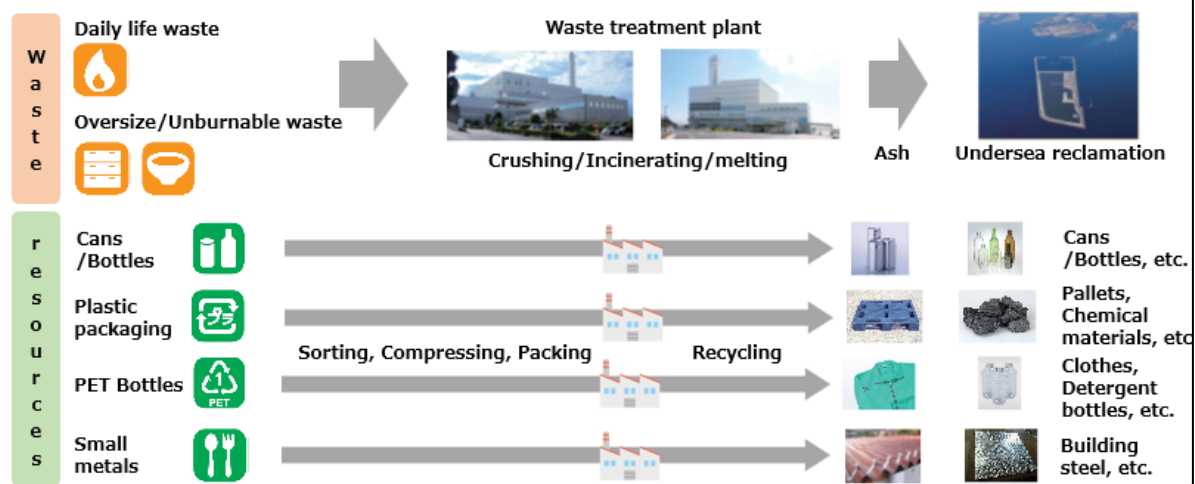
2) Initiatives Related to Decarbonization

Continuing from last year, the following decarbonization initiatives was introduced in addition to the other initiatives shown in 2.1.3. In FY2023, it was aimed to promote initiatives in each sector within Ba Ria-Vung Tau Province by widely sharing the information not only with DONRE of Ba Ria-Vung Tau Province but also with related departments such as DOIT, Department of Planning and Investment (DPI), BIZA and Department of Agriculture and Rural Development (DARD).

- Treated sewage water is colder than the outside air in summer and warmer than it in winter.
- The shopping mall near the municipal sewage treatment plant takes advantage of this characteristic, using treated sewage water as heat source for water heating and air conditioning in the facility, then cascading the water into the water-friendly space and as the toilet flushing water.

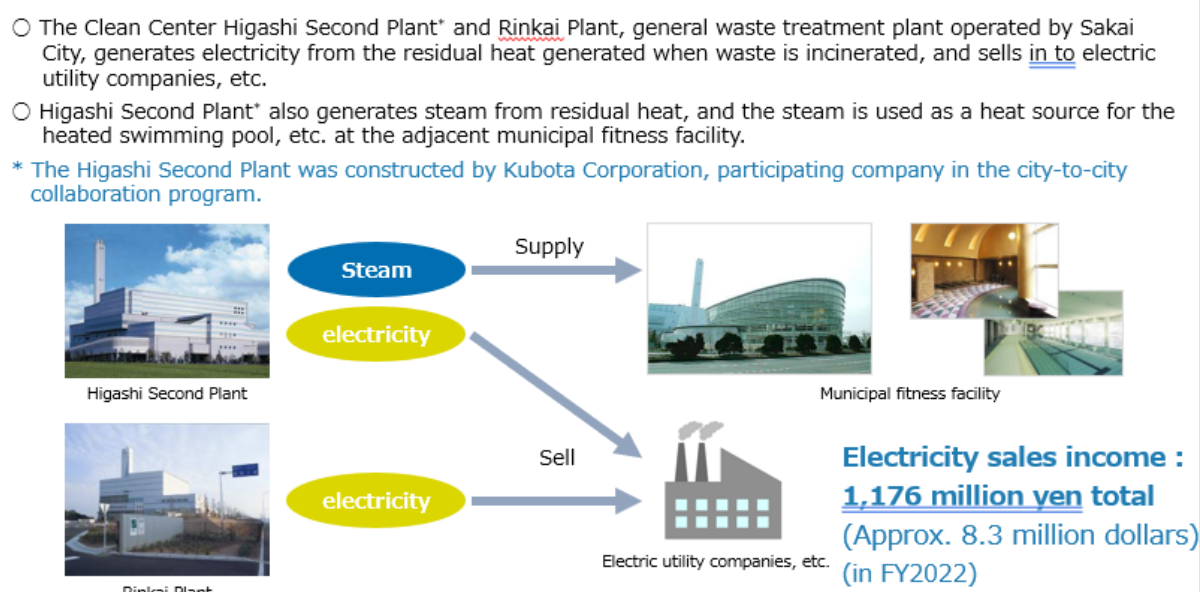


- The amount of incinerated waste is reduced through separate collection of waste.
- Collected resources are recycled for various purposes.



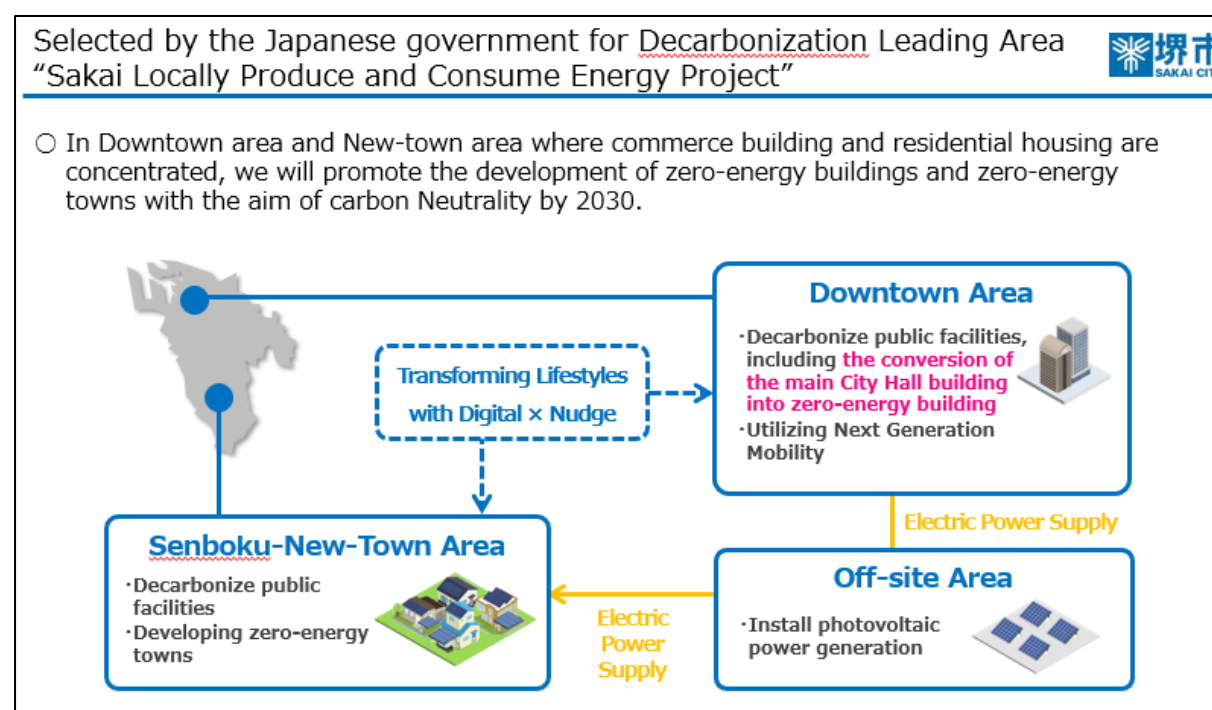
Source: Sakai City

Figure 3.10 Example of Initiatives Related to Decarbonization in Sakai City (1)



Source: Sakai City

Figure 3.11 Example of Initiatives Related to Decarbonization in Sakai City (2)



Source: Sakai City


Figure 3.12 Example of Initiatives Related to Decarbonization in Sakai City (Decarbonization Leading Area)

3) Examples of Initiatives in the Industrial Sector

Recent examples of decarbonization efforts in the industrial sector in Sakai City were included. The representative examples are the creation of low-carbon energy bases in coastal areas, strengthening


research and development of cutting-edge decarbonization technologies, and the development of Sustainable Aviation Fuel (SAF) made from waste cooking oil and other raw materials. An overview of each initiative is shown below.

Examples of Decarbonization Efforts by Industry (1)




Low-carbon energy hub in waterfront area



- ① **Environmentally advanced factory that saves and creates energy**
(Green Front Sakai, consisting of SHARP Corporation and others)
- ② **Sakai Photovoltaic Power Plant** (Kansai Electric Power CO., Inc.)
- ③ **Waste-to-energy** (Sakai City Clean Center Rinkai Plant)
- ④ **Power generation from wood waste** (Japan novopan industrial Co., Ltd.)
- ⑤ **High-efficiency LNG combined cycle power generation**
(Kansai Electric Power CO., Inc.)
- ⑥ **High-efficiency LNG combined cycle power generation** (Osaka Gas Co., Ltd.)
- ⑦ **LNG Supply** (Kansai Electric Power CO., Inc. Sakai LNG Center)
- ⑧ **Production of liquid hydrogen and other products using the cold heat of LNG** (Hydro Edge Co., Ltd.)
- ⑨ **Bioethanol production from waste wood** (DINS Kansai Co., Ltd.)
- ⑩ **Waste Recycling by Subcritical Water Reaction** (Re:CS RF Co., Ltd.)
- ⑪ **Increased light oil production by heavy oil cracker, production of bio-gasoline blended with ETBT, a biofuel made from plant materials**
(Cosmo Oil Co., Ltd.)
- ⑫ **Manufacture of lithium-ion battery components** (Ube Maxell Co., Ltd.)
- ⑬ **Production of high-purity aluminum for lithium-ion batteries**
(Sakai aluminum Corporation)
- ⑭ **Production of liquefied carbonic acid through carbon dioxide gas recovery and reuse** (Iwatani Corporation, Cosmo Oil Co., Ltd.)



Examples of Decarbonization Efforts by Industry (2)



- Chugai Ro Co., Ltd. (participating company in the city-to-city collaboration program) opened the new R&D center “Thermal Technology Creation Center” at its Sakai Works to achieve carbon neutrality.
- Strengthen R&D of advanced technologies that contribute to carbon neutrality, such as hydrogen combustion, using state-of-the-art facilities.

(Source, Press release from Chugai Ro Co., Ltd.)

Source: Sakai City and as stated in the figure.

Figure 3.13 Examples of Initiatives by Industry in Sakai City (1)

Examples of Decarbonization Efforts by Industry (3)



- The SAF (Sustainable Aviation Fuel*) production plant is scheduled to start operation in Sakai City in FY2024.
 - 100% domestic waste cooking oil will be used as raw material, and approximately 30,000 kiloliters are expected to be supplied per year.
 - Sakai City has also committed to this “Fry-to-Fly Project”.
- * Reduces CO2 emissions by approximately 80% compared to conventional aviation fuel.



(Source, material from JGC Holdings Corporation.)

Source: Sakai City (partially revised by Nippon Koei) and as stated in the figure.

Figure 3.14 Examples of Initiatives by Industry in Sakai City (2)

(3) Sharing Initiatives on Decarbonization in Ba Ria-Vung Tau Province

DONRE of Ba Ria Vung Tau Province introduced the province's initiatives in the field of decarbonization and the environment to the Environment Bureau of Sakai City and participating companies. An overview of efforts in each field is shown below.

(1) Plan No. 246/KH-UBND dated November 27, 2023 on green growth urban development in the province until 2030 (Decision No. 84/QĐ-TTg dated January 19, 2018 of the Prime Minister on approving Vietnam Green Growth Urban Development Plan until 2030)

Department of Construction is in-charge and implement following tasks

1. Topic 1: Review and adjust urban planning and urban development programs towards green growth and response to climate change, including 02 priority action tasks.
2. Topic 2: Planning to mobilize resources, apply science and technology and invest in building green growth urban development annually and by period, including 04 priority action tasks.
3. Topic 3: Urban development management for green growth, including 03 priority action tasks.
4. Topic 4: List of pilot urban areas to implement green growth urban development, including 01 priority action task



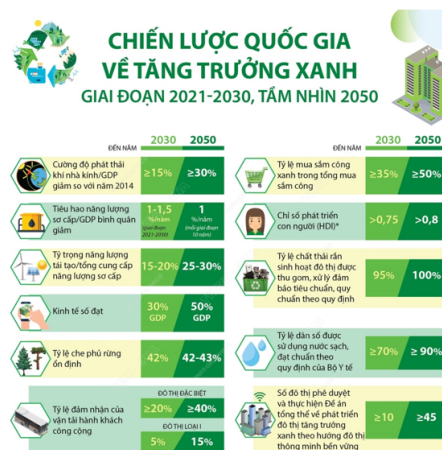
Source: DONRE of Ba Ria-Vung Tau Province

Figure 3.15 Efforts in the Decarbonization and Environmental Fields of Ba Ria-Vung Tau Province (1)

(2) Document No. 16994/UBND-VP dated December 4, 2023 on implementing the Green Growth Strategy for the period 2021-2030, vision to 2050; Decision No. 882/QĐ-TTg dated July 22, 2022 (Department of Planning and Investment presides over consultation)

1. Unify the implementation of the Green Growth Strategy for the period 2021 - 2030, vision to 2050 in Ba Ria - Vung Tau province by integrating the goals and content of the Strategy implementation in strategies, planning, plans for socio-economic development, sectors, fields and territories. Specifically, the goals and contents of the National Strategy on Green Growth for the period 2021 - 2030 will be researched and integrated into the province's plans and plans.

2. Departments, units, district-level People's Committees, relevant agencies and units study the tasks and activities assigned in Decision No. 882/QĐ-TTg dated July 22, 2022, integrating specific contents in provincial planning, general urban construction planning, district construction planning, urban and rural construction planning; socio-economic development plans, public investment plans, financial and budget plans, industry and field development plans

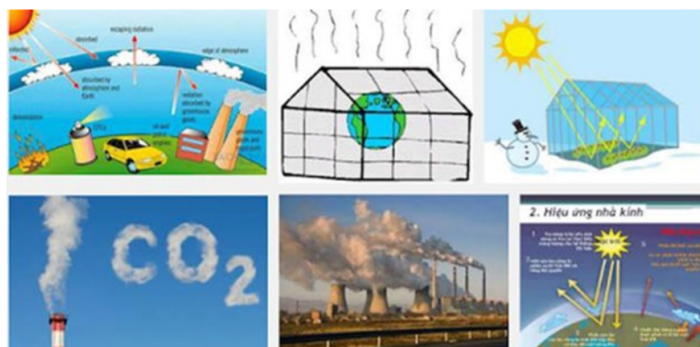


UBND TỈNH BÀ RIA - VŨNG TÀU
SỞ TÀI NGUYÊN VÀ MÔI TRƯỜNG

(3) Document No. 666/BC-UBND dated November 14, 2023 reporting to the Ministry of Natural Resources and Environment on the results of reviewing emission facilities subject to greenhouse gas inventory in 2022 (Department of Natural Resources and Environment presides in advising)

The results of the review and assessment of facilities in Ba Ria-Vung Tau province identified 108 emission facilities that must be inventoried of greenhouse gases (including 62 facilities under Decision No. 01/2022/QĐ-TTg dated January 18, 2022 and 46 new establishments have been reviewed and added). In there:

- Industry and Trade Sector: 98 establishments (including 55 establishments under Decision No. 01/2022/QĐ-TTg dated January 18, 2022 and 43 new establishments reviewed and added).
- Transportation industry: 06 establishments (under Decision No. 01/2022/QĐ-TTg dated January 18, 2022).
- Construction industry: 01 facility (under Decision No. 01/2022/QĐ-TTg dated January 18, 2022).
- Natural Resources and Environment Sector: 03 establishments (New added).



UBND TỈNH BÀ RIA - VŨNG TÀU
SỞ TÀI NGUYÊN VÀ MÔI TRƯỜNG

(4) Issued Decision No. 2066/QĐ-UBND dated August 22, 2023 approving the Project on solid waste management and classification of domestic solid waste at source in BR-VT province for the period of 2025, with an orientation to 2030. ; Plan No. 267/KH-UBND dated December 26, 2023 on implementing tasks according to Decision No. 2066/QĐ-UBND dated August 22, 2023 (Department of Natural Resources and Environment presides over consultation) A total of 96 tasks and solutions



1. Improve management, direction, administration and coordination capacity in solid waste management (14 Missions)



2. Policy mechanism and collection, storage, transportation, recycling and treatment of solid waste (19 tasks)



3. Prevent, reduce, recycle, reuse, collect, store, transport and treat solid waste (24 tasks)



4. Classify household solid waste at source (18 tasks)



5. Plastic waste management (21 tasks)

UBND TỈNH BÀ RIA - VŨNG TÀU
SỞ TÀI NGUYÊN VÀ MÔI TRƯỜNG

Source: DONRE of Ba Ria-Vung Tau Province

Figure 3.16 Efforts in the Decarbonization and Environmental Fields of Ba Ria-Vung Tau Province (2)

(4) Review of Solid Waste Management Efforts in Ba Ria-Vung Tau Province

In Vietnam, following the amendment of the Environmental Protection Law in 2020, there is an urgent need for each local government to take steps toward separate collection and recycling of solid waste. In Ba Ria-Vung Tau Province, the activities to strength the management of household waste separation, collection and transportation are underway based on Decision No. 2066/QD-UBND dated August 22, 2023 and Plan No. 267/KH-UBND dated December 26, 2023. The results of the review of these efforts are summarized in 4.2.2 below.

(5) Collaboration with C2P2

In order to realize a decarbonized society worldwide, it is necessary for various stakeholders to work together to accelerate the decarbonization of cities. In this context, the Ministry of the Environment, Japan together with JICA, launched the Clean City Partnership Program (C2P2) in February 2023. With the participation of Japanese local governments, private companies, financial institutions and others, this program works in partnership with the G7, multilateral development banks (MDBs), etc. The aim is to provide comprehensive and synergistic support to tackle urban issues including climate change, environmental pollution, circular economy, natural regeneration (nature positive) and so forth in partner cities. As part of C2P2, this Project cooperates with Technical Cooperation Project for the Development of Guidelines for Model IPs -Smart IPs towards Eco Orientation and Application of Information Technology in Management and Administration in Ba Ria Vung Tau Province, Vietnam (here after referred to “JICA Eco-IP Project” which launched in October 2023. The JICA Eco-IP Project plans to implement a pilot project and develop a draft guideline for an Eco-IP based on Decree No. 35/2022/ND-CP dated May 2022. In FY2023, the cooperation activities were conducted by dissemination of C2P2 activities at related seminars, opinion exchanges at the Project technical workshop inviting JICA and JICA Expert Teams, and discussed specific activity plans for the second half of 2024, when the activities of JICA Eco-IP Project is more active.

(6) Discussion of 2024 Activity Plan Based on MOU

Sakai City Environment Bureau and Ba Ria-Vung Tau Province DONRE exchanged opinions and discussed the contents of the 2024 activity plan based on the MOU.

CHAPTER 4 PRELIMINARY STUDY FOR JCM MODEL PROJECT

4.1 Outline of the Preliminary Study for Development of JCM Model Projects

In the Project, the preliminary study for the introduction of decarbonization technologies shown in Table 4.1 related to Japanese participating companies was conducted. In addition, basic information for forming JCM Model Project was collected in the following fields. The information collection results are shown in Section 4.2, and the survey results for each candidate project are shown in Sections 4.3 onwards.

- Gathering information on the private sector's needs for introducing renewable energy and energy conservation (Section 4.2.1)
- Collecting information on solid waste management (Section 4.2.2)
- Gathering information on smart cities (Section 4.2.3)

Table 4.1 Decarbonization Technologies to be Introduced

Candidate Projects	Related Companies Participating in the Project	Reference in the Report
Energy-saving equipment (once-through gas boiler)	Osaka Gas	Section 4.3
Biogas generation and utilization system	Air Water	Section 4.4
Hydrogen energy	Chugai Ro	Section 4.5
Waste power generation	Kubota	Section 4.6
Solar power generation in industrial park	Osaka Gas	Section 4.7

Source: Nippon Koei Co., Ltd.

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

4.2.1 Data Collection for Identifying Needs of Renewable Energy and Energy Saving in Private Sectors

As part of the JCM project preliminary study for private facilities in Ba Ria-Vung Tau Province, Nippon Koei conducted a questionnaire survey regarding the needs for introducing renewable energy and energy-saving equipment. The results are shown in the table below.

This questionnaire was distributed to member companies of VCCI Vung Tau in cooperation with the VCCI Vung Tau. A total of six companies responded to this survey. While all six responding companies expressed interest in carbon neutrality and energy conservation, four companies had CO₂ emission reduction targets, and two companies had introduced energy-saving/renewable energy equipment. It was confirmed that all three companies with issues related to energy saving and the introduction of renewable energy raised issues related to costs. Five companies mentioned solar power generation as a renewable energy facility they were interested in, confirming the high need for solar power generation. Four companies requested to participate in technical workshops and other activities related to the Project.

The result of this survey is used for technology introduction of companies participating in the Project that have various decarbonization technologies and business matching with responding companies in FY2023 and FY2024.

Table 4.2 Results of Questionnaire Survey Regarding Needs for Introducing Renewable Energy and Energy Saving Technologies

Industry	Wood Chip Manufacturing	Wind Generator Manufacturing	Industrial Park Management	Machine	Park/Green Space Maintenance/Management	Shoes Manufacturing
Energy Used	Electricity Solar power	electricity Diesel Oil (DO) LPG	Electricity Natural gas	Electricity LPG	Electricity	Electricity LPG Diesel Oil (DO) Gasoline
Energy Applications	Wood chipper	Air Compressor Welding iron bending	Boiler	Metal welding Cutting machine	Office equipment	Machine production line
Interest in Carbon Neutrality and Energy Saving	Yes	Yes	Yes	Yes	Yes	Yes
Presence of CO2 Emission Reduction Target	Yes	Yes	Yes	N/A	N/A	Yes
CO2 Emission Reduction Target	Not calculated	Approx. 1 kg/kw	Achieving net zero by 2050	-	-	Approx. 400 tonCO2eq/year
Waste Biomass	Non-standard size wood chips Bark	Nothing	Household waste Hazardous waste	N/A	N/A	Sludge Agricultural waste
Waste Biomass Emissions	5 tons/day or less	-	Household waste: 50 kg/day Hazardous waste: approx. 60 kg/day	-	-	0.01 ton/day
Waste Biomass Processing Method	Sold as wood pellets	-	Processing according to regulations	-	-	Recycling Energy recovery
Interest in Energy Saving and Renewable Energy	Yes	Yes	Yes	Yes	Yes	Yes
Installed Energy Saving/Renewable Energy Equipment	Equipment for producing wood pellets using waste	N/A	N/A	N/A	N/A	N/A
Interesting Energy Saving/Renewable Energy Equipment	Solar power Biomass utilization	Solar power	Solar power Biomass utilization Hydrogen technology	Energy saving lighting	Solar power, hydrogen technology	Solar power
Issues	Pellet plant	Budget	Management	N/A	N/A	N/A

Industry	Wood Chip Manufacturing	Wind Generator Manufacturing	Industrial Park Management	Machine	Park/Green Space Maintenance/Management	Shoes Manufacturing
Related to the Introduction of Energy Saving and Renewable Energy Equipment	installation cost	Initial cost	t of installation costs and transition to new energy			

Source: Nippon Koei Co., Ltd.

4.2.2 Data Collection on Solid Waste Management

(1) Solid Waste Management Plan and Status

1) National Strategy on Solid Waste Management in Vietnam

In Vietnam, Decision No. 491/QĐ-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.

2) Guideline on Segregation of Solid Waste at Household

The Ministry of Natural Resources and Environment (MONRE) has recently issued Official Letter No. 9368/BTNMT- KSONMT on November 2, 2023, providing technical guidance to the People's Committees of provinces and centrally-run cities on the classification of household solid waste. The guidance aims to provide a comprehensive understanding of the waste classification process to ensure that households comply with the provisions of the law. In accordance with Clause 5, Article 79 of the Law on Environmental Protection, the guidance is structured into four main components, namely the objective, scope, users, basis for classification, and detailed instructions on classification and implementation. Technical guidance on the classification of municipal solid waste has been designed in three main groups, including waste that can be reused and recycled, food waste, and other wastes. Each waste group has a list of common types of waste generated in households, and techniques for classification. Organized information of the guideline is shown in Table 4.3.

To ensure that the strict proper classification of source waste is adhered to, households and individuals who do not classify municipal solid waste according to regulations may be fined from 500,000 - 1,000,000 VND, as outlined in Decree No. 45/2022/ND-CP dated July 7, 2022. In addition, this Decree also stipulates specific penalties for leaking and discharging toxic chemicals into the land and water environment, and violating regulations on bringing waste into Vietnamese territory.

Table 4.3 Technical Guidelines on Municipal Solid Waste Classification

No.	Waste Name	Technical Guidance on Classification
Group 1. Waste That Can be Reused and Recycled		
1.1 Waste Paper		
1.1.1	Boxes, bags, jars, cups, paper cups.	- Remove water and solution contained

		inside. - Collapse, flatten, reduce size and volume.
1.1.2	Books, stories, notebooks, old newspapers, writing paper, boxes, cardboard, toilet paper cores, wrapping paper, envelopes, receipts, paper egg trays, other types of paper packaging not contaminated.	- Dispose of food and original containing products. - Collapse, flatten, reduce size and volume.
1.2 Waste Plastic		
1.2.1	Plastic packaging for food, cosmetics, pharmaceuticals, household, agricultural, medical products, etc. (not including packaging for pesticides, acids, industrial grease, detergents) contain hazardous ingredients)	- Remove the bottle caps and lids, and discard the water, solution or product contained inside. - Collapse, reduce size and volume.
1.2.2	All kinds of plastic chairs, basins, plastic pots, plastic cups	- Discard the product contained inside.
1.3 Waste Metal		
1.3.1	Aluminum, iron or other metal packaging containing food, cosmetics, pharmaceuticals, products for household, agricultural, medical use, etc. (excluding packaging for pesticides, industrial oils and greases, detergents with hazardous ingredients)	- Discard the product contained inside. - Collapse, reduce size and volume.
1.3.2	Metal kitchen utensils: pots, pans, pots, kettles, gas stoves, small items such as bowls, plates, spoons, forks, other types of waste metal items.	- Discard the product contained inside. - Collect and stack sharp objects to avoid injury during classification, collection and treatment.
1.4 Waste Glass		
1.4.1	Glass bottles and jars containing beer, wine, food, cosmetics, pharmaceuticals, products used in household, agricultural, medical (excluding packaging of pesticides, acids, industrial oils and greases industrial, detergents with hazardous ingredients)	- Remove the lid and discard the product contained inside. - Collect and arrange neatly to limit impact and breakage.
1.4.2	Vases, glass, and crystal decorations.	- Discard the product contained within; reuse with intact objects.
1.4.3	Other waste glass	- Collect and stack sharp objects to avoid injury during classification, collection and treatment.
1.5 Fabric, Leather Goods		
1.5.1	Clothing, accessories, shoes, sandals, suitcases, blankets, mosquito nets, fabric curtains, etc. (not contaminated with pesticides, acids, industrial grease, detergents with hazardous ingredients)	- Reuse clean objects. - Collapse.
1.6 Wooden		
1.6.1	Toy, Decorative objects, household items, boxes, trays, etc. made of wood	- Reuse intact items. - Collapse, reduce size and volume of damaged items for recycling.

1.7 Rubber		
1.7.1	Rubber toys.	- Reuse intact toys. - Collapse, reduce size and volume of damaged toys for recycling.
1.7.2	Tubes, tires, rubber items of all kinds.	- Bundle.
1.8 Discarded Electrical and Electronic Equipment		
1.8.1	Small electrical and electronic devices such as cameras and video recorders, mobile phones and desktop phones, computer cables and accessories; game console; electricity toy, handheld calculator, keyboard, laptops and tablets, pager, walkie talkies, LED lights, halogen lights	- Keeps its shape, does not disassemble.
1.8.2	Large electrical and electronic devices such as: desktop computers and monitors, fax machine, printers and scanners, sound system and speakers, television, typewriter, VCR/DVD player, solar panel, refrigerators, freezers, air conditioners, dishwashers, washing machines, electric fans, heaters, electric stoves, induction cookers, ovens, rice cookers	- Keeps its shape, does not disassemble.
Group 2: Food Waste		
2.1	Leftovers, expired food	- Ensure that it is stored in a sealed container, bag, packaging, etc., without leaks, preventing odors from spreading.
2.2	Vegetables, tubers, berries, fruits and waste parts after preliminary processing, food processing, etc., discarded products from livestock and poultry meat, sea food.	- Ensure that it is stored in a sealed container, bag, packaging, etc., without leaks, preventing odors from spreading.
Group 3. Other Domestic Solid Waste		
3.1 Hazardous Waste		
3.1.1	Packaging containing pesticides, waste acids, waste solvents, waste alkalis, industrial oils and greases, detergents with hazardous ingredients, mini gas tanks, etc. from daily activities, paint, ink, adhesives (types with hazardous ingredients in production materials), gloves, rags contaminated with oil and chemicals, needles, masks, and bandages contaminated with bacteria from sick people	- Ensure that it is stored in containers, bags, packaging for safety and to avoid dispersing hazardous waste into the environment. - Collect and arrange neatly sharp objects (such as needles) to avoid injury during classification, collection and treatment.
3.1.2	Types of waste fluorescent light bulbs, waste activated glass, the thermometer contains waste mercury	- Do not break. - In case of breakage, store it safely to avoid injury and prevent the spread of mercury during classification, collection and treatment.
3.1.3	Types of batteries and waste accumulators	- Keeps its shape, does not disassemble.
3.2 Bulky Waste		
3.2.1	Cabinets, tables and chairs, sofas, beds, mattresses	- Collapse, reduce size and volume. In case of dismantling, the waste is then classified

		into corresponding waste groups.
3.2.2	Iron cabinets, door frames, doors	- Collapse, reduce size and volume. In case of dismantling, the waste is then classified into corresponding waste groups.
3.2.3	Tree branches, tree stumps	- Collapse, reduce size and volume.
3.3 Other Remaining Waste		
3.3.1	Shells of nuts such as macadamia nuts, walnuts, cashew nuts, coconut, egg shells, coconut fiber, straw, rice husk from daily activities. Sedge mat; Bamboo mats; rattan, bamboo pillows, feathers of cattle, poultry, etc. All kinds of residue, such as coffee, tea (tea bags), bagasse, sugarcane residue, corn cob (corn pulp). Gardening waste from households such as leaves, roots, small twigs, grass, flowers, etc.	- Collapse, reduce size and volume.
3.3.2	Pet feces, carcasses of pet animals that die not due to disease	- Store in a sealed, leak-proof container to prevent odor spread.
3.3.3	Used diapers, diapers, bandages, toilet paper, tissue paper; used wet tissue; makeup remover cotton, masks, types of foam boxes, single-use plastic products, gum residue, cigarette filters, balloons, tape, earring picks, toothpicks	- Collapse and reduce size and volume, ensuring the avoidance of spillage.
3.3.4	Plastic shoes, slippers, rulers, ladles, plastic spoons, pens, lighters that have run out of gas, toothbrushes, tubes, toothpaste boxes, Other types of waste plastic	- Bundle.
3.3.5	Hard shells of aquatic and seafood species, coal slag from daily activities, pottery, porcelain, waste porcelain	- Collapse, reduce volume, ensure to avoid spillage.
3.3.6	Remaining waste types	- Bundle.

Source: Technical guidelines on domestic solid waste classification - (Attached to Official letter No. 9368/BTNMT-KSONMT)

3) Strategy on Solid Waste Management in Ba Ria-Vung Tau Province

Ba Ria - Vung Tau PPC has recently released Decision No. 2066/QD-UBND, approving the Project on Solids Management and Classification of Domestic Solids at Source in Ba Ria - Vung Tau Province for the period until 2025, with an orientation to 2030. The primary objective of this project is to enhance the capacity of solid waste management and simultaneously implement solutions to facilitate storage, solid waste classification at the source, collection, transportation, reuse, recycling, and treatment, which will be resulting to prevent and minimize solid waste generation.

To achieve the above objectives, Ba Ria - Vung Tau PPC has set forth specific tasks and solutions to implement by 2025, such as:

- Improving management capacity, direction, administration, and coordination in solid waste management and policy mechanisms, and

- Prevention, reduction, collection, storage, transportation, recycling, reuse, and treatment of household solid waste, and plastic waste management.

The planned contents of these initiatives based on Decision No. 2066/QD-UBND dated August 22, 2023, and Plan No. 267/KH-UBND dated December 26, 2023, of Ba Ria-Vung Tau Province are summarized in the table below.

Table 4.4 Plans for Municipal Solid Waste Management Initiatives in Ba Ria Vung Tau Province

Item	Outline of the Contents
Municipal solid waste management (collection and transportation)	<ul style="list-style-type: none"> - Ensuring the maintenance of facilities and systems for proper collection and transportation of municipal solid waste and proper treatment of leachate in accordance with Vietnamese law. - Prevention and control of odors and other environmental impacts during collection and transportation of waste. - Training and provision of appropriate equipment to ensure the safety of workers engaged in the collection and transportation of municipal solid waste. - Promotion of waste reduction, reuse, classification, collection, transportation, recycling, and disposal of solid waste through the use and investment in DX technology.
Enhancing municipal solid waste management	<ul style="list-style-type: none"> - Identification of challenges and measures for classification of household waste at the source. - Formulation of concrete action plans and implementation of training and other programs in Vietnam and abroad (collection of knowledge of other cases in Vietnam, training and knowledge acquisition in cooperation with international organizations, NGOs, etc.).
Treatment of municipal solid waste through waste-to-energy	<ul style="list-style-type: none"> - Implementation of the selection of a 1,000 ton/day solid waste treatment operator in Toc Tien District. - Installation of an incinerator for municipal solid waste treatment in Con Dao District.
Attracting municipal solid waste classification, collection, transportation, and treatment businesses, as well as recycling and solid waste treatment businesses applying advanced technologies	<ul style="list-style-type: none"> - Attracting projects that classify, collect, transport, recycle, and treat solid waste, construction waste, and plastic waste according to legal regulations. - Implementing incentives and support policies for projects that build recycling facilities, process solid waste, produce environmentally friendly alternatives to construction waste, plastic waste, and non-biodegradable plastic packaging and disposable plastic products.

Source: Prepared by Nippon Koei based on information from DONRE, Ba Ria Vung Tau Province

(2) Status of Waste-to-Energy Projects in Vietnam

1) Preferential Treatment System in Vietnam

In Vietnam, various preferential systems for Waste-to-Energy (WtE) projects have been established in accordance with the "Measures to Support the Development of Waste-to-Energy Projects in Vietnam (Decision No. 31/2014/QD-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 Committee is responsible for compensating and subsidizing the expropriation of land.

2) Waste-to-Energy Projects in Ba Ria-Vung Tau Province

In recent years, waste-to-energy facilities have continued to be constructed and operated in Vietnam, as represented by the cases in Can Tho City, Hanoi, and Bac Ninh Province. Ba Ria-Vung Tau Province also has always been promoted the development of electricity sources from solid waste to protect the environment. According to the approved Provincial Power Development Plan, there are 3 projects with a total capacity of 15MW as in below:

- a) Toc Tien WtE – capacity 5MW, expected operation year 2020.
- b) Phuoc Hoa WtE – capacity 5MW, expected operation year 2030.
- c) Lang Dai WtE – capacity 5MW, expected operation year 2035.

(3) Recycling of Valuable Materials (ZINC) Contained in Electric Arc Furnace Dust

The Multi-Retort Rotary Kiln facility developed by Chugai Ro Co., Ltd. has been introduced and utilized in Japan as a recycling facility since it enables to recover valuable materials such as zinc contained in electric arc furnace dust (EAFD) of steel companies.

Therefore, a brief information gathering is conducted to study the possibility of introducing the above multi-retort rotary kiln facility to companies in Ba Ria Vung Tau Province.

1) Major Enterprises and Factories Which Have Electric Arc Furnace in Vietnam

Vietnam currently ranks 13th in the world in steel production output, producing 20 million tons of crude steel in 2022 as shown in Table 4.5. The growth rate of Vietnam's steel production output is currently among the countries with the highest output in Asia. As for the list of main enterprises in the steel industry, there are more than 100 companies in Vietnam's steel industry, of which the larger ones include Hoa Phat Steel, Hoa Sen Steel, Vietnam Steel Corporation, SMC Steel Company Limited, VSC - POSCO STEEL CORPORATION (VPS), and so on.

Major enterprises in the steel sector in Vietnam are presented in Table 4.6.

Table 4.5 Crude Steel Production in the World (Unit: 100 million ton/year)

Country	2022		2021	
	Rank	Tonnage	Rank	Tonnage
China	1	1 018.0	1	1 035.2
India	2	125.3	2	118.2
Japan	3	89.2	3	96.3
United States	4	80.5	4	85.8
Russia	5	71.5	5	77.0
South Korea	6	65.8	6	70.4
Germany	7	36.8	8	40.2
Türkiye	8	35.1	7	40.4
Brazil	9	34.1	9	36.1
Iran	10	30.6	10	28.3
Italy	11	21.6	11	24.4
Taiwan, China	12	20.8	12	23.2
Viet Nam	13	20.0	13	23.0
Mexico	14	18.1	15	18.5
Indonesia ^(e)	15	15.6	16	14.8
France	16	12.1	18	13.9
Canada	17	12.1	19	13.0
Spain	18	11.5	17	14.2
Malaysia ^(e)	19	10.0	21	9.1
Egypt	20	9.8	20	10.3

Source: World Steel Association, 2023

Table 4.6 Major Enterprises in the Steel Sector in Vietnam

No.	Company Name	Location	Steelmaking
1	Hoa Phat Group Joint Stock Company	Northern Nhu Quynh IP – Hung Yen province	BOF EAF IF
2	Pomina Steel Co., Ltd	Southern Binh Duong province	EAF
3	Thai Nguyen Iron and Steel Joint Stock Company (TISCO)	Northern Thai Nguyen Province	EAF
4	VINA KYOEI Steel Limited	Southern Phu My I IP – Ba Ria Vung Tau province	EAF
5	Posco Yamato Vina Steel JSC	Southern Phu My II IP – Ba Ria Vung Tau province	EAF
6	Vietnam Steel Corporation	Northern Ha Noi City	EAF
7	Vnsteel-Southern Steel Company	Southern Phu My I IP – Ba Ria Vung Tau Province	EAF
8	Vietnam Italia Steel Joint Stock Company	Northern Pho Noi A IP – Hung Yen province	EAF
9	ShengLi Vietnam Special Steel Co., Ltd	Northern Cau Nghin IP – Thai Binh province	EAF
10	Dana - y steel joint stock company	Central Thanh Vinh IP – Da Nang City	EAF
11	VAS steel An Hung Tuong co., ltd.	Southern	IF
12	Viet-Trung Metallurgy and Mineral Co., Ltd	Northern Lao Cai province	BOF

Source: Obtained from the Vietnam Steel Association website and each enterprise's website.

Note: EAF - Electric arc furnace, BF - Blast furnace, BOF - Basic oxygen furnace, IF - Induction Furnace

According to the Vietnam Steel Association, EAF steel production accounted for nearly 7 million tons out of the total 20 million tons of crude steel produced in 2022¹. Since the amount of EAFD is reported to be about 2% of the total steel production, the amount of EAFD in Vietnam in 2022 can be estimated to be about 140,000 tons. The results of these calculations are shown in Table 4.7.

Steelmaking slag is commonly considered a normal category of solid waste. However, it is important to note that the dumping of slag on the ground can lead to significant environmental issues due to its high concentration of heavy metals and fine dust particles. Scrap iron is also the main iron raw material for most steel plants, as there is now a shortage of iron ore from mines and scrap iron can be re-melted through electric furnaces and produced as steel again.

Table 4.7 Estimation of EAFD Generation in Vietnam

(a)	Crude steel production in Vietnam (2022)	20.0	million ton
(b)	Crude steel production through electric arc furnaces in Vietnam (2022)	7	million ton
(c)	EAFD generation per amount of steel production (2011)	2	%
(d)=(b)*(c)	Estimation of EAFD generation (2022)	Approx. 140,000	ton

Source: Prepared by Nippon Koei based on information collection from various resources, (a): World Steel Association, 2023, (b): Vietnam Steel Association, 2023, (d): Nakayama, Electric arc furnace dust treatment process by melt reduction, 2011.

2) Major enterprises and factories which have electric arc furnace in Ba Ria-Vung Tau Province

There are many steel plants especially in Ba Ria-Vung Tau Province, which account for 70% of the total steel produced in the country, and so treating and recycling electric arc furnace dust had become an urgent need. The six steel plants in Ba Ria Vung Tau Province generate an estimated 45,000 tons of dust each year, and in recent years there has been great concern about environmental pollution². Major electric arc furnaces in Ba Ria-Vung Tau Province are summarized in the table below.

Table 4.8 Major Electric Arc Furnaces in Ba Ria-Vung Tau Province

No.	Company Name	Capital Source	Crude Steel Production Capacity in Electric Furnaces
1	Hoa Sen Group	Vietnam	1.30 million ton/year
2	Pomina Steel Corp	Vietnam	0.50 million ton/year
3	Vina Kyoei Steel Co Ltd	Japan/Vietnam	0.90 million ton/year
4	Posco Vietnam Co Ltd	Korea	1.00 million ton/year
5	Vnsteel Southern Steel Co Ltd	Vietnam	0.55 million ton/year
6	Tung Ho Steel Vietnam Corporation Ltd	Tiwan	1.00 million ton/year

Source: Prepared by Nippon Koei based on information collection from various resources. Global Steel Plant Tracker (<https://globalenergymonitor.org/>), other information on each company homepage.

¹ Vietnam Steel Association (2023), https://wtocenter.vn/file/19046/02_steelvietnam-steel-industry-overview-and-trends_vsa14.04.2023.pdf

² <https://xaydung.gov.vn/vn/tin-tuc/1273/47967/zinc-oxide-vietnam-starts-recycling-plant.aspx>

Currently, in Vietnam, recycling of EAFD is being operated to recover zinc at environmental companies such as: Tan Thien Nhen Environmental Joint Stock Company, Zinc Oxide Corporation Viet Nam Limited Liability Company (ZOCV), etc. The EAFD recycling project operated by a private company in Ba Ria – Vung Tau Province has a total investment of more than 120 million USD, design capacity is input of 100,000 tons/year of EAFD; Output of 35,000 tons/year of HZO 65% or 25,000 tons/year of IZO 80%³. The recovered zinc can then be used in applications like galvanizing, alloys, batteries, fertilizers, and chemicals.

As shown in Table 4.7, considering the estimated annual EAFD generation in Vietnam as 140,000 tons, the private company's share of recycling EAFD can be estimated to be about 71.4%. There is a high demand for zinc recovery technology in Ba Ria-Vung Tau Province, but the private company is meeting the demand for recycling of EAFD. In addition, the construction of blast furnaces has been promoted in Vietnam due to the country can produce its own iron ore with 50% Fe content⁴, which is the raw material for blast furnaces, and high-quality coal. Since crude steel production by EAF has remained flat in recent years, the construction of new EAF and the amount of EAFD generated will not increase on a large scale in the future.

Taking into account the above, it is planned to continue to study the business advantages and possibility of introducing EAFD recycling facility in Ba Ria-Vung Tau Province and other provinces.

4.2.3 Information Collection on Smart Cities

(1) Information on Industrial Parks in Ba Ria-Vung Tau Province

Ba Ria - Vung Tau Province is the largest industrial area in southern Vietnam, endowed with abundant natural resources (oil, natural gas, building materials) and Cai Mep Port, a major maritime gateway. The province is actively attracting Japanese companies, situated near Ho Chi Minh City and neighboring provinces like Binh Duong, Dong Nai, Tay Ninh, Long An, Vinh Phuc, and Tien Giang, forming a key economic region in the south. In this region, which is predicted to see an influx of foreign investment into Vietnam in the near future, there is a push to intensively develop industrial parks and smart urban areas. Characteristic of Ba Ria-Vung Tau's industrial parks is their coastal location, prioritizing heavy chemical industry investment (see Table 4.9), while inland parks focus on high-tech and telecommunications, benefiting from convenient transport routes through ports, roads, and airports.

³ <https://phumy3sip.com/zinc-oxide-corporation-viet-nam-limited-liability-company-zocv-3>

⁴ <https://srr.air-nifty.com/home/files/190520.pdf>

Table 4.9 List of Industrial Parks in Ba Ria-Vung Tau Province

No.	Industrial Park	Area	Developer		Location	Investment Priority Areas
			Capital	Name		
1	Cai Mep IP	670 ha	VN	Saigon Construction Corporation	Coastal	Logistics, Food processing, Chemistry, Ship repair, Metal products
2	Chau Duc IP	2,287 ha	VN	Sonadezi Chau Duc JSC	Inland	Electronic components/computers/semiconductors, Communication cables/materials, Pharmaceuticals/medical equipment, Precision machinery, Electrical equipment, etc.
3	Da Bac IZ	295 ha	VN	Dong A Chau Duc Joint Stock Company	Inland	Solar power generation projects
4	Dat Do 1 IP	496 ha	VN	Tin Nghia - Phuong Dong Industrial Park JSC	Inland	High-tech, telecommunications, Non-polluting industries, Downstream industries
5	Dong Xuyen IP	168 ha	VN	IZICO	Coastal	Oil services, Shipbuilding & repair, Oil equipment repair, Machinery industry, Automobile & motorcycle assembly, High-end electronic component manufacturing, Garment export, etc.
6	My Xuan A IP	304 ha	VN	IDICO	Coastal	Building materials, Precision machinery processing, Motorcycle & machinery production, Repair, textiles, Electrical & electronics, Food processing, Non-polluting fields
7	My Xuan A2 IP	422 ha	Taiwan	FIDC	Coastal	Construction materials industry, Forestry processing industry, Electronics, Refrigeration assembly industry
8	My Xuan B1 - CONAC IP	212 ha	VN	IDICO - CONAC	Coastal	Building materials, Machinery, Electronics, Light industry, Agricultural & forestry processing, Non-polluting industries.
9	My Xuan B1 - Dai Dung IP	146 ha	VN	Dai Duong Company Ltd.	Coastal	High-tech, Downstream industries, Telecommunications
10	My Xuan B1 - Tien Hung IP	200 ha	VN	Tien Hung Trading Manufacturing Co., Ltd.	Coastal	Light industry, Non-polluting industries
11	Phu My 1 IP	951 ha	VN	IZICO	Coastal	Electronics, steel, Heavy industry, Fertilizers, Building materials
12	Phu My 2 IP	621 ha	VN	IDICO	Coastal	Consumer goods processing industry, Cosmetic chemistry, Petrochemistry, Machinery assembly, Machinery repair, Electronic devices, Information technology
13	Phu My 2 Mo Rong IP	401 ha	VN	IDICO	Coastal	Building material manufacturing, Iron product processing, Electronics & electrical
14	Phu My 3 Specialized IP	1,046 ha	VN	Thanh Binh Phu My JSC	Coastal	Heavy industries (petrochemicals, chemicals, construction materials, metal processing, etc.), Downstream industries, Electronic devices, Electrical products, Textile fabrics, Dyeing, etc.

IZICO: Phu My 1 and Dong Xuan Industrial Zone Infrastructure Investment and Operation Company

IDICO: Vietnam Urban and Industrial Zone Development Investment Corporation

FIDC: Formosa International Diabolo Competition

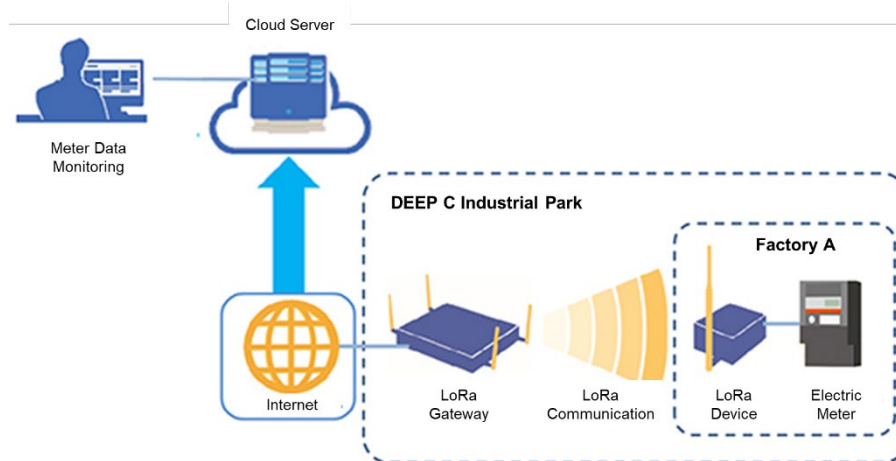
IDICO – CONAC: IDICO Investment Construction Oil and Natural Gas

Source: Based on JETRO's "Data Collection of Industrial Parks and Rental Factories in and around Ho Chi Minh City, Vietnam (August 2023)".

(2) Promoting Eco-Smart Industrial Parks by Introducing Integrated Data Platform

In Vietnam, each industrial park is going to upgrade its operations with smart meters and data platform to realize smart industrial park.

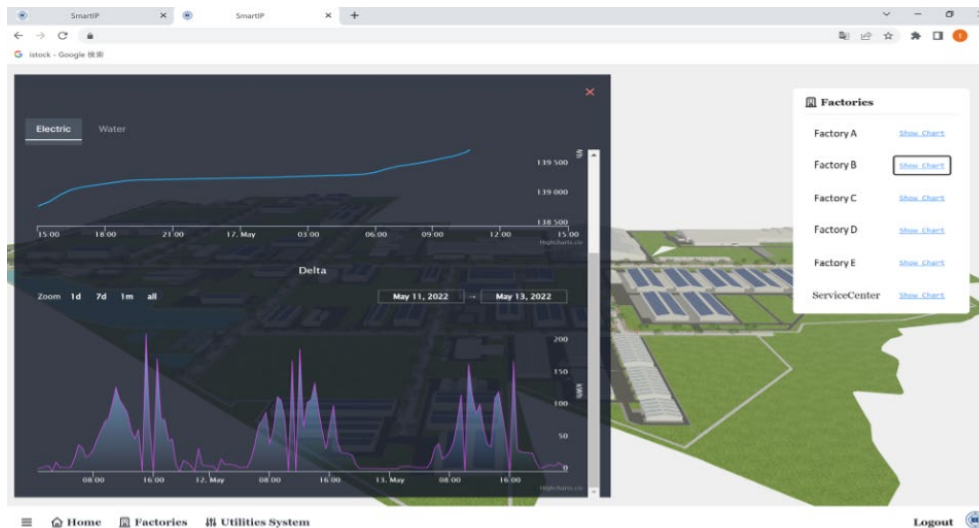
For example, in DEEP C Industrial Park located in Hai Phong City, an IoT-based electricity meter demonstration was conducted in 2018. This will improve the efficiency of electricity through real-time visualization of smart meters. Specifically, data from electricity meters will be collected in real-time, eliminating the need for manned meter checks and operational status checks.



Source: KDDI Corporation HP (<https://news.kddi.com/kddi/corporate/newsrelease/2018/05/16/3150.html>)

Figure 4.1 Demonstration of Electricity Meter Using IoT in DEEP C Industrial Park

In the Long Duc Industrial Park in Dong Nai Province, Sojitz Corporation and Nippon Koei Co., Ltd. conducted a real-time monitoring survey using electricity and water smart meters under the "FY2021 Subsidy-Based Infrastructure FS Project for Overseas Expansion (Ministry of Economy, Trade and Industry)" project. In this study, a basic plan for an integrated 3D data platform for electricity, water supply, wastewater, environment, and other fields was made for the future development of eco-smart industrial park (efficient and effective operation of industrial parks and creation of new services).

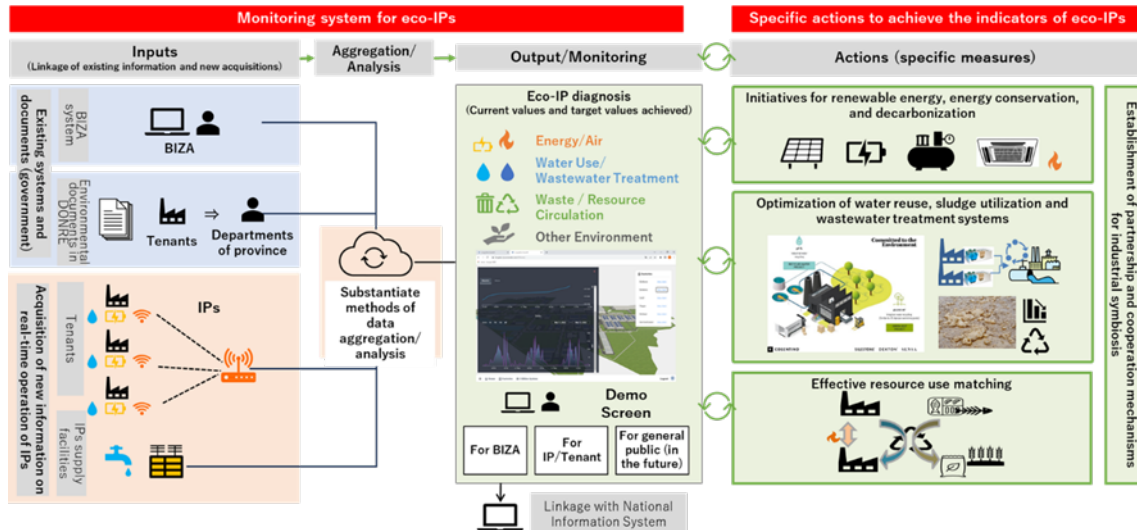


Source: Ministry of Economy, Trade and Industry (<https://infrafs.jp/report/sojitz-corporation-and-nippon-koei/index.html>)

Figure 4.2 Integrated 3D Data Platform

Decree No. 35/2022/ND-CP, promulgated in May 2022 (hereinafter referred to as Decree No. 35), stipulates the promotion of IT utilization in eco-industrial parks. In Ba Ria - Vung Tau Province, JICA's "Technical Cooperation Project for the Development of Guidelines for Model IPs – Smart IPs towards Eco Orientation and Application of Information Technology in Management and Administration in Ba Ria Vung Tau Province, Vietnam"(JICA Eco-IP Project) is being implemented from 2023 to prepare draft guidelines for evaluation and certification of model industrial parks in accordance with Decree No. 35, and for sustainable operation thereafter. In this project, the requirements for certification as an Eco-Industrial Park are not only the establishment of an environmental monitoring system for each industrial park, but also the selection of a pilot project to incentivize industrial parks and companies in the industrial parks through the system, i.e., to achieve both cost reduction and environmental load reduction.

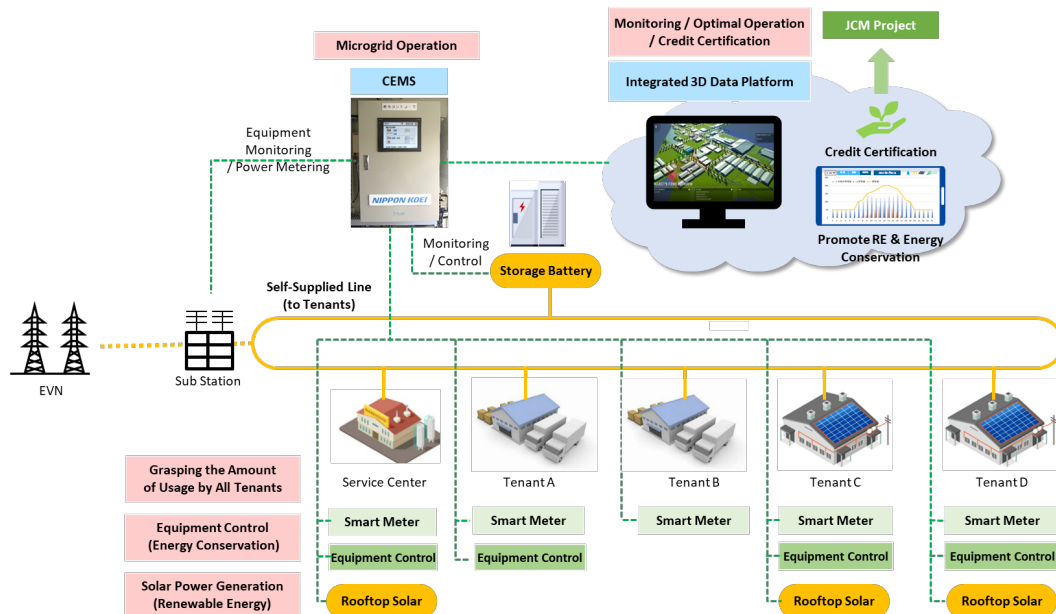
The monitoring system for eco-industrial parks will include real-time information from smart meters installed at tenants and industrial park supply facilities, the industrial park management system being developed by the Ba Ria - Vung Tau Industrial Zones Authority (BIZA) to manage basic information on management companies and tenants, environmental impact assessments, and other documents. A management system will be developed to consolidate and visualize various information managed by industrial estates, factories, and related departments. The acquired data will be used to diagnose the eco-industrial park by analyzing the data, etc. Based on the analysis, it is expected that specific measures such as initiatives for decarbonization, water reuse, utilization of sludge, and effective use of resources will be developed.



Source: JICA “Technical Cooperation Project for the Development of Guidelines for Model IPs – Smart IPs towards Eco Orientation and Application of Information Technology in Management and Administration in Ba Ria Vung Tau Province, Vietnam”

Figure 4.3 Overview of Pilot Project under JICA Eco-IP Project

Based on the above, it is expected that Ba Ria - Vung Tau Province will form a JCM Model Project for upgrading and decarbonizing industrial park management by collecting infrastructure information of industrial parks with smart meters and visualizing it with an integrated data platform, in order to create smart and eco-friendly industrial parks, which are progressing in Vietnam. The integrated data platform is expected to visualize the information on the industrial park's infrastructure. The information visualized by the integrated data platform will contribute significantly to the decarbonization of the industrial park as a whole by linking not only infrastructure usage data from smart meters but also renewable energy and energy-saving measures such as solar power generation.



Source: Nippon Koei Co., Ltd.

Figure 4.4 Image of Advanced Development for Industrial Park through Integrated Data Platform

In the future, it will be necessary to collaborate with the aforementioned JICA technical cooperation project to develop JCM Model Projects based on the needs of BIZA, existing industrial park operators, and tenant factories.

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

4.3.1 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. Following the first fiscal year of the Project, the study was composed of information gathering, introduction of decarbonization technologies and case studies at the workshop, and examination to find the candidate site for installation.

4.3.2 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 4.5 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 4.10 Advantages of High-efficiency Gas Once-through Boilers

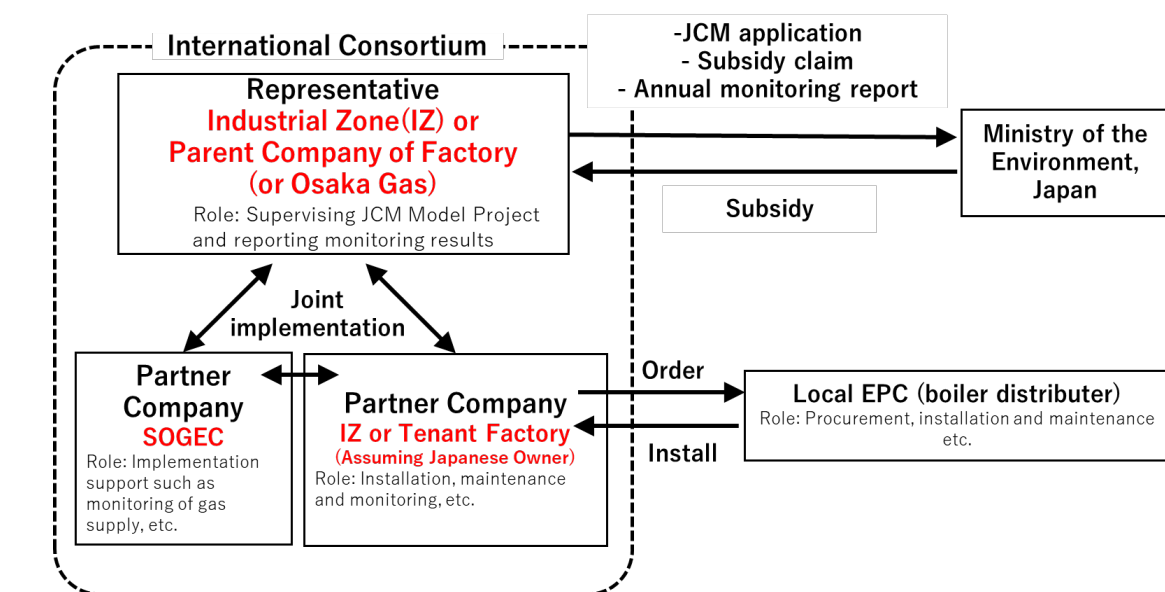
Advantages	Overview
Through-flow boiler with high mobility, load-following capability, and advanced control	Unlike the water tube boiler, in which water is pushed in from one end of the pipe and circulated, water is converted to steam inside the pipe, resulting in superior startup and load-following 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.

4.3.3 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.



Source: Nippon Koei Co., Ltd.

Figure 4.6 Image of Implementation Structure for JCM Model Project (Once-through Gas Boiler)

4.4 Preliminary Study for JCM Model Project for Biogas Generation Technologies: AIR WATER INC.

4.4.1 Outline of Study

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

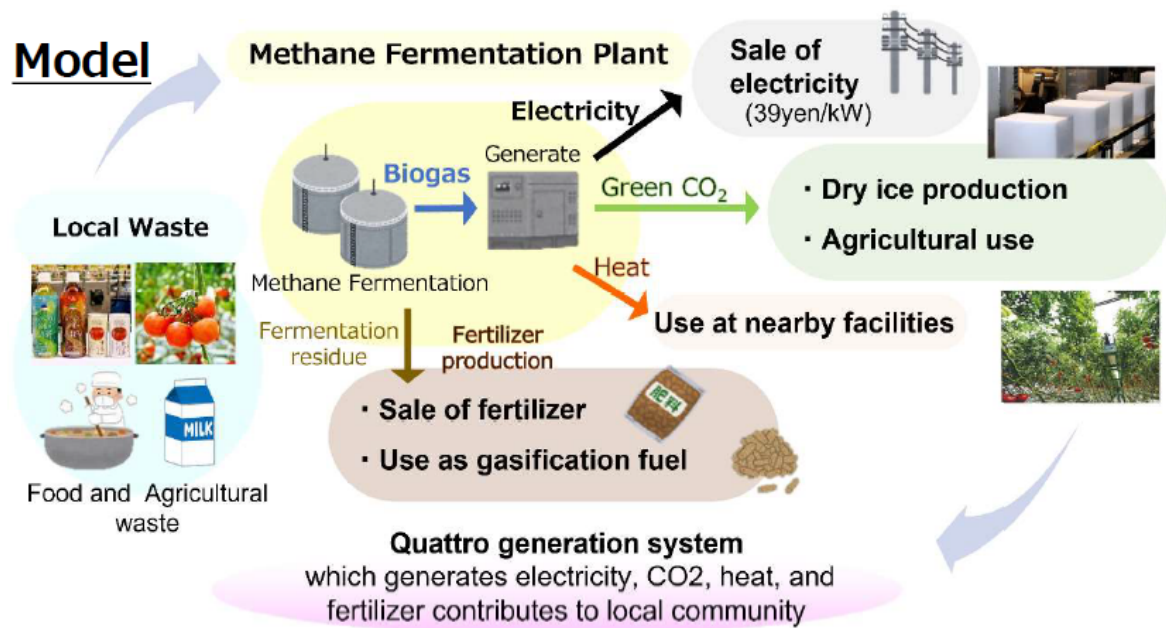
Study method and items are shown below.

- Survey method: Collection and organization of biomass-related public information and data, on-site interview survey, on-site FS survey
- Survey targets: Local government officials, the provincial Chamber of Commerce and Industry, food processors, etc.
- Survey item: Existence of potential and needs for biomass/biogas utilization

4.4.2 Technology Expected to be Introduced

Air Water is conducting demonstration experiments in Japan of biogas plants using food residue and livestock manure. The amount of biogas generated from food residue is expected to be approximately 120Nm³/t (methane: carbon dioxide = 6:4), and 30 to 40 Nm³/t from livestock manure. The business model is to contribute to the region by accepting local waste and livestock manure, and developing a "quattro generation system" that includes the sale of biomethane gas, green CO₂, heat supply with biogas boilers, and fertilizer sales.

The processing capacity is expected to be 30 tons/day in full-scale commercial scale implementation in Matsumoto City, Nagano Prefecture in 2024, and the system will be tailored to local characteristics for local governments and local companies in Ba Ria-Vung Tau Province.



Source: Air Water INC.

Figure 4.7 Quattro Generation System

4.4.3 Study Results

(1) Discussions with the VCCI and Member Companies

Discussions were held with the VCCI Vung Tau and its member companies (particularly agricultural and fishery-related companies). Regarding biomass utilization in the province, there are not many food-related companies, so the absolute amount of biomass that can be used is limited, and a large initial investment is required for the introduction of biogas generation facilities. Despite these issues, the province is promoting the use of biomass in order to achieve carbon neutrality, and it was shown that there is a high possibility of receiving support from the province (securing planned project sites, etc.).

(2) Simple FS Related to Methane Fermentation

A feasibility study was conducted within the BRVT province with the aim of performing methane fermentation using molasses residue and wastewater sludge as raw materials, extracting biogas, and using it as energy. As a result, it was confirmed that the plant has the raw material potential to produce 130,000 Nm³/day of biomethane. However, the proposed system was not introduced because it was not profitable due to the amount of waste generated. In FY2024, Air Water plans to continue to consider candidate sites of a scale (around 50 tons/day) that will yield optimal project effects.

(3) Interview with the Organic Farm

It was also found that food residue generated within the BRVT province is used as livestock feed and farm fertilizer after the fermentation process in an organic farm. The farm is scheduled to expand in size in the near future, and it is expected that surplus agricultural biomass will be generated. Air Water conducted site visit and interviews with the organic farm in Ba Ria-Vung Tau Province regarding the residue which could be used for biogas generation. Air Water has considered conducting field experiments using the agricultural biomass in collaboration with research institutions connected to

farms, with the aim of understanding the amount of biogas generated and considering the possibility of introducing the system.

4.4.4 Project Plan and Feasibility

The further study will be conducted on the installation of one treatment plant in Ba Ria-Vung Tau province, assuming a daily waste treatment capacity of 50 tons. Air Water is considering the three potential analytical institutions, and plans to conduct on-site tests using agricultural biomass in order to ascertain the amount of biogas generated. In addition, a demonstration plant in Japan is scheduled to start operation in 2024, and the feasibility of introducing it in Ba Ria-Vung Tau province will be considered based on the feasibility evaluation.

4.5 Preliminary Study for JCM Model Project for Hydrogen Energy: Chugai Ro Co., Ltd.

4.5.1 Outline of Study

In this study, the possibility of introducing combustion technology that utilizes new energies such as hydrogen and ammonia was examined targeting enterprises in Ba Ria-Vung Tau Province. In FY2023 from when Chugai Ro Co., Ltd. (hereinafter referred to as Chugai Ro) has participated in the Project, the study focused on gathering information on trends in the introduction of hydrogen and ammonia combustion technology in Vietnam and understanding the needs of local companies.

4.5.2 Technology Expected to be Introduced

The hydrogen burner developed by Chugai Ro in cooperation with Toyota Motor Corporation has a burner structure that takes advantage of the characteristics of hydrogen fuel, and in addition to zero CO₂ emissions, it has excellent low NO_x performance and high safety (see Figure 4.8 and Table 4.11).



Source: Chugai Ro Co., Ltd.

Figure 4.8 HSGB-H2 Type Hydrogen Burner (Chugai Ro)

Table 4.11 Features of HSGB-H2 Type Hydrogen Burner

Advantage	Overview
Zero CO ₂ emissions	The hydrogen fuel does not contain carbon and it does not emit CO ₂ .
Low NO _x	Low NO _x performance is achieved by lowering the flame temperature, flowing hydrogen and air in parallel within the burner which makes combustion slow.
High safety	It has a burner structure that mixes fuel with air after it is ejected from the nozzle. Since air and fuel are supplied separately, backfire does not occur during combustion, making it possible to burn safely.

Source: Chugai Ro Co., Ltd.

4.5.3 Study Results

(1) Trends in Vietnam

In Vietnam, the development of hydrogen energy has been directed by the Politburo in Resolution No. 55-NQ/TW on the orientation of Vietnam's National Energy Development Strategy to 2030, with a vision to 2045. In PDP8 mentioned above in 2.2.1 (1), the promotion of hydrogen production and

application in the industrial, transportation, and power generation sectors is strongly encouraged in order to achieve net zero target by 2050. In particular, coal-fired power plants that have been in operation for more than 20 years will gradually switch to biomass or ammonia combustion, when the price of alternative fuels is suitable. In the private sector, green hydrogen production projects are progressing in other provinces in southern Vietnam (see Table 4.12), and the development of specific national promotion measures based on PDP8 is awaited. As of the end of 2023, MOIT is preparing a draft Decree on Renewable Energy and a Hydrogen/ammonia Energy Production Strategy for the period up to 2030, with a vision to 2050.

Table 4.12 Trends in Introduction of Hydrogen and Ammonia in Vietnam

Project	Overview
Tra Vinh Green Hydrogen Plant Project	The company plans to produce 24,000 tons of green hydrogen per year for export overseas through seawater electrolysis in Tra Vinh Province in southern Vietnam. TGS Tra Vinh Green Hydrogen (TGS: Green Solution Group Corporation) plans a business in partnership with Germany's ThyssenKrupp Group (Germany). The total investment amount is approximately VND 8 trillion. The operation is scheduled to start in 2024.
Enterprise Energy offshore wind project	Enterprise Energy (Singapore) plans an offshore wind power project in Binh Thuan province in southern Vietnam. Includes a business plan to produce green hydrogen from water electrolysis. The production target is 330,000 tons of hydrogen per year.

Source: MOIT website (<https://moit.gov.vn/phat-trien-ben-vung/khoi-cong-xay-dung-nha-may-san-xuat-hydro-xanh-tra-vinh.html>, published in March 2023), MOIC/Foreign Information Services Authority website (<https://www.vietnam.vn/ja/ong-lon-ngoai-dau-tu-ti-usd-lam-du-an-dien-gio-tai-binh-thuan/>, published in December 2023), Ammonia Energy Association (<https://www.ammoniaenergy.org/articles/renewable-ammonia-in-vietnam/>, published in May 2022)

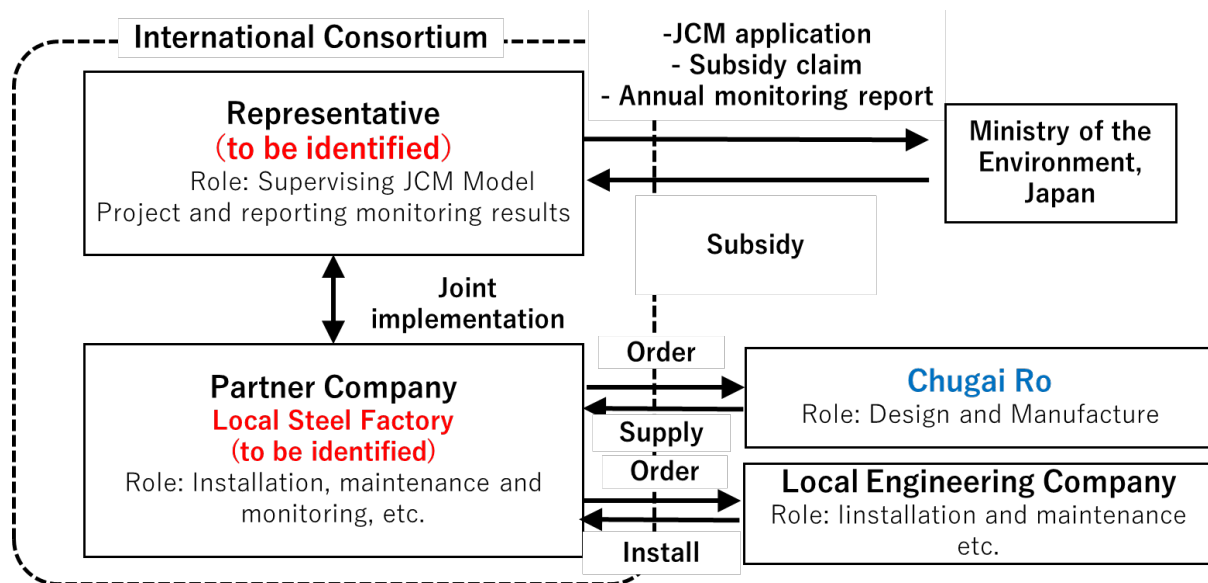
(2) Results of Local Company Needs Survey

The interviews survey with local companies and VCCI-Vung Tau was conducted to confirm their intention for hydrogen and ammonia. Local companies and small and medium-sized enterprises generally have limited interest in becoming carbon neutral, as there are currently no regulations in place for companies geared toward decarbonizing energy. On the other hand, some foreign companies have begun to consider co-combustion or introduction of hydrogen and ammonia. Some local companies are requesting support and institutional development for hydrogen supply network including supply of green. Since the domestic steel industry in Vietnam is affected by the downsizing of public works projects and the recession in the real estate sector, steel production rates are limited. The further survey is necessary targeting companies that are positive about carbon neutrality while monitoring the trends on capital investment. When introducing hydrogen gas, not only the initial investment but also the cost burden of hydrogen gas is a major issue. Initial examination of supply system and cost is necessary.

4.5.4 Draft Implementation Structure for JCM Model Project

The following implementation structure is assumed in the case of applying for a JCM Model Project. Next fiscal year, it is planned to confirm the basic specifications including ancillary equipment, and estimate the approximate costs of candidate facilities (factories, etc.) that would have a high possibility

of introducing the proposed equipment. When considering the implementation system, one of the challenges is the selection of representative company of JCM scheme.



Source: Nippon Koei

Figure 4.9 Image of Implementation System for JCM Model Project (Chugai Ro)

4.6 Preliminary Study for JCM Model Project for Waste-to-Energy: KUBOTA CORPORATION.

4.6.1 Outline of Study

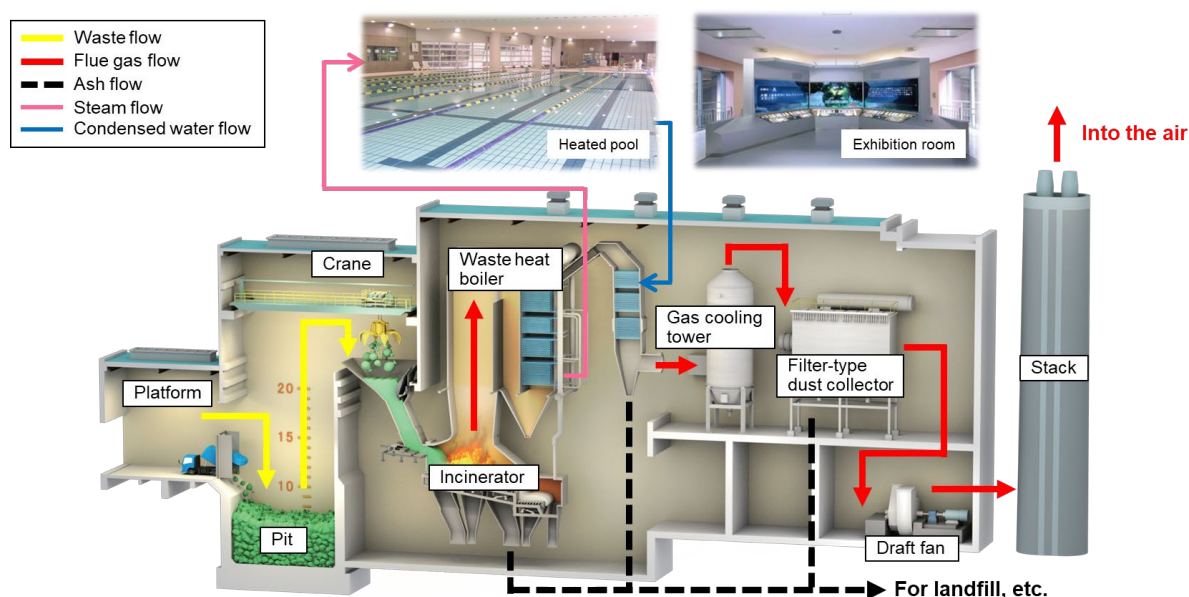
Based on the results of the beforementioned waste related survey in Ba Ria - Vung Tau Province, the feasibility of introducing a waste-to-energy project in the province was examined. This fiscal year's survey focused on information updates on waste-to-energy projects in the province, and conducting interview surveys with a waste treatment company and a recycling company.

4.6.2 Technology Expected to be Introduced

In this survey, an optimal scale and specifications for the future introduction of waste-to-energy projects 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. Pre-treatment isn't required. The waste is fed directly from a waste pit.
2. Stable combustion is capable for mixed combustion of various types of waste.
3. Easy operation control due to slow combustion.
4. High reliability with a number of successful examples.



Source: KUBOTA CORPORATION.

Figure 4.10 Image of Waste-to-Energy System

4.6.3 Study Results

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

A summary of the result of the interview survey with the industrial/hazardous waste treatment company is shown in the table below. This company is located in the Toc Tien centralized waste treatment area and is responsible for the treatment of more than 500 types of industrial and hazardous waste, mainly waste from industrial parks in Ba Ria Vung Tau Province. The company is also considering the implementation of a waste-to-energy facility in the area and has already received approval from the Province to implement the waste-to-energy project.

Table 4.13 Summary of Result of the Interview Survey with an Industrial/Hazardous Waste Treatment Company

Date and Time	January 18, 2024, 13:30-15:00
Facility location	Toc Tien centralized waste treatment area
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.

	<ul style="list-style-type: none"> - The company mainly processes waste generated from industrial parks in the province. - The company has industrial and harmful waste incinerator system that includes 2 incinerators. Its capacity is 500 kg/hour/incinerator, a total of 24 tons/day. - The company has total of 10 waste treatment facilities and 30 waste transportation vehicles.
Status of waste-to-energy project	- The company is getting into bidding stage for launching WtE business. (Other technical information is not disclosed)

Source: Nippon Koei Co., Ltd.

A summary of the result of the interview survey with the recycling company is shown in the table below. This company applies pyrolysis technology to recycle waste tires generated from Ba Ria - Vung Tau Province into useful products, aiming to reduce pollution in our environment and together make our world a better place.

The company has processed more than 10 % of waste tires in Vietnam. Waste tires is recovered into recycled oil, iron scrap and Carbon Black. These recycled materials are supplied and sold at market again.

Table 4.14 Summary of Result of the Interview Survey with an Recycling Business

Date and Time	January 18, 2024, 9:00-11:00
Facility location	Toc Tien centralized waste treatment area
Year of commencement of business	2012
Business	<ul style="list-style-type: none"> - Applying pyrolysis technology to recycle tires into renewable energy and useful products. - A recycling factory, area of 1 ha, is located at the centralized Waste Treatment Zone, Toc Tien Commune, Phu My Town, Ba Ria – Vung Tau Province. (Other technical information is not disclosed)
Other information collected	<ul style="list-style-type: none"> - There is no technology transfer from outside, and the experience and knowledge of each technician at the company is integrated to run the whole facility from design, assemble, and operation itself. - Subsidy has not been received from the central government so far. Under the EPR system, which will be launched as of January 1, 2024, subsidies will be distributed to waste treatment/recycling companies based on the type of waste to be treated. - The potential entry of new competitors into the same market/business they are running is a concern, but the company believes that challenges can be addressed if they focus on its own research and development efforts to promote advanced technologies. - Recycled oil is more affordable to purchase than natural oil, and for the past 20 years there has been a high demand for recycled oil in Vietnam. (Other technical information is not disclosed)

Source: Nippon Koei Co., Ltd.

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

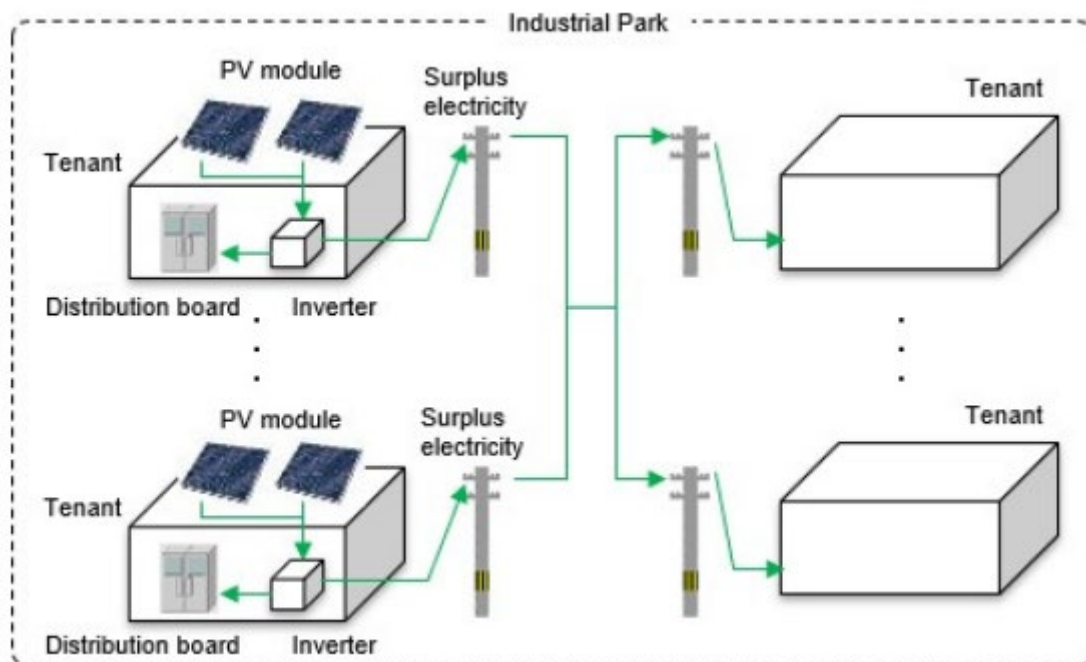
4.7.1 Outline of Study

Regarding a roof-top solar power system, the outline of system and model cases of JCM Model Projects were introduced to industrial parks and tenant factories in Ba Ria- Vung Tau Province through the technical workshop. The individual proposals have been delivered to companies which are interested in. In the next fiscal year, it is planned to apply for the JCM Model Project for an eligible factory that meet the requirements. When installing solar power generation, relevant authorities are concerned about a decline in the stability of grid power, so business proposals that use storage batteries are considered necessary for future project formulation.

4.7.2 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.

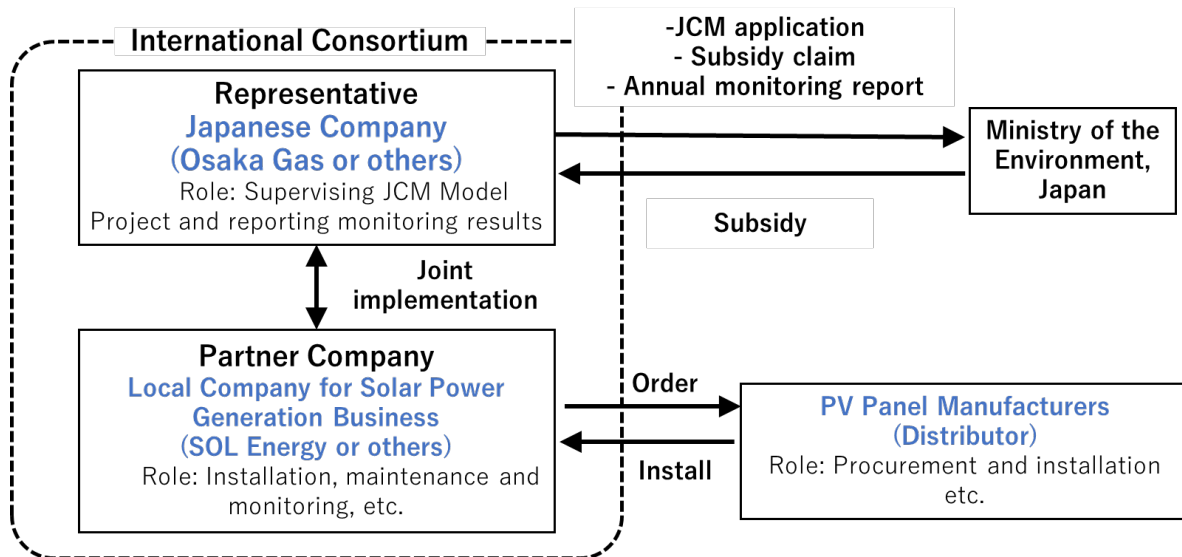


Source: GEC Website: https://gec.jp/jcm/projects/21pro_vnm_06/

Figure 4.11 Image of Solar Power Generation System in Industrial Parks

4.7.3 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 Looop Inc.



Source: Nippon Koei Co., Ltd.

**Figure 4.12 Image of Implementation Structure for JCM Model Project
(Solar Power Generation System)**

CHAPTER 5 FUTURE PLAN

5.1 Summary of Activity in FY2023

The results of activities in FY2023 are summarized in the table below.

Table 5.1 Summary of Activity Results

Item	Contents of Plan	Approach	Main Achievements
Support for Institutional Development	<ul style="list-style-type: none"> Sharing of decarbonization initiatives in Sakai city, city-to-city discussion for building a decarbonized society in Ba Ria-Vung Tau (BRVT) province 	<ul style="list-style-type: none"> Exchange of opinions and knowledge in individual areas that address challenges in the province, such as strengthening initiatives related to energy saving and introduction of renewable energy in industrial parks and enterprises, and promoting waste separation, recycling, and effective use. Concluding of MOU between city/province and promotion of cross-departmental collaboration with BRVT province Collaboration with JICA Eco IP Project (C2P2 initiative promotion) 	<ul style="list-style-type: none"> Concluded the MOU between city/province to build decarbonized city and circular economy and form JCM project Mutual sharing of the efforts of both city/province in the field of decarbonization and environment, including related departments, and exchange of opinions on collaborative activities based on the MOU Disseminating C2P2 initiatives at related seminars and workshop and discussing future activities
Energy saving/renewable energy field	<ul style="list-style-type: none"> Sharing of Sakai city's decarbonization and other initiatives Study for introduction of energy saving/renewable energy technology for JCM Model Project formation 	<ul style="list-style-type: none"> Business matching expanding to non-Japanese local companies and other sectors Elaboration of plans for forming JCM Model Project at business models and candidate sites considered in the first fiscal year 	<ul style="list-style-type: none"> Strengthen cooperation with VCCI and conduct joint survey Basic survey for project finding targeting industrial parks and enterprises including local companies
Hydrogen energy field	<ul style="list-style-type: none"> Information gathering and needs survey regarding the utilization of hydrogen energy Study for introduction of hydrogen energy technology in industrial furnaces for JCM Model Project formation 	<ul style="list-style-type: none"> Sorting out issues and challenges for introducing hydrogen/ammonia combustion technology Information collection and coordination among related parties for project formulation 	<ul style="list-style-type: none"> Information gathering and needs survey in each field Individual preliminary feasibility study at local companies

Item	Contents of Plan	Approach	Main Achievements
Solid waste treatment field	<ul style="list-style-type: none"> ▪ Gathering information on solid waste treatment ▪ Study for introducing solid waste treatment technology for JCM Model Project formation 		

Source: Nippon Koei

5.2 Challenges Identified from Project Activities

In order to consider the activity plan for City-to-City Collaboration Project in FY2024, the following challenges were identified and organized through Project activities.

5.2.1 Support for Institutional Development

(1) Implementation of Activities Based on Intercity MOU

One of the major achievements of the Project in FY2023 is to conclude the MOU on decarbonization and other relevant areas. Both cities have continued to prepare and coordinate for the MOU since FY2022. Invited by the Ministry of the Environment, Japan, both cities were able to hold the MOU signing ceremony at the C2P2 seminar at the Japan Pavilion at COP28, where they announced that they hope to contribute to the further development of amicable relations between Japan and Vietnam as both counties celebrate the 50th anniversary of the establishment of diplomatic relations, and to promote intercity cooperation to build a zero-carbon city. It is expected that activities based on this MOU will proceed and produce outcomes in the near future. The specific activities are further to be discussed between the relevant departments in both cities. The forthcoming activities should be effective one in line with the priority measures of Ba Ria-Vung Tau Province, such as GHG inventory preparation and training necessary to implement the provincial plan on solid waste management.

(2) Development of Measures in Partner Countries and Cities for the Dissemination of Decarbonization Technology

Discussions between the two cities during FY2022 city-to-city collaboration activities were limited to a general introduction of decarbonization-related measures. In FY2023, both cities have discussed decarbonization efforts in collaboration with the industrial sector and private businesses, in a manner that also involved related departments of Ba Ria-Vung Tau Province. However, especially when promoting renewable energy and new energy projects, it is essential to develop laws, regulations and guidelines for spreading those new technologies. It is necessary to encourage local governments and areas to promote model projects through exchanges of opinions with DOIT and other relevant authorities, especially regarding the installation of rooftop solar power generation and support measures for clean hydrogen, following and confirming regulations and measures of Vietnamese central government.

5.2.2 Energy Saving/Renewable Energy/Hydrogen Energy/Waste Treatment Fields

(1) Gathering Local Needs in Response to Decarbonization Technologies to be Introduced

In the first fiscal year, the Project conducted the project finding surveys mainly targeting Japanese industrial parks and enterprises. This fiscal year, the Project activities strengthened collaboration with VCCI, conducting joint surveys and matching with local companies, targeting a wide range of sectors and enterprises including Vietnamese-owned businesses. The efforts made progress in discussions with individual companies in the fields of heavy industry and agriculture. On the other hand, as some industries such as food manufacturers and hotels were unable to be covered to fully understand local needs in the survey in FY2013. More efforts should continue to be made to gather local needs in response to decarbonization technologies to be introduced.

(2) Improving the Probability of Project Realization for Application of JCM Model Project

The challenges for the third year of the Project are summarized as how to increase the feasibility of formulating a JCM Model Project. Several surveys were able to proceed with simple feasibility studies and basic examination with candidates of potential contractor or representative companies of JCM Model Project. Next fiscal year, it is planned to conduct preliminary tests on the utilization of biomass energy in preparation for applying for JCM Model Project, and to continue detailed discussions among related parties regarding feasibility evaluation of business and implementation structures for the other candidate projects as well. On the other hand, for decarbonization technologies that have regional restrictions in terms of resource supply or industrial sectors, it is necessary to explore multiple candidates for the Project with a high probability of application, including the horizontal deployment of existing technologies and consideration of other surrounding regions.

Regarding the C2P2 collaboration that was proceeded this fiscal year, pilot activities for JICA Eco-IP Project is scheduled to begin next year. One effective method would be to promote synergistic support for urban issues, such as promoting an application for JCM Model Project in model industrial parks for decarbonization.

5.3 Project Proposal for FY2024

The table below summarizes the proposed activities for FY2024 based on the results and challenges of FY2023.

Table 5.2 Draft Plan of Project Activities in FY2024

Field	Approach	Outline
Support for Institutional Development	<ul style="list-style-type: none"> ▪ Implement activity plan based on the MOU and strength collaboration with related departments ▪ Strength infrastructure development for introducing decarbonization technologies 	In order to induce provincial commitment to realizing CN, the Project will strengthen activities toward building a decarbonized and circular economy and forming a JCM project based on the intercity MOU concluded in FY2023. Specifically, consider holding a high-level meeting between cities on decarbonization and mini seminar(s) for provincial government officials. In addition, opinions will be exchanged to strengthen government support measures, which are essential for the spread of next-generation energy.
Energy Saving/Renewable Energy/Hydrogen Energy/Waste Treatment Fields	<ul style="list-style-type: none"> ▪ Continue project support to candidate sites for JCM Model Project ▪ Find more project candidates which have higher possibilities for project application 	There will be continued studies toward project development at candidate sites currently under discussion. Among others, one Japanese company plans to conduct methane fermentation tests or other tests. Expand business matching using the network of local Chambers of Commerce and Industry and developers who are promoting eco-friendly industrial parks. In addition, it is planned to conduct detailed studies focusing on technological fields with high feasibility, such as energy-saving equipment and horizontal expansion of existing JCM Model Projects.

Source: Nippon Koeif