FY2023 Project for Ministry of the Environment Japan

FY2023
City to City Collaboration for Zero-carbon Society

Carbon-Free Model Area Development Project (Phase 2)
(City of Kitakyushu－Iskandar Regional Development Authority Collaboration Project)
Report

March 2024

NTT Data Institute of Management Consulting, Inc.

Table of Contents

Chapter 1. Overview and Background
1.1 Overview
1.2 Background

Chapter 2. Create inter-industry collaboration projects for decarbonization of the industrial sector
2.1 Overview of the Activity
2.2 Results of last year's survey
2.3 Conducting Questionnaires for Each Industrial Park
2.4 Consultation with individual companies
2.5 Future Directions

Chapter 3. Introduction of Waste-to-Energy as a base-load power source for decarbonization of the consumer sector
3.1 Overview of Activities
3.2 Review of the progress of the Waste-to-Energy project in Johor, Malaysia
3.3 Investigation of regulations related to waste-to-energy
3.4 Technical aspects of the introduction of waste-to-energy facilities
3.5 Results of waste investigation
3.6 Future Directions

Reference Materials

Table of Contents

Chapter 1. Overview and Background 2
1.1 Overview 2
1.1.1 Objective 2
1.1.2 Activities 2
1.1.3 Project methodology 3
1.1.4 Action framework for study 3
1.2 Background 5
1.2.1 Overview of the IRDA 5
1.2.2 The Malaysian Government's Efforts to Reduce Greenhouse Gas Emissions 7
1.2.3 The IRDA's greenhouse gas emission reduction initiatives 13
1.2.4 Cooperative relationship between Kitakyushu and the Iskandar Regional Development Authority 16

Chapter 1. Overview and Background

1.1 Overview

1.1.1 Objective

According to the report of Working Group III of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) released in 2022, approximately 70% of global GHG emissions originate from cities, and it is essential to accelerate climate action in cities to achieve the 1.5 degree target set in the Paris Agreement. In Japan, the national government and cities are working together to create more than 100 leading decarbonization regions under the Regional Decarbonization Roadmap formulated in June 2021, with the aim of achieving zero-carbon cities, and are promoting efforts to expand these regions throughout Japan.

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

As an example, the Japanese Ministry of the Environment launched the Clean Cities Partnership Program (C2P2) with JICA in February 2023, based on this project, in order to address today's challenges faced by cities around the world from multiple perspectives. This program will provide comprehensive and synergistic support to partner cities to address urban challenges including climate change, environmental pollution, circular economy, and nature positive issues through further mobilization of technology and funds in collaboration with Japanese local governments, private companies, and financial institutions. It will also promote collaboration with other key stakeholders, including the G7 and other like-minded countries and international development finance institutions.In light of the above, this project will promote collaboration between Kitakyushu City with experience and expertise in decarbonization and the Iskandar Regional Development Authority (IRDA) to support the realization of a decarbonized society and the introduction of facilities that contribute to the formation of a decarbonized society, including the realization of inter-industry collaboration in industrial parks and the introduction of waste power generation, which will contribute to reducing energy-derived CO2 emissions.

1.1.2 Activities

This study will be conducted with support from Malaysia's Iskandar Regional Development Authority and Kitakyushu and will involve the following activities aimed at promoting decarbonization in Malaysia and achieving a JCM project that will contribute to this goal.

- Activity 1：Create inter-industry collaboration projects for decarbonization of the industrial sector
- Activity 2：Introduction of waste-to-energy as a base-load power source for decarbonization of the consumer sector

1.1.3 Project methodology

(3) - 1. Create inter-industry collaboration projects for decarbonization of the industrial sector

#	Activity	Details
1)	Detailed understanding of waste heat generation and feasibility study	Through activities (1) through (3), based on the status of waste heat and wastewater treatment at each company, we will study energy management for the entire industrial park beyond the boundaries of industries and companies, and collective supply and collective treatment of wastewater for use. This year, a survey will be conducted on the status of wastewater and waste heat generation in the candidate industrial parks, as well as on the status of infrastructure development, including facilities and pipelines for use and drainage. In addition, candidate companies will be selected, and a consortium will be formed to discuss the formation of a pilot project.
2)	Survey on the status of drainage facilities, pipelines, and other infrastructure in the industrial park	
3)	Selection of candidate companies (local companies and Japanese companies with related technologies)	
4)	Formation and discussion of consortia by selected candidate participating companies	

(3)-2. Activity２：Introduction of waste-to-energy as a base-load power source for decarbonization of the consumer sector

	Activity	Details
1)	Waste quality survey conducted at the Seelong Landfill	Conduct a waste quality survey at the Seelong final disposal site in cooperation with Uni-Technology.
2)	Checking the progress of waste-to-energy projects in Johor, Malaysia	Check the progress of the waste-to-energy project (Bukit Payong) in the Iskandar region.
3)	Refinement and upgrading of project proposals based on survey results	Conduct a study of the proposed project plan based on the results of the waste quality survey.

1.1.4 Action framework for study

As shown inTable 1-1, this survey is conducted in collaboration with City of Kitakyushu, NTT Data Institute of Management Consulting, Nippon Steel Engineering, Amita Corporation and the Iskandar Regional

Development Agency.

Table 1-1 Implementation System Diagram

Member	Role
Kitakyushu	・ Cooperation and coordination with companies in Kitakyushu
NTT Data Management Laboratories	・ Compilation of the Project ・ Coordination of meeting discussions with IRDA and others ・ Study on the realisation of inter-industry collaboration in industrial estates
JAPAN STEEL ENGINEERING	・ Technical considerations for the realization of waste power generation
Amita Corporation	・ Investigation of the possibility of introducing Japanese technology in inter-industry collaboration projects
Iskandar Regional Development Authority (IRDA)	・ Collaboration and coordination with companies within the Iskandar region ・ Gathering local information on waste-to-energy

1.1.5 Study schedule

The three-year business plan envisioned for this project is shown inFigure 1-1. This year is the second of the three-year period. The project period is from 23 June 2023 to 8 March 2024.

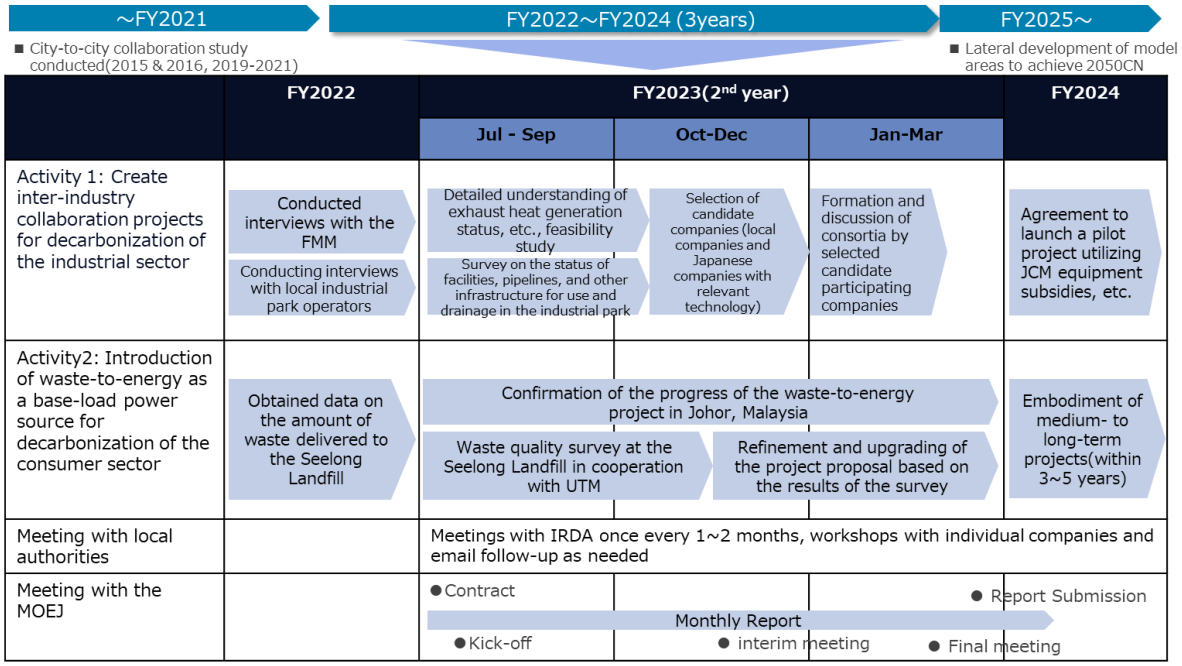

Figure 1-1 Study schedule

1.2 Background

1.2.1 Overview of the IRDA

(1) About the IRDA

The Iskandar Regional Development Authority (IRDA) is a governmental agency established in 2007 to direct efforts at promoting Iskandar Malaysia. By regulating public and private interests, it aims to promote the development of a sustainable international city. The IRDA has three core functions and areas of legal authority for achieving the above objectives.

(a) Planning

Integrating and recommending planning policy from the federal government, the state of Johor, and local governments to help improve well-being in Iskandar Malaysia. Identifying and developing strategies to enhance infrastructure, skills, and scientific research for Iskandar Malaysia development.

(b) Promotion

Undertaking broad-based promotion of Iskandar Malaysia to the general public and potential investors. Driving, coordinating, and monitoring the development of economic sectors and social infrastructure for both local and overseas.

(c) Facilitation

Providing consultation and information on investing in Iskandar Malaysia. Acting as the principal coordinating agent on behalf of relevant government agencies in relation to receiving, processing, and expediting requisite approvals for investors in Iskandar Malaysia. Assisting existing investors in resolving issues affecting their business environment.

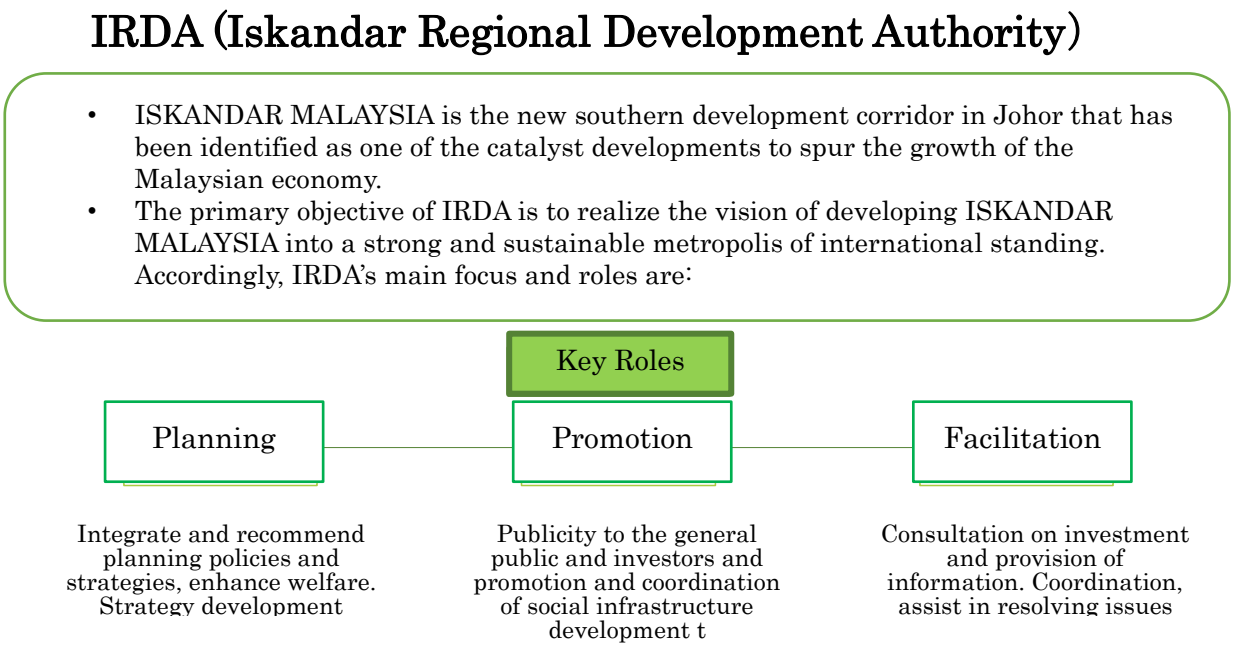

Figure 1-2 Functions of the Iskandar Regional Development Authority[1]

(2) Iskandar Development Region

The Iskandar Development Region lies at the southern edge of the Malay Peninsula in southern Johor, a Malaysian state on the coast across from Singapore. With a population of around 1.9 million, it is the country's second most important centre for economic activity after Kuala Lumpur. Malaysia's federal government established five economic corridors (key development regions) during the period of the Ninth Malaysia Plan (2006-2010), with comprehensive regional development projects being conducted in Iskandar Malaysia. The Eleventh Malaysia Plan (2016-2020), submitted to the Parliament of Malaysia by former prime minister Najib Razak in 2015, also establishes the Iskandar Development Region as a key development region. The five-year plan focuses on five main initiatives: environmental education and creative clusters, tourism and logistics centres, environment and energy, food, and the development of manufacturing industries focused on oleo chemistry. Iskandar Malaysia occupies 2,217 square kilometres and comprises five flagship zones. This is roughly the same area as the Tokyo Metropolitan area and three times the size of Singapore. On February 22, 2019, Prime Minister Mahathir Mohamad announced that Iskandar Malaysia would be expanded to 4,749 square kilometres, suggesting even more active development is in store for the Iskandar Development Region.[2]

The aforementioned five flagship zones making up the Iskandar Development Region have the following functions and characteristics.

Table 1-2 Characteristics of each region

Zone	Characteristics
Zone A: Johor Bahru City Centre	This zone focuses on, among other things, business centre development, culture and tourism, strengthening immigration functions, and waterfront property development. It has trading infrastructure, a financial centre, and a service centre (linked to Singapore via the Johor-Singapore Causeway).
Zone B: Iskandar Puteri (formerly Nusajaya)	Zone activities include Johor state government building construction, attracting education, medicine, and entertainment industry players, and Puteri Harbour development. Specifically, the zone comprises an academic city with universities offering foreign curricula, entertainment functions that include a movie filming studio as well as LEGOLAND and other theme parks, medical tourism and other service industries, and state government functions.
Zone C: Western Gate Development	This zone is centred on marine logistics centre and power plant development and contains physical distribution, free trade, and oil storage port facilities. It links to Singapore via the Malaysia–Singapore Second Link. Zone development leverages the Port of Tanjung Pelepas's geographical

[1] Prepared by NTT Data Institute of Management Consulting, Inc. based on data from the Iskandar Regional Development Authority's website

[2] New Straits Times (22/02/2019) Iskandar Malaysia to be extended, covering more areas in Johor

	advantage of being near Singapore and other Southeast Asian nations and water deep enough to accommodate even larger vessels. Connected by sea routes to ports around the world, the Port of Tanjung Pelapas is the second largest in Malaysia in terms of container transaction volume and the 18th in the world3. The port has a total area of roughly 7.8 square kilometres and comprises a container port and an adjoining free-trade zone.
Zone D: Eastern Gate Development	This zone's functions consist of electrical, chemical, and oleo chemical product manufacturing and has a petrochemical storage port. Comprising Pasir Gudang Port, Tanjung Langsat Port, and Tanjung Langsat Technology Park, the zone occupies a total of approx. 15 square kilometres. It also contains Pasir Gudang Industrial Park, which has attracted foreign manufacturing firms from around the world.
Zone E: Senai-Skudai	This zone's functions consist of Senai International Airport, a logistics centre, a high-tech industry, a space-related industry, a shopping centre, and a cyber-city. Home to University of Technology, Malaysia (UTM), one of Malaysia's most prestigious national universities, the zone also has Johor Bahru Premium Outlets, the first of its kind in Southeast Asia, making it an attractive area for tourism as well as industry.

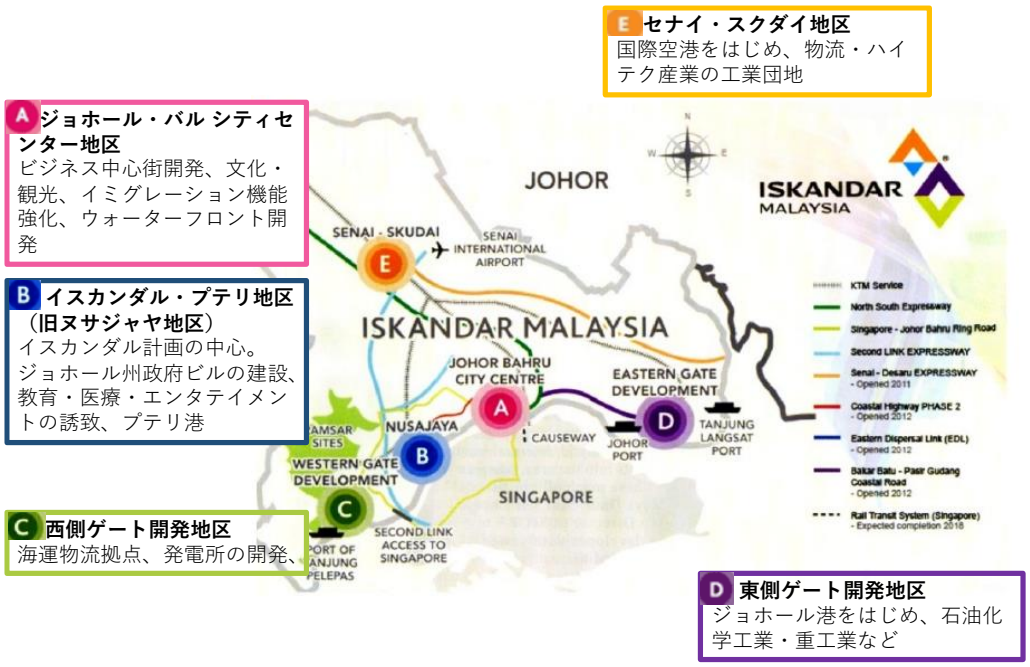

Figure 1-3 Map of the Iskandar Development Region

1.2.2 The Malaysian Government's Efforts to Reduce Greenhouse Gas Emissions

Malaysia's recent decarbonization policies include the 12th Malaysia Plan announced in 2021, the National Energy Transformation Roadmap (NETR) in 2023, which identifies 10 key projects in 6 sectors to focus

on. In 2024, a Long-Term Low Emission Development Strategy (LT-LEDS) based on the Paris Agreement is scheduled to be formulated, which will also specify the role of industry and guidelines on carbon taxation, which is expected to further stimulate the decarbonization movement.

Table 1-3 Malaysia's decarbonization-related policies and overview

Malaysia's decarbonization-related policies and overview	
2021	**The 12th Malaysia Plan (2021-2025)** Sustainability as one of the three pillars of the plan, reaffirming the target of 31% of electricity supply from renewable energy by 2025. Mentioned the importance of renewable energies such as solar power and biomass.
	Renewable Energy Roadmap 2021 In addition to hydropower, increase the share of renewable energy, mainly solar power, to 31% by 2025 and 40% by 2035.
2022	**National Energy Policy 2022-2040** 9 goals under 12 strategies and 31 action plans.
2023	**National Energy Transition Roadmap (NETR)** (Phase I) Identifies 10 key projects in 6 areas that the government should focus on to achieve carbon neutrality. (Phase 2) Set specific measures and targets to implement the projects, with a focus on establishing a fund and governance by a national council.
	Energy Efficiency And Conservation Act (EECA) House of Representatives passes law requiring energy consumers to take measures to save energy
2024	**Long-Term Low Emission Development Strategy (LTLEDS)** to be developed. Long-term strategy for low emission development as Malaysia

(1) Efforts in the Environmental Sector under the 12th Malaysia Plan

(Summary)

In September 2021, Malaysian Prime Minister Ismail Sabri announced the 12th Malaysia Plan (12MP) (2021-25), a new five-year plan for national development. The three major objectives of the Plan are as follows.

1) To create a prosperous, inclusive, and sustainable Malaysia
2) Economic revitalization under the COVID-19
3) Laying the foundation to position Malaysia as a country with high technological and economic power.

It is also positioned as "the first five years of the Shared Prosperity Vision 2030[3]" and "the final reform within

[3] The 10-year national development plan for the period 2021-2030, announced by Prime Minister Mahathir in 2019, aims to achieve "sustainable growth through fair and equitable distribution among income groups, ethnic groups, religions, and supply chains" by 2030. It is the successor to "Vision 2020," which was proposed by the Prime Minister in 1991 and aims for the country to become a developed country by 2020.

the National Recovery Plan[4].

(Scheme)

Three pillars of the plan and four supporting policies are presented, and 14 game changers have been established for each.

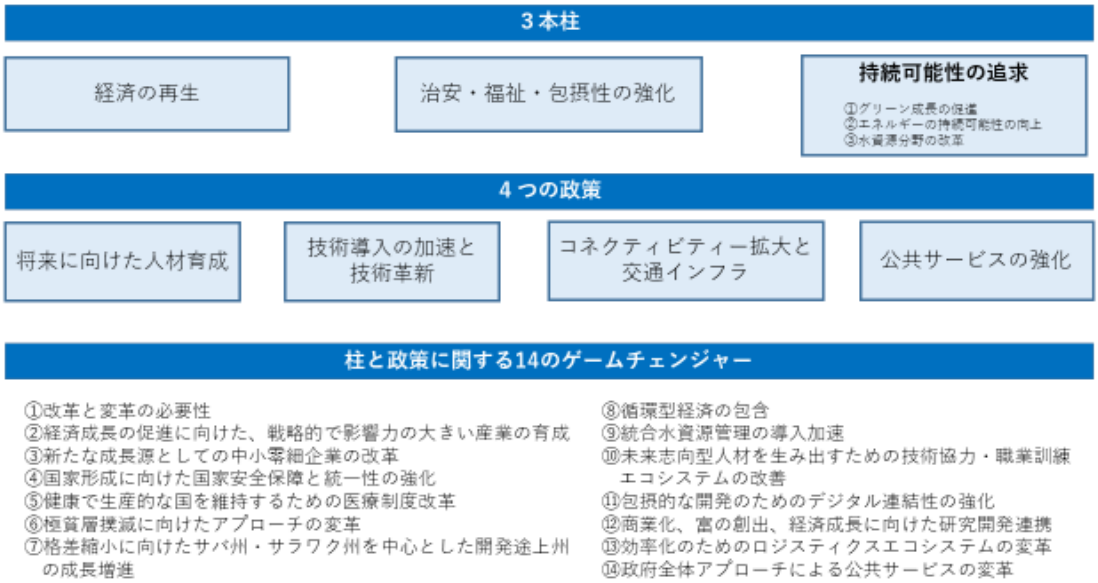

Figure 1-4 Overall picture of the 12th Malaysia Plan[5]

(Theme 3: Pursuit of Sustainability)

The pursuit of sustainability not only promotes continued economic growth and improved quality of life, but also preserves the environment and natural resources. It is also important to understand that economic development does not necessarily have negative impacts on the environment or result in unsustainable use of natural resources.

Therefore, Theme 3 sets forth three strategies. Promote green growth to enhance sustainability and resilience in the country, in light of recent global trends such as the shift toward sustainable economic activities and lifestyles. Energy and water resources will be managed holistically and sustainably, taking into account the balance between supply and demand. These three strategies to achieve Theme 3 complement Themes 1 and 2.

I. Promoting Green Growth

To promote green growth, society as a whole must share the responsibility of transitioning to a low-carbon society, as well as properly manage natural resources and equally share the benefits derived from them. It is also important to accelerate the formation of a circular economy, which will not only generate more

[4] An exit strategy from the new coronavirus pandemic announced by then Prime Minister Muhyiddin Yassin in June 2021, consisting of four phases, with gradual mitigation of economic and social activities depending on the new coronavirus infection status.

[5] Prepared by NTT DATA Institute of Management Consulting, Inc based on Malaysian government data.

responsible business and investment, but also expand green markets and generate new business opportunities.

(→ Game Changer 8: Inclusion of the Circular Economy)

<Indicators>

Reduce greenhouse gas emission intensity to GDP to 45% of 2005 levels by 2030.

Increase the percentage of green procurement by the government to 25.

Increase the percentage of land and inland water conservation to at least 20.

Increase the percentage of coastal and marine areas to at least 10%.

Introduce legislation on disaster risk management.

II. Improving Energy Sustainability

Improving energy sustainability requires adequate supply of energy and related infrastructure, as well as proper addressing of the energy trilemma problem (3E problem). To this end, a comprehensive national energy policy should be developed that integrates existing energy-related policies and provides a framework for addressing various issues in the energy sector. In addition, the use of renewable energy as an alternative energy source should be expanded, focusing on the demand side.

<Indicators>

Introduce a comprehensive domestic energy policy.

Increase the share of renewable energy to 31%.

III. Reform of the water resources sector

The highest priority for Integrated Water Resources Management (IWRM) will be to achieve the government's long-term goals of water resource management efficiency, wealth creation, and job security. (→ Game Changer 9: Accelerating the adoption of Integrated Water Resources Management) To this end, the focus will be on strengthening water resources governance and sustainable financial conditions.

<Indicators>

Increase the percentage of people with access to clean and safe water to 98% in rural areas.

(2) National Energy Transition Roadmap (NETR)

On July 27, 2023, the Malaysian Ministry of Economy released the first phase of its Energy Transformation Roadmap (NETR), which outlines a path toward decarbonization by 2050. The first phase of the roadmap identifies major projects worth RM25 billion (approximately JPY775 billion) and aims to reduce carbon dioxide (CO2) emissions by 10 million tons per year. In addition, as environment-related projects to be promoted jointly with the private sector, 10 core projects in the following 6 areas are listed, along with the names of the ministries and companies leading the projects. The Ministry of Economy estimates that 23,000 high-quality jobs will be created through the promotion of the projects.

Table 1-4 Focus Areas and Core Projects

#	Focus area	Core projects

1	Energy Efficiency	· Efficient switching (of energy used)
2	Renewable energy	· Renewable energy zone · Energy storage · Energy secure
3	Hydrogen	· Green Hydrogen · Hydrogen for Power
4	Bioenergy	· Biomass Demand Creation
5	Green Mobility	· Future Mobility · Future Fuel
6	Carbon Capture, Utilisation and Storage（CCUS）	· CCS for industry

The second phase of the project was subsequently announced on August 29. The second phase includes specific measures and targets for implementing the above projects, with the establishment of a fund and governance by the National Energy Council as the main pillars. New numerical targets are also set for six major areas to be realized by 2050. For example, in energy efficiency, the industrial sector and the residential sector are to reduce energy consumption by 23% and 20%, respectively. As for renewable energy, new targets have been set to eliminate coal-fired power generation by 2050, and to increase the ratio of renewable energy to total power generation to 70% by 2050.

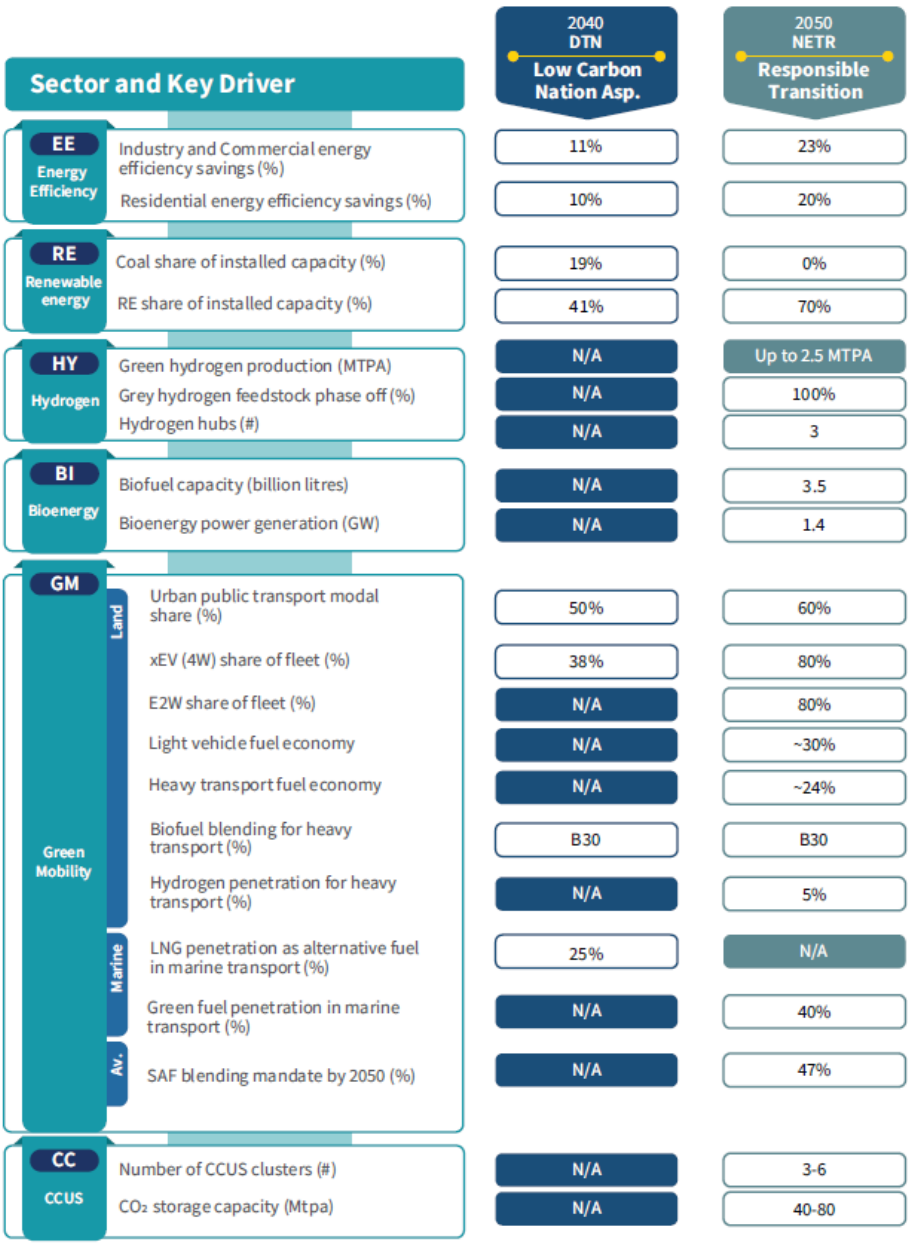

Figure 1-5 Numerical Targets in NETR[6]

Prime Minister Anwar Ibrahim has announced the launch of the National Energy Transition Facility (NETF), a fund to support energy transition-related projects, where RM2 billion will be allocated for the realization of the NETR. The biggest challenge in realizing the energy transition is financing, which the government estimates will require an investment of at least RM1.2 trillion from 2023 to 2050. Over the next 10 years, it is estimated that RM60-90 billion will be allocated for expanding public transportation, strengthening the power grid infrastructure, and retraining human capital.

The government will also launch a National Energy Council to oversee the progress of the NETR. According to Economy Minister Rafizi Ramli, the first meeting of the National Energy Council is scheduled for October.

[6] Source：Ministry of Economy in Malaysia（2023）National Energy Transition Roadmap

Prime Minister Anwar will chair the council, and the Ministry of Economy will serve as its secretariat. The Council will set high-level direction and policies for the promotion of the NETR, and each working group will manage progress.

(3) Energy Efficiency and Conservation Act (EECA)

The Energy Efficiency and Conservation Act was passed by the lower house of Malaysia's federal parliament in October 2023. The law, which aims to bring Malaysia's energy efficiency regulations into compliance with international standards, requires the country's largest energy consumers to take conservation measures and applies to large electricity users that consume more than 21,600 gigajoules (GJ) of electricity. Under the new regulations, large industrial and commercial businesses will be required to appoint a registered energy manager who will be responsible for conducting energy audits and developing power management systems. In addition, these businesses will be required to submit regular reports on their energy consumption to the regulator. In addition, buildings larger than 8,000 square meters would have to comply with specified energy efficiency requirements.

When the bill was introduced in Parliament, Minister of Natural Resources, Environment and Climate Change Nick Nazmi said that it is expected to affect about 1,500 industrial businesses and about 500 commercial businesses that are responsible for 70% of the sector's energy consumption, which accounts for less than 1% of the total number of users in both sectors but he said, will contribute significantly to energy consumption. The minister also estimated that the law will result in significant energy savings of 2,017 million GJ by 2050, equivalent to 97.1 billion ringgit (US$20.5 billion) in energy bills. It also estimates that it will help reduce greenhouse gas (GHG) emissions by 197,877 kilotons of carbon dioxide equivalent by 2050.

1.2.3 The IRDA's greenhouse gas emission reduction initiatives

(1) Iskandar Malaysia's low carbon society plan for 2025

With support from Japan Science and Technology Agency (a National Research and Development Agency) and the Japan International Cooperation Agency (JICA), an international research team comprising members from such organizations as Kyoto University, the National Institute for Environmental Studies, Okayama University, University of Technology Malaysia, and the Iskandar Regional Development Authority began activities in 2010 aimed at Iskandar Malaysia and in November 2012 announced the Low Carbon Society Blueprint toward 2025 ("the Blueprint"). The plan was officially approved as an official document for the development program by the Iskandar Regional Development Authority at a March 20, 2014 meeting of the Approvals and Implementation Committee.

The Blueprint was formulated in response to concerns Iskandar Malaysia development projects would bring about a rapid rise in greenhouse gas emissions following the region's being designated a special economic zone in 2006. The Blueprint, a low carbon society plan aimed at making the region into a low-carbon area, establishes a goal of reducing greenhouse gas emissions by 40% by 2025 in a Business as Usual scenario (56% emission strength compared to 2005). The plan outlines 12 Actions and 281 Programs concerning areas

such as transportation systems, construction (green buildings), energy systems, waste management, industrial processes, governance, air pollution, urban structure, and education.

A new Low Carbon Society Blueprint Iskandar Malaysia 2030 was formulated and published at the end of 2022. The content of the Blueprint concretises the efforts to tackle climate change in the Iskandar region up to 2030.

Table 1-5 List of actions in Low Carbon Society Blueprint Iskandar Malaysia 2030.[7]

Iskandar Malaysia 2030 Sectoral GHG Emission Reduction Potential ($ktCO_{2eq}$) and Contributing LCS Mitigation Actions:

Actions	Thrusts / Enabler	RES	COM	IND	TRA	MUW
Action 01 Green Sustainable Value Chain	Enabler	√	√	√	√	√
Action 02 Sustainable Smart Farming	Green Economy					
Action 03 Sustainable, Resilient & Liveable Cities	Green Environment	√	√		√	
Action 04 Natural Environment & Habitats	Green Environment					
Action 05 Green Transportation & Mobility	Green Economy		√	√	√	
Action 06 Sustainable Waste Management	Green Environment	√	√			√
Action 07 Consensus Building & Education	Green Community					
Action 08 Green & Renewable Energy	Green Economy	√	√	√	√	
Action 09 Low Carbon Green Building & Infrastructure	Green Economy	√	√	√		
Sectoral Reduction Potential ($ktCO_{2eq}$)		**690**	**2,501**	**3,288**	**3,292**	**100**

(2) Comprehensive Development Plan (CDP)

Comprehensive Development Plan (CDP) is the main plan that will guide the economic, social and environmental planning and management of Iskandar Malaysia towards the establishment of an internationally viable and sustainable metropolis.

The provisions of the IRDA Act 2007 [Act 664] stipulate that IRDA shall prepare a CDP and provide the overall framework, vision and objectives for the development of Iskandar Malaysia. The Act also states that IRDA shall formulate its proposals for planning and implementation initiatives to realise the aforementioned strategies.

The first Comprehensive Development Plan of Iskandar Malaysia, CDP 2006-2025, was prepared as an outcome of a feasibility study for an economic region in the southern part of Johor. Initially known as the South Johor Economic Region (SJER), the document was prepared to guide and drive Iskandar Malaysia's development during its early foundation-building phase, whereby the focus was on catalytic investments, infrastructure development, and institutional strengthening.

Hence, the CDP was reviewed in the year 2011 and the Comprehensive Development Plan ii (CDPii) Iskandar Malaysia 2014-2025 was subsequently launched in the year 2014. The CDPii 2014-2025 framework was set in accordance with the principles of the Circle of Sustainability that promotes a holistic

[7] Source：IRDA（2023）Iskandar Malaysia's low carbon society plan for 2025.

ecosystem in which wealth is created and shared equally through the optimum use of resources.
Since the landscape of development and growth in Iskandar Malaysia has changed remarkably, necessitating a review of CDPii earlier than its planning horizon to redefine the region's milestones. Comprehensive Development Plan iii (CDPiii) Iskandar Malaysia 2022-2030 aims to enhance the CDPii by emphasising resilient and inclusive aspects post-COVID era. These realignments and enhancements are to ensure that Iskandar Malaysia moves towards a stronger, resilient, inclusive, and carbon-neutral region.

Table 1-6 Purpose and Intent of Each CDP[8]

CDP issued	Intention:
COMPREHENSIVE DEVELOPMENT PLAN FOR SOUTH JOHOR ECONOMIC REGION 2006-2025	・ To establish South Johor Economic Region (SJER) as one of the major economic development corridors in Peninsular Malaysia. ・ To diversify economic development by using current economic resources in a sustainable manner and by introducing new, innovative, and productive foundations. ・ To establish a strong institutional framework and create strong regulatory authority. ・ To focus on human capital enhancement and to facilitate existing local industries to move up the value chain. ・ This document is known as Comprehensive Development Plan.
COMPREHENSIVE DEVELOPMENT PLAN ii ISKANDAR MALAYSIA 2014-2025	・ To ensure continuous, stable, sustainable, and resilient income generation for the people of Iskandar Malaysia. ・ To achieve just and equitable wealth for the community through inclusiveness and equal opportunity to participate in wealth generation. ・ To increase economic participation through knowledgeable and skilled human capital as well as to attract and attain talent. ・ To achieve continuous sustainable development and integration of infrastructure resources as well as better connectivity through the focus on resource optimisation and low carbon.
COMPREHENSIVE DEVELOPMENT PLAN iii ISKANDAR MALAYSIA 2022-2030	・ To increase the resiliency of the economic performance and value chain of Iskandar Malaysia's promoted sectors. ・ To create a stronger foundation by emphasising resiliency and inclusiveness aspects. ・ To ensure the benefits of growth are shared to make growth stronger, more durable, and more resilient. ・ To reduce the incidence of imbalances in income distribution and urban poverty through increasing productivity.

[8] Prepared by NTT DATA Institute of Management Consulting, Inc. based on CDPiii.

	・ To increase readiness, preparedness, and capacity to overcome the effects of climate change, potential risks, and disasters in the future.

CDP iii describes the following four priority areas;

- ・ High-Value economy
- ・ Productive society
- ・ Climate-Resilient and carbon neutral region
- ・ Integrated and livable city

The initiative "Facilitate the development of Circular Economy Park (CEP)," which is part of the High-Value Economy, clearly states that "Industrial Symbiosis," "Eco Town," and "Waste to Energy," which have been implemented by the Kitakyushu-Iskandar Regional Development Agency, will be continued as programs currently being implemented by the IRDA.

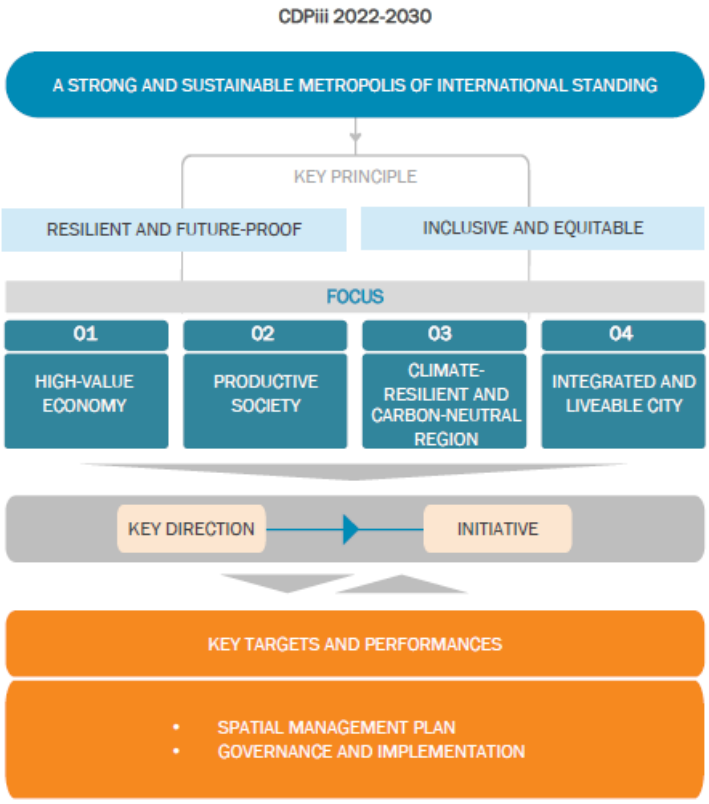

Figure 1-6 Framework for CDP iii[9]

1.2.4 Cooperative relationship between Kitakyushu and the Iskandar Regional Development

[9] Source : IRDA (2023) Comprehensive Development Plan iii

Authority

With the goal of reducing carbon emissions in the Iskandar Development Region, Kitakyushu has worked with the IRDA in fiscal years 2014, 2015, and 2016. The details of these activities are provided below.

(1) Activities in FY 2014

In the FY 2014 Large-scale JCM Project Creation Feasibility Study Project for Realizing Low-carbon Societies in Asia, Kitakyushu conducted a basic study aimed at helping to reduce carbon emissions in an industrial park in the city of Pasir Gudang, while also building a relationship with the city.

The study, which involved holding discussions with Pasir Gudang stakeholders and gathering information from enterprises in the industrial park, proposed a path towards establishing four key programs for a "Pasir Gudang that aspires to be a green and healthy city."

Figure 1-7 Path to establishing four key programs for Pasir Gudang

(2) Activities in FY 2015

Kitakyushu conducted the Foundation Building Project for Across-the-Board Expansion of Decarbonisation Projects (Kitakyushu-State of Johor Cooperation Project) in Iskandar Malaysia as part of the FY 2015 Cooperation Project for Realization of Low Carbon Societies in Asia. The following three studies were discussed with the goal of industrial park decarbonisation in Pasir Gudang.

- Activity 1: Waste heat collection, cogeneration, and energy-saving efforts in industrial parks
- Activity 2: Industrial waste recycling and general waste power generation
- Activity 3: Developing JCM businesses in Iskandar Malaysia and supporting the design of systems to advance such development

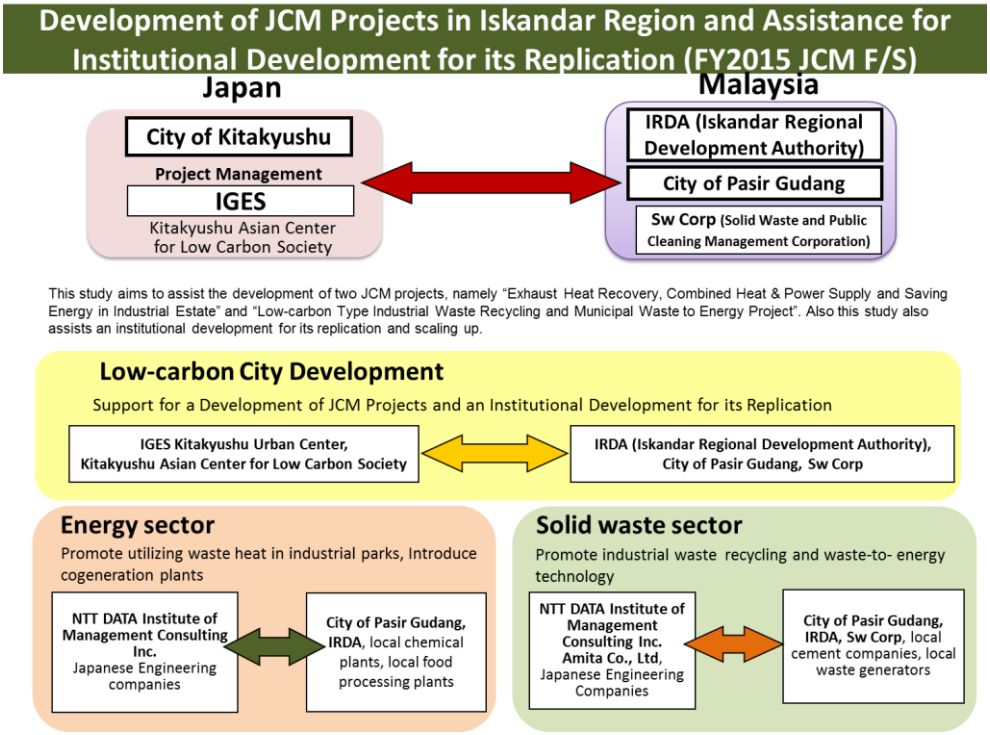

Figure 1-8 Overview of activities for developing JCM businesses in Iskandar Malaysia and supporting the design of systems to advance such development.

(4) Activities in FY 2016

Kitakyushu conducted the Project to Accelerate Low Carbonization Model Projects in Iskandar Development Area for Expansion of JCM (Kitakyushu-IRDA Cooperation Project) as part of the FY 2016 Large-scale JCM Project Creation Feasibility Study Project for Realizing Low-carbon Societies in Asia. Following on the FY 2015 study, this study targeted mainly local governments and businesses with their own factories or other production facilities and closely examined the feasibility of JCM adoptability. With the goal of promoting activities aimed at establishing model businesses in order to facilitate Malaysia's timely participation in the JCM, the following two energy-saving related projects were studied.

- Activity 1: Deploying cogeneration technologies at factories that require steam.
- Activity 2: Promoting energy-saving efforts for factories and buildings inside factories.

Table 1-7 Overview of activities conducted for the Accelerate Low Carbonization Model Projects in Iskandar Development Area for Expansion of JCM

	Company A	Company B	Company C	Company D	Company E
Project Content	Surfactant production	Epoxy resin production	Styrene monomer production	Polymer production	Paper bag production
Project Possibility	(Low)	(High)	(High)	(Medium)	(Low)
Situation toward Energy saving implementation	At the present time, it is not the time to renew various energy-saving equipment.	Already company B is implementing energy conservation initiatives, but, with further energy conservation, it is considering possibility of using the subsidy scheme.	As projects abandoned due to cost reasons in the past, considering possibility of using the subsidy scheme. Renovation to LED lighting in factory is also considered.	As interested in energy saving project, already have project candidates. Under consideration about possibility of utilization of subsidy scheme	Energy saving targets are set in factories, although there's possibility of energy saving with air conditioners, etc., the equipment will not be renewed on timely basis.
Local status	 Shot at the site	 Shot at the site	 Shot at the site	 Shot at the site	 Shot at the site

On August 22, 2016, Kitakyushu concluded a Letter of Understanding with the IRDA which clearly stipulated the city's intention to promote decarbonisation in the Iskandar Development Region.

Figure 1-9 Signature ceremony at the IRDA office

(5) Activities in FY2019

Kitakyushu City implemented the "Project for Promoting Low Carbonization in the Iskandar Region (Kitakyushu City -Iskandar Development Area Collaboration Project)" in the "city-to-city collaboration project for realizing a low-carbon society in 2019". In order to achieve the goals, set out in the Low Carbon Society Blueprint, we have developed an action plan until 2025 and carried out the following activities with the aim of creating concrete projects using JCM.

- Activity 1: Examination of action plan based on the blueprint for a low-carbon society that has already been formulated.
- Activity 2 Follow-up survey of surveys conducted in FISCAL 2015 and 2016
- Activity 3 Excavation of waste heat recovery power generation projects with potential

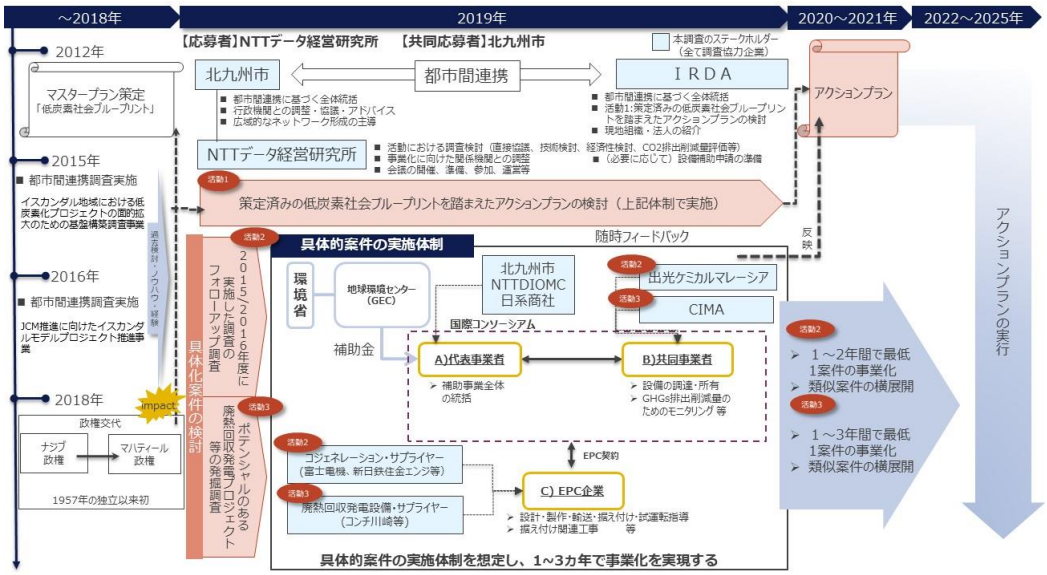

Figure 1-10 FY2019 activities

(6) Activities in FY2020

The City of Kitakyushu implemented the "Low Carbon Promotion Project in Iskandar Region (Kitakyushu-Iskandar Development Region Collaboration Project)" as part of the "Intercity Collaboration Project for Realization of Low Carbon Society in FY2028. In the course of the study in FY2048, the activities indicated in the Blueprint for a Low Carbon Society were steadily developed, and the following three themes were identified by IRDA as important: "Industrial Symbiosis," "Eco Town," and "Waste to Energy". The following three activities were carried out under the keywords.

Activity 1: Activities to realize an eco-town with industrial symbiosis.

Activity 2: Activities to realize waste-to-energy generation.

Activity 3: Identification of JCM-applicable projects

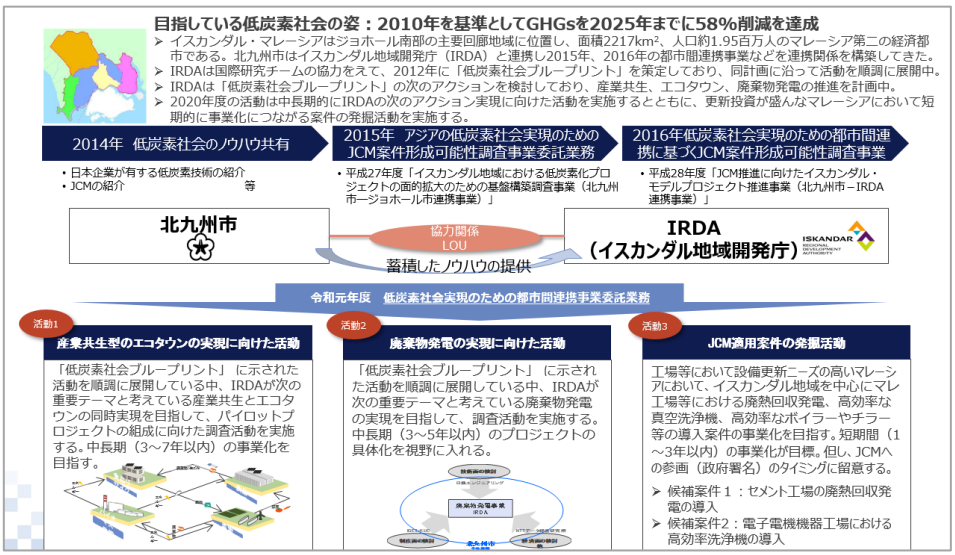

Figure 1-11 Activities in FY2020

As mentioned above, Kitakyushu has steadily built up its interactions with IRDA. In this project, based on the results of past projects, a follow-up survey will be conducted for each project. In addition, activities for the realization of an eco-town with industrial symbiosis and waste power generation, which were promoted in the FY2020 project, will continue to be undertaken. In addition, as this is the final year of the three-year plan, the results of the past three years' activities will be compiled into an action plan for decarbonisation in the Iskandar Development Region, which will be used as the basis for future decarbonisation efforts in the region. The project is being implemented with the expectation that it will contribute to the realization of a society.

(7) Activities in FY2021

In FY2021, the project continued to work on activities for the realisation of an eco-town with industrial symbiosis and waste-to-energy generation, which had been promoted in the FY2021 project. As FY2021 was also the final year of the three-year plan, discussions were held with IRDA on how to utilise the results of the past three years' activities for the decarbonisation of the Iskandar region. In the course of these discussions, it was agreed that the concepts of 'Industrial Symbiosis', 'Eco Town' and 'Waste to Energy', which have been addressed in the project, and the content of future initiatives, would be incorporated into the Comprehensive Development Plan (CDP). It was agreed to include the concepts and future initiatives of 'Industrial Symbiosis', 'Eco Town' and 'Waste to Energy' in the Comprehensive Development Plan (CDP).

The CDP is reviewed and updated every five years, with the current plan in place until 2025 (CDP: 2006-2025; CDP2: 2014-2025). The latest version, CDP3, is currently being prepared and will run until 2030. The concepts of 'Industrial Symbiosis' and 'Eco Town' and 'Waste to Energy' will be included in the newly developed CDP3.

It is considered a significant achievement that the activities in this project have contributed to the decarbonisation efforts in the Iskandar region.

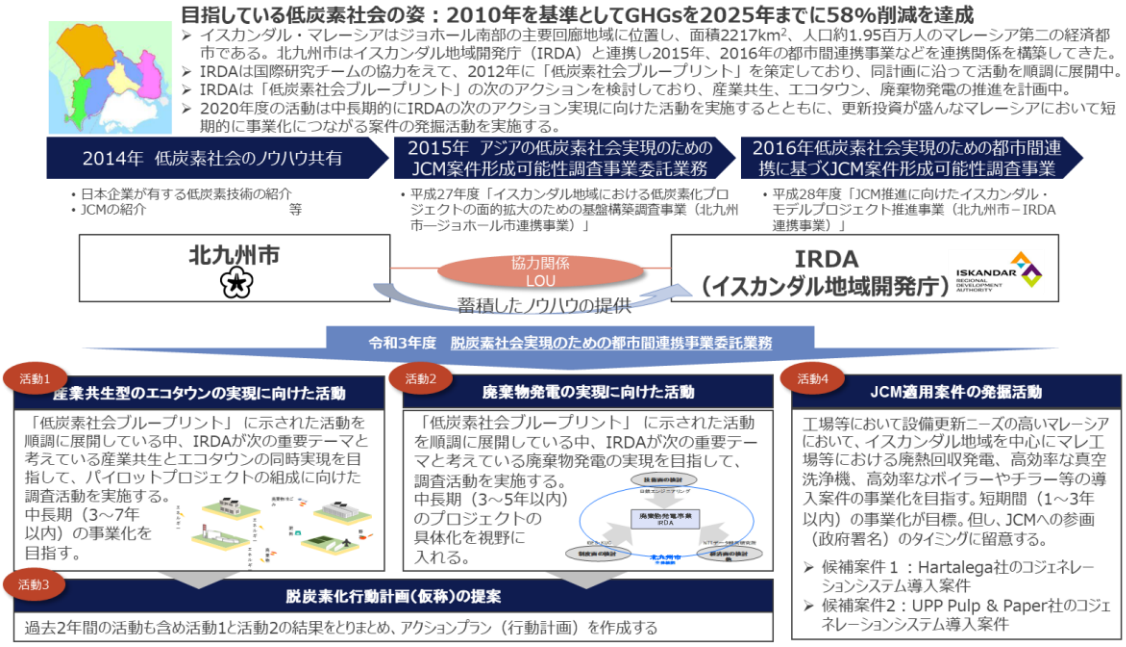

Figure 1-12 Activities in FY2021

(8) Activities in FY2022

In FY2022, three activities were carried out to contribute to the realization of decarbonization in the Iskandar region by taking a step further than the projects carried out in FY2021 to FY2021, namely, " Create inter-industry collaboration projects for decarbonization of the industrial sector," " Introduction of solar PV facilities based on '100% Renewable Energy Kitakyushu Model'," and "Realize Waste-to-Energy as a base-load power source," with the aim of establishing a decarbonization model area in the region.

Table 1-8 Activities in FY2022

Activities	Results
Activity 1: Create inter-industry collaboration projects for decarbonization of the industrial sector	• Conducted interviews with the Federation of Malaysian Manufacturers (FMM) and established relationships with them. • Conducted interviews with companies operating industrial parks in Malaysia and established relationships with them.
Activity2-1 Introduction of solar PV facilities based on '100% Renewable Energy Kitakyushu Model'	• Estimated the solar potential and cost vs. CO2 reductions for commercial facilities in the Iskandar region. • Programs and regulations regarding the introduction of renewable energy in Malaysia were investigated.
Activity2-2 Realize Waste-to-Energy as a base-load power source	• Visited the Seelong Landfill to obtain data on the amount of waste received at the site. • Conducted discussions with UTM on the waste quality survey plan.

Table of Contents

Chapter 2. Create inter-industry collaboration projects for decarbonization of the industrial sector 2
2.1 Overview of the Activity 2
2.2 Results of last year's survey 5
2.2.1 Outline of Interviewees 5
2.2.2 Interview Results 8
AME Development 8
2.3 Conducting Questionnaires for Each Industrial Park 9
2.3.1 Implementation Methods of the Questionnaire 9
2.3.2 Questionnaire Content 10
2.3.3 Workshop Results 11
2.3.4 Results of Questionnaire Responses 15
2.4 Consultation with individual companies 20
2.5 Future Directions 24

Chapter 2. Create inter-industry collaboration projects for decarbonization of the industrial sector

2.1 Overview of the Activity

As part of the "Promotion of Carbon-Free Society in Iskandar Regional Area (City of Kitakyushu-Iskandar Regional Development Authority Collaboration Project)" for FY2020-2021, an industrial park in the Iskandar region was developed as an "Industrial Symbiotic Eco-Town". In this project, the inventory data of each factory in the industrial park in the region was investigated to see if there was any possibility to use the waste from each factory as raw fuel for other factories, and reviewed how to match the needs of each factory. The review showed that the Iskandar region has already developed a certain level of recycling technology, and commercial transactions related to waste disposal are maturing, so it did not immediately lead to the creation of a project to apply Japanese recycling technology.

Meanwhile, waste is not the only thing being discharged from factories. For example, as shown in **Table 2-1**, the highest energy demand in the Iskandar region is in food, beverage, and tobacco production. These come with heating and cooling processes and waste heat such as exhaust gas is generated, but may be unused due to temperature, location and time constraints of available destinations. Moreover, in many cases, large amounts of water are used as cooling water and then drained away without further use. Wastewater from manufacturing is treated by each company or individual contractor, and there are cases where highly concentrated organic wastewater is incinerated to avoid deterioration of the treated water quality. In addition, water for manufacturing (pure water) is also produced by each company, but due to its aging and extended continuous operation period, there are few maintenance opportunities, which could be a potential risk factor for stable operations.

Table 2-1 Energy consumption by industry in the Iskandar region[1]

Subsector	Share of energy demand	Consumption in 2019 (ktoe)						
		Natural gas	Petrol	Diesel	Fuel Oil	LPG	Electricity	Others
Food, beverages and tobacco	37.7%	484.3	7.84	10.66	7.84	0.31	73	-
Chemical	15.8%	99.2	4.36	23.10	25.20	0.81	92	-
Non-metallic mineral products	10.0%	7.5	-	3.22	7.23	-	35	Coal: 100.92
Non-ferrous metals	0.3%	1.1	-	-	-	-	4.26	-
Iron and steel	4.1%	39.1	-	7.79	1.10	1.93	14	-
Wood and wood products	0.5%	0.3	0.05	0.75	1.12	-	5	-
Pulp, paper and printing	0.6%	2.0	0.13	1.16	-	-	7	-
Textile and leather	1.6%	7.9	0.25	1.92	0.71	0.05	14	-
Machinery	8.8%	1.8	17.66	20.10	-	-	97	-
Transportation equipment	1.7%	1.9	-	15.35	-	0.03	9	Kerosene: 0.06
Not specified elsewhere	18.8%	38.0	1.73	8.06	24.19	14.97	204	-

Based on the status of waste heat and wastewater treatment at each of these companies, a study was conducted aimed at energy management for the entire industrial park beyond the boundaries of industries and companies, as well as collective supply and collective treatment of wastewater for use.

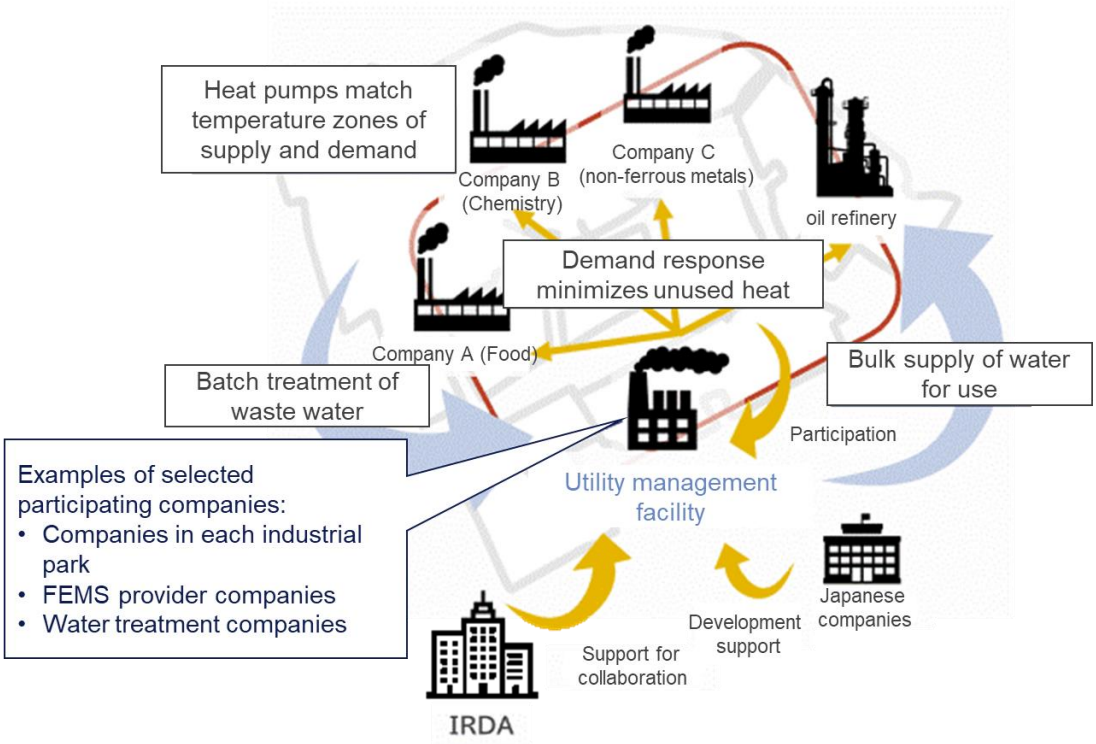

Figure2-1 Industrial symbiosis in the industrial park (image)

[1] Source： ESCAP (2022) Energy transition pathways for the 2030 agenda

In the FY2022 project, meetings were held with the management companies of the two industrial parks to hear about the current status of the industrial parks. We were able to gain interest in the concept of inter-industry collaboration and found that there is still room for implementation of inter-industry collaboration, as intensive drainage and heat treatment have not yet been implemented in each industrial park.

Therefore, this year, we will conduct a questionnaire and interviews with individual companies in the industrial parks operated by AME Development and TPM Technopark, where we conducted interviews last year, and conduct a detailed survey on the status of wastewater and waste heat generation and the facilities each company possesses. Based on the results of the interviews and questionnaires, promising companies will be selected for the establishment of a pilot project.

The following activities are envisioned this fiscal year for the creation of pilot projects.

1) Detailed understanding of waste heat generation and feasibility study
2) Survey on the status of drainage facilities, pipelines, and other infrastructure in the industrial park
3) Selection of candidate companies (local companies and Japanese companies with related technologies)
4) Formation and discussion of consortia by selected candidate participating companies

For each of the above activities, we will proceed based on the division of roles as shown below in **Table 2-2**.

Table 2-2 Assignment of roles by each stakeholder

#	Activities	IRDA	City of Kitakyushu	Amita	NTTD IOMC
1	Detailed understanding of waste heat generation and feasibility study	●			●
2	Survey on the status of drainage facilities, pipelines, and other infrastructure in the industrial park	●			●
3	Selection of candidate companies (local companies and Japanese companies with related technologies)	●	●	●	●

4	Formation and discussion of consortia by selected candidate participating companies	●	●	●	●

2.2 Results of last year's survey

In order to investigate the feasibility of inter-industry collaboration projects, it is necessary to investigate the actual wastewater and waste heat emissions at the factories and the facilities that each factory has. However, if the industrial park already has centralized drainage and waste heat treatment facilities, it would be difficult to apply this concept; therefore, it is necessary to investigate the situation in the industrial park first. As such, at IRDA's suggestion, the project first conducted interviews with the Federation of Malaysian Manufacturers (FMM) to investigate what kind of industrial parks could be targeted. Interviews were then conducted with the two industrial parks identified by FMM as potential options.

2.2.1 Outline of Interviewees

AME Development Sdn. Bhd.

AME Development Sdn. Bhd. (hereafter "AME Development") was established as a real estate developer with a strong commitment to quality and a dynamic results-oriented approach. Over the years, the company has been actively involved in the planning and design of industrial park developments and is now highly regarded as an integrated industrial park developer in Malaysia. In particular, the company has a track record of developing projects such as i-Park, which is managed under the Clean & Green concept.

i-Park is AME Development's flagship project, which aims to provide a healthy work-life balance for its employees with facilities such as a gym, swimming pool, health studio, outdoor sports court, jogging track, bike path, and multipurpose offices. The list of industrial parks operated by AME Development is shown in **Figure 2-2**, but this time we conducted interviews at Senai Airport City, which is relatively new among them.

Senai Airport City is a 195-acre industrial park located near Senai International Airport.

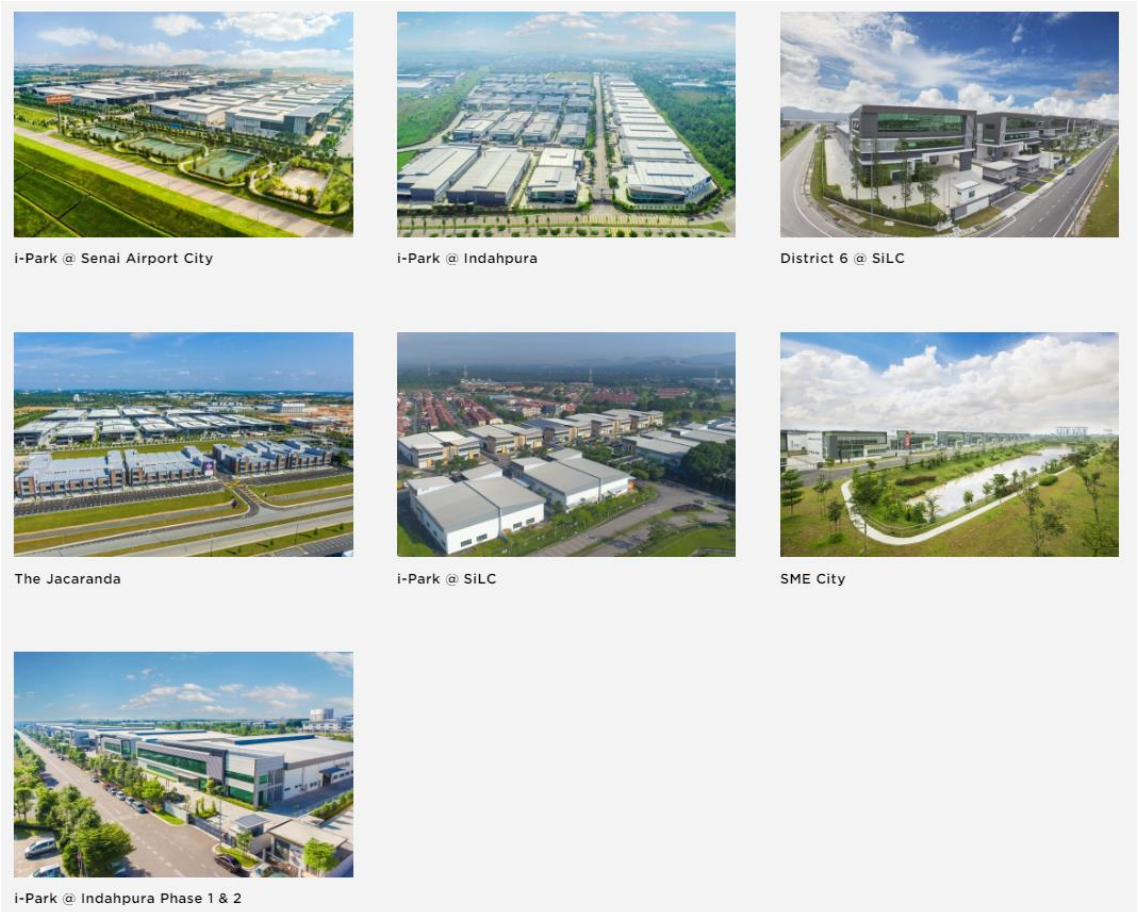

Figure 2-2 Industrial Park operated by AME Development[2]

TPM Technopark Sdn. Bhd.

TPM Technopark Sdn. Bhd. ("TPM Technopark") is a wholly owned subsidiary of the Industrial Development Division (IDD) of Johor Corporation (JCorp) Group. TPM Technopark provides project management services for commercial and industrial development, as well as sales promotion services for industrial sites and properties owned by JCorp. TPM Technopark plays a key role as project manager for JCorp Group's construction projects, as well as for projects commissioned by the federal government through the Johor State Development Office (SDO).

Since 2011, TPM Technopark has managed more than 65 projects with a total value of MYR103.48 million (approximately USD32.25 million).

[2] Source: AME Development website

Figure2-3 JCorp Organizational Structure[3]

This time, we conducted interviews at Tanjung Langsat Industrial Park, one of the industrial parks managed and operated by TPM Technopark.

Tanjung Langsat Industrial Park (TLIC) is one of the few industrial parks in southern Malaysia dedicated to heavy industry. Located right next to the more mature Pasir Gudang Industrial Park, TLIC has a total area of 4,835 acres. It is also a modern integrated industrial park with a Free Commercial Zone (FCZ), warehouses, marine supply base, Palm Oil Industry Cluster (POIC), Johor Skills Development Center (PUSPATRI), centralized workers' dormitory, and port facilities at Tanjung Langsat Port Terminal (TLPT).

The industries covered by TLIC include the construction sector, chemical industry, warehousing, palm oil, port services, and tank storage.

[3] Source: TPM Technopark website

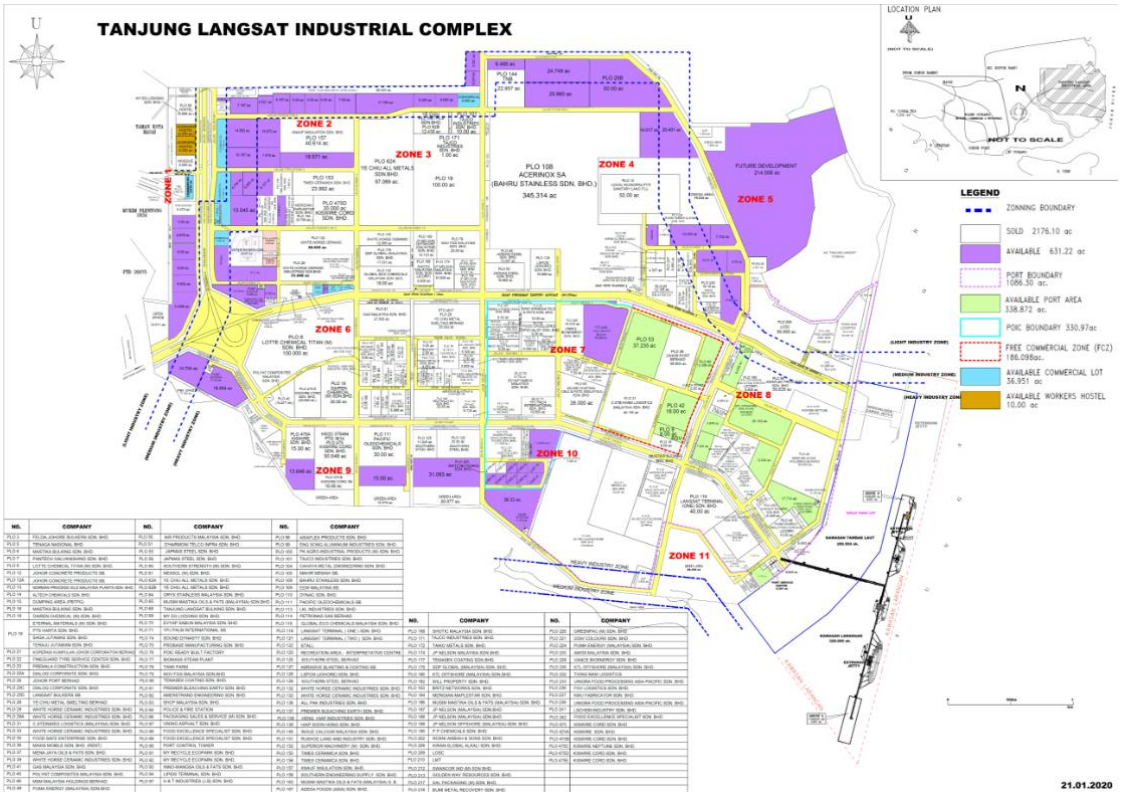

Figure2-4 Overall view of TLIC[4]

2.2.2 Interview Results_

AME Development

The interviews revealed that the industrial parks managed by AME Development do not emit that much wastewater or waste heat, and therefore, it is possible that they do not have the facilities at their respective factories in the first place. In addition, it was found that each factory has a contract with its own supplier for electricity and water, and that the management company does not supply them collectively.

Although no steps are taken to decarbonize their operations yet, the Malaysian Ministry of Environment has requested them to do so, and the factories are also expected to do so in the future, so they believe that there is interest. AME Development also plans to build an industrial park based on UNIDO's Eco Industrial Park[5], indicating a high level of interest in decarbonization efforts.

[4] Source: TPM Technopark website

[5] *UNIDO: Eco Industrial Park

UNIDO has identified the promotion of Eco Industrial parks as one of its contributions to the Sustainable Development

TPM Technopark

The interviews found that, just as AME Development, the industrial parks operated by TPM Technopark also carry out wastewater and waste heat treatment at each factory. Regarding the concept of inter-industry collaboration, there were comments, particularly with regard to wastewater treatment, that there is a high demand for initiatives to reuse industrial water in Malaysia, given the country's water scarcity issues. In addition, since TLIC is primarily focused on heavy industry, it generates a large amount of waste heat and wastewater, making it likely that the concept of inter-industry collaboration could be applied.

Similarly with electricity, for now it is difficult to install enough solar power to generate a surplus due to the contract with TNB, and it is also difficult to supply electricity generated by the solar power to other factories. Unlike in Japan, it is not possible to sell electricity in Malaysia except through TNB, resulting in difficulty sharing electricity among factories.

Meanwhile, some commented that if the concept of inter-industry collaboration is to be implemented, it would be better to do so in newly constructed industrial parks rather than in existing industrial parks where businesses are already in place. This is because the infrastructure is already in place in the existing industrial parks, making it difficult to install new pipes for waste heat and wastewater, and the timing for replacing existing equipment differed from factory to factory, making it difficult to integrate their facilities.

2.3 Conducting Questionnaires for Each Industrial Park

Based on the results of last year's survey, this year we decided to collect information on each company's current status of wastewater and waste heat treatment, as well as their initiatives and needs for decarbonization. This was done by conducting a questionnaire for the companies belonging to each industrial park.

2.3.1 Implementation Methods of the Questionnaire

In preparation for the survey, we coordinated with the management company of each industrial park.

Goals.

An Eco Industrial park is a community of companies located on a shared site that seeks to improve environmental, economic, and social performance by enabling companies to jointly manage environmental and resource issues. This is called industrial symbiosis and is a means for companies to gain competitive advantage through the physical exchange of materials, energy, water, and by-products, and to promote inclusive and sustainable development.

Based on this, we decided on the following: for i-park@Senai airport cityn, the questionnaire is sent to all companies in the industrial park through AME Development; for Tanjung Langsat Industrial Complex (TLIC), a workshop is held on site with the target companies.

（1） AME Development : i-park@ Senai airport city

Since we could not receive the list of companies due to the NDA between the management company and the companies in the industrial park, we distributed the questionnaire to all companies via the management company by e-mail without narrowing down the target companies.

（2） TPM Technopark : Tanjung Langsat Industrial Complex

Having received a list of companies from the management company, the first step was to select businesses to conduct the questionnaire. The selection targets were narrowed down to the chemical industry, food manufacturing industry, steel industry, and ceramic, stone and clay products industry, which emit a large amount of wastewater and waste heat. Invitations to the workshop were sent to the selected companies, and questionnaire responses were collected from the companies participating in the workshop.

2.3.2 Questionnaire Content

This questionnaire was designed to obtain information on the status of generation and treatment of wastewater, waste heat, designated wast, etc., and on the equipment owned by the companies in each industrial park. It also examined the needs for participation in inter-industry collaboration projects by surveying the implementation status of energy conservation measures, as well as decarbonization-related measures that are already being implemented/under consideration. The questions in the questionnaire sent to the target companies are shown in **Table 2-3**.

Table 2-3 List of Questionnaire Questions

#	Questionnaire Questions
1	1. Of the electricity purchased, is there electricity derived from renewable energy sources/what is the ratio of such electricity purchased? (%) 2. Of the steam used, is the steam purchased from other companies? (Options: (1) We do not use steam at our company / (2) All of the steam we use is purchased from other companies / (3) Some of the steam we use is purchased from other companies / (4) We do not purchase steam from other companies)
2	Type, amount, and disposal method (landfill, incineration, recycling, or other) of designated waste generated by the company

3	1. Wastewater and waste heat treatment methods (Options: (1) Treated collectively in the industrial park / (2) Treated in-house / (3) Not treated / (4) No wastewater or waste heat generated in the first place) 2. If treatment is done at each plant, is it done in-house or outsourced?
4	1. Do you implement energy conservation measures in your company (Yes/No)? 2. If yes, what specific energy conservation measures are you taking? 3. Do you feel that the energy conservation measures you are currently implementing have reached their limits in lowering your company's CO2 emissions any further?
5	Own in-house power generation equipment (including cogeneration) / heat utilization equipment. 1. Number of in-house power generation equipment by type of equipment installed. 2. Consideration of fuel conversion and decarbonization of in-house power generation equipment (Options: (1) Measures already implemented, (2) Not yet implemented but policy has been decided, (3) Currently under consideration, (4) Currently not under consideration but will be considered in the future, (5) Currently not under consideration and not planned for consideration in the future) 3. Details of measures and policies that have been implemented or decided upon
6	1. Number of heat utilization equipment by type of equipment installed. 2. Consideration of fuel conversion and decarbonization of heat utilization equipment (Options: (1) Measures already implemented, (2) Not yet implemented but policy has been decided, (3) Currently under consideration, (4) Currently not under consideration but will be considered in the future, (5) Currently not under consideration and not planned for consideration in the future) 3. Details of measures and policies that have been implemented or decided upon

2.3.3 Workshop Results

In Tanjung Langsat Industrial Complex, as a result of coordination with the management company, a workshop was held on site with the target companies. In the workshop, participating companies were asked to answer a questionnaire after an explanation of the JCM system and the concept of inter-industry collaboration. The workshop schedule was as shown in **Table 2-4**.

Table 2-4 Workshop Schedule

TIME	PROGRAMME DETAILS
9.30 a.m. – 10.30 a.m.	Registration (with breakfast)
10.30 a.m. – 10.40 a.m.	**Welcoming remark** By Head, Resilient Environment (IRDA)
10.40 a.m. – 11.00 a.m.	**Session 1:** Presentation on City-to-City Collaboration between City of Kitakyushu & IRDA and overview of the Joint Crediting Mechanism (JCM) by MOEJ by Project Consultant, NTT Data
11.00 a.m – 11.15 a.m	Coffee Break
11.15 a.m – 11.45 a.m	**Session 2:** Presentation on Overview of Inter-industry collaboration project in City-to-City Collaboration by Project Consultant, NTT Data
11.45 a.m – 1.00 p.m	**Consultancy & Data Gathering Exercise** One-on-one session with companies
1.00 p.m	Lunch & End of Programme

Figure2-5 Workshop

The following six companies participated in the workshop.

- Bahru Stainless Sdn Bhd（BS）
- Total Project Management Sdn Bhd（TPM）
- MSM Sugar Refinery (Johor) Sdn Bh（MSM）
- Musim Mastika Oils & Fats (M) Sdn Bhd（MMOF）
- Nippon Paint (M) Sdn Bhd（NP）
- JLand Group Sdn. Bhd. (JLand)

After the explanation by the secretariat, a discussion was held with the participants on the contents of the JCM system and inter-industry collaboration projects. Regarding the JCM system, some companies were interested in the equipment subsidy program. Regarding inter-industry collaboration, there was interest in the concept of centralized management and treatment of wastewater and waste heat throughout the industrial park, and comments were made on the initiatives currently being considered by each company. At the moment, TLIC does not have any equipment that are draining and exhausting heat on a large scale. Participants also suggested that consideration should be given to how energy efficiency and decarbonization initiatives could be implemented across the entire industrial park, including the management company. This confirmed the high level of interest in the concept of inter-industry collaboration.

Below are comments from participants and responses to their comments.

About JCM

- We have plans to build a biomass plant. Is there a possibility to collaborate with JCM in the future? (MSM)
  - If it is in the planning stage, an application can be made, but not once construction has begun. The only thing is that Malaysia has not yet signed the JCM, and that is a big problem (NDK)
- How will carbon credits from the JCM be distributed among various stakeholders? (IRDA)
  - In principle, the Japanese government will obtain credits for a percentage of the amount it subsidizes. The remainder will be divided among the participants on the Malaysian side (NDK)
- I believe many companies in Malaysia offer interest-free financing methods for some renewable energy for small-scale power generation (BS)
  - However, JCM is a subsidy and does not affect later payments (IRDA)

Inter-industry Collaboration

- How do Japanese companies treat wastewater (MMOF)

- In Japan, each plant usually has a wastewater treatment facility. Since Japan has been practicing energy conservation for more than 70 years now, each plant sets an annual energy conservation target. However, recently, most plants in Japan have been lacking capacity to consume energy independently. Therefore, a network could be created with other plants, so that if wastewater is generated at one plant, for example, another plant could use that wastewater as a resource. Such collaboration among plants is now underway (NDK).
- We are heavy water consumers, using about 15,000 kL per month. Therefore, I think such a centralized wastewater treatment plan would be welcomed (MMOF)
- In the Yokogawa Electric case study, it was estimated that energy costs could be reduced by 20-30% with a centralized system rather than having wastewater facilities at each plant. We are also using methods such as establishing an SPC and building a new plant, but since the timing of equipment changeover differs from plant to plant, I believe that is also discussed at the SPC (NDK)

- We are not that interested in putting in solar panels. I think there is potential if we can make good use of the CO2 being emitted. There are also plans to produce ethanol and hand sanitizer (MSM)
- Does TLIC have a centrally controlled steam equipment? (IRDA)
  - It does, but it does not cover that large an area (about 20 acres) (JLand)
  - Is the facility shared by all companies? (NDK)
  - Yes, it is. Facility is owned by JCORP (JLand)
- After we treat the water, we simply discharge it into a public drainage. Even if we recover the resource, we don't know where we can use it. We have not discussed these concepts with companies inside the industrial park (BS)
  - That is why I introduced this concept this time. The Pasir Gudang region is an industrial area, mainly heavy industry, and we have to think 5-20 years ahead (IRDA)
  - I think this type of collaboration is necessary (BS)
- Already collaborated with several companies on solid waste to conduct a study on recycling sludge into building blocks (SB)
- Currently TLIC is installing solar power at individual companies, but could we install solar on a large scale within the industrial park and share it? We actually considered introducing it 5 years ago, but could not do so on a large scale due to government policy (SB)

- You are right, but there are some restrictions on distributing surplus power to other companies (IRDA)

- Since BS is in the steel industry, I believe they pay millions of dollars for energy, especially electricity. I heard that they also produce wastewater and sludge. Do you use any technology, such as for wastewater treatment? (IRDA)
  - The produced waste is metal sludge, which is generated from the process used to produce standard steel. We pay to send our sludge to the brick plant. Sending them to a landfill is always the last option (BS)
- Very interested in how to capture CO2 and convert it to something else. I'd like a little more explanation (BS)
  - In Japan, CO2 is absorbed by amines and carbon is produced again elsewhere. CO2 is converted to CH4 and ethanol. Hydrogen can also be produced from CO2 by artificial photosynthesis (NDK)
  - Does Japan already have converter technology to produce hydrogen, CH4, and ethanol? (BS)
  - It does, although it is in the demonstration phase. Absorption through amines is already commercialized, but it is costly (NDK)
  - One of the challenges in this regard is that hydrogen energy has been proposed to replace fossil fuels and other energy sources, but the technology is still in its infancy and is expensive (BS)
  - To achieve artificial CH4, it is necessary to obtain large quantities of hydrogen, especially green hydrogen. For this reason, the Japanese government is considering a policy of subsidizing green hydrogen to bring its price closer to the price of natural gas while there is a cost gap (NDK)

2.3.4 Results of Questionnaire Responses

A total of five companies responded to the questionnaire through AME Development and through the distribution of TLIC questionnaires at the workshop (i-park @ senai airport city: 3 companies, TLIC: 2 companies). The results of each question of the survey are described in detail below.

（1） Of the electricity purchased, is there electricity derived from renewable energy sources? (Question 1.1)

Of the electricity currently purchased, three of the five companies used electricity derived from

renewable energy sources.

Table 2-5 Whether they use electricity derived from renewable energy sources

Options for responses	Number of responses
All renewable energy	0
Partially renewable energy	3
Do not purchase electricity derived from renewable energy sources	2
Unknown	0

（2） Of the steam used, is the steam purchased from other companies? (Question 1.2)

Two of the companies that responded to the questionnaire indicated that they do not particularly use steam, but the three companies that do use steam do not purchase it from other companies, so it is thought that they are reusing their own waste steam.

Table 2-6 Steam purchased from other companies

Options for responses	Number of responses
(1) We do not use steam at our company	2
(2) All of the steam we use is purchased from other companies	0
(3) Some of the steam we use is purchased from other companies	0
④ We do not purchase steam from other companies	3

（3） Type, amount, and disposal method (landfill, incineration, recycling, or other) of designated waste generated by the company (Question 2)

The results show that most of the designated waste generated by companies responding to the questionnaire is recycled and some is incinerated.

Table 2-7 Type, amount generated, and disposal method of designated waste

Company Name	Industry	Designated waste type	Amount generated (t/year)	Disposal method			
				Landfill	Incineration	Recycled	Other
Company A	Fibers & Textiles	SW 204	9.81			✓	

Company A	Fibers & Textiles	SW 409	1.795			✓	
Company A	Fibers & Textiles	SW 416	1.268			✓	
Company A	Fibers & Textiles	SW 410	0.243			✓	
Company B	Logistics Services	SW 410	Not sure				✓
Company C	Plastic Products	SW 303	0.24				✓
Company C	Plastic Products	SW 307	1.177				✓
Company C	Plastic Products	SW 409	0.592				✓
Company C	Plastic Products	SW 410	0.978				✓
Company C	Plastic Products	SW 422	0.029				✓
Company C	Plastic Products	SW 311	0.0003				✓
Company D	Metal Products	SW 204	1000			✓	
Company D	Metal Products	SW 104	500			✓	
Company D	Metal Products	SW 307	35			✓	
Company D	Metal Products	SW 312	25			✓	
Company D	Metal Products	SW 408	5		✓		
Company D	Metal Products	SW 409	5			✓	
Company D	Metal Products	SW 410	90			✓	
Company D	Metal Products	SW 429	1		✓		
Company D	Metal Products	SW 110	6			✓	
Company D	Metal Products	SW 422	10			✓	
Company D	Metal Products	SW 306	6			✓	
Company E	Food Manufacturing	SW 109	0.2				✓
Company E	Food Manufacturing	SW 110	0.3				✓
Company E	Food Manufacturing	SW 305	4				✓
Company E	Food Manufacturing	SW 322	0.5				✓
Company E	Food Manufacturing	SW 409	4				✓
Company E	Food Manufacturing	SW 410	1				✓
Company E	Food Manufacturing	SW 102	1				✓
Company E	Food Manufacturing	SW 411	8				✓
Company E	Food Manufacturing	SW 427	15				✓

（4） Wastewater and waste heat treatment methods (Question 3.1)

With regards to the treatment method of wastewater and waste heat at each company, for wastewater, three companies treated wastewater in-house, one company did not treat them, and one company did not generate wastewater in the first place. As for waste heat, two companies treated waste heat in-house, one company did not treat them, and two companies did not generate waste heat in the first

place.

Table 2-8 Wastewater and waste heat treatment methods

Options for responses	Number of responses	
	Wastewater	Waste heat
Treated collectively in the industrial park	0	0
Treated in-house	3	2
Not treated	1	1
No wastewater or waste heat generated in the first place	1	2

（5） If treatment is done at each plant, is it done in-house or outsourced? (Question 3.2)

In relation to the above question, the respondents were asked whether they treat wastewater and waste heat at their own plants or outsource the treatment of wastewater and waste heat. The majority of the respondents answered that they treat both wastewater and waste heat at their own plants.

Table 2-9 **Is wastewater/ waste heat treatment done in-house/outsourced?**

Options for responses	Number of responses	
	Wastewater treatment	Waste heat treatment
Treated in-house	3	2
Outsourced to other companies	1	0

（6） Do you implement energy conservation measures in your company (Questions 4.1, 4.2)?

With Malaysia currently considering enacting an energy conservation law, it will be necessary for companies to take energy conservation measures in the future. Therefore, when asked if they had already implemented energy conservation measures in their own companies, all companies responded that they had already implemented energy conservation measures.

Table 2-10 **Whether they implement energy conservation measures**

Options for responses	Number of responses
Yes	5
No	0

Switching to LED lights was cited by all respondents as a specific energy conservation measure. Other initiatives included the introduction of centrally controlled inverter air conditioners, cooling tower pumps, and variable speed fan motors.

（7） Do you feel that the energy conservation measures you are currently implementing have reached their limits in lowering your company's CO2 emissions any further? (Question 4.3)

In relation to the above question, all respondents answered "yes" when asked if they felt they have reached their limit to their energy conservation measures. Although each company has already implemented energy conservation measures, as mentioned above, only simple equipment installation such as switching to LED lights has progressed, and it is thought that they are looking for opportunities for further energy conservation measures.

Table 2-11 Limitations to energy conservation measures

Options for responses	Number of responses
Yes	5
No	0

（8） Do you have own in-house power generation equipment (including cogeneration) / heat utilization equipment? (Questions 5)

Few companies had in-house power generation equipment, and only one company (Company E), a food manufacturer, had such equipment. Meanwhile, three of the five companies already had in-house heat utilization equipment.

Table 2-12 Ownership of In-house Power Generation Equipment / Heat Utilization Equipment

Options for responses	Number of responses	
	In-house power generation equipment (Including cogeneration)	In-house heat utilization equipment
Yes	1	3
No	4	2

<u>In-house power generation equipment</u>

Company E, a food manufacturing company, said it owned a steam turbine.

Company E also listed the following three initiatives for fuel conversion and decarbonization of its in-house power generation equipment, which it has not yet implemented, but is already considering.

- A biomass boiler will be constructed in 2024-2025.
- Reuse 20% of CO2 emissions.
- Convert fuel forklift trucks to lithium battery powered forklift trucks.

<u>Heat utilization equipment</u>

Textile manufacturer A has two boilers (one in operation and one to be installed in the future); metal manufacturer D has two boilers, two heating furnaces, and one other type of furnace; and food manufacturer E has two boilers.

With regard to initiatives for fuel conversion and decarbonization of heat utilization equipment, textile manufacturer A responded, "Not currently being considered, but will consider it in the future," and food manufacturer E responded, "Currently considering it." As for metal manufacturer D, the company plans to consider fuel conversion and decarbonization initiatives in the future for its boilers, and has already implemented fuel conversion for its heating furnaces. One specific initiative is to replace sectional furnaces with a sealed system that has been modified to allow the outlet opening to be adjusted to minimize heat loss in the furnace.

2.4 Consultation with individual companies

In the course of conducting the above questionnaire, we held an online meeting with Company E (MSM Sugar Refinery (Johor) Sdn Bhd) separately, as they were highly interested in utilizing JCM for the construction of a biomass plant, which they are currently considering.

During the meeting, there were many questions about the JCM system and a lively discussion ensued. Company E plans to start efforts to construct a biomass plant in the second and third quarters of 2024, and is interested in utilizing the JCM equipment installation subsidy. Although they were positively considering the use of JCM during the meeting, they were concerned that they will not be able to meet the construction schedule planned by Company E because the JCM conclusion with the Malaysian government has not been completed at this time. We received comments that if there is a possibility, they would consider using JCM, as they may be able to apply if the inter-governmental JCM agreement is concluded before the construction work begins.

The following is a description of the main content of the discussion.

＊MSM Sugar Refinery (Johor) Sdn Bhd＝MSM

＊NTT DATA Institute of Management and Consulting, Inc＝NDK

About JCM

- Is there a cap on the amount of the grant? (MSM)
  - There is a cap of 2 billion yen ($20 million at 1 yen = 100 yen) per case (NDK)
  - If there is a $100 million project, the maximum subsidy rate would be 50%, but if the maximum subsidy amount is $20 million, the subsidy rate would be 20% (NDK)
- Where is the subsidy for? (MSM)

- This relates to the initial investment in the installation of equipment. In the above case, if the equipment is installed and operating without problems, the Japanese government will pay a 20% subsidy (NDK)

- The cost will also need to be calculated in terms of the reduction in carbon emissions. If the cost-benefit was less than $20 million of the subsidy amount, the lower amount would be the subsidy amount (NDK)
  - So is the subsidy based on the cost of reducing carbon emissions? (MSM)
  - No, both the installation and reduction costs are compared and the lower amount is applied (NDK)
- Is my understanding correct that this is a mechanism whereby the government would purchase carbon credits? (MSM)
  - Yes (NDK)
  - Are all carbon credits purchased by the Japanese government? (MSM)
  - No, it is proportional to the subsidy rate. If the subsidy rate is 20%, the Japanese government gets a credit for 20%. The remainder remains with the applicant (NDK)
- Are credits issued annually? (MSM)
  - Reductions are calculated and issued annually during the legal life (NDK)
- Will installation costs increase annually? (MSM)
  - No, it is paid in a lump sum after the installation of equipment is completed. The credits issued each year will be in the form of a transfer to the Japanese government, which has already paid the money (NDK)
- Our company must also meet our emission reduction targets. Handling of credit will be a delicate matter (MSM)
  - As you say, if the credits are transferred to the government, they cannot be included in the calculation as company reductions (NDK)
- One of our potential projects is the construction of a biomass plant. For example, how do you calculate carbon emissions from biomass? (MSM)
  - Usually the emission factor of the Malaysian power company is used. You would estimate how much CO2 you were able to reduce by how many kWh of electricity could be replaced (NDK)
  - We envision introducing biomass to reduce the consumption of natural gas, not electricity. We currently use a boiler, can we estimate the reduction in natural gas in that case? (MSM)

- It is possible (NDK)

- Assuming a project life cycle of 15 years, the plant may not even be operational. This would reduce the cumulative CO2 reduction - how would that be handled? (MSM)
  - I don't think there is any penalty except for intentional suspension, etc. (NDK)
- When forming a consortium, will it set up a representative from a Japanese company? (MSM)
  - Yes, it will. The reason why such a system was developed is that if the international consortium fails, the Japanese company is obligated to repay the subsidy (NDK)
- Are there any specifications regarding the equipment to be installed? (MSM)
  - Generally no, but if it is very energy inefficient, opinions may be expressed (NDK)
- What is the progress of discussions with the Malaysian government regarding the conclusion of the JCM? (MSM)
  - The Japanese government has requested that Malaysia become a member, but the Malaysian government has refused. The Japanese government is looking for candidate projects through this project because it wants to form a JCM project in Malaysia (NDK)
- Can the application for JCM be made after the project is completed or must it be made before? (MSM)
  - It must be made before. To be precise, once the international consortium's application is accepted and officially registered with the Japanese government, local companies can start installing equipment (NDK)
  - The project we are considering, if we were to start now, would take at least two, two and a half years to complete the EPC. Can I apply halfway through the process? (MSM)
  - Typically, it takes six months to initiate an application and complete registration. Project design work is not eligible for subsidy, so applications can be submitted halfway through as long as construction has not started (NDK)
- Are JCM subsidies only for the Iskandar region, or there are similar plans for non-Iskandar regions? (MSM)
  - If the Malaysian government accepts the JCM agreement, all regions in Malaysia will be covered (NDK)
- What does the government think about JCM? (MSM)
  - It is still in the discussion phase. Many companies want to take advantage of carbon credits. If they cannot offset within their own country, they will need to utilize credits from other countries (IRDA)

- What are the needs within the Iskandar region? (MSM)
- The investigation is still ongoing. I personally believe that TLIC is best suited to implement this concept (IRDA)

About the project under consideration by MSM

- There are three potential projects. The first is the construction of a biomass plant, the second is the use of natural gas, and the third is the drying and conversion of mud, a by-product, into fertilizer. These plants will start in Q2 and Q3 of this year (MSM)
- Can we calculate CO2 reductions for a project that would convert waste into fertilizer? (NDK)
  - We understand the importance of a circular economy, but JCM projects require reduction of CO2 emissions from energy use (NDK)
- For solar power, we are already buying power through the EPCC program (MSM)
  - In Japan, there is a third-party owned program called PPA. In that case, the consortium must include a third party (NDK)
  - If so, who gets the incentive? (MSM)
  - It is the third-party organization. However, their investment funds will be reduced, so we may be able to negotiate around the electricity rate (NDK)
- We are signatories to SBTi and therefore must meet our reduction targets. We need to think about how to utilize the credits (MSM)
- I believe there are other entities in MSM's supply chain and value chain that are considering decarbonization. I would like to see this proposal included as one of the consideration material. The meeting is also intended to test the enthusiasm of each industry for decarbonization (IRDA)
- It is regrettable that the JCM has not yet been concluded. We want to utilize JCM, but we do not want to delay our initiatives. If there is a possibility to apply while we are working on this project, I would consider it (MSM)

2.5 Future Directions

Through this fiscal year's project, a feasibility study was conducted to determine whether the concept of inter-industry collaboration could be implemented in an industrial park in Malaysia. The results of this project include a questionnaire survey of companies in each industrial park through AME Development and TPM Technopark, with whom we established a relationship last year, and we received responses from a total of five companies. All of these five companies confirmed that they felt limited in their ability to conserve energy on their own.

In addition, for TLIC, we held a workshop with target companies on site and we were able to gather information on the needs and current status of each company. Since TLIC is a heavy industrial park, there are many energy-intensive companies. We could confirm that each plant was making efforts to conserve energy and, in addition, to switch to renewable energy and energy use with low CO2 emissions in response to the trend toward decarbonization.

One of the participating companies in the questionnaire and workshop had a plan to install a biomass boiler in their plant to reduce the use of natural gas and lead to decarbonization and was very interested in the JCM equipment subsidy project, so a separate meeting was held with the company. As a result of the separate meeting, we confirmed that the company had plans to start efforts to construct a biomass plant in the second and third quarters of 2024 and was interested in utilizing the JCM equipment installation subsidy. The biggest concern, however, was that Malaysia has not signed the JCM, and the schedule for the company's planned biomass boiler installation does not match the application and approval schedule for the JCM equipment subsidy project.

In the next fiscal year, we plan to form a consortium and formulate concrete plans for the concept of inter-industry collaboration, focusing on the two industrial parks surveyed this year (i-park @ Senai airport city/Tanjung Langsat Industrial Complex), especially plants that participated in the questionnaire and workshop and are interested in the concept of inter-industry collaboration.

Table of Contents

Chapter 3.Introduction of Waste-to-Energy as a base-load power source for decarbonization of the consumer sector 3-2
3.1 Overview of Activities 3-2
3.1.1 Technology Applied 3-3
3.1.2 3-Year Study Plan 3-4
3.2 Review of the progress of the Waste-to-Energy project in Johor, Malaysia 3-5
3.2.1 About the Waste-to-Energy Facility Construction Project in Bukit Payong 3-6
3.2.2 Progress 3-7
3.3 Investigation of regulations related to waste-to-energy 3-8
3.3.1 Power sales system 3-8
3.3.2 Construction Licenses and Permits 3-9
3.4 Technical aspects of the introduction of waste-to-energy facilities 3-10
3.4.1 Study Plan for this Project 3-10
3.4.2 Introduction of Seelong Landfill Site 3-11
3.4.3 Method and Plan of Waste Survey 3-13
3.5 Results of waste investigation 3-19
3.5.1 Schedule of waste sampling and analysis 3-19
3.5.2 Amount of Waste Delivered per Waste Type (Source Category) 3-20
3.5.3 Waste Material Fraction 3-22
3.5.4 Analysis of Waste Proximate and Elemental Composition 3-30
3.6 Activities for Nest Year 3-33

Chapter 3. Introduction of Waste-to-Energy as a base-load power source for decarbonization of the consumer sector

3.1 Overview of Activities

Malaysia has been facing serious problems in recent years in terms of increasing amount of municipal solid waste (hereinafter "**MSW**") and its management due to the nation's rapid economic growth. In Iskandar Malaysia, Iskandar Regional Development Agency (hereinafter "**IRDA**") in collaboration with City of Kitakyushu, Japan and NTT Data Institute of Management Consulting, Inc. has conducted the "City-to-City Collaboration for Low-Carbon Society" organized by the Ministry of Environment, Japan since 2019, and has shown its interest in developing a Waste to Energy (hereinafter "**WTE**") project. Hence, in response to the expectation of IRDA, "FY2020 City-to-City Collaboration for Low-Carbon Society (Phase 2)" and "FY2021 City-to-City Collaboration for Low-Carbon Society (Phase 3)" included within its activities, a preliminary study for exploring possibilities to implement the WTE project in Iskandar Malaysia.

In order to contribute to the realisation of decarbonised society in the Iskandar region by brushing up the study of this project, which completed 3 years of study period in FY2021, Nippon Steel Engineering Co., Ltd (hereinafter "**NSE**") has joined this project again and continuously studied "City-to-City Collaboration for Low-Carbon Society in Iskandar Region (Phase 1) " since FY2022.

This "Promotion of Carbon-Free Model Area in Iskandar Region (Phase 2)" (hereinafter the "**Project**"), being selected by the Ministry of Environment, Japan as one of the projects in "FY2023 City-to-City Collaboration for Low-Carbon Society", is a continuation project of the aforementioned project conducted in FY2021 and FY2022 and aims to investigate further the feasibility of introducing a WTE plant in Iskandar Malaysia.

Based on the results of activities in FY2022, this year we confirmed the progress of the waste power generation project promoted by the Malaysian government, and in cooperation with a local company (SWM Environment Sdn. Bhd. and others), this year we conducted a survey on the quality of waste to be treated as a survey of information related to assumptions for the facility plan. In summary, the activities in FY2023 were as follows.

1) Waste quality survey conducted at the Seelong Landfill
2) Checking the progress of waste-to-energy projects in Johor, Malaysia
3) Refinement and upgrading of project proposals based on survey results.

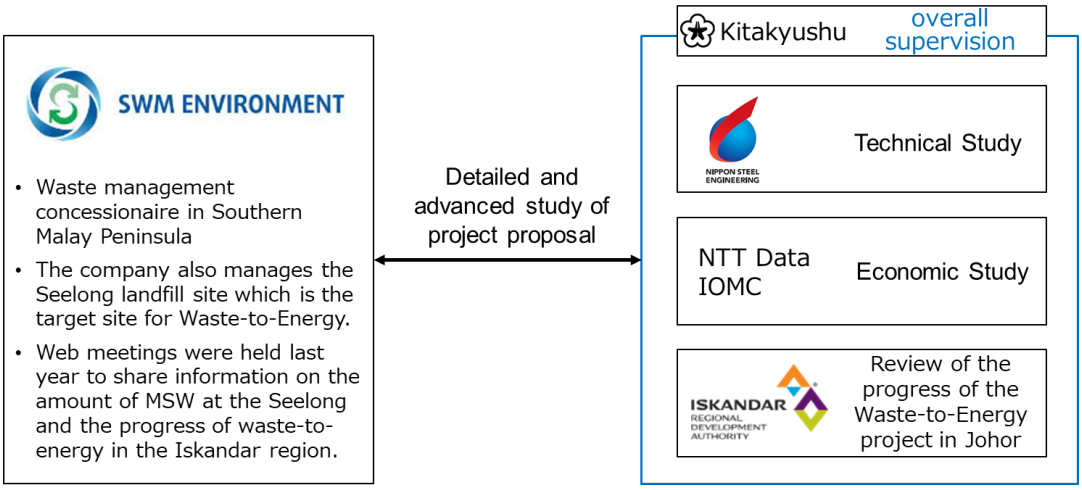

Figure 3-1 Implementation Structure of FY2023 Projects

3.1.1 Technology Applied

In this Technical Study, grate-type incineration technology is applied as the technology for the presumed WTE plant. Japan is one of the most advanced countries in the world in terms of thermal treatment of MSW. Japan has one the largest number of WTE plants installed, which comprises of WTE plants with various kind of technologies applied, such as grate-type incineration, fluidized-bed-type incineration and gasification, which all successfully demonstrates stable operation for a long period of time. Furthermore, advanced ash treatment and stabilization technologies and flue gas treatment technologies has been developed and installed in the WTE plants, which are propelled by the need to comply with stringent Japanese environmental standards with additional technical requirements implemented by each local government. Given the above, this Project aims to study the promotion of this advanced Japanese WTE technology in Malaysia.

NSE has a track record of over 500 units of WTE plants which has utilized its grate-type incineration technology and been installed all over the world. Such WTE plant installed by NSE is designed to be capable of achieving continuous annual operation days of 300 to 330 days, and has been proven to realize long continuous operation. Longer annual operation days generally entails higher annual power generation amount (power sales amount). On the other hand, shorter annual operation days would result in the need to construct a WTE plant with larger waste treatment capacity, in addition to the need to consider alternative methods for disposal of MSW during the non-operational days, whereby resulting in a higher initial investment cost. Therefore, NSE's technology, being able to attain longer annual operational days, is capable of satisfying local needs for achieving proper waste management in a cost-effective manner.

In addition, through attaining high steam parameters for boilers, optimizing materials for super heaters, reduction of combustion air ratio, reduction of flue gas temperature and reduction of turbine exhaust pressure, NSE has realized improvements in power generation rate ranging up to 25% to 28%. These efforts which results in higher electric power sales amount through high power generation efficiency, is welcomed by local governments that face problems in securing adequate financial resources for waste management.

NSE's grate-type WTE plant technology proposed in this Technical Study comprises of the following technological features. Additionally, the overall flowchart (reference only) is shown in **Figure 3-2** in the following page.

1) Accommodates a wide range of waste quality
   - Stable combustion possible for waste with calorific values ranging from 1,200 kcal/kg up to 5,000 kcal/kg
2) Scale-up properties
   - Treats waste up to a maximum of 1,200 tons/day per line
3) High power generation efficiency
   - Achieves maximum of 30% power generation efficiency
4) Advanced flue gas cleaning system
   - Provides various treatment technologies which suits the client's needs (dry, semi-dry, wet)
5) Long continuous operation
   - Achieves high plant availability of over 8,000 hours

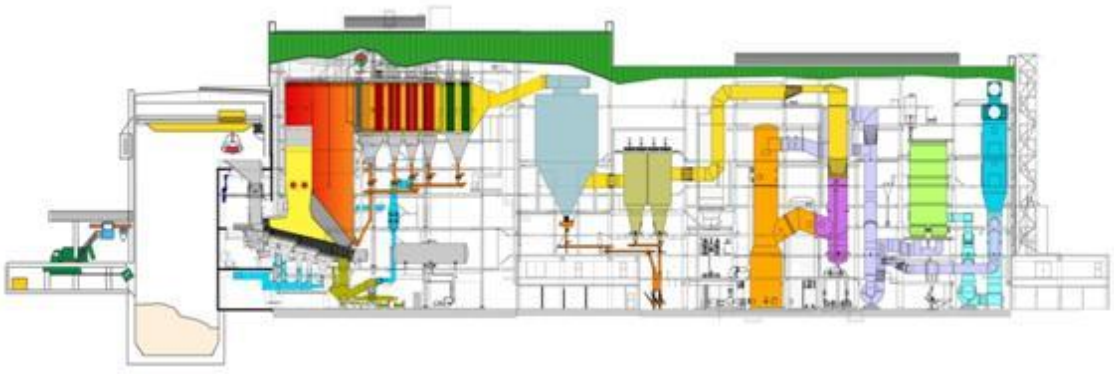

Figure 3-2 Waste-to-Energy Plant overall flowchart (reference)

3.1.2 3-Year Study Plan

The following lists the items which needs investigation in order to assess the feasibility of implementing WTE plant in Iskandar Malaysia and is based on a study period of 3 years. Furthermore, this study is to be executed by a team consisting of City of Kitakyushu together with IRDA under the

city-to-city collaboration scheme, NTT Data Institute of Management Consulting, Inc., who will be responsible for institutional and economic study, such as research of applicable laws and regulation and assessment of financial viability among others, and NSE will be responsible for technical study such as the plant design and estimation of project costs.

This year, we conducted a survey on the composition and properties of waste to be treated and a survey and organization of the legal system related to the implementation of the project as a survey of information related to the premises of the facility plan.

#	Survey Contents

1)	• Investigation of pre-requisite information for plant design
	  • Waste amount and quality data
	  • Laws and regulations applicable to plant design (air emission standards, wastewater standards, seismic standards, ash handling conditions, etc.)
	  • Project site (existence of basic infrastructure such as water, electricity, access road, etc.)

2)	• Investigation of laws and regulations pertaining to project execution
	  • Energy (electricity sales)
	  • Environmental Impact Assessment
	  • Construction Law (contractor's license, permits, etc.)
	  • Tax, customs clearance procedure

3)	• Conditions for project execution
	  • Appropriate division of responsibility between public and private entity
	  • Expected role of IRDA

4)	Investigation of project scheme

5)	• Assessment of project feasibility
	  • Estimation of project cost (CAPEX and OPEX)
	  • Assessment of financial viability (incl. quantifying environmental benefits)

3.2 Review of the progress of the Waste-to-Energy project in Johor, Malaysia

In this year's project, we confirmed the progress of the WTE project being promoted by the Malaysian government.

According to the federal government's plan, 11 WTE projects are planned in Malaysia as a whole and

two in Johor (see the table below). The target project in Iskandar region is No. 11 in the table below.

Table 3-1 candidate sites under consideration for installation of WTE facilities

No.	state	Candidate sites	Current volumes (t/day)
1	Kedah	Semeling Landfill, Gurun	450
2	Pulau Pinang	Pulau Burong Landfill, Seberang Prai	2,000
3	Perek	Lahat Landfill, Ipoh	650
4	Selangor	Jeram Landfill, Klang	3,000
5	Kuala Lumpur	Taman Beringin Transfer Station	2,300
6	Melaka	Sungai Udang Landfill	900
7	Terengganu	Marang Landfill, Marang	100
8	Pahang	Jabor-Jerangau Landfill, Kuantan	500
9	Negeri Sembilan	Tanah Merah Landfill, Port Dickson	585
10	Johor	Bukit Payung Closed Landfill, B. Pahat	2,875
11	**Johor**	**Seelong Landfill, Johor Bahru**	**3,164**

There are two potential WTE sites in Johor: the Seelong Landfill (No. 11 in the above table) and the Bukit Payung Closed Landfill (No. 10 in the above table). Of these two sites, one site outside the Iskandar region (Bukit Payong) has started bidding for the WTE project in 2020. We believe that there is a possibility that a similar tender will be held for WTE in the Iskandar region, so we will check the progress of the tender for Bukit Payong.

3.2.1 About the Waste-to-Energy Facility Construction Project in Bukit Payong

According to the Request for Proposal (RFP) announced in August 2020 for the construction of a WTE facility in Bukit Payong, Johor, and the project will be implemented through a PPP contract for design, construction, financing, operation, maintenance and closure. At the end of the concession period, the concessionaire will dismantle all the facilities and transfer the land and related assets to the Malaysian government. Payment will be based on performance and service level compliance.

As a project requirement, the Government of Malaysia requires the procurement of a solid waste management facility with a capacity of at least 800 t/day (292,000 t/year), including commercial, industrial and institutional waste generated from the northern part of Johor. In addition, bidders will need to demonstrate compliance with the following parameters.

- company with at least 51% Malaysian owned entity;
- experienced in managing Municipal Solid Waste Treatment Facility and landfilling;
- experienced in managing similar Municipal Solid Waste Management Facility as proposed by bidder with a minimum capacity of 800 tonnes per day;
- the proposed technology solution has at least 3 years track record; and
- the proposed technology has minimum 8000 operating hours per annum.

In addition to the treatment and disposal of contracted solid waste, the concession agreement shall also include the management of all outputs from waste management, including the movement and sale of recovered materials or products (including energy (or power)), and the movement, transportation, and disposal of waste and processing residues. The bidder shall include in the proposal details regarding the management and disposal of all contracted solid waste when the facility is not operational due to planned and unplanned maintenance. All costs related to the above items shall be recovered through gate fees and shall not be payable separately by the Government of Malaysia.

3.2.2 Progress

This year, we have continued to gather information on the waste-to-energy bidding project in Bukit Payong, including the progress of the contractor selection process and the selected candidate, we have received information that Worldwide Holdings Bhd. has bid for the project. Worldwide Holdings Bhd is a major conglomerate in Malaysia. Its business activities include real estate, environmental management services, and medical equipment manufacturing. It is also the operator of a sanitary landfill owned by Perbadanan Kemajuan Negeri Selangor (PKNS).

Worldwide Environment, a subsidiary of Worldwide Holdings Bhd, has initiated a project to develop a 22 MW waste-to-energy (WTE) plant in Selangor.

As mentioned earlier, in the Bukit Payong waste-to-energy bid project, the operator is required to implement the management of all outputs from the waste treatment and the cost must be covered by gate fees. However, in the Bukit Payong project, no reliable information on the FIT ratio or the price of the gate fee has been disclosed at this time. Edge Malaysia[1], a business and investment newsletter, reported that Worldwide Holdings Bhd. has set a gate fee of RM77 per ton for waste power generation at Bukit Payong.

We will continue to monitor the status of the Bukit Payong project and provide updates as the same conditions are likely to be imposed on the bidding for waste power generation at the Seelong Landfill site as in Bukit Payong.

[1] The Edge Malaysia (2023) PKNS-owned Worldwide builds up WTE assets, adds Bukit Payong project to portfolio

3.3 Investigation of regulations related to waste-to-energy

3.3.1 Power sales system

In Malaysia, feed-in tariffs (FITs) are issued through the Sustainable Energy Development Authority (SEDA). FITs for waste power generation such as incineration and AD fall under the biomass (waste) sector.

The requirements for those who apply to SEDA regarding the application of the FIT scheme are as follows.

- The applicant must be a Malaysian entity or an entity that is at least 51% owned by a Malaysian company. However, it is possible for a Malaysian entity to act as the business entity and a foreign company to be awarded the EPC contract.
- The project must have a business license in Malaysia.

For RE facilities (grid-connected) greater than 180 kW, a power system study (PSS) is required to evaluate the potential impact of distributed generation on the planning and operation of DL's distribution system. The PSS is conducted by the distribution utility. A Connection Confirmation Check (CCC) is required for installations of distributed generation greater than 72 kW and up to 180 kW.

The application procedure for FIT approval is shown in Table 3-2; the application to SEDA is expected to take approximately 4-8 weeks.

RE Installation Capacity (MW)	Fee Amount	Time Frame
≤ 1 MW	RM20,000	30 days
> 1 MW ≤ 10 MW	RM40,000	30 days
> 10 MW ≤ 30 MW	RM60,000	42 days
Additional For Insulation Coordination Studies If Required	RM20,000	10 days
Additional for Solar PV – Dynamic Study (Voltage Fluctuations) If Required	RM10,000	-

Figure 3-3 PSS Fee and Time Frame[2]

Table 3-2 The application procedure for FIT approval

Step1	Confirmation of FIT Authorization Holder (FIAH) requirements compliance and

[2] Source：SEDA: FEED-IN TARIFF (FiT) IN MALAYSIA

	qualification, purchase price, and renewable energy source criteria
Step2	Conduct power system study (turnaround time of approximately 30 days) Final version of project proposal
Step3	Application for FIT to SEDA (turnaround time of approximately 4-8 weeks)
Step4	Execution of Renewable Energy Power Purchase Agreement (REPPA) and registration of the executed REPPA with SEDA
Step5	Connection of renewable energy generation (design and construction)
Step6	Receive provisional license from the Energy Commission
Step7	FiT meter installation
Step8	Commissioning and Commissioning (T&C)/ Acceptance Test (AT)
Step9	Obtain FIT start date (FiTCD)
Step10	FIT administration (meter reading, payment billing)

3.3.2 Construction Licenses and Permits

Registration with the Construction Industry Development Board Malaysia (CIDB) is required to carry out construction work in Malaysia. Foreign construction companies with foreign capital exceeding 30% are subject to a two-step procedure: registration to enable participation in certain tenders, and registration through a contract for the award of a specific project, which requires them to register as a construction company for each project and to pay a registration fee.

For Malaysian government investment projects, both local and foreign construction companies must register with the Construction Company Operations Center (PKK: Pusat Khidmat Kintractor) and the Ministry of Finance (MOF). When registering with the CIDB as a JV or consortium, registration is on a project-by-project basis.

In Malaysia, the construction industry is positioned as an important industry for the country, and from the perspective of fostering and protecting domestic contractors, a system called the Bumiputra Policy has been designed. Thirty percent of the total amount of government procured construction projects is allocated to Bumiputra firms. Therefore, there are restrictions on foreign investment in the construction industry registration system, which stipulates that a larger share of home country capital is advantageous. The scope of construction projects, both those ordered by the private sector and the government, are subject to restrictions. The scope of government-ordered projects that foreign construction companies are eligible for is as follows.

- ODA projects for which international bidding is required by the financier.
- Projects that cannot be carried out by local construction companies.
- Large-scale projects that are open to foreign firms in terms of value.

In addition, there are further restrictions on bidding for public works projects based on the ratio of

foreign investment. If the ratio of foreign capital is 100%, the company cannot participate as a prime contractor.

It is difficult for foreign firms to obtain more advanced forms of licenses, and they often bid as Malaysian construction companies through joint ventures or consortiums. For relatively small projects, it is possible for foreign firms to obtain a construction license.

3.4 Technical aspects of the introduction of waste-to-energy facilities

3.4.1 Study Plan for this Project

In FY2022 study, since travel restrictions imposed in Malaysia in response to the global spread of COVID-19 has eased in 2022, the study plan for FY2022 Project was discussed with IRDA and SWM Environment Sd. Bhd. (hereinafter "**SWME**") the operator of Seelong Sanitary Landfill with the plan of conducting a site visit and was actually conducted. In addition, upon face-to-face discussion with SWME in Iskandar, it was revealed that SWME did not conduct waste analysis for itself, and hence did not possess any waste quality data. Therefore, in order to plan for conducting a waste sampling and analysis activity at Seelong Sanitary Landfill, online meeting with a research team from Department of Chemical Engineering of Universiti Teknologi Malaysia (hereinafter "**UTM**"), who has extensive experience in conducting waste sampling and analysis, was conducted.

In FY2023 study, we discussed the details of the waste sampling and analysis with UTM and agreed to conduct waste sampling and analysis twice in 2023 and 2024 (once a year). We witnessed the sampling activity conducted by UTM at the Seelong Landfill in November 2023.

Table 3-3 Contents of FY2023 study

Activity	Contents
1. Discussion and preparation on study plan	Date & time: 9 August 2023, 14:00~14:30 Purpose: Discussion with IRDA on request for preparation of waste quality investigation in November. Place: Web meeting Attendees: • Malaysia side: IRDA/Ms. Siambun (Vice-President, Environment) • Japan side: City of Kitakyushu, NTT Data Institute of Management Consulting, Inc, NSE

2. On-site witness for waste sampling	Date & time: 7 November 2023 9:00~12:00 Purpose: On-site witness for waste sampling works Place: Seelong Sanitary Landfill (Iskandar Malaysia) Attendees: • Malaysia side: Uni-Technologies Sdn. Bhd./Dr. James, Mr. Arif, IRDA/ Ms. Siambun (Vice-President Environment) • Japan side: NSE

3.4.2 Introduction of Seelong Landfill Site

In Malaysia, the Federal Government's National Solid Waste Management Department (JPSPN: Jabatan Pengurusan Sisa Pepejal Negara) is responsible for developing regulatory framework and policies, and the Solid Waste Management and Public Cleansing Corporation (SWCorp) is responsible for the actual implementation of solid waste management. On the other hand, IRDA is a Malaysian Federal Government statutory body (Co-Chaired by Prime Minister of Malaysia and Chief Minister of Johor) tasked with the objective of regulating and driving various stakeholders in both public and private sector towards realizing the development of Iskandar Malaysia and is not responsible for regulating solid waste management in Iskandar. IRDA is organized into divisions based on "key strategic drivers" and the appointed personnel in this Project is assigned under "Resilient Environment".

Figure 3-4 shows the flow of waste collection and disposal (landfill) flow in Iskandar region. Iskandar region has 2 landfill sites. Seelong landfill site covers the areas of Majlis Bandaraya Johor Bahru (MBJB), Majlis Bandaraya Iskandar Puteri (MBIP), Majlis Perbandaran Kulai (MPK). On the other hand, Tanjugn Langsat landfill site, located in eastern Johor covers Majlis Bandaraya Pasir Gudang (MBPG) areas, located in eastern Iskandar region. In the near future, expected in the year 2025, Seelong Sanitary Landfill will also receive around 300 tonnes per day of solid waste from the Pontian district as the Pekan Nanas Solid Waste Transfer Station comes into operation.

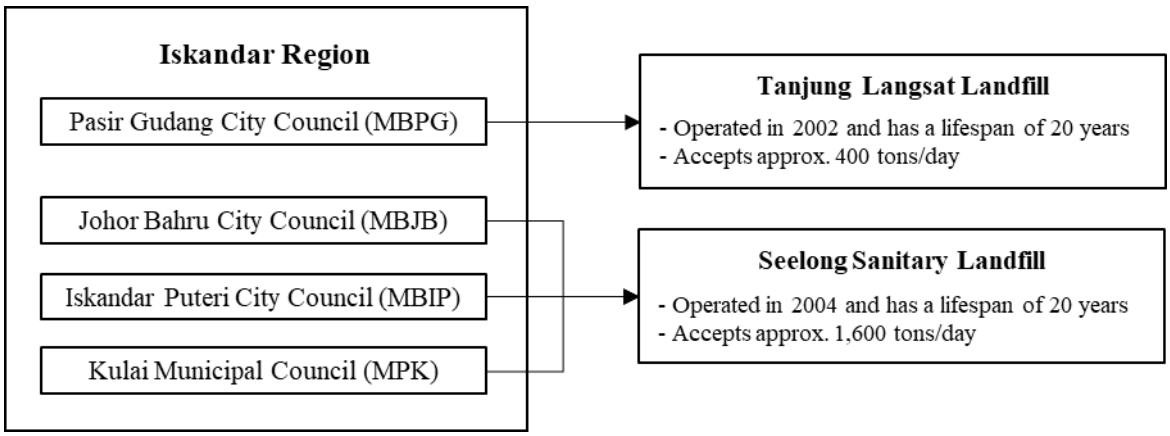

Figure 3-4 Waste disposal sites in Iskandar Malaysia[3]

Seelong Landfill is sanitary landfill (leachate-controlled-type landfill), located in Seelong, Iskandar Development Region, Johor, Malaysia. The landfill has an area of 275 acres (approximately 1.11 km^2) and its capacity is 18.8 million m^3 (approximately 15 million ton). SWME has been contracted by the federal government (central government) to dispose waste for 20 years since 2004.

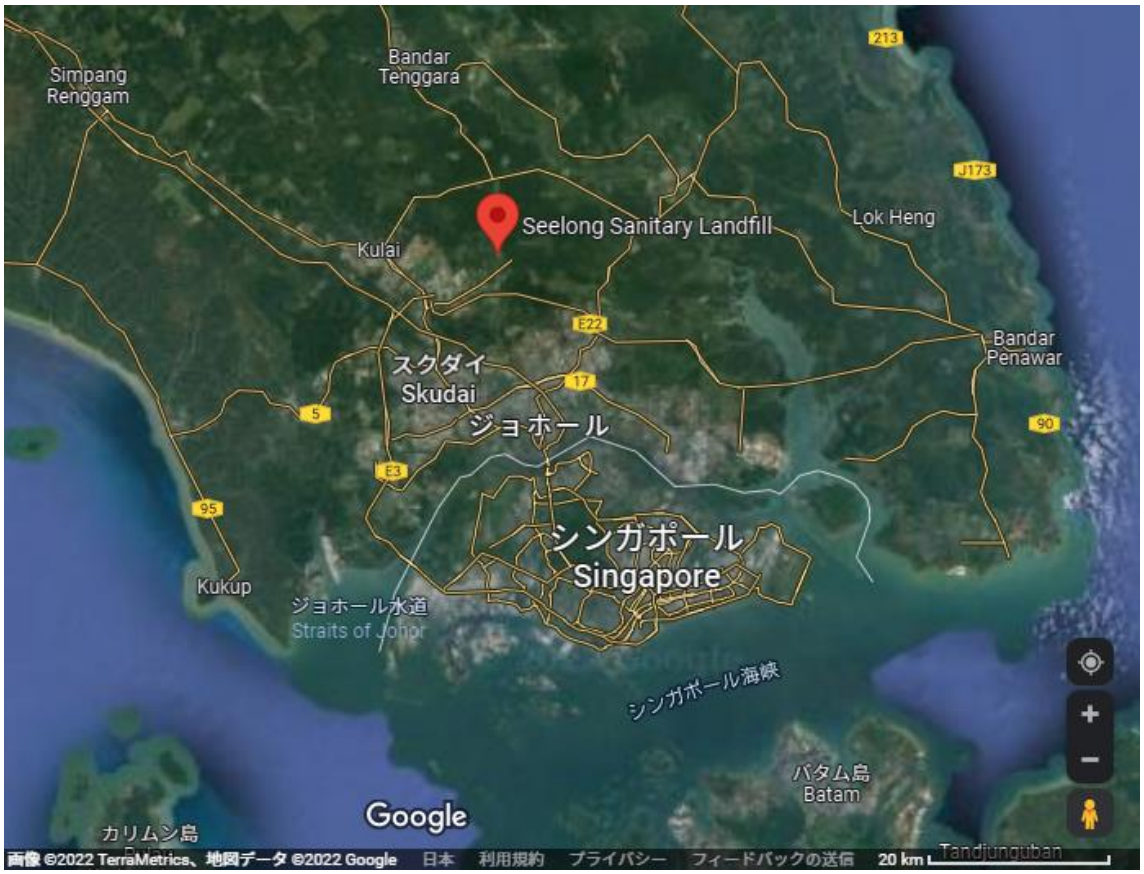

Figure 3-5 Location of Seelong Sanitary Landfill (Source: Google Map)

[3] Source: Universiti Teknologi Malaysia

Table 3-4 Waste treatment and disposal processes at Seelong Sanitary Landfill

Process	Treatment / Disposal	Remarks
1) Weigh Bridge	Weigh and record a compaction car	Measured at entry and exit, respectively
2) Transfer Station	Transship collected waste Sorting and removal of plastic waste	To reduce congestion at landfill sites (Only some vehicles are transshipped.)
3) Landfilling	Dump waste to the landfill	Currently landfilling in cell No.7 (out of 13 total cells)
4) Leachate Treatment Plant (LTP)	After biological, chemical and physical treatment, discharged into river	Water quality is measured Daily (for internal control), Weekly, Monthly (for reporting to authorities)
5) Landfill Gas Utilization	Power generation by gas engine	Updated from flare stack (previous installation)
6) Recyclable waste segregation	Waste home appliances, cardboard, and bottles are sorted and sold	

Waste treatment and disposal at Seelong Sanitary Landfill consists of the following 6 processes: 1) Weigh Bridge, 2) Transfer Station, 3) Landfilling, 4) Leachate Treatment Plant, 5) Landfill Gas Utilization and 6) Recyclable Waste Segregation (**Table 3-4**). SWME processes leachate properly just as in Japan and discharge it only after appropriate water quality control. In addition, they proactively recover landfill gas (methane gas), known as a greenhouse gas, and generate electricity by use of gas engine. Through our visit and surveys in FY2022, it was confirmed that SWME is a reliable waste landfill operator who has managed wastes properly.

3.4.3 Method and Plan of Waste Survey

Although waste quality data is an essential pre-condition for designing WTE plant, for FY2019~2021 projects, because site investigation was not possible due to Covid-19 travel restrictions, the technical study utilized waste quality data from a published academic article (results of the waste details analysis conducted in 2011 and 2013 by Siti Norbaizura and Professor Takeshi Fujiwara from Okayama University at Seelong Sanitary Landfill Facility in Johor. See **Table 3-5**) to set the design waste quality to determine plant design which was then used to estimate project costs.

Table 3-5 Design waste composition we assumed based on the literature in our previous project in 2021[4]

Parameter		**Unit**	**Value**
Calorific value (LHV)		kcal/kg	1,591
Proximate analysis	Moisture	wet%	56.90
	Ash	wet %	8.20

[4] Source: Norbaizura, Siti, M.R. & Fujiwara, Takeshi (2013). Characterization of Household waste in Iskandar Malaysia and its Suitability for Alternative Waste Handling Methods. Journal of Japan Society of Civil Engineers, Ser. G (Environmental Research), Vol.9, No.5 : I_209-I_216., ultimate analysis results adjusted by NSE.

	Combustible	wet %	34.90
Ultimate analysis	Carbon (C)	wet %	18.90
	Hydrogen (H)	wet %	2.70
	Oxygen (O)	wet %	12.67
	Nitrogen (N)	wet %	0.39
	Sulphur (S)	wet %	0.05
	Chlorine (Cl)	wet %	0.19

In the second year of the three-year project (in this fiscal year), we carried out waste analysis for waste collected in Iskandar area, where a new WtE plant is planned to be constructed, for the purpose of improving the plant technical specifications and the accuracy of estimation of the business cost. The waste sampling and analysis work was outsourced to Uni-Technologies Sdn. Bhd (hereinafter "**Uni-Technology**").

(1) About Uni-Technology company

Uni-Technology is an entity under UTM, whose main campus is located in Iskandar region.

Uni-Technology has carried out waste analysis work for government and private organizations in Kuala Lumpur, Melaka, Labuan, Cameron Highland, Northern Johor, Pontian, Pasir Gudang, Johor Bahru and Kulai in Malaysia. It has more than 30-year experience on waste analysis work. Uni-Technology also has experience working with Japanese companies.

(2) Objectives of this waste quality analysis study

The following is the objectives of waste composition analysis:

1) Understanding of waste generation amount for each waste type in Iskandar region,
2) Obtaining waste fraction data for each of the waste types mentioned above,
3) Obtaining waste analysis data (physical and chemical properties) for each of the waste types mentioned above.

(3) Sampling location and period

Waste sampling will be carried out at Seelong Sanitary Landfill, which is considered to be representative on composition of waste generated in Iskandar area.

On the one hand, the change in water content between wet and dry season is negligible since containers with lids are used for waste collection in Iskandar region. On the other hand, previous UTM studies showed that waste composition varies between the season when the durian harvest is most active (July and November) and the other seasons. Based on this information, it was decided to conduct the sampling campaign in this study in two separate sessions, one in the fruiting season (November 2023) and one in the non-fruiting season (September 2024).

(4) Waste types to be sampled (Source Category)

The following four types of waste will be sampled.

1) Household waste

2) Commercial waste

3) Industrial waste (non-hazardous)

4) Mixed waste

4) Mixed waste is set up for the purpose of ascertaining the average composition of waste delivered to Seelong Sanitary Landfill. Delivery vehicles will be randomly selected for sampling (for example, one vehicle is selected from every three delivery vehicles for waste sampling), and waste from multiple vehicles are then mixed for analysis.

(5) Items of waste quality analysis

The following analyses was carried out for four waste samples in each season mentioned in (3) and (4) above.

1) Material fraction analysis

2) Proximate analysis

3) Ultimate analysis

4) Ash elemental analysis

1) Waste fraction Analysis

In order to obtain accurate material fraction data, it was planned that the collected 200 kg of waste sample is sorted into the following 16-material fractions.

- Food Waste
- Fruit Husk
- Yard Waste
- Paper
- Tetrapak
- Plastic
- Dry Wood
- Textile
- Rubber and Leather
- Metal
- Glass
- Nappies
- Face Mask
- Hazardous Waste related to COVID-19

- Other Hazardous Waste
- Others

It is also possible to make comparisons with existing Japanese waste composition data by reclassifying the 16-material fraction data into the 7-material fraction data which is commonly used in Japan (*).
(*) 7-material fractions: 1) paper, 2) textiles, 3) synthetic resins/rubber/leather, 4) wood/bamboo/grass/straw, 5) kitchen waste, 6) noncombustible materials, and 7) others (miscellaneous materials).

2) Proximate analysis

The analysis items and applied standard methodologies are listed as below.

・ Moisture Content	ASTM Standard D3173:2011
・ Combustibles	ASTM Standard D3174:2011
・ Ash Content	ASTM Standard D3174:2011
・ Lower Heating Value (LHV)	BS EN ISO 14918:2009
・ Bulk Density	ASTM E1109-86:2009

3) Ultimate analysis

The analysis items and applied standard methodologies are listed below.

・ C	BS EN ISO 16948:2015
・ H	BS EN ISO 16948:2015
・ N	BS EN ISO 16948:2015
・ O	Calculated with C, H, N, S, Cl and Ash content
・ S	BS EN ISO 16948:2015
・ Cl	BS EN ISO 16994:2015

4) Ash Elemental Analysis

The elemental items to be analyzed for ash composition are listed below. ICP optical emission spectrometry was used to analyze metal elements, and the APHA 4500-F-D method was used to analyze fluorine.

Ca, Si, Al, Mg, Pb, Zn, Na, K, Cu, Cd, F, Hg, Fe, Ti, Sb, As, Cr, Co, Ni, V

(6) Sampling Method

Sampling method was planned to obtain representative data as much as possible, based on the method published by the Japanese Ministry of Environment (Notice No.95).

The flow of waste sampling and analysis is shown in **Figure 3-6**. Material fraction analysis and unit volume weight (waste bulk density) measurements was performed on-site at the landfill site using a 200 kg waste sample collected. Based on the results of the material fraction analysis obtained, a 2 kg mixed waste sample was prepared and brought back to the lab. Then, proximate analysis, ultimate analysis, and ash elemental analysis was performed.

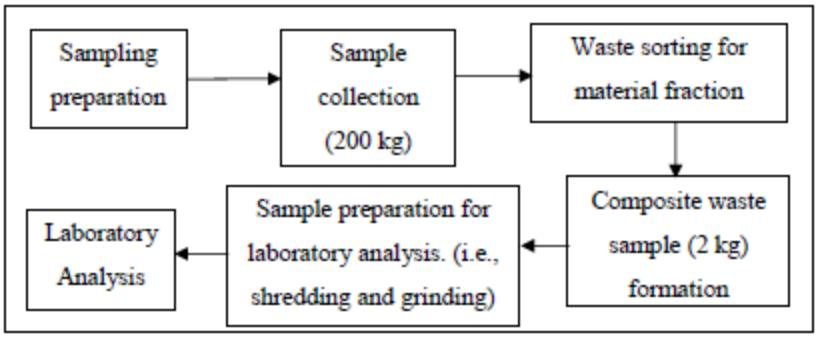

Figure 3-6 Flow of waste sampling and analysis

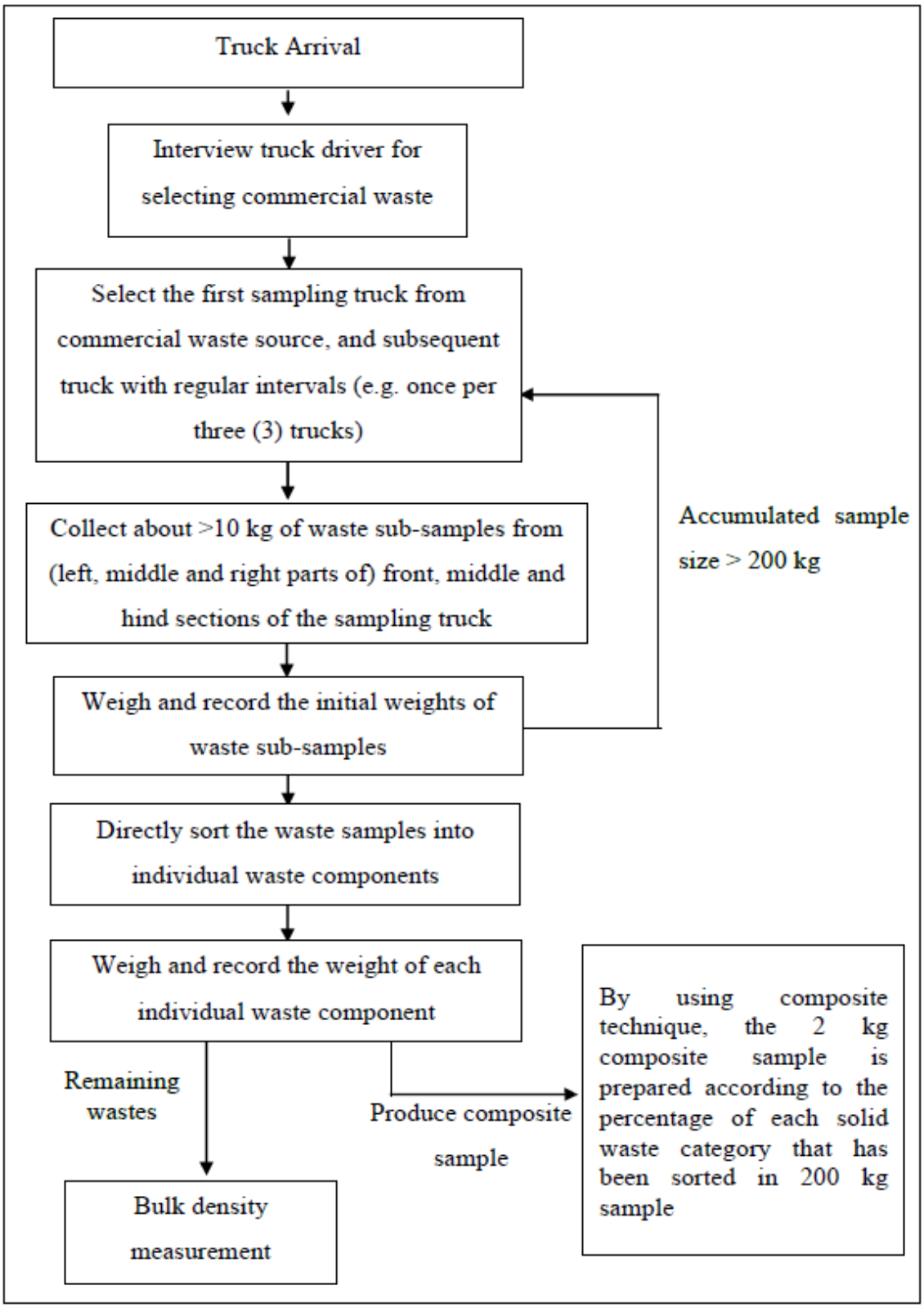

Figure 3-7 Waste sampling flow in the landfill site (this is an example for commercial waste)

Table 3-7 shows the on-site waste sampling flow in the landfill site. At first, the truck driver was

interviewed to determine the origin of the truck (e.g., commercial area). Once the truck's details were identified, they were guided to the designated sampling location in the landfill site. We took care not to bias the waste quality as much as possible by guiding the target trucks to the sampling location with a predetermined interval (e.g., once per three trucks). At least 10 kg each were collected from several delivery vehicles, for a total of 200 kg per sample. When sampling from each delivery truck, the waste was sampled from the front, center, and rear of the loading area, respectively, and mixed to ensure that the waste was representative of each delivery truck as much as possible. (**Table 3-8Figure 3-8**)

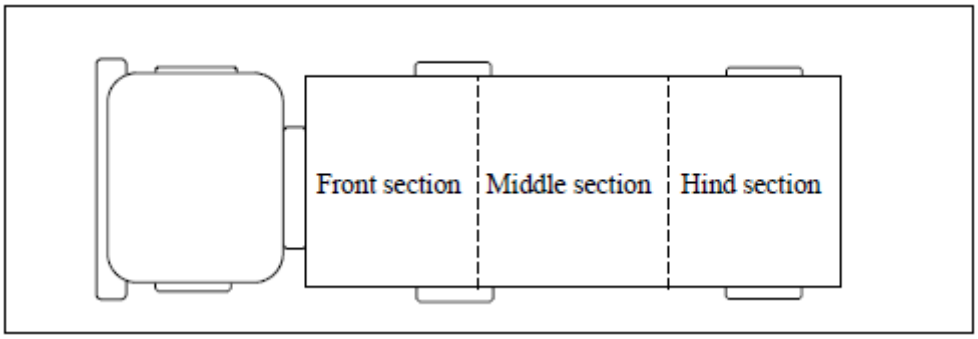

Figure 3-8 Sampling locations from each delivery trucks

3.5 Results of waste investigation

3.5.1 Schedule of waste sampling and analysis

The schedule for waste sampling and analysis for FY 2023 project is shown in **Table 3-6**.

Table 3-6 Schedules of waste sampling and analysis

No	Task	Start Date	End Date	Year 2023											
				October				November				December			
				W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Site entry approval	31/10/2023													
2	Sampling preparation	1/11/2023	3/11/2023												
3	Waste sampling and sorting	7/11/2023	10/11/2023												
4	Sample preparation for lab analyses	7/11/2023	10/11/2023												
5	Lab analyses	12/11/2023	30/11/2023												
6	Data analyses	12/11/2023	9/12/2023												
7	Report preparation and submission	9/12/2023	16/12/2023												

Figure 3-9 Group photo taken at the time of witnessing the waste sampling activity, on 7th of Nov. 2023

3.5.2 Amount of Waste Delivered per Waste Type (Source Category)

Table 3-7 shows the average daily waste delivery volume during the two-week period around the waste sampling period (October 30-November 12, 2023). The average daily waste delivery during the period was 2,175 t/d, which is higher than the 1,721 t/d in 2021 in the waste delivery data (**Figure 3-10**) obtained from SWME in the previous fiscal year (FY2022), suggesting that the amount of waste received at the Seelong landfill is on the increase, We will continue to monitor the trend of the waste volume in the next fiscal year's project. It should also be noted that, as mentioned earlier in 3.4.2, the amount of waste received is expected to increase by about 300 t/d around 2025 with the start of operation of the Pekan Nanas Solid Waste Transfer Station.

In terms of waste type (source category), residential waste was the most common, accounting for 79.8% of the total amount of waste delivered, industrial waste (non-hazardous waste) accounted for 11.7%, and commercial waste 4.5%. Institutional waste and bulky waste, which were not included in the waste quality survey, together accounted for 4% of the total.

Table 3-7 Amount of waste delivered in Seelong Landfill (for each waste type (source

category))

	Waste Type				Total
	Residential	**Commercial**	**Industrial**	**Institutional & Bulky**	
Daily Average of Waste Delivered (t/d)	1,736	98	255	86	2,175
Annal Waste Delivered (Conversion Ref.) (t/year) *1	633,479	35,810	92,947	31,547	793,784
Ratio (%)	79.8%	4.5%	11.7%	4.0%	100.0%

*1: Average daily delivery volume simply multiplied by 365

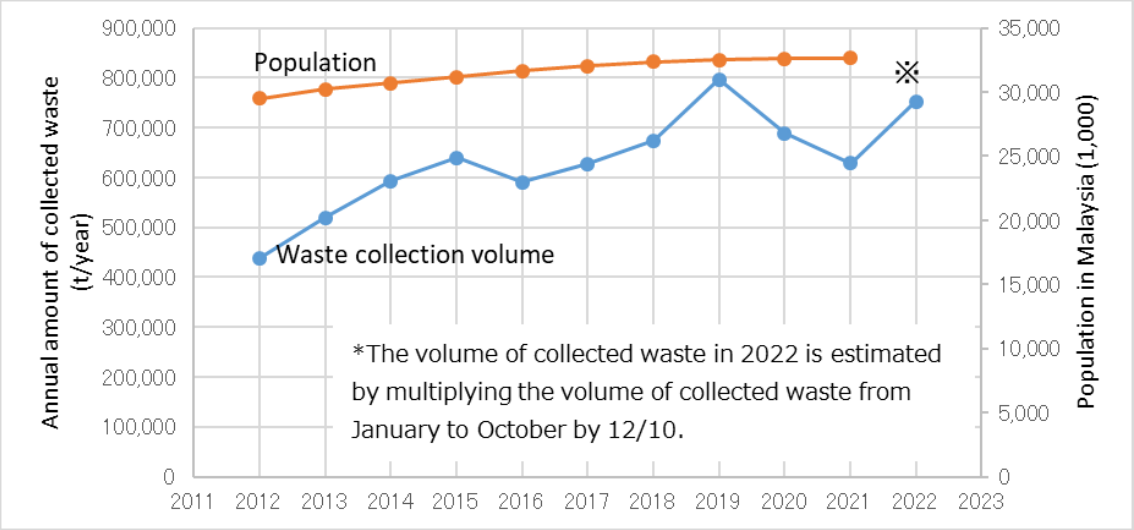

Figure 3-10 Trend of the annual waste delivery in the Seelong Sanitary Landfill (Reprinted from the FY2022 report)[5]

[5] Source from Malaysian population data：Department of Statistics Malaysia Official Potal (https://www.dosm.gov.my/v1/index.php)

3.5.3 Waste Material Fraction

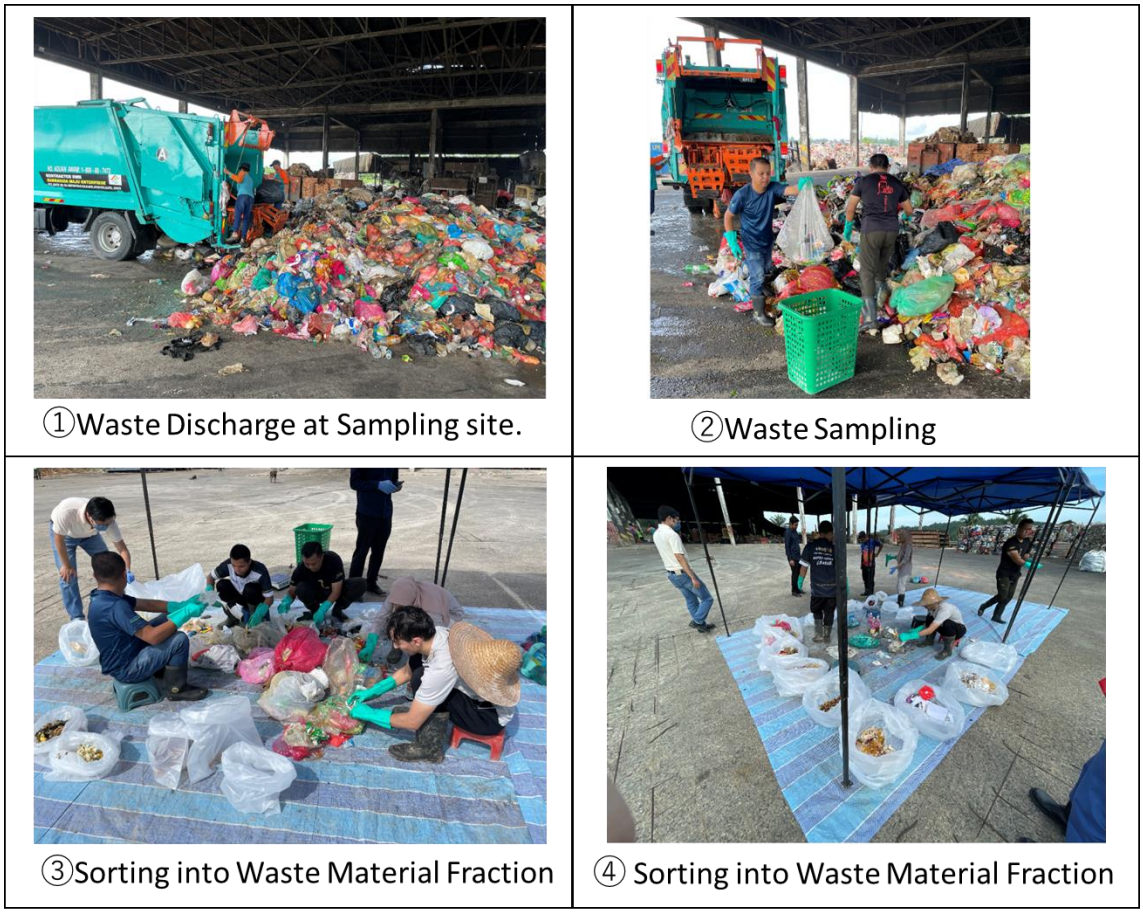

Figure 3-11 Picture of waste sampling and material fraction sorting work, on 7th of Nov. 2023

Table 3-8 Waste material fraction analysis results for each waste type (source category)

No.	Material Fraction	Sub-fraction	Material Fraction (wt.%wet)			
			Residential	Commercial	Industrial	Mixed waste
1.	Food Waste		**32.4**	**33.2**	**5.2**	**24.2**
		Avoidable Food Waste	11.3	15.8	2.8	10.4
		Unavoidable Food Waste	21.1	17.4	2.4	13.8
2.	Fruit Husk	-	2.0	0.0	0.0	0.4
3.	Yard Waste	-	0.3	0.1	0.6	0.0
4.	Paper		**14.6**	**22.1**	**19.6**	**11.1**
		Mixed Paper	2.1	6.4	0.8	1.4
		Newsprint	0.0	0.0	0.0	0.0
		Corrugated Paper	0.1	3.7	11.6	3.9
		Non-recyclable Paper	12.4	12	7.2	5.8
5.	Tetrapak	-	0.8	0.2	0.2	0.8
6.	Plastic		**23.3**	**22.3**	**34.5**	**29.4**
		Rigid	7.2	6.6	9.5	7.7
		Foam	0.8	1.5	12.8	3.0
		Film	15.3	14.2	12.2	18.7
7.	Dry Wood	-	0.4	8.2	27.3	3.8
8.	Textile	-	2.6	1.1	1.7	5.6
9.	Rubber and Leather	-	0.4	0.4	0.3	8.0
10.	Metal*	-	1.9	1.6	2.7	2.5
11.	Glass*	-	3.6	5.7	0.2	1.5
12.	Nappies	-	13.7	2.2	0.1	4.2
13.	Face Mask	-	0.4	0.1	0.3	0.2
14.	Hazardous Waste related to COVID-19*	-	0.0025	0.0	0.0	0.0
15.	Other Hazardous Waste*	-	0.4	1.1	0.4	0.4
16.	Others*	-	3.3	2.0	7.2	8.1

* Not included in laboratory analysis

Table 3-8 summaries the material fraction of all waste type (source categories). The material fraction varies depending on the waste source categories. For instance, in the commercial waste source category, the “food waste” was more prominent than others. For the “plastic” waste, it was more dominant in the industrial waste sources category. “Food”, “plastic”, and “paper” were the major material fractions for all sources. Meanwhile, however, “Dry Wood” makes up 27.3% of the large percentage of the total, as in the case of industrial waste. It should be noted that material fractions marked with * ("Metal", "Glass, Hazardous Waste related to COVID-19", "Other Hazardous Waste", and "Others") are not subject to laboratory analyses such as proximate analysis, ultimate analysis, and ash elemental analysis. **Figure 3-12**shows photographs of the material fractions after sorted out.

In **Table 3-8** and **Figure 3-13**, commercial waste demonstrated the highest “Food Waste” material fraction at 33.2%, followed by residential, mixed, and industrial waste at 32.4%, 24.4%, and 5.2%, respectively. The high fraction of “Food Waste” in commercial waste is associated with the location

of waste collection. Based on the data survey conducted from 1/11/2023 to 3/11/2023 (Sample Preparation, **Table 3-5**), commercial waste collection covers various locations, including shop lots, super/hypermarkets, and wet markets. Therefore, it is expected that these collection points are the major contributors to “Food Waste” disposal, especially in waste collected from wet markets. In addition, “Plastic Waste” was the second major fraction after “Food Waste” in every waste source, in which the industrial waste category had the highest “Plastic Waste”, accounting for 34.5%, followed by mixed, residential, and commercial waste with 29.4%, 23.3%, and 22.3%, respectively. Analysing "Plastic Waste" sub-fractions, it was observed that "Plastic Film" dominates the composition in "Residential", "Commercial", and "Mixed Waste", compared to other plastic sub-fractions ("Plastic Form" and "Rigid Plastic"). Meanwhile, the "Plastic Foam" sub-fraction in industrial waste was slightly higher than other plastic sub-fractions (**Figure 3-15**). For the "Rigid Plastic" sub-fraction, the material fraction percentages for all waste sources ranged from 6.6% to 9.5%, with industrial waste having the highest composition.

In addition, for all waste sources categories, the third major component was "Paper Waste". Commercial waste had the highest "Paper Waste" fraction at about 22.1%, followed by industrial (19.6%), residential (14.6%), and mixed waste (11.1%). In the sub-fraction classification, "Non-Recyclable Paper Waste" emerged as the major sub-fraction when compared to "Corrugated Paper", "Mixed Paper", and "Newsprint" waste (**Figure 3-13**, **Figure 3-14** and **Figure 3-16**). However, for industrial waste sources, "Corrugated Paper" waste was higher than "Non-Recyclable Paper" waste, constituting 11.6% and 7.2%, respectively (**Figure 3-15**). Apart from these major material fractions, other fractions were found to have high percentages in specific waste sources. For instance, as previously mentioned for "Dry Wood" waste, industrial waste sources exhibited the highest "Dry Wood" waste fraction at 27.3%, followed by commercial waste at 8.2%, and mixed and residential waste sources at 3.8% and 0.4%, respectively.

Furthermore, the waste fraction from "Nappies" appears to be significant in residential sources, accounting for 13.7%, followed by mixed waste and commercial at 4.2% and 2.2%, respectively. Among all waste source categories, mixed waste sources were observed to have much more noticeable "Rubber and Leather" and "Textiles" waste fractions at 8.0% and 5.6%, respectively, while the others demonstrated much lower fractions. For the "Glass" waste fraction, commercial and residential was observed to have high percentages at 5.7% and 3.6%, respectively, while for metal waste, industrial and mixed waste was higher, compared to residential (1.9%) and commercial (1.6%). For "Fruit Husk" waste fraction, it was observed to be present only in the waste from residential and mixed waste source categories. The waste fraction percentages were about 2.0% and 0.4%, respectively. This low "Fruit Husk" waste fraction is a consequence of a minor fruit season occurring in November. This low

percentage of "Fruit Husk" can be attributed to the fact that November was a minor fruit season compared to other fruit seasons (e.g. July).

Specifically related to fruit waste, it is directly proportional to the fruit season. Taking durian as an example, Malaysia generates approximately 320,000 tonnes of durian per year, with only 15-30% of the entire durian being edible. Therefore, an estimated 255,000 tonnes of durian peel end up in landfills across the country[6].

According to the Regional Minister of Agriculture Offices in Johor and Pulau Pinang, the fruit season is considered minor in November. In Malaysia, the main fruit season occurs from April to July in northern Malaysia and June to September in southern Malaysia. In addition, for some regions experiencing a dry season, durian harvesting takes place from November to January[7].

[6] Payus, C. M. (2021). *Durian husk wastes as low-cost adsorbent for physical pollutants removal.*

[7] Jabatan Pertanian Negeri Johor. (2018). *Pengurusan Perosak Bersepadu (IPM).* , Jabatan Pertanian Negeri Pulau Pinang. (2020). *Buah-Buahan.*

Figure 3-12 Photo of Waste Material Fraction after sorting

a) sample selection process, b) sample sorting process, c) food waste (ci: unavoidable and cii: avoidable waste), d) fruit waste, e) paper waste (ei: mixed, eii: corrugated and ciii: non-recyclable paper), f) tetrapak, g) plastic waste (gi: rigid, gii: foam and giii: film), h) dry wood, i) textiles, j) nappies, k) metal, l) face mask, and m) hazardous waste.

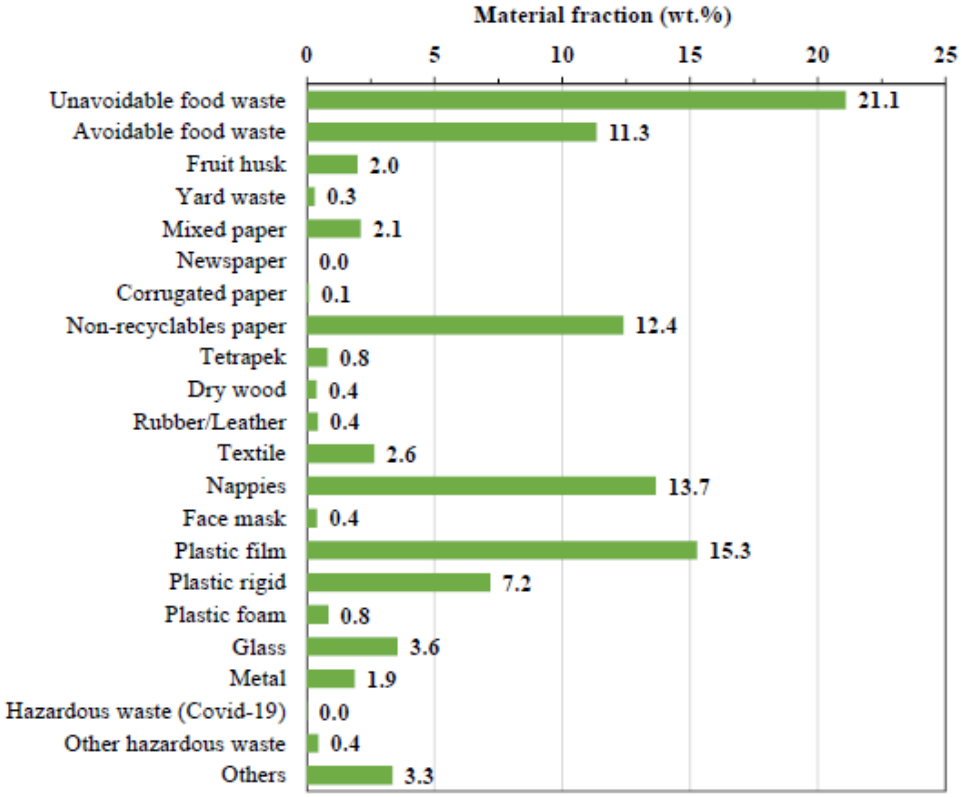

Figure 3-13 Residential Waste Material Fraction

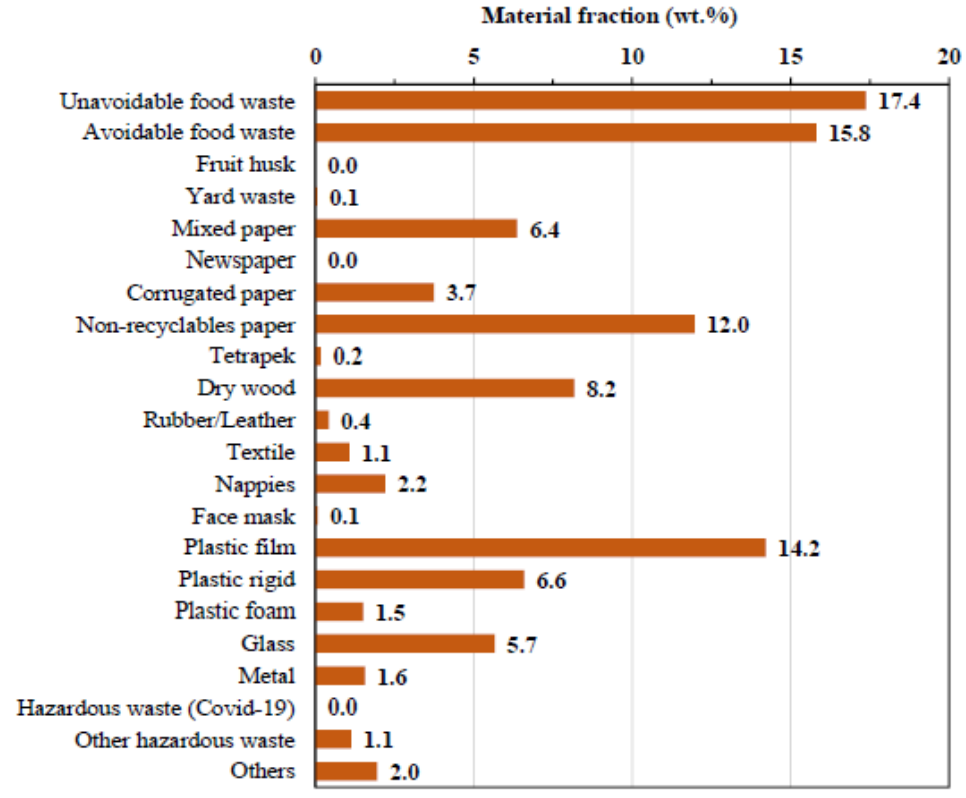

Figure 3-14 Commercial Waste Material Fraction

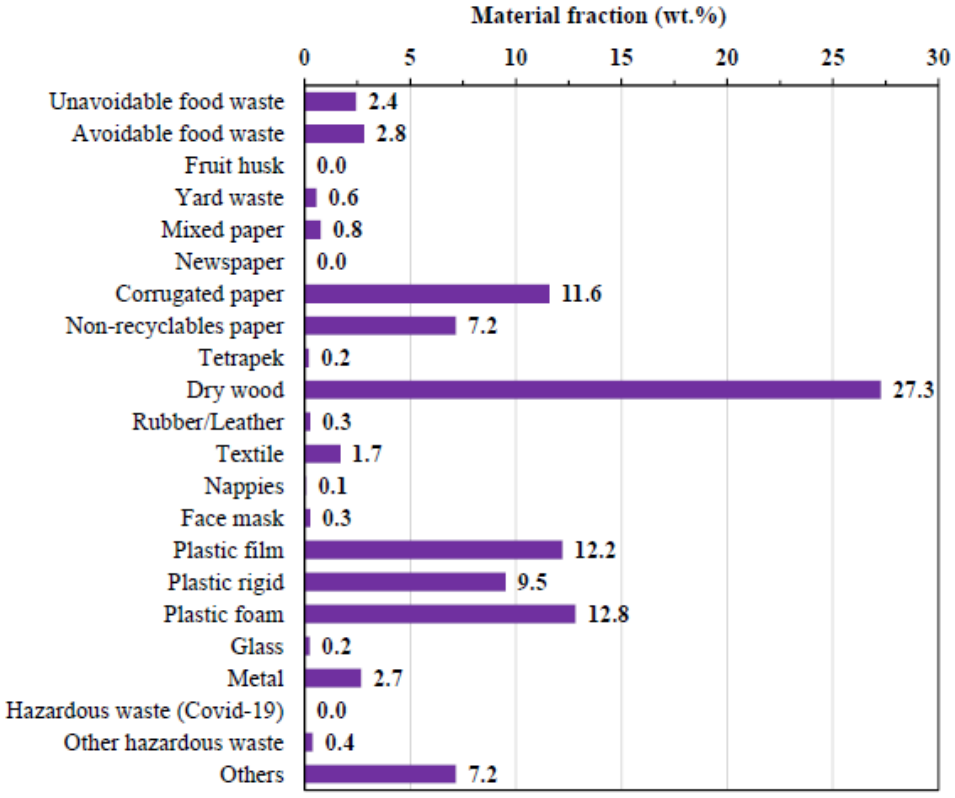

Figure 3-15 Industrial Waste Material Fraction

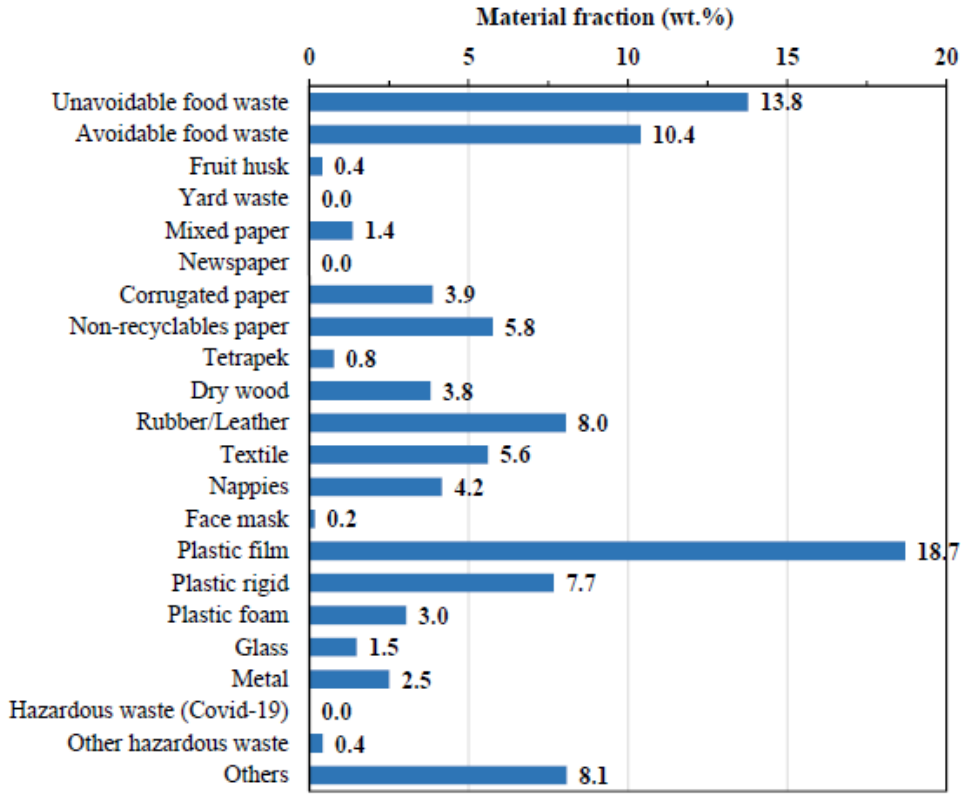

Figure 3-16 Mixed Waste Material Fraction

Table 3-9 shows the results of the material fraction analysis for the four waste types (residential, commercial, industrial, and mixed waste) obtained this time, which were reclassified into the material fraction categories common in Japan. Here, "Nappies", which has high moisture content, are classified as "Kitchen waste/Food waste". It should be noted that the composition of "Residue (fines<5mm)" (i.e., miscellaneous waste of 5mm or less) was left blank as such material fraction was not set by Uni-Technology. In addition, the results of the material fraction analysis voluntarily conducted by SWME in 2022 (previously reported in the FY 2022 project) and the example of material fraction data of Japanese residential waste are also listed in the table.

The results of SWME's voluntary analysis in 2022 and the results of this time analysis of residential waste and mixed waste were similar, but the results of the 2022 analysis showed a higher percentage of "Wood, Bamboo, Grass and Straw". The percentage of "Kitchen waste/Food waste" in the 2022 analysis was 38.5%, which was about the median of the residential waste (48.1%) and mixed waste (28.8%) in the analysis this time.

Comparing the composition of residential waste sampled at the Seelong Landfill with that of Kitakyushu City (analysed in FY2019), which was shown as an example of Japanese waste, the proportion of "Kitchen waste/Food waste" was similar in both cities, while the proportion of "Plastic, Synthetic resin, Rubber and Leather" (23.7%) was about three times higher than that of Japanese waste (7.9%). The percentage of plastics in the above-mentioned Japanese household waste (Kitakyushu City) is low because plastics for containers and packaging are sorted at households and collected separately. Conversely, the percentage of "Papers" was slightly lower in the analysis this time (15.4%) than in Japan (24.0%).

Table 3-9 Comparison to Japan's Waste Material Fraction[8]

	Material Fraction (wt%wet)				Reference	
	Residential	Commercial	Industrial	Mixed waste	SWM data *1	Japanese waste data *2
Papers	15.4	22.3	19.8	11.9	13.4	24.0
Textiles	3.0	1.2	2.0	5.8	5.4	
Plastics, Synthetic resin, Rubber and Leather	23.7	22.7	34.8	37.4	24.9	7.9
Wood, Bamboo, Grass and Straw	0.7	8.3	27.9	3.8	9.3	
Kitchen waste/Food waste	48.1	35.4	5.3	28.8	38.5	46.9
Non-combustibles	5.5	7.3	2.9	4.0	8.7	
Residue (fines <5 mm)						
Others	3.7	3.1	7.6	8.5		21.2
Total	100	100	100	100	100	100

*1 Waste self-analysis results performed by SWME in 2022

*2 Results of residential waste composition study in Kitakyushu City (FY2019) [Kitakyushu City Environmental Council, 2021]

[8] City of Kitakyushu, Environmental Council. (2021). The Second Basic Plan for the Promotion of a Circulating Society in Kitakyushu City. City of Kitakyushu.

3.5.4 Analysis of Waste Proximate and Elemental Composition

Table 3-10 Analysis results of proximate and combustibles elements composition

			Waste Type				Weighted Average
			Residential	Commercial	Industrial	Mixed waste	
Bulk Density		kg/m^3	225	202	133	171	212
Proximate	Moisture	%,wet	41.2	27.7	32.6	35.1	39.5
	Ash	%,wet	13.0	14.1	9.2	7.6	12.6
	Combustibles	%,wet	45.7	58.2	58.2	57.3	47.8
Combustible Elements Composition	C	%,wet	24.35	31.21	29.29	29.16	25.28
	H	%,wet	3.45	4.42	4.18	4.04	3.59
	N	%,wet	0.50	1.09	0.45	0.50	0.52
	O	%,wet	16.70	20.18	23.47	22.87	17.69
	S	%,wet	0.44	0.52	0.50	0.47	0.45
	Cl	%,wet	0.28	0.82	0.34	0.23	0.31
Calorific Value	Higher heating Value (Actual)	kcal/kg	2,470	3,614	2,965	3,122	2,584
	Low Heatingc Value (Actual)	kcal/kg	2,026	3,192	2,544	2,690	2,144
	Low Heatingc Value (Estimate) (*1)	kcal/kg	2,231	3,045	2,690	2,639	2,325

*1: Estimated by Steuer's equation based on the results of elemental composition analysis

Table 3-10 shows the result of bulk density and laboratory analyses of proximate composition, combustible elements composition, and calorific value for all waste source categories. In addition to the analysis results of four waste type conducted sampling (residential, commercial, industrial and mixed waste), the weighted average for the amount of each waste type is shown in the rightmost column. Among the fractions that were not included in the laboratory analysis ("Metal", "Glass", "Hazardous Waste related to COVID-19", "Other Hazardous Waste", and "Others"), "Metal" and "Glass" were assumed to have an ash content of 100%, and their three-component, elemental composition, and calorific value were taken into account in the calculations. "Hazardous Waste related to COVID-19", "Other Hazardous Waste", and "Others" fractions were not considered here. Concerning bulk density, the residential waste source showed the highest value, followed by commercial, mixed, and industrial waste. In addition, in terms of moisture content, residential waste displayed the highest figure at 41.2%, followed by mixed, industrial, and commercial waste at 35.1%, 32.6%, and 27.7%, respectively. The high moisture content was considered to be affected by the material fractions of “Nappies” and “Food waste”.

The ash content was not extremely high for any of the waste types, ranging from 7.6% to 14.1%. In the combustibles, the content of chlorine, a corrosive component, ranged from 0.23% to 0.82% wet, with the highest value in commercial waste. The chlorine content in residential waste was 0.28%, wet, which is similar to the level of the waste composition planned for a new WTE facility in Kitakyushu City, Japan (Shin-Hiagari Waste Incineration Plant, 0.28%, wet), and is not an extremely high number. On the other hand, the sulfur content ranged from 0.44% to 0.52%, wet, with the highest value also

observed in commercial waste. The sulfur content in residential waste was 0.44%, wet, which was notably higher than the 0.11%, wet in the planned waste composition in Kitakyushu City, Japan. [9]

The measured lower heating value (LHV) (wet basis) was 3,192 kcal/kg for commercial waste, followed by mixed waste (2,690 kcal/kg), industrial waste (2,544 kcal/kg), and residential waste (2,026 kcal/kg). The weighted average based on the amount of delivery was 2,144 kcal/kg. The lower heating value estimated by Steuer's equation based on the results of elemental composition analysis was higher than the actually measured heating value for all waste types.

The waste composition (**Table 3-5**), which was set in reference to literature values (results of surveys in 2011 and 2013) in the FY2021 project, was 56.90% of moisture content, 8.20% of ash content, 34.90% of combustibles, and 1,591 kcal/kg of lower heating value. The weighted average of 2,144 kcal/kg of measured values is 1.35 times higher than 1,591 kcal/kg of assumption made in FY2021 project, suggesting that the change in the lifestyle of citizens in the waste-generating area over a period of about 10 years has led to lower moisture content and higher plastics content in the waste. It is suggested that for planning of a WTE facility in the Iskandar region, it will be necessary to review the waste quality assumptions based on the results of the waste surveys made in this year and planned in next year.

Finally, **Table 3-11** shows the results of ash elemental analysis of each waste type.

9 City of Kitakyushu. (2022, 9 15). *New-Hiagari Waste to Energy Plant Construction（PFI）*.

Table 3-11 Results of Ash Elemental Analysis

Parameter		Waste Type			
		Residential	Commercial	Industrial	Mixed waste
Calcium (Ca)	wt% dry	24.5	23.1	26.4	26.7
Silicon (Si)	wt% dry	0.017	0.012	0.014	0.014
Aluminium (Al)	wt% dry	1.9	2.0	1.8	3.4
Iron (Fe)	wt% dry	1.4	0.6	0.9	1.7
Magnesium (Mg)	wt% dry	1.2	1.2	1.0	1.2
Sodium (Na)	wt% dry	9.2	5.3	2.7	1.4
Potassium (K)	wt% dry	2.9	3.8	1.7	0.9
Lead (Pb)	mg/kg dry	3.2	0.7	<0.01	<0.01
Zinc (Zn)	mg/kg dry	87	2143	203	142
Copper (Cu)	mg/kg dry	185	216	259	369
Cadmium (Cd)	mg/kg dry	0.2	<0.1	<0.1	0.3
Fluorine (F)	mg/kg dry	<0.2	<0.2	<0.2	<0.2
Mercury (Hg)	mg/kg dry	<0.01	<0.01	<0.01	<0.01
Titanium (Ti)	mg/kg dry	183	293	226	742
Antimony (Sb)	mg/kg dry	<0.01	<0.01	<0.01	3
Arsenic (As)	mg/kg dry	<0.01	<0.01	<0.01	<0.01
Chromium (Cr)	mg/kg dry	111	76	32	112
Cobalt (Co)	mg/kg dry	6.2	9.3	15	12
Nickle (Ni)	mg/kg dry	58	24	12	41
Vanadium (V)	mg/kg dry	14	16	13	25

3.6 Future Directions

In next year's project, we plan to continue the waste quality survey of this year's project. The waste sampling and analysis work will be conducted at the Seelong Landfill in collaboration with Uni-Technology, as well. The analysis and evaluation of the "non-fruiting season" waste, which could not be included in this fiscal year, will be conducted. A proposed schedule for sampling and analysis is shown in **Table 3-12**.

In the next fiscal year's project, based on the results of the waste analysis conducted this year and scheduled next year, we plan to review the technical specifications and feasibility study for the WTE facility conducted in FY2021.

Table 3-12 Waste Sampling and Analysis Schedule in FY2024

TASK	START DATE	END DATE	Year 2024											
			August				September					October		
			W1	W2	W3	W4	W1	W2	W3	W4	W5	W1	W2	W3
Site entry approval		11/8/2024												
Sampling preparation	14/8/2024	3/9/2024												
Waste sampling and waste sorting	4/9/2024	10/9/2024												
Sample preparation for lab analyses	4/9/2024	17/9/2024												
Lab analyses	11/9/2024	1/10/2024												
Data analyses	4/9/2024	7/10/2024												
Report preparation and submission	7/10/2024	14/10/2024											*	

*: Milestone

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環境省　御中

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令和5年度　脱炭素社会実現のための都市間連携事業
イスカンダル地域における脱炭素モデルエリア構築事業
（フェーズ2）キックオフミーティング資料

2023年7月13日
株式会社エヌ・ティ・ティ・データ経営研究所
社会・環境戦略コンサルティングユニット

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1. 本年度調査事業の概要
2. 活動計画の詳細
    1. 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
    2. 民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入
3. 現地及び国内調査
4. 事業計画

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1. 本年度調査事業の概要

都市間連携に基づく、ゼロカーボン先行エリア創出事業

- イスカンダル・マレーシアはジョホール南部に位置し、面積2217km^2、人口約2.23百万人のマレーシア第二の経済都市である。
- 2019年度～2021年度まで、北九州市の経験とノウハウを生かして産業共生・エコタウン・廃棄物発電の事業化を検討。3か年の活動成果をCDP（Comprehensive Development Plan）Ⅲに反映させる計画。
- 2022年度からは、イスカンダル地域においてゼロカーボン先行エリアを生み出すべく、北九州の有するゼロカーボンシティ実現のための計画策定ノウハウ等を活用し、産業部門・民生部門において、わが国の先端的な技術を用いた先行プロジェクトを創出、脱炭素モデルエリアの構築を目指す。

北九州市 ⇔ 協力関係 LOU ⇔ **IRDA（イスカンダル地域開発庁）** ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

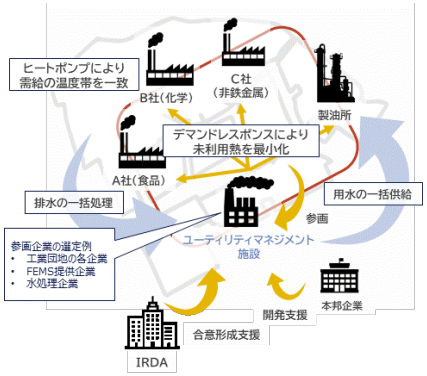
蓄積したノウハウの提供

令和5年度　脱炭素社会実現のための都市間連携事業委託業務

活動1

産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

各企業の廃熱・排水の処理状況を踏まえ、業種・企業の壁を超えた工業団地全体のエネルギーマネジメント、用排水の一括供給・一括処理を目指した検討を行う。
本年度は、候補工業団地における排水・排熱等の発生状況等や用排水の設備・パイプライン等のインフラ整備状況調査を実施する。また、参画候補企業の選定を実施し、コンソーシアムを形成・協議することでパイロットプロジェクトへの組成を検討する。



活動2

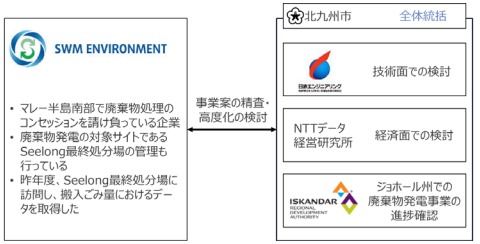
民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

Seelong最終処分場におけるごみ質調査の実施及び、事業計画案の精査・高度化等を実施する。

1）Seelong最終処分場におけるごみ質調査の実施

2）マレーシア国におけるジョホール州での廃棄物発電事業の進捗の確認

3）事業計画案の精査・高度化



先行プロジェクトの創出 ＋ イスカンダル地域内外に横展開可能なモデルエリア構築

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1. 本年度調査事業の概要

昨年度事業の成果と本年度事業の方針

昨年度は下記3つの活動を実施。今年は活動①と活動②-2を昨年度から継続して実施する。

活動	2022年度の成果・課題	2023年度の事業方針
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討	**成果** • マレーシア製造業連合会（FMM）へのヒアリングを実施し、関係性を構築した。 • マレーシア現地の工業団地運営企業へのヒアリングを実施し、関係性を構築した。	• AME DevelopmentとTPM Technoparkの運営する工業団地に入居する個別企業に対してアンケート及びヒアリングを実施 • 排水や排熱の発生状況及び各企業の有している設備等について詳細調査を実施する。
活動②-1 再エネ100%北九州モデルによる太陽光発電設備導入	**成果** • イスカンダル地域における商業施設の太陽光ポテンシャル及び費用対CO2削減効果を試算した。 • マレーシアにおける再エネ導入に関するプログラム及び規制を調査した。	–（本年度は活動なし）
活動②-2 ベースロード電源としての廃棄物発電設備導入	**成果** • Seelong最終処分場に訪問し、現地の搬入ごみ量に関するデータを取得した。 • UTMとごみ質調査計画について協議を実施した。	• UTMとごみサンプリング及びごみ質分析を実施する。 • 制度設計に関する調査を深堀、事業実施に関連する法制度や課題を整理する。

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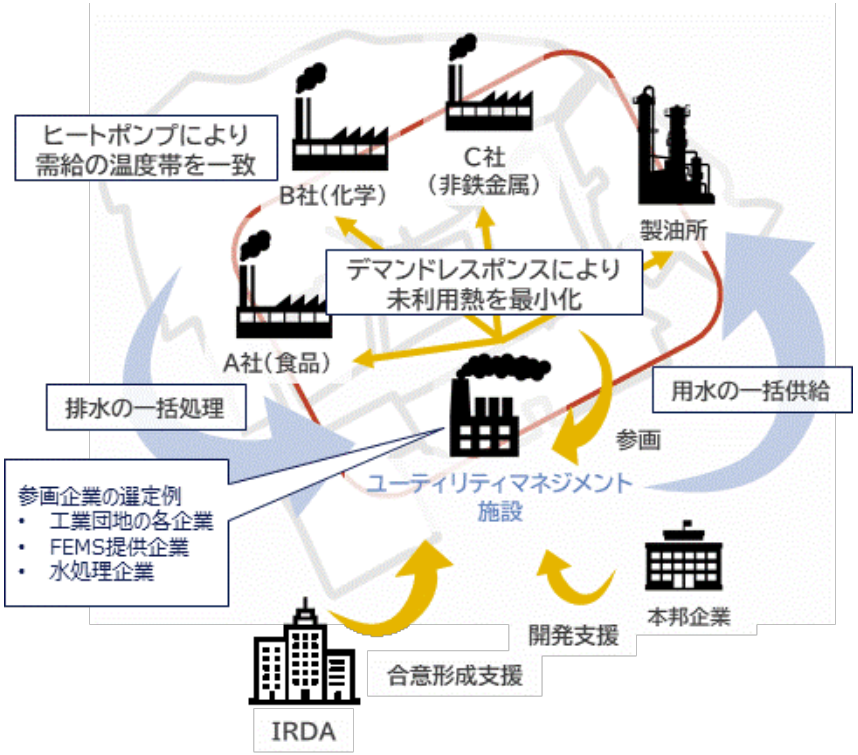
2. 活動計画の詳細
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

活動内容について

産業間連携プロジェクトの創出に向けて以下の活動を実行する

#	Activities	IRDA	北九州市	アミタ	NTTD経営研
1	排熱発生状況等の詳細把握、実現可能性調査	●			●
2	工業団地内の用排水の設備・パイプライン等のインフラ整備状況調査	●			●
3	参画候補企業の選定(現地企業及び上記の関連技術を持つ本邦企業)	●	●	●	●
4	選定した参画候補企業によるコンソーシアムの形成・協議	●	●	●	●



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2. 活動計画の詳細
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
現地工業団地へのヒアリングの実施

昨年度ヒアリングを実施した現地工業団地の協力をいただき、各工業団地に所属している企業へのアンケートを実施する。

AME Development Sdn. Bhd.

- Clean＆Greenコンセプトで管理されている「i-Park」などの開発実績を有する
- i-Parkはジム、プール、ジョギングコース、サイクリングロード、多目的オフィスなどの施設を備え、従業員に健康的なワークライフバランスを提供することを目的としている。
- Senai Airport Cityは、セナイ国際空港の近くに位置する工業団地で195エーカーの広さを誇る

i-Park @ Senai Airport City

TPM Technopark Sdn. Bhd.

- ジョホールコーポレーション（JCorp）グループの産業開発部門（IDD）に属する100%子会社。
- TPM Technoparkは、商業・工業開発のプロジェクトマネジメントサービスや、JCorpが所有する工業用地や不動産の販売促進サービスを実施
- 2011年以降、TPM Technopark は65件以上のプロジェクトを管理し、その総額は1億348万リンギット（約3225万米ドル）にのぼる。

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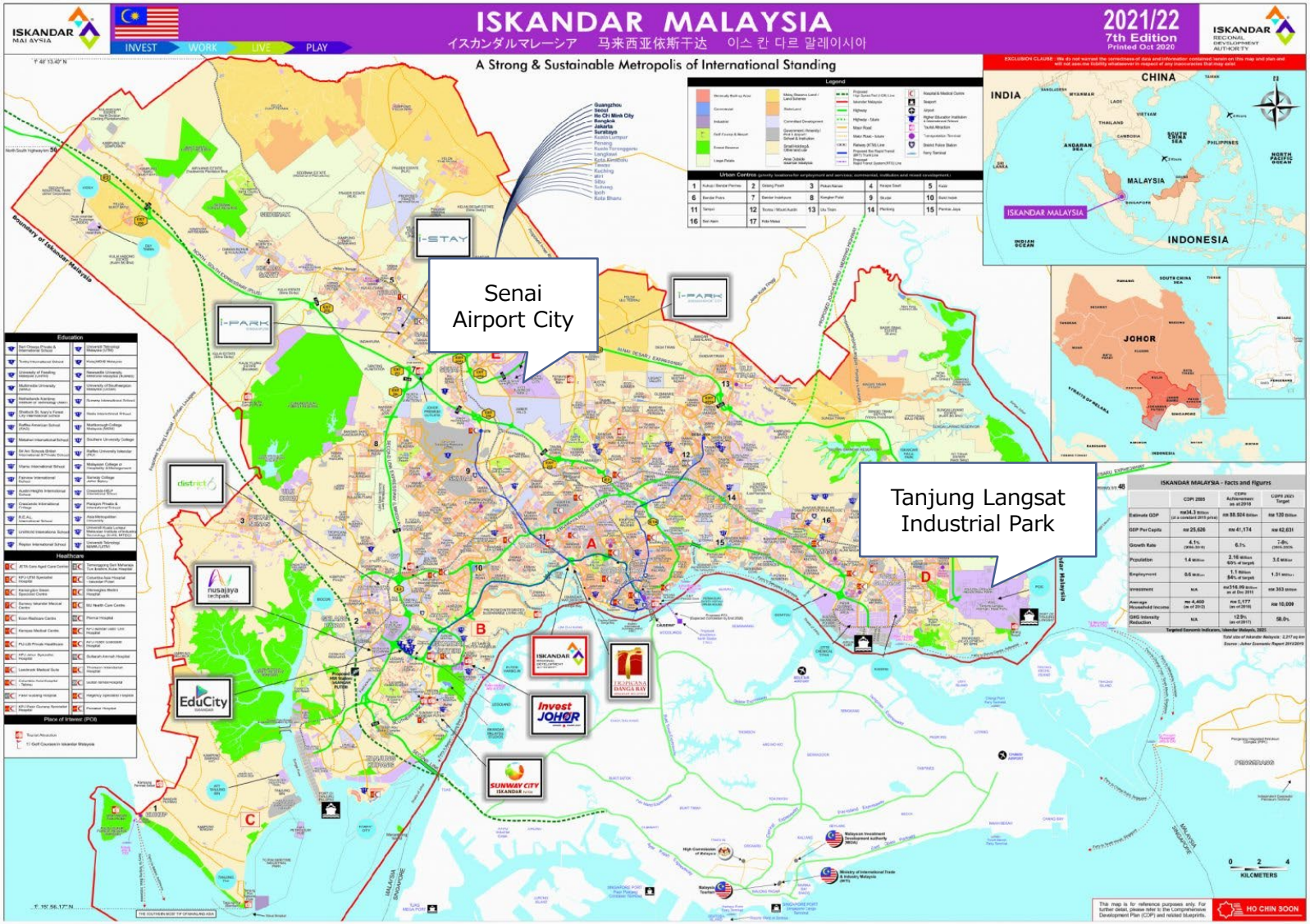
2. 活動計画の詳細
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
（参考）工場の位置関係



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2. 活動計画の詳細
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
現地工業団地へのヒアリング内容

各企業へのヒアリング内容は以下の通り。

1. 工業団地内の各施設に電気や水は一括で供給されているか？
   - ✓ その場合、電力は再生可能エネルギーで供給されているか？
   - ✓ 使用されているエネルギーのうち、再生可能エネルギーは何%か？

2. 水処理、廃熱処理は工業団地内で一括して行っているか？
   /あるいは各工場で行っているか？

3. 脱炭素化に向けた取り組みは実施しているか？
   - ✓ 実施している場合、具体的にどのような取り組みを行っているか？
     (例：電化の推進、省エネ機器の導入など) 。
   - ✓ 実施していない場合、課題として認識されていることはあるか？
     (例：費用対効果など)

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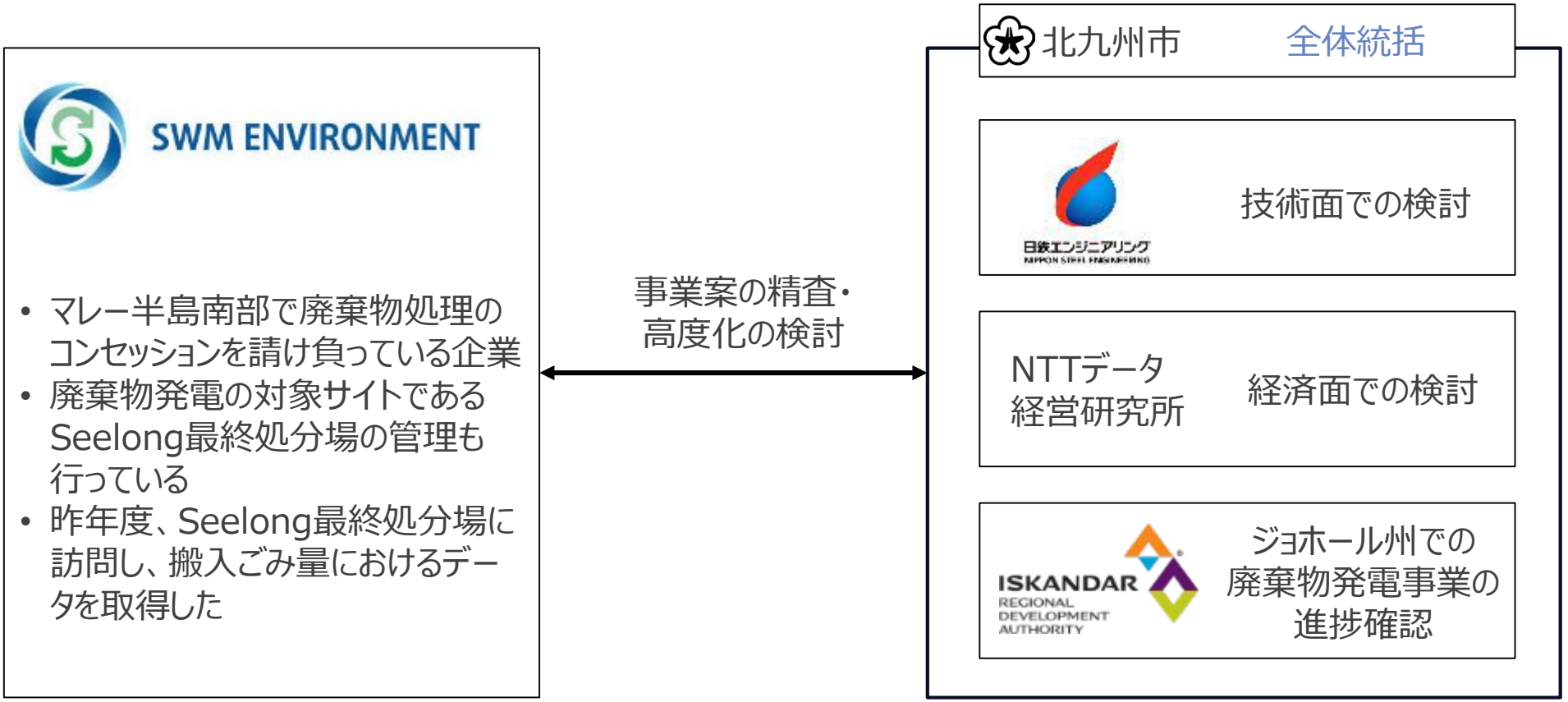
2. 活動計画の詳細
活動② ベースロード電源としての廃棄物発電設備導入

活動内容について

イスカンダル地域における廃棄物発電事業の進捗を確認するとともに、現地企業（SWM Environment Sdn. Bhd. 他）との連携による事業案の精査・高度化の検討を実施する



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2. 活動計画の詳細
活動② ベースロード電源としての廃棄物発電設備導入
３ヶ年の調査計画案

廃棄物発電に関する調査の3か年計画は以下の通り。

本年度は施設計画の前提に係る情報の調査として処理対象ごみ質に関する調査と事業実施に関連する法制度について調査を実施する。

#	調査内容
1）	施設計画の前提に係る情報の調査と整理 • 処理対象ごみの量及び組成・性状等 • 施設設計に適用される法制度（排ガス・排水基準、耐震基準、焼却灰・飛灰の受入条件等） • 建設予定地（水道、電気、アクセス道路等の基本インフラの整備状況調査）
2）	事業実施に関連する法制度の調査と整理 • 売電制度 • 環境影響評価 • 建設業関連許認可 • 税制・通関手続き
3）	事業実施条件・課題整理 • 官民の適切な責任分担 • IRDAへ期待する役割
4）	事業実施体制の検討
5）	事業採算性の評価 • 概算事業費（施設建設・運営コスト）の算定 • 事業採算性の評価（環境負荷低減効果の算定含む）

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2. 活動計画の詳細
活動② ベースロード電源としての廃棄物発電設備導入
ごみ質調査の実施計画

昨年度Seelong最終処分場のごみ質に関するデータは取得できなかったため、本年度はUni-Technology社と共同でSeelong最終処分場でのごみ質調査を実施する。
計画案は以下の通りである。

#	検討内容	詳細
1	本ごみ質分析調査の目的	① イスカンダル地域におけるごみ種毎の発生量の把握 ② 上記ごみ種毎のごみ種類組成（Waste Fraction）データの取得 ③ 上記ごみ種毎のごみ質分析（物理的・化学的性状）データの取得
2	サンプリング場所及びサンプリング時期	• Seelong最終処分場においてごみサンプリングを実施 • 果実季（2023年11月予定）と非果実季（2024年度予定）の2回に分けて実施
3	サンプリング対象ごみ種	① 家庭ごみ ② 産業系廃棄物（有害廃棄物でないもの） ③ 商業系廃棄物 ④ 混合ごみ
4	ごみ質の分析項目	① 種類組成分析 ② 三成分分析、工業分析 ③ 可燃分元素組成分析 ④ 灰分元素組成分析
5	サンプリング方法	ごみのサンプリング方法は日本における環整95号に規定されるサンプリング方法を基本としながら、極力代表性のあるごみのサンプリングができる方法を採用
6	サンプリング及び分析のスケジュール	2023年10月～2024年10月を想定

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3. 現地及び国内調査

現地調査においては基本的にIRDAを通じてオンラインで実施するが、必要に応じて現地渡航も実施する。
また国内企業の情報収集も実施する。

1. 現地調査および情報共有等
   - 現地調査にあたっては、現地傭人および現地企業を活用し行う。但し必要に応じて現地渡航を実施する。
   - 現地調査、ワークショップ等の情報共有はオンラインにて行う

2. 国内調査およびオンライン調査
   - 本邦企業の発掘のため、国内の企業情報の収集等（オンライン調査を含む）を実施する

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4. 事業計画

～2021年 | 2022～2024年（3ヵ年） | 2025年～

■ 都市間連携調査実施
（2015年&2016年、2019～2021年）

■ 2050CN達成に向けた
モデルエリアの横展開

	2022年度	2023年度(2カ年目：本事業)			2024年度
		7～9月	10～12月	1～3月	
活動1：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討	マレーシア製造業連合会（FMM）へのヒアリングの実施 マレーシア現地の工業団地運営企業へのヒアリングの実施	排熱発生状況等の詳細把握、実現可能性調査 工業団地内の用排水の設備・パイプライン等のインフラ整備状況調査	参画候補企業の選定（現地企業及び関連技術を持つ本邦企業）	選定した参画候補企業によるコンソーシアムの形成・協議	JCM設備補助等を活用したﾊﾟｲﾛｯﾄﾌﾟﾛｼﾞｪｸﾄの立ち上げ合意
活動2：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入	Seelong最終処分場の搬入ごみ量に関するデータを取得	マレーシア国におけるジョホール州での廃棄物発電事業の進捗の確認 UTMとSeelong最終処分場におけるごみ質調査を実施		調査結果を基に事業案の精査・高度化の検討	中長期のプロジェクトの具体化（3~5年以内）
現地との打ち合わせ		1～2か月に1度IRDAと打ち合わせを実施するほか、個別企業とのワークショップやメールフォローを適宜実施			
報告書の作成 御省との打合せ		●契約 月次報告 ●キックオフ	●中間打合せ	●報告書提出 ●最終打合せ	（※打合せは、必要に応じて追加）

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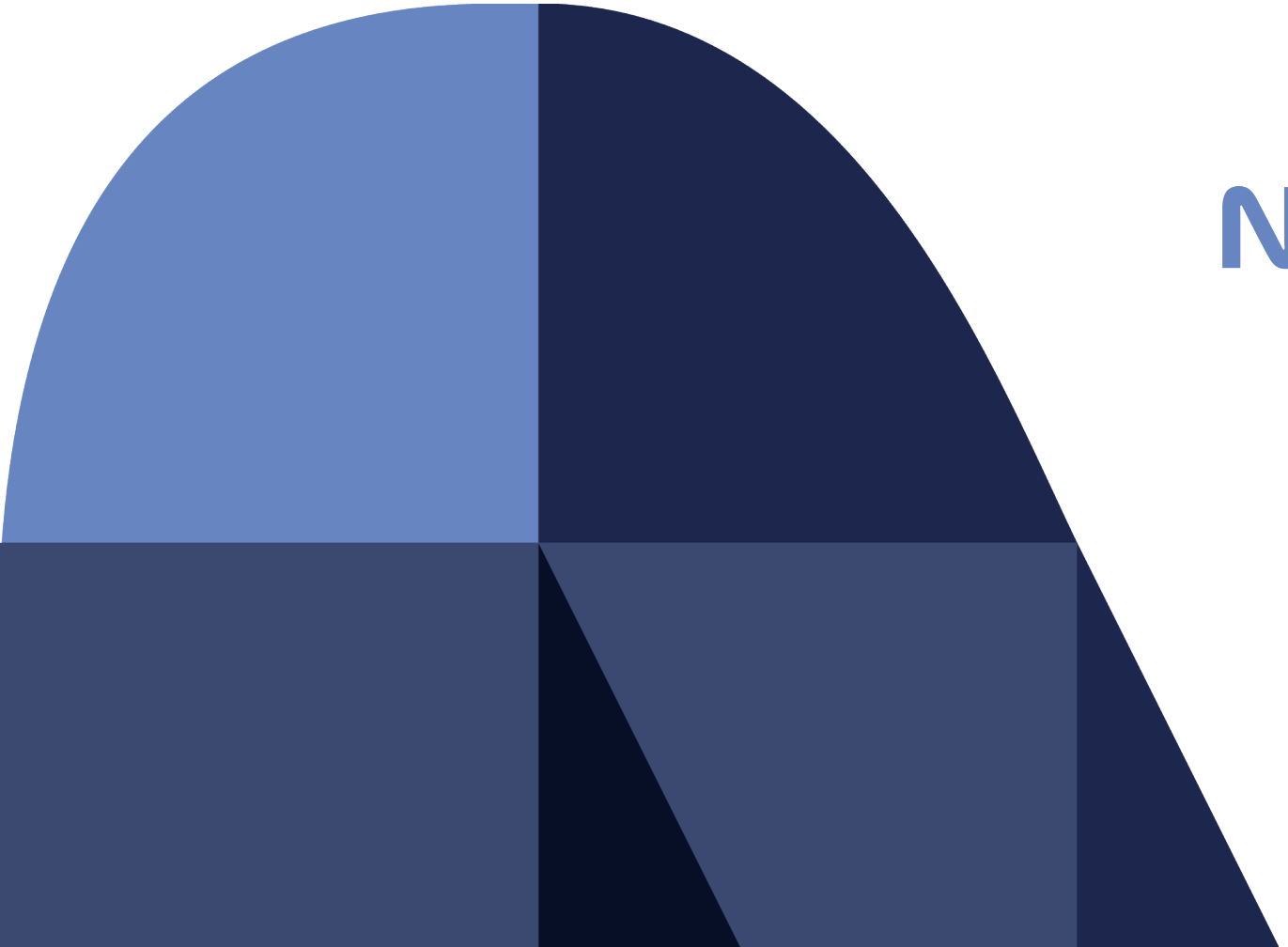

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情 報 種 別 ： 秘密（関係者限り）
会　社　名 ： NTTデータ経営研究所
情報所有者 ： 社会・環境戦略コンサルティングユニット

環境省　御中

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令和5年度　脱炭素社会実現のための都市間連携事業
イスカンダル地域における脱炭素モデルエリア構築事業
（フェーズ2）中間報告資料

2023年11月14日

株式会社エヌ・ティ・ティ・データ経営研究所
社会・環境戦略コンサルティングユニット

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1. 本年度事業の概要
    1. 調査事業の全体像
    2. 活動内容の詳細
    3. 事業計画

2. 7月からの進捗状況

3. 今後の予定

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1. 本年度事業の概要
1.1本年度事業の全体像

都市間連携に基づく、ゼロカーボン先行エリア創出事業

- イスカンダル・マレーシアはジョホール南部に位置し、面積2217km^2、人口約2.23百万人のマレーシア第二の経済都市である。
- 2019年度～2021年度まで、北九州市の経験とノウハウを生かして産業共生・エコタウン・廃棄物発電の事業化を検討。3か年の活動成果をCDP（Comprehensive Development Plan）Ⅲに反映させる計画。
- 2022年度からは、イスカンダル地域においてゼロカーボン先行エリアを生み出すべく、北九州の有するゼロカーボンシティ実現のための計画策定ノウハウ等を活用し、産業部門・民生部門において、わが国の先端的な技術を用いた先行プロジェクトを創出、脱炭素モデルエリアの構築を目指す。

北九州市 ⇔ 協力関係 LOU ⇔ **IRDA（イスカンダル地域開発庁）** ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

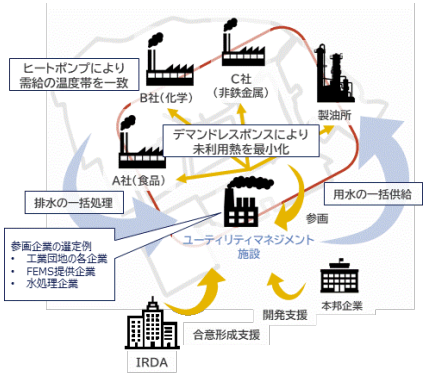
蓄積したノウハウの提供

令和5年度　脱炭素社会実現のための都市間連携事業委託業務

活動1

産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

各企業の廃熱・排水の処理状況を踏まえ、業種・企業の壁を超えた工業団地全体のエネルギーマネジメント、用排水の一括供給・一括処理を目指した検討を行う。
本年度は、候補工業団地における排水・排熱等の発生状況等や用排水の設備・パイプライン等のインフラ整備状況調査を実施する。また、参画候補企業の選定を実施し、コンソーシアムを形成・協議することでパイロットプロジェクトへの組成を検討する。



活動2

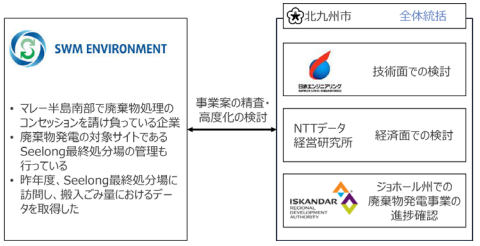
民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

Seelong最終処分場におけるごみ質調査の実施及び、事業計画案の精査・高度化等を実施する。

1）Seelong最終処分場におけるごみ質調査の実施

2）マレーシア国におけるジョホール州での廃棄物発電事業の進捗の確認

3）事業計画案の精査・高度化



先行プロジェクトの創出 ＋ イスカンダル地域内外に横展開可能なモデルエリア構築

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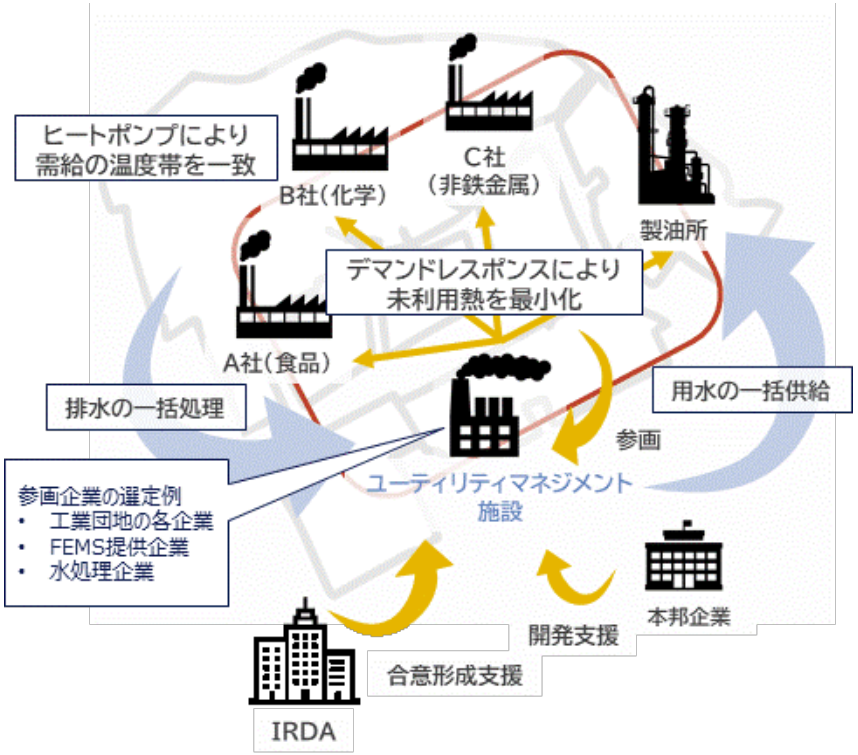
1. 本年度事業の概要
1.2 活動内容の詳細
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

産業間連携プロジェクトの創出に向けて以下の活動を実行する

#	Activities	IRDA	北九州市	アミタ	NTTD経営研
1	排熱発生状況等の詳細把握、実現可能性調査	●			●
2	工業団地内の用排水の設備・パイプライン等のインフラ整備状況調査	●			●
3	参画候補企業の選定(現地企業及び上記の関連技術を持つ本邦企業)	●	●	●	●
4	選定した参画候補企業によるコンソーシアムの形成・協議	●	●	●	●



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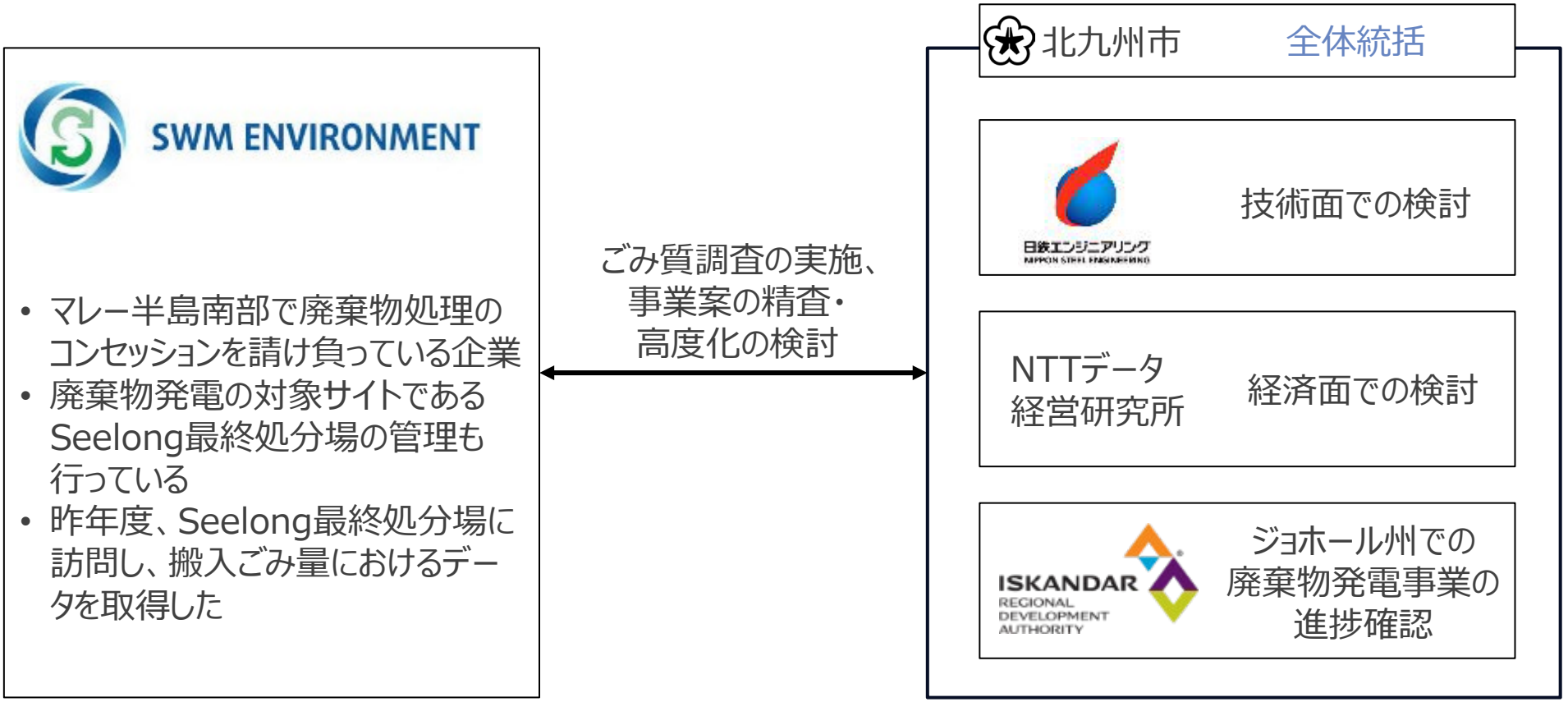
活動② ベースロード電源としての廃棄物発電設備導入

イスカンダル地域における廃棄物発電事業の進捗を確認するとともに、現地企業（SWM Environment Sdn. Bhd. 他）との連携により、本年度は施設計画の前提に係る情報の調査として処理対象ごみ質に関する調査を実施する



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2. 活動計画の詳細
活動② ベースロード電源としての廃棄物発電設備導入

活動内容について

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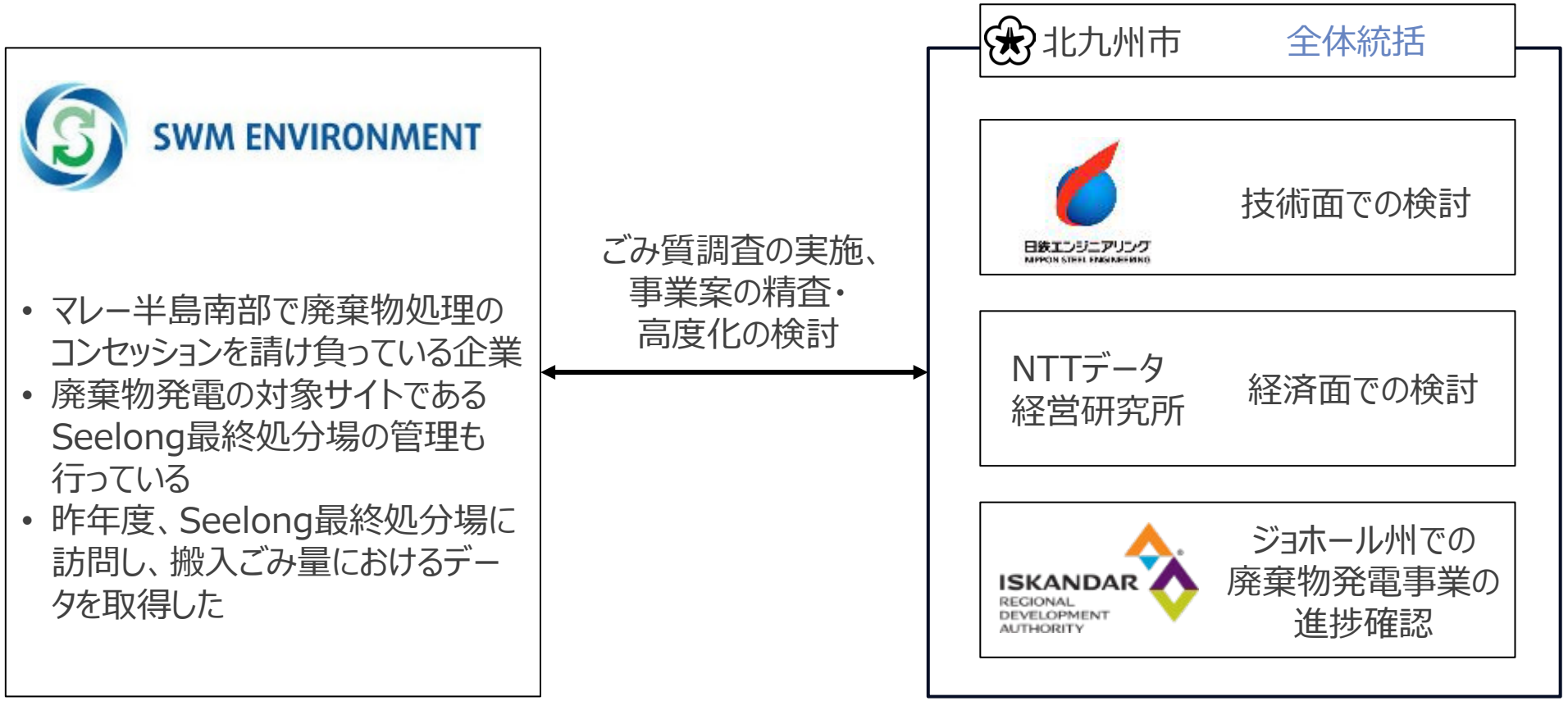

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1. 本年度事業の概要
1.3 事業計画

～2021年
■ 都市間連携調査実施
（2015年&2016年、2019～2021年）

2022～2024年（3ヵ年）

2025年～
■ 2050CN達成に向けた
モデルエリアの横展開

	2022年度	2023年度(2カ年目：本事業)			2024年度
		7～9月	10～12月	1～3月	
活動1：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討	マレーシア製造業連合会（FMM）へのヒアリングの実施 マレーシア現地の工業団地運営企業へのヒアリングの実施	排熱発生状況等の詳細把握、実現可能性調査 工業団地内の用排水の設備・パイプライン等のインフラ整備状況調査	参画候補企業の選定（現地企業及び関連技術を持つ本邦企業）	選定した参画候補企業によるコンソーシアムの形成・協議	JCM設備補助等を活用したﾊﾟｲﾛｯﾄﾌﾟﾛｼﾞｪｸﾄの立ち上げ合意
活動2：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入	Seelong最終処分場の搬入ごみ量に関するデータを取得	マレーシア国におけるジョホール州での廃棄物発電事業の進捗の確認 UTMとSeelong最終処分場におけるごみ質調査を実施		調査結果を基に事業案の精査・高度化の検討	中長期のプロジェクトの具体化（3~5年以内）
現地との打ち合わせ		1~2か月に1度IRDAと打ち合わせを実施するほか、個別企業とのワークショップやメールフォローを適宜実施			
報告書の作成 御省との打合せ		●契約 月次報告 ●キックオフ	●中間打合せ	●報告書提出 ●最終打合せ	（※打合せは、必要に応じて追加）

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1. 本年度事業の概要
    1. 調査事業概要
    2. 活動内容の詳細
    3. 事業計画

2. 7月からの進捗状況

3. 今後の予定

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2．7月からの進捗状況
活動①　産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

現地工業団地へのヒアリングの実施

昨年度ヒアリングを実施した現地工業団地の協力をいただき、各工業団地に所属している企業へのアンケートを実施する。

AME Development Sdn. Bhd.

- Clean＆Greenコンセプトで管理されている「i-Park」などの開発実績を有する
- i-Parkはジム、プール、ジョギングコース、サイクリングロード、多目的オフィスなどの施設を備え、従業員に健康的なワークライフバランスを提供することを目的としている。
- Senai Airport Cityは、セナイ国際空港の近くに位置する工業団地で195エーカーの広さを誇る

i-Park @ Senai Airport City

TPM Technopark Sdn. Bhd.

- ジョホールコーポレーション（JCorp）グループの産業開発部門（IDD）に属する100%子会社。
- TPM Technoparkは、商業・工業開発のプロジェクトマネジメントサービスや、JCorpが所有する工業用地や不動産の販売促進サービスを実施
- 2011年以降、TPM Technopark は65件以上のプロジェクトを管理し、その総額は1億348万リンギット（約3225万米ドル）にのぼる。

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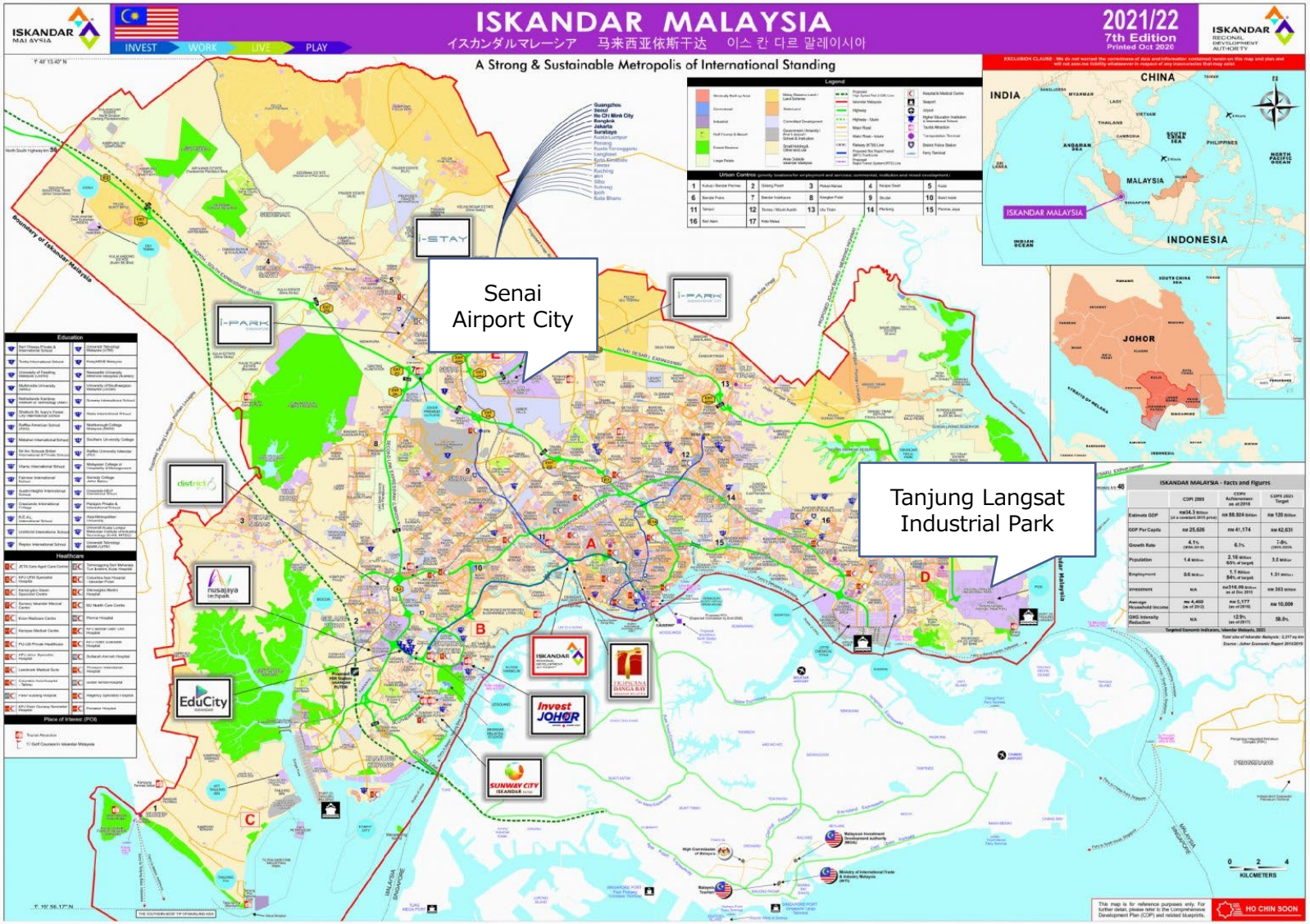
2. 7月からの進捗状況
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
（参考）工場の位置関係



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2. 7月からの進捗状況
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
対象となる事業者の選定

まずは工業団地の運営会社から企業リストを受領し、アンケートを実施する事業者を選定した。今回は排水、排熱を多く排出する化学工業、食品製造業、鉄鋼業、窯業・ 土石製品の業種に絞った。

#	Company name	Type of Industry	#	Company name	Type of Industry
1	ADEKA FOODS (ASIA) SDN. BHD.	Food	24	NORMAN PROCESS OILS MALAYSIA PLANT SDN. BHD.	Chemical
2	ALL PAK INDUSTRIES SDN. BHD.	Chemical	25	NOV FGS MALAYSIA SDN. BHD.	Steel industry
3	BAHRU STAINLESS SDN. BHD.	Steel industry	26	ORYX STAINLESS MALAYSIA SDN. BHD.	Steel industry
4	BRITZ NETWORK SDN. BHD.	Food	27	P.P. CHEMICALS SDN. BHD.	Chemical
5	DAIREN CHEMICAL (M) SDN. BHD.	Chemical	28	PACIFIC OLEOCHEMICALS SDN. BHD.	Chemical
6	DDW COLOURS SDN. BHD.	Food	29	PACKAGING SALES & SERVICES (M) SDN. BHD.	Steel industry
7	EEW MALAYSIA SDN. BHD.	Steel industry	30	PK AGRO-INDUSTRIAL PRODUCTS (M)SDN. BHD.	Food
8	EVYAP SABUN MALAYSIA SDN. BHD.	Chemical	31	POLYNT COMPOSITES MALAYSIA SDN BHD	Chemical
9	FOOD EXCELLENCE SPECIALIST SDN. BHD.	Food	32	RUSHOE LAND AND INDUSTRY SDN. BHD.	Steel industry
10	FOOD SAFE ENTERPRISE SDN. BHD.	Food	33	SAL PACKAGING (M) SDN. BHD.	Chemical
11	GREENPAC (M) SDN. BHD.	Chemical	34	SDP GLOBAL (MALAYSIA) SDN BHD	Chemical
12	INNO-WANGSA OILS & FATS SDN. BHD.	Food	35	SOUND DYNASTY SDN. BHD.	Chemical
13	JAPMAS STEEL SDN. BHD.	Steel industry	36	SOUTHERN STEEL MESH SDN. BHD.	Steel industry
14	KIRAN GLOBAL CHEMICALS SDN. BHD.	Chemical	37	SWANCOR IND. (M) SDN. BHD.	Chemical
15	KNAUF INSULATION SPRL VISE	Ceramic	38	TAICO INDUSTRIES SDN. BHD.	Steel industry
16	LION ECO CHEMICALS SDN. BHD.	Chemical	39	TEMASEK COATING SDN. BHD.	Chemical
17	LOTTE CHEMICAL TITAN (M) SDN. BHD.	Chemical	40	TIMES CERAMICA SDN. BHD.	Ceramic
18	LSOHEM INDUSTRY SDN. BHD.	Chemical	41	UNIGRA FOOD PROCESSING ASIA PACIFIC SDN.	Food
19	MASTIKA BULKING SDN. BHD.	Food	42	VANCE BIOENERGY SDN. BHD.	Chemical
20	MSM MALAYSIA HOLDINGS BERHAD	Food	43	VIKING ASPHALT SDN. BHD.	Chemical
21	MUSIM MASTIKA OILS & FATS (MALAYSIA) SDN. BHD.	Food	44	WHITE HORSE CERAMIC INDUSTRIES SDN. BHD.	Ceramic
22	NEXSOL (M) SDN. BHD.	Chemical	45	YPJ PALM INTERNATIONAL SDN. BHD.	Chemical
23	NIPPON PAINT (M) SDN. BHD.	Chemical			

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2. 7月からの進捗状況
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
現地工業団地へのアンケート内容

各企業へのヒアリング内容は以下の通り。

1	1. 購入している電力のうち、再生可能エネルギー由来の電力の有無/購入割合（%） 2. 使用している蒸気のうち、他社から購入している蒸気の有無 （選択肢：①自社では蒸気を使用していない/②全て他社から購入した蒸気を使用している/③一部他社から購入した蒸気を使用している/④他社から蒸気を購入していない）
2	自社から発生している指定廃棄物の種類、発生量及び処分方法（埋立、焼却、リサイクル、その他）
3	1. 排水・排熱の処理方法（選択肢：①工業団地内で一括で処理されている/②自社で処理を行っている/③処理を行っていない/④そもそも排水・排熱が発生していない） 2. 各工場で処理している場合、自社で処理しているか/委託しているか
4	1. 自社で省エネ対策を実施しているか（Yes/No） 2. 「はい」と答えた場合、具体的にどのような省エネ対策をしているか？ 3. 現在実施している省エネ対策でこれ以上自社のCO_2排出量を下げるのに限界を感じているか？
5	自家発電設備（コジェネ含む）を保有している/熱利用設備を保有している 1. 自家発電設備について、導入している設備種別の個数 2. 自家発電設備の燃料転換、脱炭素化の検討状況（選択肢：①既に対策を実施済み、②未実施であるが方針を決定済み、③現在検討中、④現在未検討であるが今後検討予定、⑤現在未検討であり今後も検討する予定はない） 3. 実施済み、決定済みの対策・方針の内容について
6	1. 熱利用設備について、導入している設備種別の保有数 2. 熱利用設備の燃料転換、脱炭素化の検討状況（選択肢：①既に対策を実施済み、②未実施であるが方針を決定済み、③現在検討中、④現在未検討であるが今後検討予定、⑤現在未検討であり今後も検討する予定はない） 3. 実施済み、決定済みの対策・方針の内容について

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2. 7月からの進捗状況
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
アンケート実施方法・スケジュール

Senai airport cityは現在アンケートを配布し回答を回収中。TLICについては今後現地に訪問し、候補企業に対するワークショップを実施予定。

	AME Development： i-park@ Senai airport city	TPM Technopark Tanjung Langsat Industrial Park
アンケート実施方法	運営会社経由で各企業にメールで アンケート用紙を配布。	対象企業を集め、ワークショップ等を現地で 実施し、アンケート回答を収集する。
対象企業	NDAの関係で企業リストを受領出来ず。そのため 対象企業を絞らずに全社にアンケート用紙を送付	P10に記載の通り、業種により対象企業を ピックアップした
実施時期	10/23～ （当初は11/4が締切であったが、回答の収集率 が良くないため延長中）	12/4～7を予定
アンケート実施後	回答を分析し、産業間連携プロジェクトに参画可能性がある企業に個別ヒアリングを実施	

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2. 7月からの進捗状況
活動② ベースロード電源としての廃棄物発電設備導入
ごみ質調査の実施計画

まずUni-Technology社と共同でSeelong最終処分場でのごみ質調査を開始した。
計画案は以下の通りである。

#	検討内容	詳細
1	本ごみ質分析調査の目的	① イスカンダル地域におけるごみ種毎の発生量の把握 ② 上記ごみ種毎のごみ種類組成（Waste Fraction）データの取得 ③ 上記ごみ種毎のごみ質分析（物理的・化学的性状）データの取得
2	サンプリング場所及びサンプリング時期	• Seelong最終処分場においてごみサンプリングを実施 • 果実季（2023年11月予定）と非果実季（2024年度予定）の2回に分けて実施
3	サンプリング対象ごみ種	① 家庭ごみ ② 産業系廃棄物（有害廃棄物でないもの） ③ 商業系廃棄物 ④ 混合ごみ
4	ごみ質の分析項目	① 種類組成分析 ② 三成分分析、工業分析 ③ 可燃分元素組成分析 ④ 灰分元素組成分析
5	サンプリング方法	ごみのサンプリング方法は日本における環整95号に規定されるサンプリング方法を基本としながら、極力代表性のあるごみのサンプリングができる方法を採用
6	サンプリング及び分析のスケジュール	2023年10月～2024年10月を想定

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2. 7月からの進捗状況
活動② ベースロード電源としての廃棄物発電設備導入
ごみ質調査の実施スケジュール

契約期間は10月12日から開始し、12月16日までに分析レポートの作成が完了するスケジュールである。

TASK	START DATE	END DATE	Year 2023											
			October				November				December			
			W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
Site entry approval		12/10/2023												
Sampling preparation	16/10/2023	5/11/2023												
Waste sampling and waste sorting	6/11/2023	12/11/2023												
Sample preparation for lab analyses	6/11/2023	19/11/2023												
Lab analyses	13/11/2023	3/12/2023												
Data analyses	6/11/2023	9/12/2023												
Report preparation and submission	9/12/2023	16/12/2023										*		

実際は11/7～10の4日間で実施

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2. 7月からの進捗状況
活動② ベースロード電源としての廃棄物発電設備導入
現地訪問

サンプリング時期に合わせてSeelong最終処分場に現地訪問した。

日時	イベント	内容
2023年11月7日 9:00～12:00	• **Seelong最終処分場のサンプリング収集の見学**	• サンプリング収集の実施方法について説明を受けながら実際にサンプリングを実施している様子を見学

日本側参加者：日鉄エンジニアリング 2名
相手側参加者：Uni-Technologies社、IRDA

＜見学結果＞

- Uni-Technologies社による計画書通りに実施
  - ① ごみ集積場にてパッカー車からごみを取り出す
  - ② ごみ20kgを無作為に取り出す。20kg×10台分＝合計200kgを採取
  - ③ 採取したごみは分類表の種別ごとに分別（9名で実施）
- 採取したごみ種別の割合にそって2kgのサンプルをラボに持ち帰って分析予定

▲参加者による集合写真

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7月からの進捗状況
活動②　ベースロード電源としての廃棄物発電設備導入

（参考）サンプリング実施の様子

①サンプリング場所でのごみ排出

②ごみサンプリング

③ごみ種類組成への分別作業

④ごみ種類組成への分別作業

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1. 本年度事業の概要
    1. 調査事業の全体像
    2. 活動内容の詳細
    3. 事業計画

2. 7月からの進捗状況

3. 今後の予定

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3. 今後の予定

活動①　産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討：

- 12月上旬にTLIC内の候補企業に対してワークショップを実施し、アンケート回答を収集
- Senai airport Cityに対しても引き続きアンケート回収を試みる
- アンケート回収後、回答を分析する（12月中を想定）
- 年明け後は、分析の結果、産業間連携プロジェクトに参画可能性がある企業に個別ヒアリングを実施

活動②　ベースロード電源としての廃棄物発電設備導入：

- 12月中旬に分析結果が出る予定
- （今回はFruit seasonの分析を実施したが、来年度にNon-Fruit Seasonの検査を実施予定）

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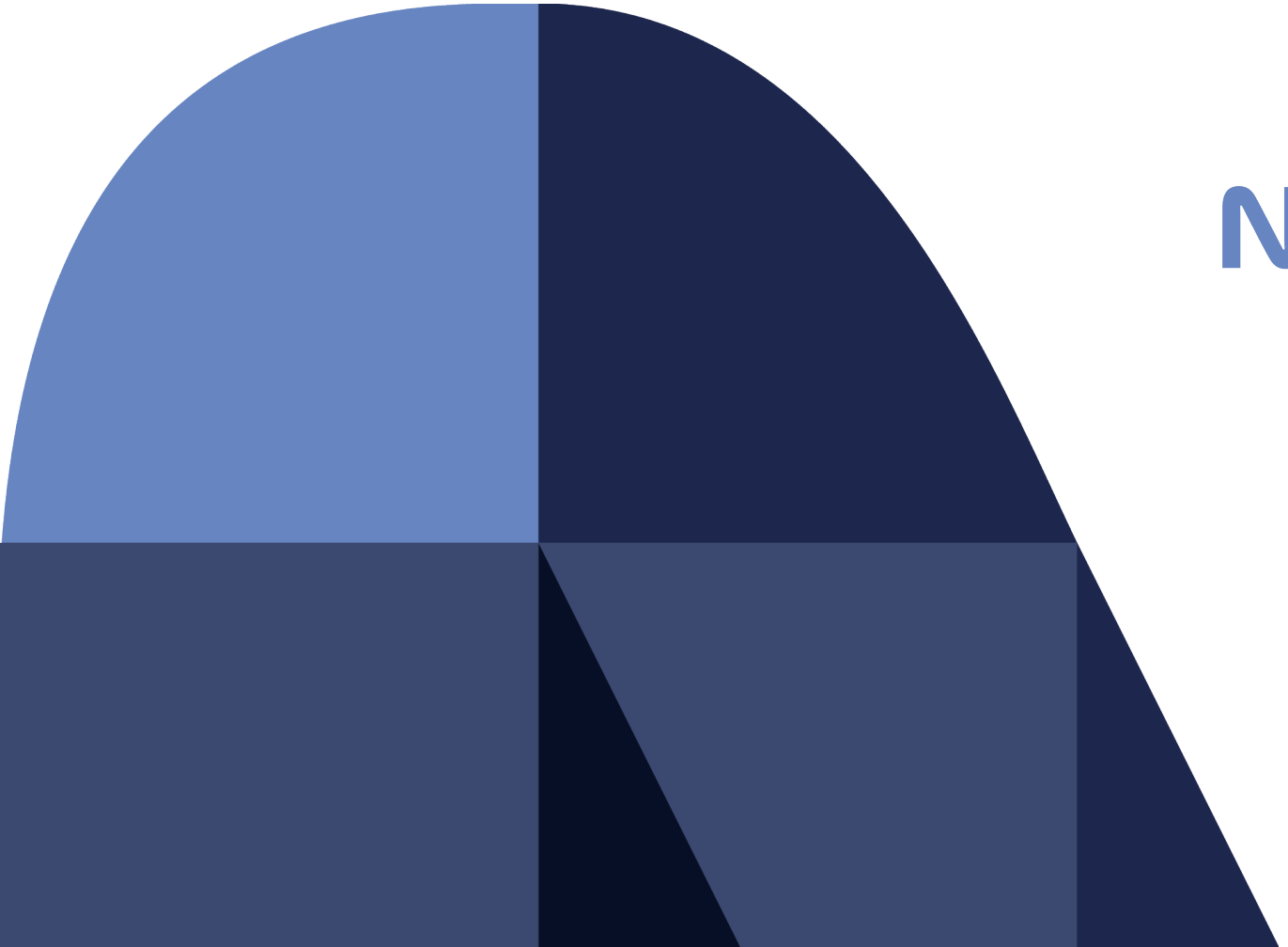

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Session on inter-industry collaboration contributing to decarbonization

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Session1

Presentation on City-to-City Collaboration between City of Kitakyushu & IRDA and overview of the Joint Crediting Mechanism (JCM)

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01

Introduction

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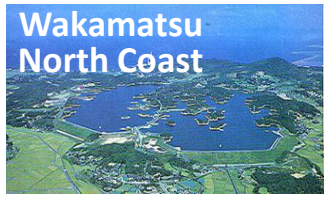
1.1 Kitakyushu City（1/5）-Attractive Resources in Kitakyushu

Population: **939,622**
（**National Census in 2020**）
Area: **492 km²**

Surrounded by Nature



Regional Specialties

Buzen Sea Oysters

Ouma Bamboo Shoots

Leading Companies in Kitakyushu

Nippon Steel

Yaskawa Electric

TOTO

Mitsubishi Chemical

Toyota

Nissan

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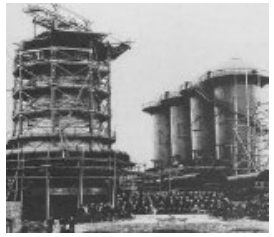
1.1 Kitakyushu City（2/5）-Overcoming Environmental Pollution

1901



Imperial Steel Works

Developed as a steel industrial city

1950

1960～

Severe Problem

Blue Sea & Sky

Pollution countermeasures with the trinity

Creating documentary movies

Initiatives taken by women's associations

Seminars with academicians

Residents

Environmental monitoring

Municipality

Companies

Establishing "Pollution Control Bureau" ahead of the country

Developing and promoting environmental technology

Dredging of Dokai Bay

pollution prevention agreements

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1.1 Kitakyushu City（3/5）-Experience in Environmental Technologies

Cleaner Production (CP) Pollution Prevention (End of Pipe)

CP

- Evaluation and improvement of raw materials and fuel use
- Improvement of production process
- Thorough maintenance and management, training personnel, etc.

→ Reduction of pollutants, energy conservation, resource conservation

End of Pipe


Electric dust collectors


Flue gas desulfurization equipment


Wastewater treatment

Recycling and Waste Management

Kitakyushu Eco Town Project


Home appliances


Plastic bottles


Cars


Office automation equipment

Japan's first and largest project to combine recycling and environmental industries

Public-Private Partnership

Energy Management

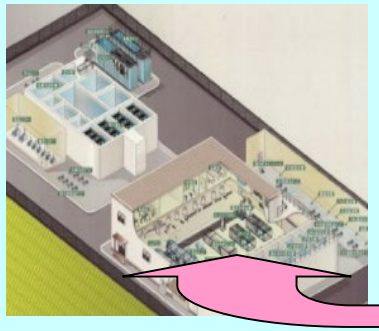
Manage local energy by the city's regional energy conservation center


The Yahata Higashida area, being redeveloped in an eco-friendly way


Kitakyushu Smart Community

Water Business

Water Plaza：Plant demonstrating water recycling



- Advanced desalination system
- Combines membrane treatment of sewage with seawater desalination

Hiagari Sewage Treatment Plant

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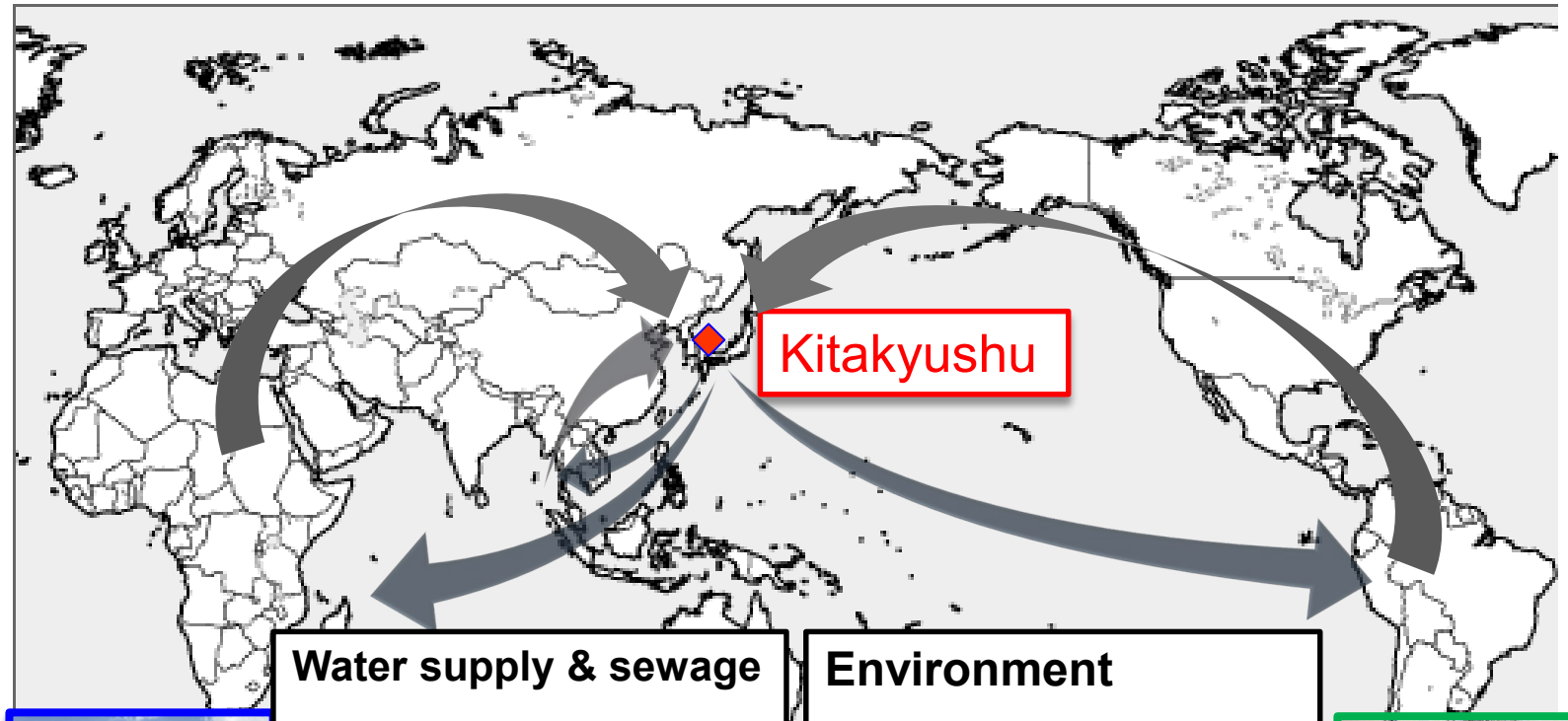
1.1 Kitakyushu City（4/5）-Providing Technology to Overcome Pollution to the World

Promoting "international environmental cooperation" centered on human resource development in order to utilize its accumulated environmental technology and know-how to improve the environment in developing countries.



Water supply & sewage

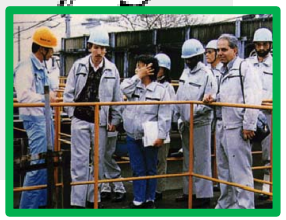
Trainees in Kitakyushu
6,682 from 156 countries

Experts from Kitakyushu
213 to 13 countries

Environment

Trainees in Kitakyushu
10,499 from 168 countries

Experts from Kitakyushu
244 to 30 countries



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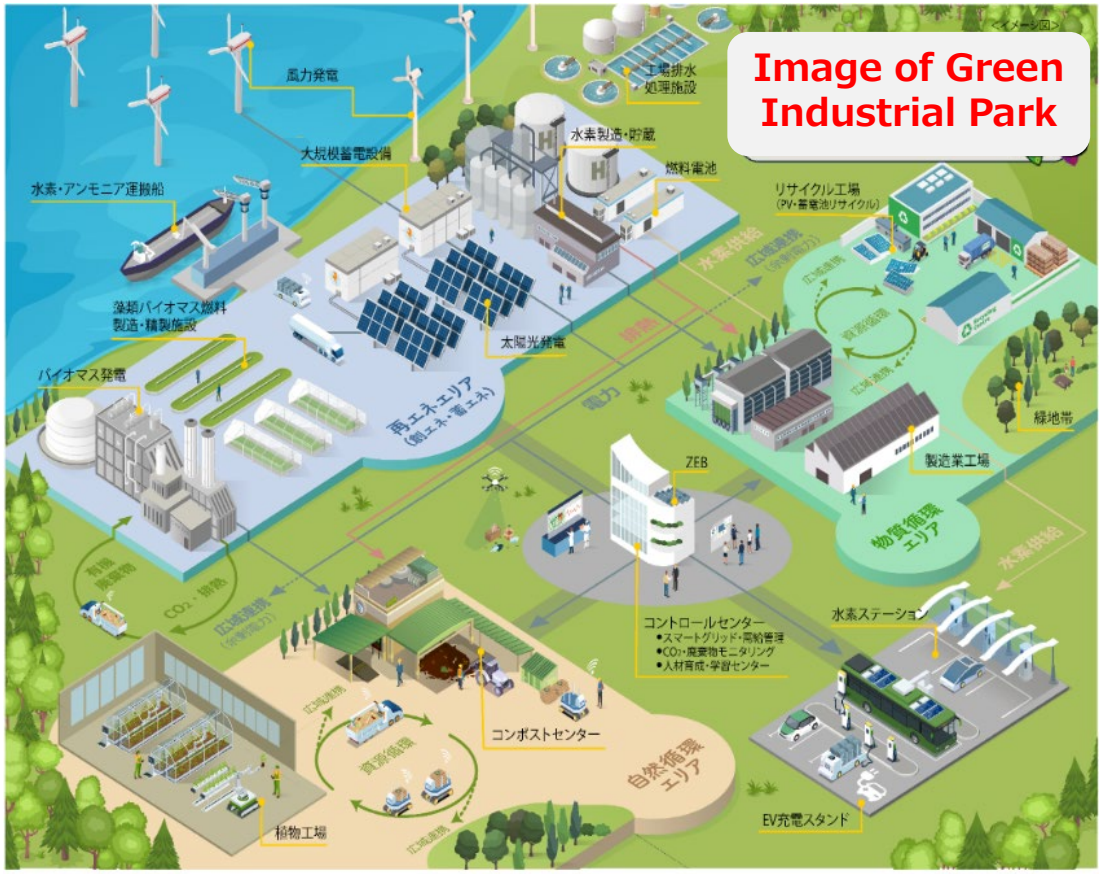
1.1 Kitakyushu City（5/5）-Two "zeros" and economic growth toward 2050

Realization of a positive cycle between the environment and the economy by accelerating the export of environment-related technologies and infrastructure

Zero Emission（recycling society）

Economic Growth

Zero Carbon（Carbon-Neutral Society）



Contact:

Kitakyushu Asia Center for Carbon Neutrality (KCN)

3F, Kitakyushu International Village Center, 1-1-1 Hirano, Yahatahigashi-ku, Kitakyushu City, Fukuoka Prefecture 805-0062, JAPAN

TEL.+81-93-662-4020

https://asiangreencamp.net/eng/



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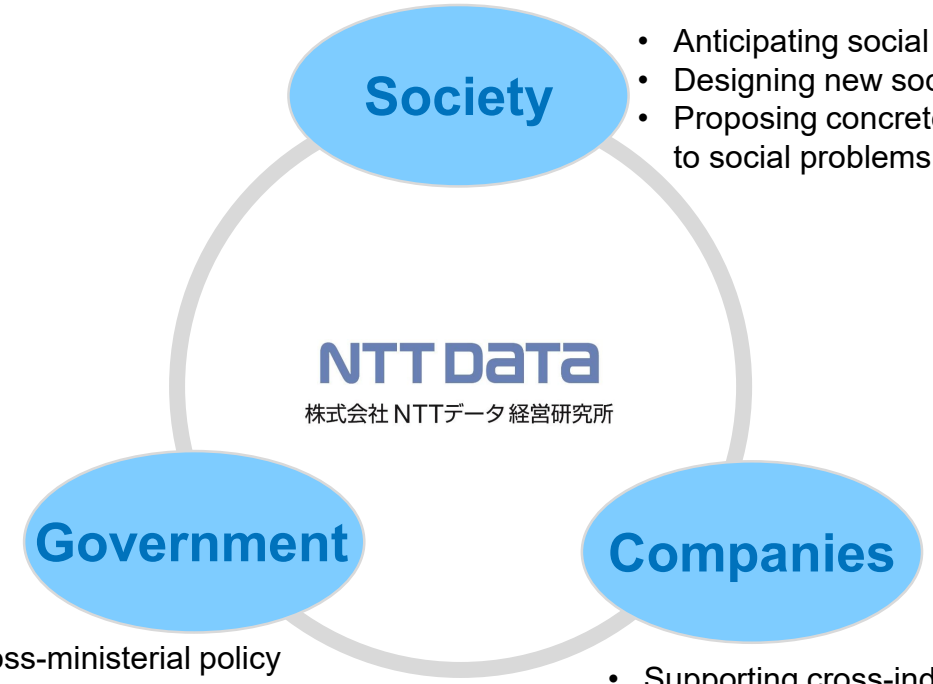
1.2 NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.

NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc. is a consulting firm that continues to work on socially relevant topics.



- Anticipating social change
- Designing new societies
- Proposing concrete solutions to social problems

- Cross-ministerial policy recommendations on social issues
- Value chain engineering for public-private partnership

- Supporting cross-industry collaboration between companies
- Supporting the transformation of companies into digital businesses (IoT, AI).

Socio & Eco Strategic Consulting Unit

In response to urgent issues such as global warming and the transition to a recycling-based society, we support our customers in their efforts to develop smart and sustainable cities, export infrastructure, a consortium of local companies and other activities.

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02

Overview of JCM

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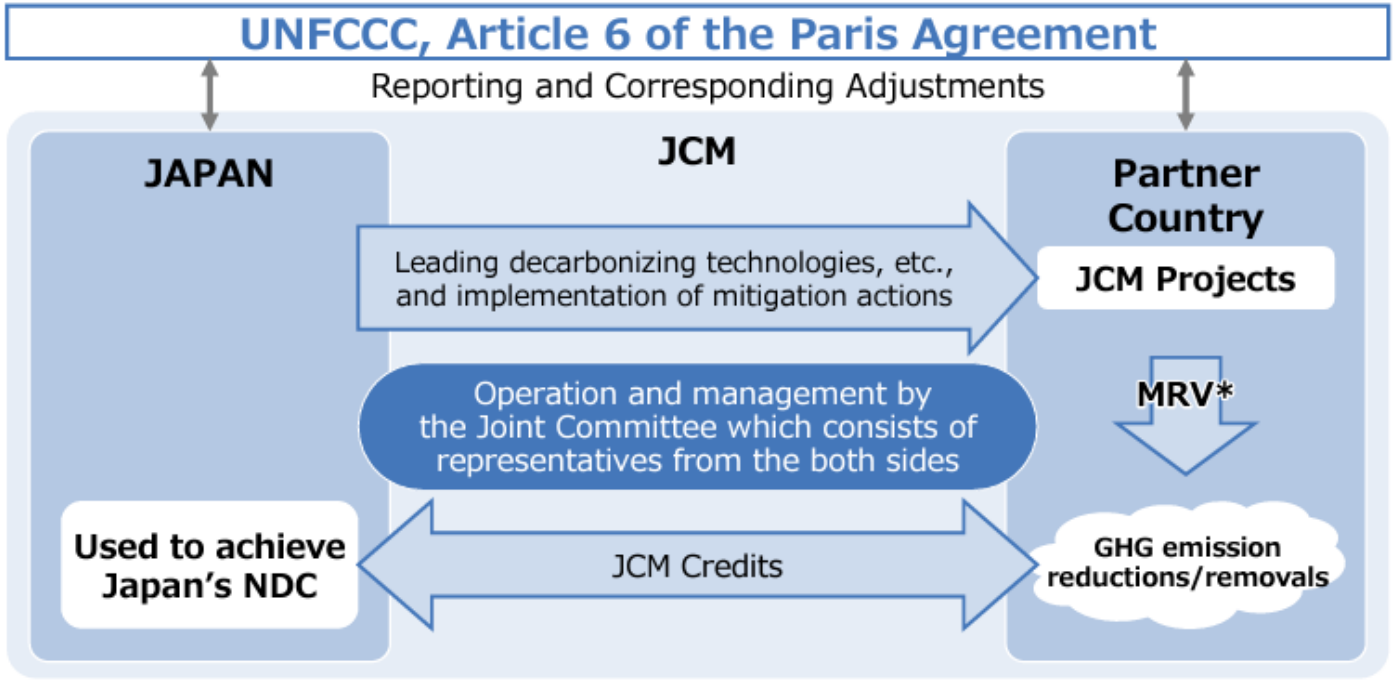
2.1 Basic Concept of the JCM (Joint Crediting Mechanism

- Facilitating diffusion of leading low carbon technologies, products, systems, services and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries;
- Appropriately evaluating contributions from Japan to GHG emission reductions or removals in a quantitative manner, and use them to achieve Japan's emission reduction target;
- Contributing to the ultimate objective of the UNFCCC by facilitating global actions for GHG emission reductions or removals



Source: Ministry of Environment, Japan

*measurement, reporting and verification

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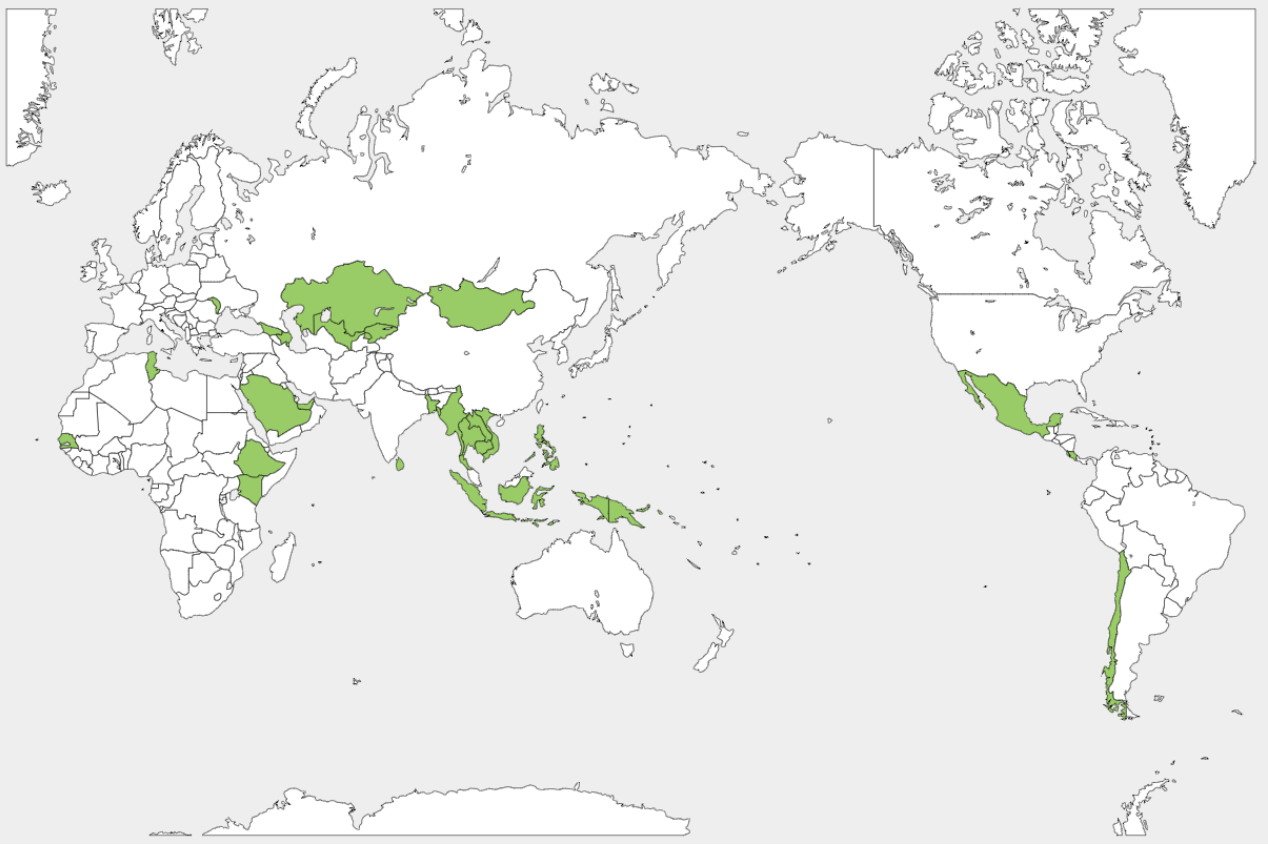
2.2 JCM Partner Countries

Japan has held consultations for the JCM with developing countries since 2011.
Currently, Japan has established the JCM with 28 countries.



Year of conclusion

2013	Mongolia
	Bangladesh
	Ethiopia
	Kenya
	Maldives
	Vietnam
	Laos
	Indonesia
	Costa Rica
2014	Palau
	Cambodia
	Mexico
2015	Saudi Arabia
	Chile
	Myanmar
	Thailand
2017	Philippines
2022	Senegal
	Tunisia
	Azerbaijan
	Moldova
	Georgia
	Sri Lanka
	Uzbekistan
	Papua New Guinea
2023	United Arab Emirates
	Kyrgyz
	Kazakhstan

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2.3 JCM Subsidy Program

- Scope of the financing: facilities, equipment, vehicles, etc. which reduce CO2 fromfossil fuel combustion as well as construction cost for installing those facilities, etc.
- Eligible Projects : starting installation after the adoption of the financing and finishing installation within three years.

Budget for projects starting from FY 2023 is approx. 15 billion JPY (approx. USD 109 million) in total by FY2025 **(1 USD = 137 JPY)**

Government of Japan

* Includes collaboration with projects supported by JICA and other governmental-affiliated financial institute.

Finance part of an investment cost (**up to half**)

Conduct MRV and expected to deliver JCM credits issued

International consortiums (which include Japanese entities)

Source: Ministry of Environment, Japan

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(Ref) Projects supported by the JCM financing programmes

Renewable Energy

Solar power, FARMLAND Co., Ltd., Chile

Floating Solar PV,TSB Co., Ltd.,Thailand

Hydro Power Plant, Toyo Energy Farm Co., Ltd., Indonesia

Biomass Co-Generation System, Fuji-Foods Coporation, Thailand

Binary Power Generation Project at Geothermal Power Plant, MHI, Ltd., Philippines

Energy efficiency [Consumer sector]

High-efficiency refrigerator, Mayekawa MFG, Indonesia

Energy saving at convenience stores, Panasonic, Indonesia

High-efficiency air-conditioning system, Hitachi, Daikin, Vietnam

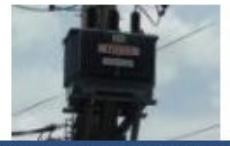
Energy efficiency [Industrial sector]

Optimization in petroleum refining plant, Yokogawa Electric Corp. Indonesia

Energy-saving of mobile communications base transceiver stations, KDDI Corp. Indonesia

Energy efficiency [Urban sector]

LED street lighting system with wireless network control, MinebeaMitsumi, Cambodia



Amorphous transformers in power distribution, Hitachi Materials, Vietnam

Waste

Power Generation with Methane Gas Recovery System, NTTDATA, Mexico

Waste to Energy Plant, JFE engineering, Myanmar

Transport

CNG-Diesel Hybrid Public Bus, Hokusan Co., Ltd., Indonesia

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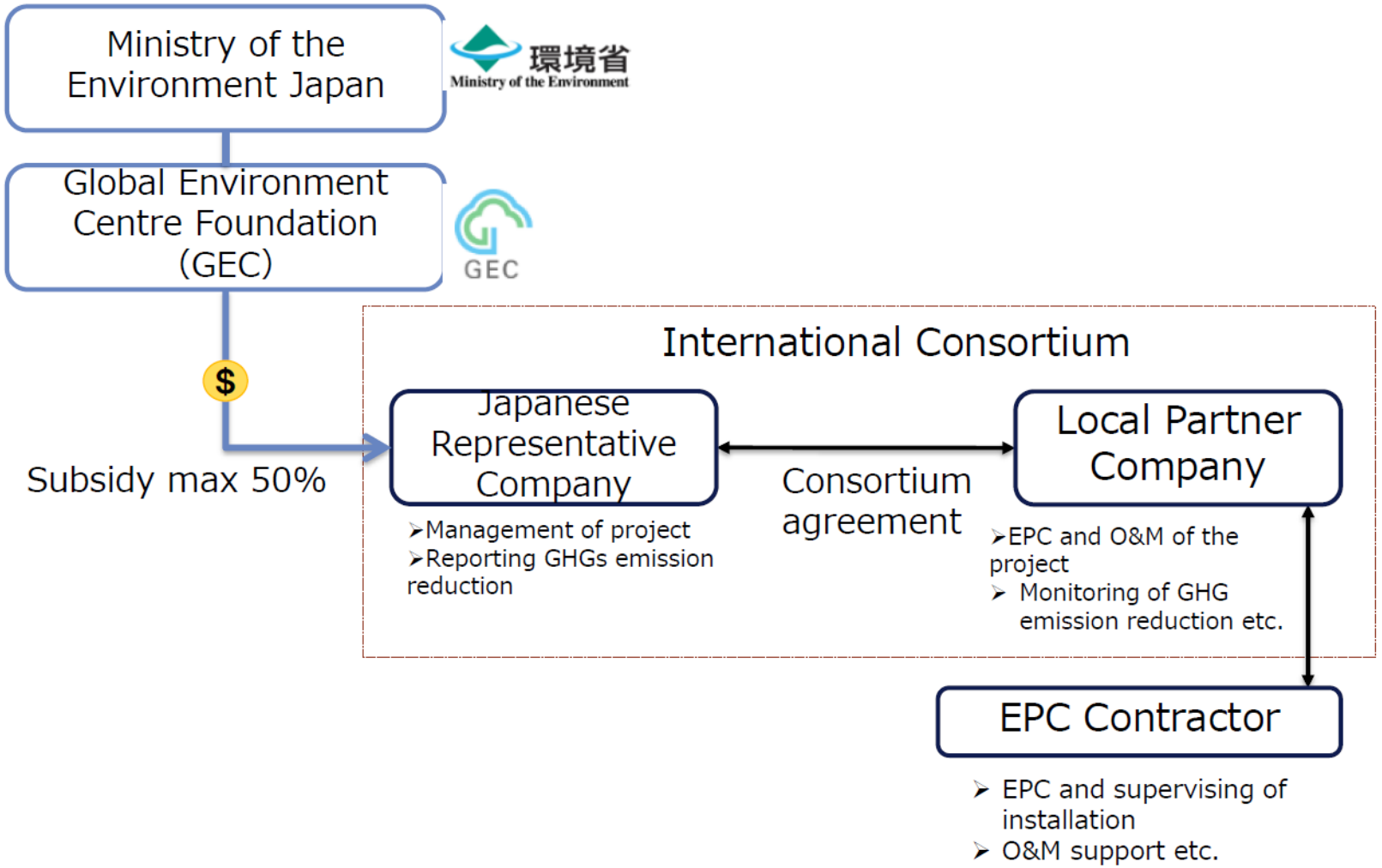
2.4 Organization at Implementation Phase

Required organization scheme for JCM subsidy application



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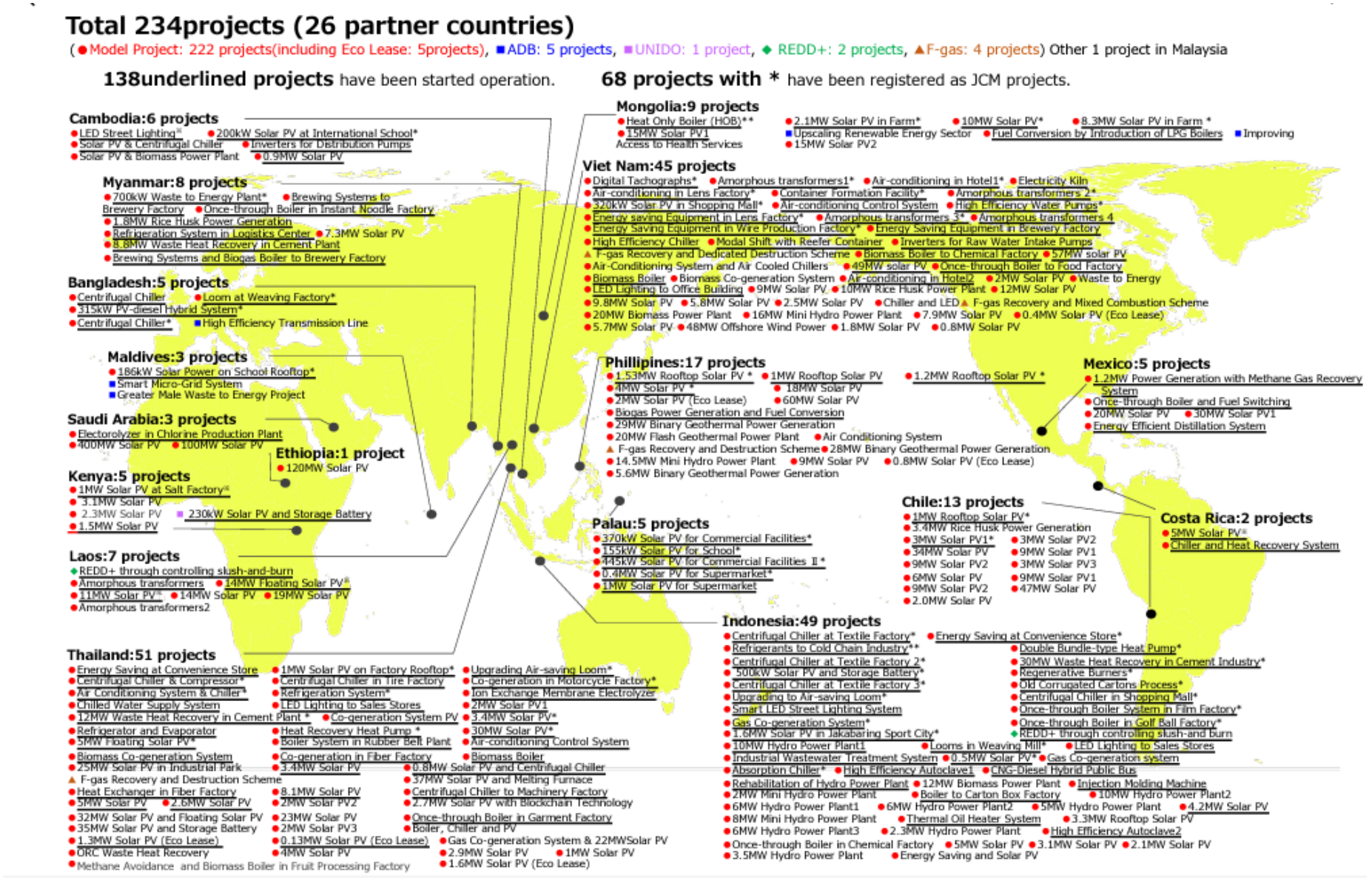
2.5 JCM Financing Programme by MOEJ (FY2013~2022)



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Source: GEC Explanation Material of JCM

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2.6 JCM Subsidy Detail of Cost-effectiveness and Payback Period

Points of Attention Regarding Application for JCM Subsidy

- Subsidy rate changes depending on the contents of the project and country.

Adoption number of similar technology in the country to implement the project	0	1 ~ 3	Over 4
Subsidy rate	**Maximum 50 %**	**Maximum 40%**	**Maximum 30%**

- There are 2 Check points to get subsidy

1. Cost effectiveness for subsidy vs amount of reduced CO2

【New Criteria from FY2017】
Regardless of the amount of subsidy, Cost effectiveness should be less than
4000JPY/t-CO2 (approx. 35USD/t-CO2)

3,000JPY/t-CO2 (5 or more similar projects in one country)
2,500JPY/t-CO2 (10 or more similar projects in one country)

2. Payback period
   - Payback period should be longer than three years.

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Session2

Presentation on Overview of Inter-industry collaboration project in City-to-City Collaboration

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03

City-to-City Collaboration Project in 2023

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3.1 Project Overview

Creation of Zero Carbon Advance Areas based on city-to-city collaboration

- Iskandar Malaysia, in Johor Malaysia, is the second economic city. (Land Area: 2217km2,Population:about 2.23 million people)
- From FY 2019 to FY 2021, we have been studying the commercialization of industrial symbiosis, eco-towns, and waste-to-energy projects, Using the experience and Know-How of City of Kitakyushu. We plan to reflect the results of our three-year project in CDP（Comprehensive Development Plan）Ⅲ.
- In order to create a leading zero-carbon area in the Iskandar area, a zero-carbon plan in the industrial and consumer sectors will be developed in FY2022, utilizing City of Kitakyushu's expertise in planning for the realization of a zero-carbon city. In addition, we aims to establish leading areas using Japan's advanced technologies and to create leading projects in the area.

City of Kitakyushu ⟷ Cooperative Agreement LOU ⟷ IRDA (Iskandar Regional Development Authority)

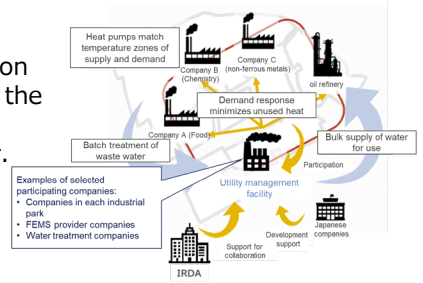
Provide Accumulated Know-Hows

Kitakyushu-IRDA Collaboration Project in 2023

Activity1

Create inter-industry collaboration projects for decarbonization of the industrial sector

Based on the status of waste heat and wastewater treatment in each company, a study will be conducted aiming at energy management for the entire industrial estate beyond the boundaries of industries and companies, as well as bulk supply and bulk treatment of waste water for use.
This year, a survey will be conducted on the status of waste water and waste heat generation in the candidate industrial parks, as well as on the status of infrastructure development, such as facilities and pipelines for use and waste water.
In addition, candidate companies will be selected, and a consortium will be formed and discussed to consider the formation of a pilot project.



Activity2

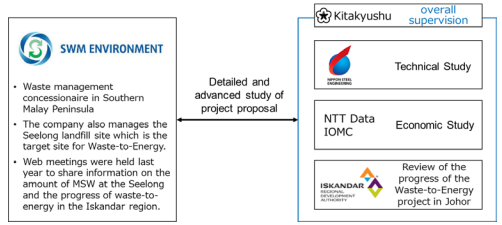
Introduction of waste-to-energy as a base-load power source for decarbonization of the consumer sector

Carry out waste quality surveys at the Seelong final landfill site, and scrutinise and upgrade the draft project plan, etc.

(1) Conduct a waste quality survey at the Seelong Landfill Site.

(2) Confirmation of the progress of the waste-to-energy project in the State of Johor, Malaysia.

(3) Scrutinise and upgrade the draft project plan.



Creation of pilot projects +
Establishment of model areas that can be expanded horizontally within and outside of Iskandar Malaysia

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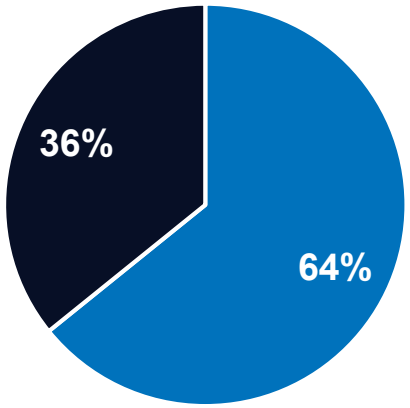
3.2 Energy consumption and GHG emissions from Industry

Approximately 64% of the energy consumption in the industrial sector in the Iskandar region is fossil fuels.

In terms of GHG emissions from fossil fuel consumption, natural gas accounts for about 60%, followed by coal.

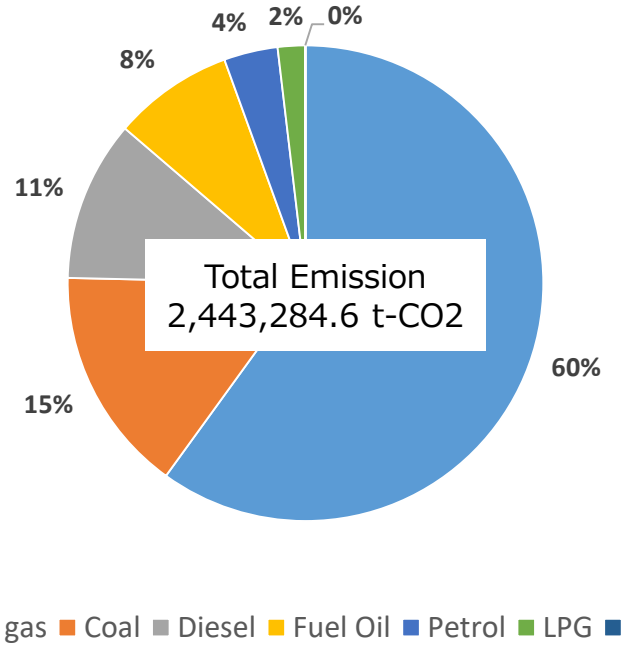
→In order to reduce GHG emissions, fossil fuel energy use must be reduced.

Energy Consumption in Industry, 2019 (ktoe)



Energy	Consumption (ktoe)
Fossil fuel	993.7
Electricity	554.26

GHG emissions in Industry by fossil fuel type, 2019 (t-CO2)



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3.3 The energy consumption of industries in Iskandar

The table shows the energy consumption of various industries in the Iskandar region. We would like to investigate what energy is currently being wasted in each plant and consider whether energy can be used more efficiently.

Subsector	Share of energy demand	Consumption in 2019 (ktoe)						
		Natural gas	Petrol	Diesel	Fuel Oil	LPG	Electricity	Others
Food, beverages and tobacco	37.7%	484.3	7.84	10.66	7.84	0.31	73	-
Chemical	15.8%	99.2	4.36	23.10	25.20	0.81	92	-
Non-metallic mineral products	10.0%	7.5	-	3.22	7.23	-	35	Coal: 100.92
Non-ferrous metals	0.3%	1.1	-	-	-	-	4.26	-
Iron and steel	4.1%	39.1	-	7.79	1.10	1.93	14	-
Wood and wood products	0.5%	0.3	0.05	0.75	1.12	-	5	-
Pulp, paper and printing	0.6%	2.0	0.13	1.16	-	-	7	-
Textile and leather	1.6%	7.9	0.25	1.92	0.71	0.05	14	-
Machinery	8.8%	1.8	17.66	20.10	-	-	97	-
Transportation equipment	1.7%	1.9	-	15.35	-	0.03	9	Kerosene: 0.06
Not specified elsewhere	18.8%	38.0	1.73	8.06	24.19	14.97	204	-

For example…
In food, beverage and tobacco production,

- there are processes for heating and cooling respectively.
- Waste heat, such as exhaust gases, is generated, but may be unused due to temperature, location and time constraints with available destinations.
- Large amounts of water are used as cooling water and then drained away without any further use.

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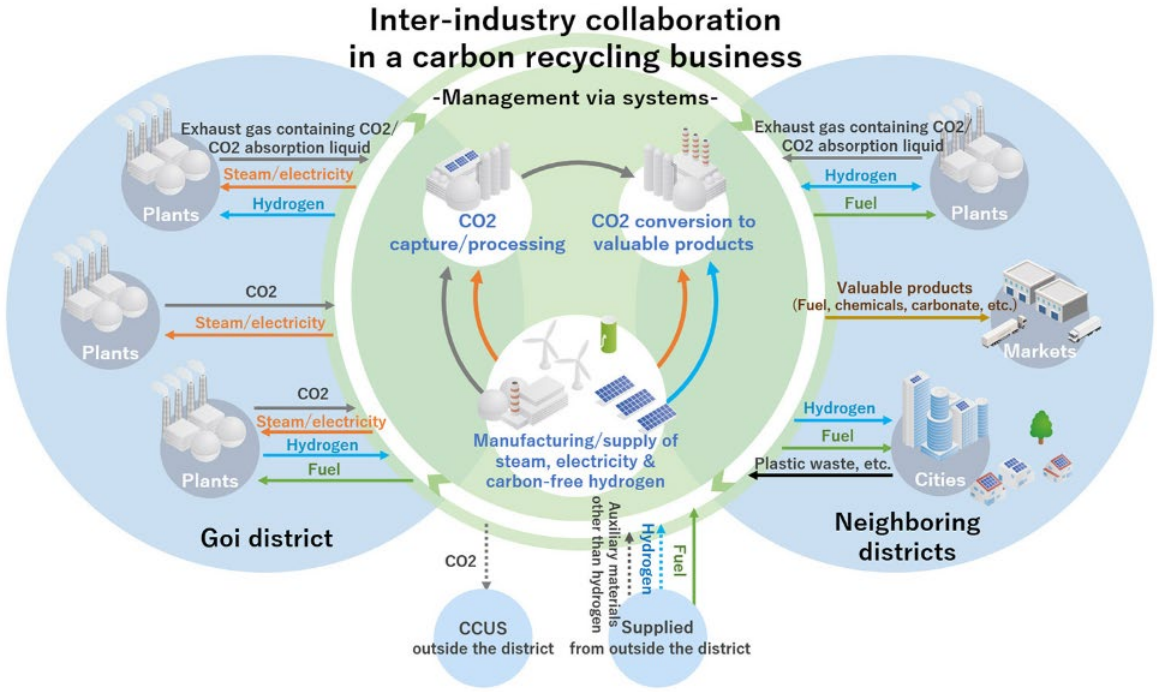
(Ref) Inter-Industry Collaboration Study Project by Yokogawa Electric Co.

Yokogawa Electric Co. has launched inter-industry collaborative study project for the achievement of carbon neutrality in industrial parks.

This study examines the possibility of collaboration in carbon recycling projects by companies from different industries, and investigates the current energy balance of each plant and the recovery and reuse of CO2 emitted from the plants.



Inter-industry collaboration in a carbon recycling business

(Reference) Yokokawa News release

Study on the realization of a carbon cycle business from the three perspectives of 'effective use of materials and energy', 'CO2 capture and utilization' and 'hydrogen management'.

Leveraging know-how held across the entire Yokogawa Group:

- Digital energy management solutions with real-time data, site-wide digital twin and unique analytics
- Virtual power plant technology that can control supply and demand on a regional level

etc.

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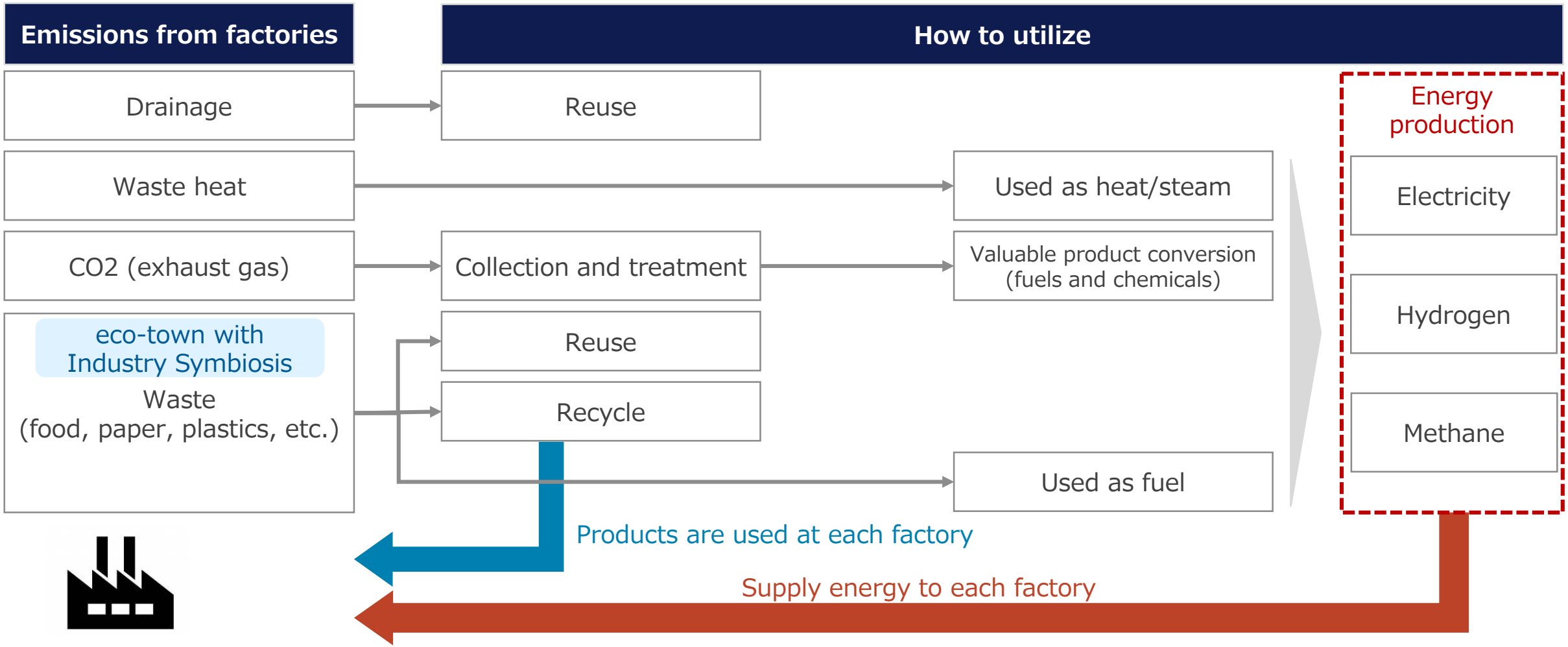
3.4 How to utilize emissions from factories

The idea is to utilize wastewater, waste heat and waste from the factories in the following ways.



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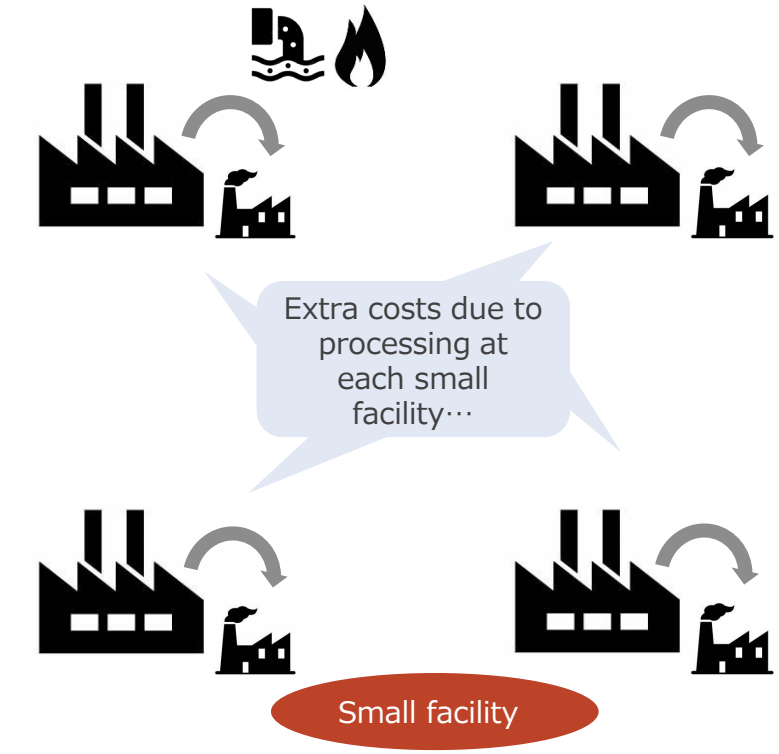
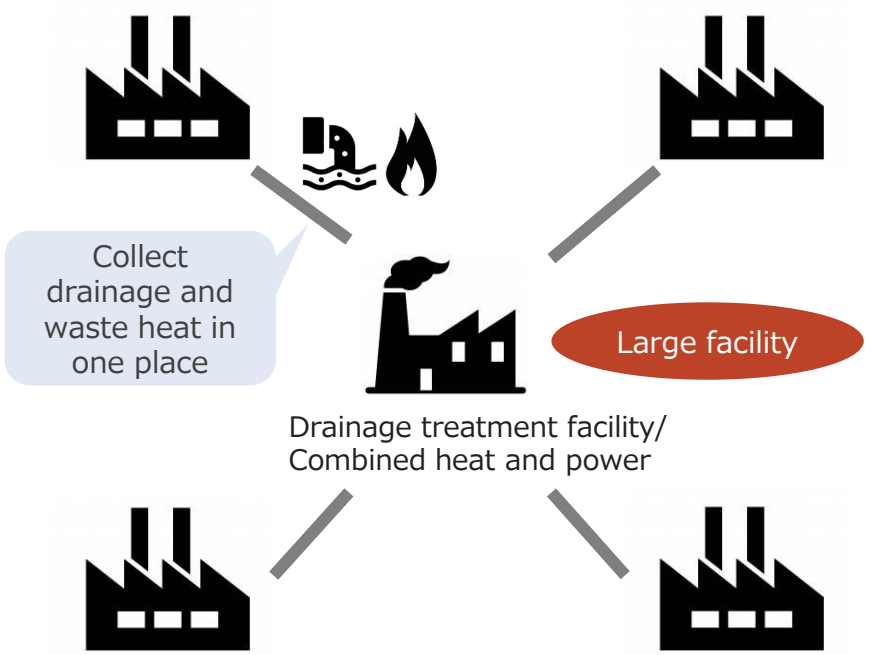
3.5 Integration of treatment facilities to improve treatment efficiency

Integrating treatment facilities for wastewater, waste heat, etc. to improve the efficiency of waste treatment.

At the moment, if each company handles its own waste…



Integrating and sharing facilities within an industry can make processing more efficient!



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3.6 Interviews: questions

With regard to the questions to be asked of each plant, we consider the following;

We would like to include the concept of eco-town with Industry Symbiosis by asking not only about waste heat and waste water, but also how waste is treated.

1. **Does your plant use renewable energy?**
   - ✓If so, What percentage of the energy used is renewable energy?
2. **What types of waste are produced in the factory?** (e.g. food, paper, ceramics, metal)
   1. How is it treated? (Disposal or recycling?)
3. **How are wastewater and waste heat treated?**
   1. Is each treatment managed centrally within the industrial estate? Or are they managed at each plant?
   2. Are wastewater and waste heat treated in your own plant? Or is it outsourced to others?
4. **Equipment owned by the company:**
   1. Does the factory own heat utilisation equipment (eg. Boilers)/power generation facilities?
   2. If yes, how many they are owned?
5. **Status of consideration of decarbonisation:**
   1. Measures that have been considered (electrification, purchasing carbon-neutral fuels)
   2. Priorities in consideration (cost, plant operational stability, CO2 reduction benefits)

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Request for questionnaire on treatment facilities and decarbonisation of energy at each plant

We are looking at a system of industrial parks that make optimal use of energy, with the aim of decarbonising the industrial sector in the Iskandar region.
We would be grateful if you could complete the following questionnaire to help us understand the current status of each company. (e.g. use of renewable energy, treatment of wastewater and waste heat, information on the equipment they have, etc.)

Company name：

Type of Industry：

1．Please indicate the main source of energy for company operation.

（1） Please indicate the main source of energy and energy provider for company operation.

Source of energy		Note
Purchase electricity from the grid Energy provider:		Energy provider：
Renewable energy sources (off-grid for operation self-consumption)		
Other sources/remarks/comment:		

（2）Please indicate knowledge/awareness whether or not the electricity you purchase is derived from renewable energy sources by ticking "✓" in one of the relevant boxes for the applicable options.

Options	
All of them are renewable energy sources.	
Partially renewable energy sources.	
No renewable electricity is purchased.	
Not sure	

<u>If you answered 'partly from renewable energy sources',</u> please indicate the percentage of your total electricity consumption that is purchased from renewable energy sources.

Percentage of renewable energy purchased		%

（3）Please indicate whether any of the steam used is purchased from other companies by ticking "✓" in one of the relevant boxes for the applicable options.

Options	
Do not use steam	
All use steam purchased from other companies	
Use some steam purchased from other companies	
Not purchasing steam from other companies	

2. Please enter the Schedule Waste code that is being emitted by your company.
(Select from pull-down menu – refer Appendix B)
In addition, please indicate the amount of each waste generated (t/year) and "✓" for one of the applicable options in the disposal method.

Schedule waste Code		amount of waste generated (t/year)	Disposal Method			
			Landfill	Incineration	Recycle	Other
1						
2						
3						
4						
5						

6						
7						
8						
9						
10						

2．Please provide information on waste water and waste heat treatment facilities and methods.

（1）Please indicate a "✓" for one of the applicable options for each treatment.

Options	Waste water	Waste heat
Batch processing in industrial parks.		
Processing by each company		
There is no processing.		
No waste water or waste heat is generated		

（2）**If treatment is carried out at each plant,** indicate '✓' if the treatment is carried out at the company's own plant and 'x' if the treatment is outsourced.

Options	
Waste water treatment	
Waste heat treatment	

3. Please indicate the energy saving measures implemented in your company.

（1）Are you implementing energy saving measures in your company?
(e.g., replacement with LED lighting, replacement with high-efficiency air-conditioning equipment, etc.)

Yes	
No	

（2）If you answered "Yes", what specific energy-saving measures do you take?

（3）Do you feel that the energy saving measures you are currently implementing are not enough to lower your company's CO2 emissions any further?

Yes	
No	

4. Regarding equipment owned, please indicate 'Yes' in the relevant column if you own one or more of the equipment listed below, or 'No' if you do not own any of the equipment listed below.

Options	
Own power generation facilities (including cogeneration) *1	
Own heat utilisation facilities*2	

※1 Emergency equipment should be excluded from the response.
※2 Heating and cooling equipment such as boilers and industrial furnaces that use fuel oil, gas, etc.

<u>If you answered 'No' to both questions, the survey is closed.</u>

5. This question for those who answered in question 4 that they own their own power generation equipment. (If you do not have your own power generation facility, please go to section 6.)

（1）For private power generation equipment, please state the type of equipment installed.

	Type of power generation equipment
Facility	

※1 Examples of power generation facilities include：
Steam turbine, gas turbine, gas engine, gas turbine combined cycle, etc.

（2）Please enter a "✓" in one of the relevant columns for the applicable option regarding the status of consideration of fuel conversion and decarbonisation of on-site power generation facilities.

Options	
Measures already in place	
Not yet implemented but policy has been decided	
Currently under review	
Not currently under consideration but will be in the future	
Not currently under consideration and will not be considered in the future	

（3）This question is asked of those who answered in question（2）that **they have already implemented measures** or that **they have not yet implemented measures but have decided on a policy.**
Please put a '✓' in the appropriate column for all applicable options for the measures/policies that have already been implemented or decided upon.

Contents of measures/policies		Additional information※1
Eliminate on-site power generation facilities and purchase grid electricity		
Purchase carbon neutral LNG		
Retrofit or upgrade facilities and convert all or part of the fuel to		
Retrofit or upgrade facilities and convert all or part of the fuel to		
Retrofit or upgrade facilities and convert part or all of the fuel to biomass		
CO2 capture and utilisation		
Other（　　）		

※1 Please provide any additional information on the content of the measures/policies (optional).

6．This question is asked of those who answered that they own heat utilisation equipment in question 4．
（1）Please indicate the number of heat utilisation facilities you own by type of facility in the table below.

Type of heat utilisation equipment	Number of facilities owned
Boilers (excluding private power generation equipment)	
Chilled and heated water generator	
Melting furnaces*1	
Heating furnaces*1	
Heat treatment furnaces*1	
Firing furnace*1	
Drying furnace*1	
Incinerator*1	
Other furnaces	
Other heat utilisation equipment (　　)	

※1 Furnaces are classified as follows.
Melting furnaces: furnaces for melting objects.
Heating furnaces: furnaces in which objects are heated by an open flame with fuel
Heat treatment furnaces: Furnaces in which objects are heated and cooled above a certain temperature.
Firing furnaces: furnaces in which the object is baked at a temperature below the melting point.
Drying furnaces: Furnaces in which objects are dried and baked.
Incinerator furnaces: Furnaces in which objects are burnt.

（2）Please enter a "✓" in one of the relevant columns for the applicable option regarding the status of consideration of fuel conversion and decarbonisation of heat utilisation equipment.

Options	
Measures already in place	
Not yet implemented but policy has been decided	
Currently under review	
Not currently under consideration but will be in the future	
Not currently under consideration and will not be considered in the future	

（3）This question is for those who answered in question (2) that they have **already implemented measures or that they have not yet implemented but have decided on a policy.**
Please fill in the details of the measures/policies that have already been implemented or decided on, and the heat utilisation equipment covered by them.

Contents of measures/policies	Types of equipment※1	Additional information※2
Electrification (replacement with electric furnaces, etc.)		
Elimination of boilers etc. and purchase of carbon-neutral steam from other		
Purchase carbon neutral LNG		
Retrofit or upgrade facilities and convert all or part of the fuel to		
Retrofit or upgrade facilities and convert all or part of the fuel to		
Retrofit or upgrade facilities and convert part or all of the fuel to biomass		
CO2 capture and utilisation		
Other（　　）		

※1 Please indicate the type of heat utilisation equipment that is the subject of the measures/policies.
Please enter the type of heat utilisation equipment that corresponds to the type of heat utilisation equipment you have answered in question (1).
※2 If you selected 'Other', please provide specific details in the 'addiotional information'.

That is all for the questionnaire. Thank you very much for your cooperation.

Appendix A

No	Type of Industry
1	Basic Metal Products
2	Chemical and Chemical Products
3	Electronics & Electrical Products
4	Fabricated Metal Products
5	Food Manufacturing
6	Furniture & Fixtures
7	Machinery & Equipment
8	Non-Metallic Mineral Products
9	Paper, Printing & Publishing
10	Petroleum Products (Including Petrochemicals)
11	Plastic Products
12	Rubber Products
13	Scientific & Measuring Equipment
14	Textiles & Textile Products
15	Transport Equipment
16	Wood & Wood Products
17	Waste Recovery/Recycling
18	Others

Appendix B

Scheduled Waste (Only applicable if the industry generate scheduled waste)

No	Code	Waste
1	SW 101	Waste containing arsenic or its compound
2	SW 102	Waste of lead acid batteries in whole or crushed form
3	SW 103	Waste of batteries containing cadmium and nickel or mercury or lithium
4	SW 104	Dust, slag, dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium excluding slag from iron and steel factory
5	SW 105	Galvanic sludges
6	SW 106	Residues from recovery of acid pickling liquor
7	SW 107	Slags from copper processing for further processing or refining containing arsenic, lead or cadmium
8	SW 108	Leaching residues from zinc processing in dust and sludges form
9	SW 109	Waste containing mercury or its compound
10	SW 110	Waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl
11	SW 201	Asbestos wastes in sludges, dust or fibre forms
12	SW 202	Waste catalysts
13	SW 203	Immobilized scheduled wastes including chemically fixed, encapsulated, solidified or stabilized sludges
14	SW 204	Sludges containing one or several metals including chromium, copper, nickel, zinc, lead, cadmium, aluminium, tin, vanadium and beryllium
15	SW 205	Waste gypsum arising from chemical industry or power plant
16	SW 206	Spent inorganic acids
17	SW 207	Sludges containing fluoride
18	SW 301	Spent organic acids with pH less or equal to 2 which are corrosive or hazardous
19	SW 302	Flux waste containing mixture of organic acids, solvents or compounds of ammonium chloride
20	SW 303	Adhesive or glue waste containing organic solvents excluding solid polymeric materials
21	SW 304	Press cake from pretreatment of glycerol soap lye
22	SW 305	Spent lubricating oil
23	SW 306	Spent hydraulic oil
24	SW 307	Spent mineral oil-water emulsion
25	SW 308	Oil tanker sludges
26	SW 309	Oil-water mixture such as ballast water
27	SW 310	Sludge from mineral oil storage tank
28	SW 311	Waste oil or oily sludge
29	SW 312	Oily residue from automotive workshop, service station oil or grease interceptor
30	SW 313	Oil contaminated earth from re-refining of used lubricating oil
31	SW 314	Oil or sludge from oil refinery plant maintenance operation
32	SW 315	Tar or tarry residues from oil refinery or petrochemical plant
33	SW 316	Acid sludge
34	SW 317	Spent organometallic compounds including tetraethyl lead, tetramethyl lead and organotin compounds
35	SW 318	Waste, substances and articles containing or contaminated with polychlorinated biphenyls (PCB) or polychlorinated triphenyls (PCT)
36	SW 319	Waste of phenols or phenol compounds including chlorophenol in the form of liquids or sludges
37	SW 320	Waste containing formaldehyde
38	SW 321	Rubber or latex wastes or sludge containing organic solvents or heavy metals
39	SW 322	Waste of non-halogenated organic solvents
40	SW 323	Waste of halogenated organic solvents
41	SW 324	Waste of halogenated or unhalogenated non-aqueous distillation residues arising from organic solvents recovery process
42	SW 325	Uncured resin waste containing organic solvents or heavy metals including epoxy resin and phenolic resin
43	SW 326	Waste of organic phosphorus compound
44	SW 327	Waste of thermal fluids (heat transfer) such as ethylene glycol
45	SW 401	Spent alkalis containing heavy metals
46	SW 402	Spent alkalis with pH more or equal to 11.5 which are corrosive or hazardous
47	SW 403	Discarded drugs containing psychotropic substances or containing substances that are toxic, harmful, carcinogenic, mutagenic or teratogenic
48	SW 404	Pathogenic wastes, clinical wastes or quarantined materials
49	SW 405	Waste arising from the preparation and production of pharmaceutical product
50	SW 406	Clinker, slag and ashes from scheduled wastes incinerator
51	SW 407	Waste containing dioxins or furans
52	SW 408	Contaminated soil, debris or matter resulting from cleaning-up of a spill of chemical, mineral oil or scheduled wastes
53	SW 409	Disposed containers, bags or equipment contaminated with chemicals, pesticides, mineral oil or scheduled wastes
54	SW 410	Rags, plastics, papers or filters contaminated with scheduled wastes
55	SW 411	Spent activated carbon excluding carbon from the treatment of potable water and processes of the food industry and vitamin production
56	SW 412	Sludges containing cyanide
57	SW 413	Spent salt containing cyanide
58	SW 414	Spent aqueous alkaline solution containing cyanide
59	SW 415	Spent quenching oils containing cyanides
60	SW 416	Sludges of inks, paints, pigments, lacquer, dye or varnish
61	SW 417	Waste of inks, paints, pigments, lacquer, dye or varnish
62	SW 418	Discarded or off-specification inks, paints, pigments, lacquer, dye or varnish products containing organic solvent
63	SW 419	Spent di-isocyanates and residues of isocyanate compounds excluding solid polymeric material from foam manufacturing process
64	SW 420	Leachate from scheduled waste landfill
65	SW 421	A mixture of scheduled wastes
66	SW 422	A mixture of scheduled and non-scheduled wastes
67	SW 423	Spent processing solution, discarded photographic chemicals or discarded photographic wastes
68	SW 424	Spent oxidizing agent
69	SW 425	Wastes from the production, formulation, trade or use of pesticides, herbicides or biocides
70	SW 426	Off-specification products from the production, formulation, trade or use of pesticides, herbicides or biocides
71	SW 427	Mineral sludges including calcium hydroxide sludges, phosphating sludges, calcium sulphite sludges and carbonates sludges
72	SW 428	Wastes from wood preserving operation using inorganic salts containing copper, chromium or arsenic of fluoride compounds or using compound containing chlorinated phenol or
73	SW 429	Chemicals that are discarded or off-specification
74	SW 430	Obsolete laboratory chemicals
75	SW 431	Waste from manufacturing or processing or use of explosives
76	SW 432	Waste containing, consisting of or contaminated with, peroxides
77	SW 501	Any residues from treatment or recovery of scheduled wastes

情 報 種 別 ： 秘密（関係者限り）
会　社　名 ： NTTデータ経営研究所
情報所有者 ： 社会・環境戦略コンサルティングユニット

環境省　御中

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Trusted Global Innovator

令和5年度　脱炭素社会実現のための都市間連携事業
イスカンダル地域における脱炭素モデルエリア構築事業
（フェーズ2）最終報告資料

2024年3月4日
株式会社エヌ・ティ・ティ・データ経営研究所
社会・環境戦略コンサルティングユニット

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1. 本年度事業の概要

2. 各活動の成果

1. 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討
2. 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

3. 今後の展開

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1. 本年度事業の概要
1.1本年度事業の全体像

都市間連携に基づく、ゼロカーボン先行エリア創出事業

- イスカンダル・マレーシアはジョホール南部に位置し、面積2217km^2、人口約2.23百万人のマレーシア第二の経済都市である。
- 2019年度～2021年度まで、北九州市の経験とノウハウを生かして産業共生・エコタウン・廃棄物発電の事業化を検討。3か年の活動成果をCDP（Comprehensive Development Plan）Ⅲに反映させる計画。
- 2022年度からは、イスカンダル地域においてゼロカーボン先行エリアを生み出すべく、北九州の有するゼロカーボンシティ実現のための計画策定ノウハウ等を活用し、産業部門・民生部門において、わが国の先端的な技術を用いた先行プロジェクトを創出、脱炭素モデルエリアの構築を目指す。

北九州市 ⇔ 協力関係 LOU ⇔ **IRDA（イスカンダル地域開発庁）** ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

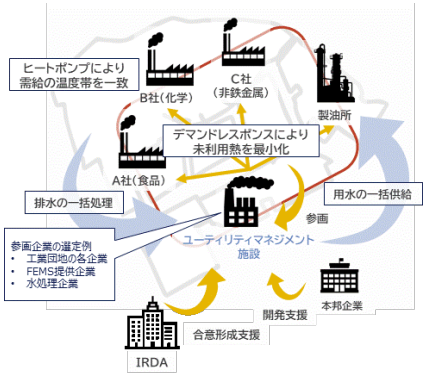
蓄積したノウハウの提供

令和5年度　脱炭素社会実現のための都市間連携事業委託業務

活動1

産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

各企業の廃熱・排水の処理状況を踏まえ、業種・企業の壁を超えた工業団地全体のエネルギーマネジメント、用排水の一括供給・一括処理を目指した検討を行う。
本年度は、候補工業団地における排水・排熱等の発生状況等や用排水の設備・パイプライン等のインフラ整備状況調査を実施する。また、参画候補企業の選定を実施し、コンソーシアムを形成・協議することでパイロットプロジェクトへの組成を検討する。



活動2

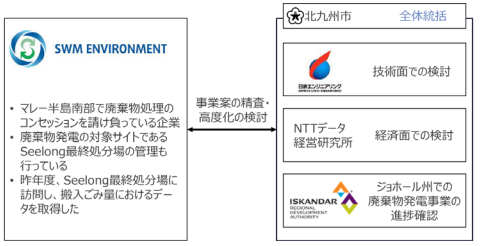
民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

Seelong最終処分場におけるごみ質調査の実施及び、事業計画案の精査・高度化等を実施する。

1）Seelong最終処分場におけるごみ質調査の実施

2）マレーシア国におけるジョホール州での廃棄物発電事業の進捗の確認

3）事業計画案の精査・高度化



先行プロジェクトの創出 ＋ イスカンダル地域内外に横展開可能なモデルエリア構築

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1. 本年度事業の概要
1.3 事業計画

～2021年
■ 都市間連携調査実施
（2015年&2016年、2019～2021年）

2022～2024年（3ヵ年）

2025年～
■ 2050CN達成に向けた
モデルエリアの横展開

	2022年度	2023年度(2カ年目：本事業)			2024年度
		7～9月	10～12月	1～3月	
活動1：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討	マレーシア製造業連合会（FMM）へのヒアリングの実施 マレーシア現地の工業団地運営企業へのヒアリングの実施	排熱発生状況等の詳細把握、実現可能性調査 工業団地内の用排水の設備・パイプライン等のインフラ整備状況調査	参画候補企業の選定（現地企業及び関連技術を持つ本邦企業）	選定した参画候補企業によるコンソーシアムの形成・協議	JCM設備補助等を活用したﾊﾟｲﾛｯﾄﾌﾟﾛｼﾞｪｸﾄの立ち上げ合意
活動2：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入	Seelong最終処分場の搬入ごみ量に関するデータを取得	マレーシア国におけるジョホール州での廃棄物発電事業の進捗の確認 UTMとSeelong最終処分場におけるごみ質調査を実施		調査結果を基に事業案の精査・高度化の検討	中長期のプロジェクトの具体化（3~5年以内）
現地との打ち合わせ		1～2か月に1度IRDAと打ち合わせを実施するほか、個別企業とのワークショップやメールフォローを適宜実施			
報告書の作成 御省との打合せ		●契約 月次報告 ●キックオフ	●中間打合せ	●報告書提出 ●最終打合せ	（※打合せは、必要に応じて追加）

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1. 本年度事業の概要

2. 各活動の成果

   1. 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

   2. 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

3. 今後の展開

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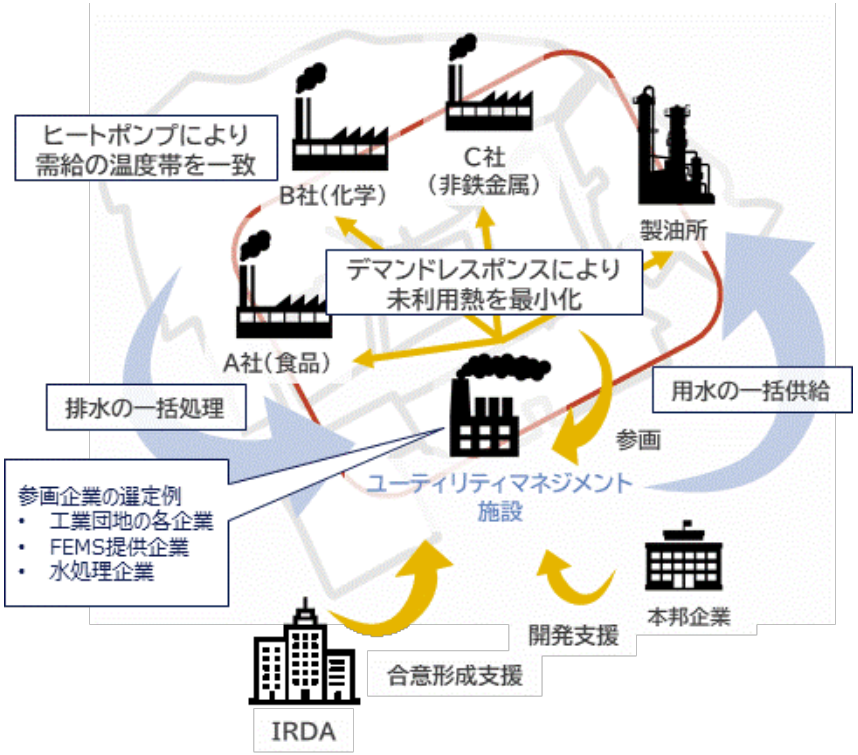
2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

活動内容

産業間連携プロジェクトの創出に向けて以下の活動を実行する

#	Activities	IRDA	北九州市	アミタ	NTTD経営研
1	排熱発生状況等の詳細把握、実現可能性調査	●			●
2	工業団地内の用排水の設備・パイプライン等のインフラ整備状況調査	●			●
3	参画候補企業の選定(現地企業及び上記の関連技術を持つ本邦企業)	●	●	●	●
4	選定した参画候補企業によるコンソーシアムの形成・協議	●	●	●	●



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2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

現地工業団地へのアンケート内容

各企業へのヒアリング内容は以下の通り。

1	1. 購入している電力のうち、再生可能エネルギー由来の電力の有無/購入割合（%） 2. 使用している蒸気のうち、他社から購入している蒸気の有無 （選択肢：①自社では蒸気を使用していない/②全て他社から購入した蒸気を使用している/③一部他社から購入した蒸気を使用している/④他社から蒸気を購入していない）
2	自社から発生している指定廃棄物の種類、発生量及び処分方法（埋立、焼却、リサイクル、その他）
3	1. 排水・排熱の処理方法（選択肢：①工業団地内で一括で処理されている/②自社で処理を行っている/③処理を行っていない/④そもそも排水・排熱が発生していない） 2. 各工場で処理している場合、自社で処理しているか/委託しているか
4	1. 自社で省エネ対策を実施しているか（Yes/No） 2. 「はい」と答えた場合、具体的にどのような省エネ対策をしているか？ 3. 現在実施している省エネ対策でこれ以上自社のCO_2排出量を下げるのに限界を感じているか？
5	自家発電設備（コジェネ含む）を保有している/熱利用設備を保有している 1. 自家発電設備について、導入している設備種別の個数 2. 自家発電設備の燃料転換、脱炭素化の検討状況（選択肢：①既に対策を実施済み、②未実施であるが方針を決定済み、③現在検討中、④現在未検討であるが今後検討予定、⑤現在未検討であり今後も検討する予定はない） 3. 実施済み、決定済みの対策・方針の内容について
6	1. 熱利用設備について、導入している設備種別の保有数 2. 熱利用設備の燃料転換、脱炭素化の検討状況（選択肢：①既に対策を実施済み、②未実施であるが方針を決定済み、③現在検討中、④現在未検討であるが今後検討予定、⑤現在未検討であり今後も検討する予定はない） 3. 実施済み、決定済みの対策・方針の内容について

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2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

ワークショップの実施

Tanjung Langsat Industrial Complexにおいては、運営企業との調整の結果、現地で対象企業を集め、ワークショップを開催した。ワークショップ内ではJCM制度に関する説明及び産業間連携のコンセプトを説明した上でアンケートへの回答を参加企業に依頼した。

TIME	PROGRAMME DETAILS
9.30 a.m. – 10.30 a.m.	Registration (with breakfast)
10.30 a.m. – 10.40 a.m.	**Welcoming remark** By Head, Resilient Environment (IRDA)
10.40 a.m. – 11.00 a.m.	**Session 1:** Presentation on City-to-City Collaboration between City of Kitakyushu & IRDA and overview of the Joint Crediting Mechanism (JCM) by MOEJ
11.00 a.m – 11.15 a.m	Coffee Break
11.15 a.m – 11.45 a.m	**Session 2:** Presentation on Overview of Inter-industry collaboration project in City-to-City Collaboration
11.45 a.m – 1.00 p.m	**Consultancy & Data Gathering Exercise** One-on-one session with companies
1.00 p.m	Lunch & End of Programme

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2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

ワークショップ参加者の声

参加企業は以下6社である。JCM制度や産業間連携のコンセプトに関して積極的な議論がなされ、脱炭素化に寄与するコンセプトに対する関心の高さを確認できる結果となった。

参加企業リスト

参加企業名	業種
Bahru Stainless Sdn Bhd	金属製造
Total Project Management Sdn Bhd	工業団地の運営
MSM Sugar Refinery (Johor) Sdn Bhd	食品製造
Musim Mastika Oils & Fats (M) Sdn Bhd	石油精製
Nippon Paint (M) Sdn Bhd	塗料製造
JLand Group Sdn. Bhd	建設・不動産

参加企業による主なコメント

- 当社は水の消費量が多く、月に15,000kLほど使用している。そのため、集中型の排水処理計画は歓迎されると思う（MMOF）
- TLICでは大規模に排水・排熱処理を実施している設備はない。（JLand）
- 固形廃棄物に関して既に複数社と共同で汚泥を建築用ブロックに再利用する研究を実施したことがある（SB）
- 排出されているのは金属スラッジであるため、標準鋼を製造するためのプロセスから生成される。私たちはスラッジをレンガ工場にお金を払って送っている。埋立地に送るのは常に最後の選択肢である（BS）
- CO2をどのように回収し、それを他のものに変換するかについて非常に興味がある（BS）

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2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

アンケート回答企業

AME Development社を通じたアンケート配布及び、ワークショップを通じたTLICアンケート配布によって回収できたアンケート回答数は合計５社であった（i-park @ senai airport city：3社、TLIC：2社）

#	企業名	業種	所属工業団地
1	A社	繊維産業	i-park@Senai airport city
2	B社	物流サービス	i-park@Senai airport city
3	C社	プラスチック製品	i-park@Senai airport city
4	D社	金属製品	Tanjung Langsat Industrial Complex
5	E社	食品製造	Tanjung Langsat Industrial Complex

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2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

（参考）アンケート回答結果（1/5）

現在購入している電力の内、再生可能エネルギー由来の電力を使用している企業は5社中3社であった。
蒸気については、使用している3社は他社から特に購入していないため、自社における廃蒸気を再利用していると考えられる。

#	企業名	1.1 購入している電力のうち、再生可能エネルギー由来の電力の有無/購入割合（%）	再エネ比率(%)	1.2 使用している蒸気のうち、他社から購入している蒸気の有無
1	A社	再エネ電力を一部購入している	38	④他社から蒸気を購入していない
2	B社	再エネ電力を一部購入している	11	①自社では蒸気を使用していない
3	C社	再エネ由来電力を購入していない	0	①自社では蒸気を使用していない
4	D社	再エネ電力を一部購入している	57	④他社から蒸気を購入していない
5	E社	再エネ由来電力を購入していない	0	④他社から蒸気を購入していない

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（参考）アンケート回答結果（2/5）

アンケート回答企業から排出されている指定廃棄物はほとんどリサイクルされ、一部焼却されているという結果となった。

	企業名	業界	指定廃棄物の種類	処分方法			
				埋立	焼却	リサイクル	その他
1	A社	繊維製品	SW 204、SW 409、SW 416、SW 410			✓	
2	B社	物流サービス	SW 410				✓
3	C社	プラスチック製品	SW 303、SW 307、SW 409、SW 410、SW 422、SW 311				✓
4	D社	金属製品	SW 204、SW 104、SW 307、SW 312、SW409、SW410、SW110、SW422、SW306			✓	
			SW 408、SW 429		✓		
5	E社	食品製造	SW 109、SW 110、SW 305、SW 322、SW 409、SW 410、SW 102、SW 411、SW 427				✓

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2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

（参考）アンケート回答結果（3/5）

各社における排水・排熱の処理方法としては、排水については自社で処理を行っている企業が3社、処理を行っていないのが1社、そもそも排水が発生していないのが1社であった。排熱に関しては自社で処理を行っているのが2社、処理を行っていないのが1社、そもそも排熱が発生していないのが2社であった。

処理方法としては、排水や排熱どちらもほとんどは自社で処理をしているといった結果となった。

#	企業名	3.1 排水・排熱の処理方法		3.2 各工場で処理している場合、自社で処理しているか/委託しているか	
		排水処理	排熱処理	排水処理	排熱処理
1	A社	②自社で処理を行っている	②自社で処理を行っている	自社で処理	自社で処理
2	B社	④そもそも排水が発生していない	④そもそも排熱が発生していない		
3	C社	③処理を行っていない	③処理を行っていない	他社に委託	他社に委託
4	D社	②自社で処理を行っている	②自社で処理を行っている	自社で処理	自社で処理
5	E社	②自社で処理を行っている	④そもそも排熱が発生していない	自社で処理	

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（参考）アンケート回答結果（4/5）

全社が省エネ対策を既に実施していると回答。省エネ対策に関しても全社限界を感じており、各社既に省エネ対策は実施しているものの、上記の通りLED電灯への切り替えなど簡易的な設備導入しか進んでいないため、更なる省エネ対策の機会を探っていると考えられる。

#	企業名	4.1 自社で省エネ対策を実施しているか	4.2 「はい」と答えた場合、具体的にどのような省エネ対策をしているか？	4.3 現在実施している省エネ対策でこれ以上自社のCO2排出量を下げるのに限界を感じているか？
1	A社	はい	LED lighting, Inveter aircond with centralise control, motor with VSD inverter, inverter air compressor.	はい
2	B社	はい	All lights are LED	はい
3	C社	はい	Using LED fluorescent light tube	はい
4	D社	はい	1) LED replacement 2) Compressed Air optimization 3) Variable Speed drive for Utilities system - Cooling tower pump and fan motor	はい
5	E社	はい	LED Bulb & Aircond with Inverter	はい

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（参考）アンケート回答結果（5/5）

自家発電設備については保有している企業が少なく、食品製造業のE社のみであった。一方、自家熱利用設備については5社中3社が既に有している状況である。

#	企業名	5. .自家発電設備（コジェネ含む）を保有している/熱利用設備を保有している	
		自家発電設備	熱利用設備
1	A社	いいえ	はい
2	B社	いいえ	いいえ
3	C社	いいえ	いいえ
4	D社	いいえ	はい
5	E社	はい	はい

自家発電設備

食品製造業であるMSM SUGAR REFINERY (JOHOR) SDN BHDは蒸気タービンを保有。

また、まだ実行はしていないが、既に検討している自家発電設備の燃料転換や脱炭素化への取組が以下3つ挙げられた。

- 2024年～2025年にバイオマスボイラーを建設予定。
- CO2排出量の20%を再利用する。
- 燃料フォークリフトをリチウム電池式に変更する。

熱利用設備

回答した企業の内、3社が熱利用設備を保有。

企業名	保有している設備	熱利用設備の燃料転換や脱炭素化への取組
A社	• ボイラー2台（稼働中1台と今後導入予定1台）	現在は検討されていないが、将来的には検討する予定
D社	• ボイラー2台 • 加熱炉2台 • その他の炉1台	ボイラー：将来的に燃料転換や脱炭素化への取組は検討する予定 加熱炉：既に燃料転換を実施している
E社	• ボイラー2台	現在検討中

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2.1 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

個別企業へのヒアリングの実施

上記アンケートを実施した中で、MSMSugar Refinery (Johor) Sdn. Bhd.については設備導入にJCMを活用することに関心が高いことから個別でオンライン打ち合わせを実施した。現時点でマレーシア政府とのJCMの署名が完了していないが、もし設備導入スケジュールに合えば活用したいとコメントをもらっている。

MSM Sugar Refinery (Johor) Sdn. Bhd.

- MSM Malaysia Holdings Berhad（MSM）の子会社
- ジョホール州Tanjung Langsatに拠点を置く
- マレーシア最大規模の製糖所を運営
- 年間生産能力に最大100万トン
- 需要の増加に伴い、生産規模の拡張を2025年までに開始する予定。（最大200万トン）

- 打ち合わせでは、JCM設備導入補助制度に関する詳細な質問が多く、関心の高さが見受けられた。
- MSM Sugar Refinery (Johor) Sdn. Bhd.は、2024年の第2，3四半期からバイオマスプラントの建設の取組を開始する予定であり、JCM設備導入補助の活用に関心がある。
- 前向きにJCMの活用を検討しているが、現時点でマレーシア政府とのJCM締結が完了していないため、現在予定している建設スケジュールには間に合わないことを懸念している。
- 工事が始まる前までに政府間のJCM締結が完了すれば応募できる可能性があるため、もし可能性があればJCMの活用を検討したいとのこと。

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1. 本年度事業の概要

2. 各活動の成果

   1. 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

   2. 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

3. 今後の展開

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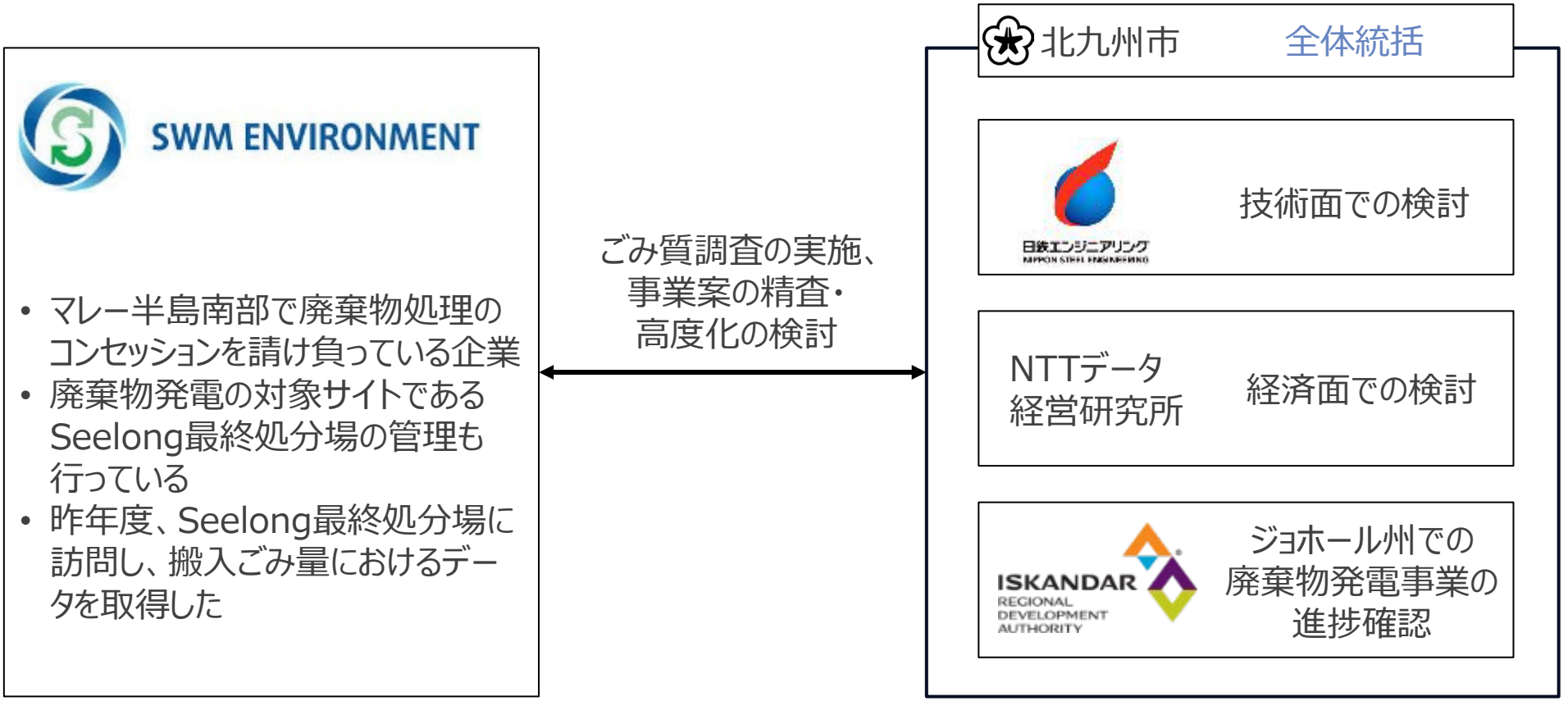
2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

活動内容について

イスカンダル地域における廃棄物発電事業の進捗を確認するとともに、現地企業（SWM Environment Sdn. Bhd. 他）との連携により、本年度は施設計画の前提に係る情報の調査として処理対象ごみ質に関する調査を実施する



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2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

Bukit Payong案件の進捗状況の確認

Bukit Payongでの廃棄物発電入札案件について、業者選定の進捗状況や選定候補者の件を含め情報収集を実施したところ、Worldwide Holdings Bhdが入札したという情報を入手した。ただ、FIT率やゲートフィーといった情報は確かなものが公開されていない。

Worldwide Holdings Bhdの概要

- 大手コングロマリット
- Perbadanan Kemajuan Negeri Selangor (PKNS)が所有する衛生埋立地の運営会社
- 事業内容としては、不動産、環境管理サービス、医療機器製造など
- 主なサービス展開先はマレーシア
- Worldwide Holdings Bhdの子会社であるWorldwide Environmentは、セランゴール州にて、廃棄物発電（WTE）プラントの開発プロジェクトを開始している。
  - 22MWの発電計画

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2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

ごみ質調査の実施計画

Uni-Technology社と共同でSeelong最終処分場でのごみ質調査を開始した。
計画案は以下の通りである。

#	検討内容	詳細
1	本ごみ質分析調査の目的	① イスカンダル地域におけるごみ種毎の発生量の把握 ② 上記ごみ種毎のごみ種類組成（Waste Fraction）データの取得 ③ 上記ごみ種毎のごみ質分析（物理的・化学的性状）データの取得
2	サンプリング場所及びサンプリング時期	• Seelong最終処分場においてごみサンプリングを実施 • 果実季（2023年11月予定）と非果実季（2024年度予定）の2回に分けて実施
3	サンプリング対象ごみ種	① 家庭ごみ ② 産業系廃棄物（有害廃棄物でないもの） ③ 商業系廃棄物 ④ 混合ごみ
4	ごみ質の分析項目	① 種類組成分析 ② 三成分分析、工業分析 ③ 可燃分元素組成分析 ④ 灰分元素組成分析
5	サンプリング方法	ごみのサンプリング方法は日本における環整95号に規定されるサンプリング方法を基本としながら、極力代表性のあるごみのサンプリングができる方法を採用
6	サンプリング及び分析のスケジュール	2023年10月～2024年10月を想定

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2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

ごみ質調査の実施スケジュール

契約期間は10月12日から開始し、12月16日までに分析レポートの作成が完了するスケジュールで実施した。

No	Task	Start Date	End Date	FY2023											
				October				November				December			
				W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Site entry approval	31st Oct					■								
2	Sampling preparation	1st Nov	3rd Nov					■							
3	Waste sampling and sorting	7th Nov	10th Nov						■						
4	Sample preparation for lab analysis	7th Nov	10th Nov						■						
5	Lab analysis	12th Nov	30th Nov							■	■				
6	Data analysis	12th Nov	9th Dec							■	■	■	■		
7	Report preparation and submission	9th Dec	16th Dec											■	

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2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

ごみ種（発生源カテゴリー）毎の搬入量

期間中の日平均ごみ搬入量は2,175t/dであり、2021年のデータと比較しても多い数値であった。
Seelong最終処分場での受入ごみが増加傾向であることを示唆している。

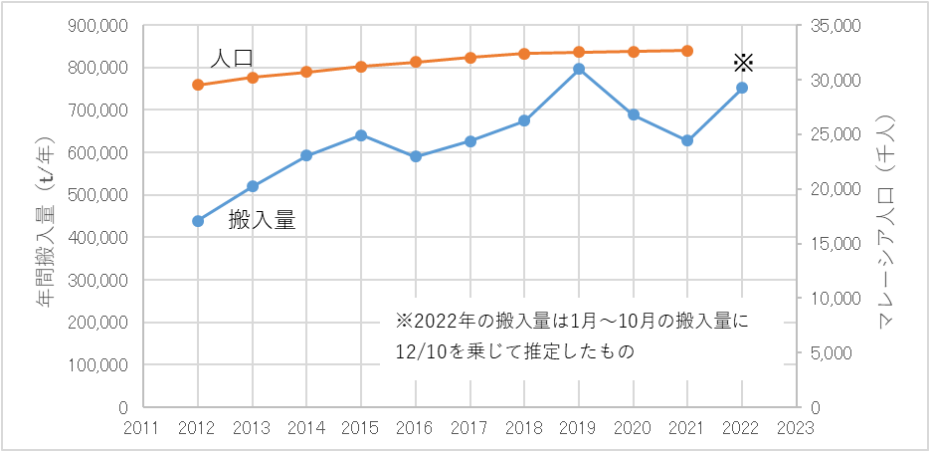
- 期間中の日平均ごみ搬入量は2,175t/dであり、令和4年度事業にてSWME社より入手したごみ搬入量データ（右図8）中の2021年の1,721t/dと比較しても多い数値であった。Seelong最終処分場での受入ごみが増加傾向であることを示唆しており、来年度事業においても引き続きごみ量の推移を継続監視することが必要。
- 2025年頃にはPekan Nanas Solid Waste Transfer Stationの運用開始に伴い、300t/d程度のごみ搬入量増が見込まれることにも留意する必要がある。
- ごみ種（発生源カテゴリー）に着目すると、家庭ごみが最も多く搬入量全体の79.8%を占める

ごみサンプリング期間近傍の2週間のごみ搬入量の平均値

	ごみ種（Waste Type）				合計
	家庭ごみ	商業系ごみ	産業系ごみ	組織排出ごみ・粗大ごみ	
日平均搬入量（t/d）	1,736	98	255	86	2,175
年間搬入量（換算参考値）（t/year)*1	633,479	35,810	92,947	31,547	793,784
割合（%）	79.8%	4.5%	11.7%	4.0%	100.0%

*1: 日平均搬入量を単純に365倍したもの

Seelong最終処分場の年間搬入ごみ量のトレンド（令和4年度）



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2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

ごみ種類組成データの取得

全てのごみ種（発生源カテゴリー）についてのごみ種類組成のデータを取得した。

全てのごみ種（発生源カテゴリー）についてのごみ種類組成

No.	Material Fraction	Sub-fraction	Material Fraction (wt.%wet)			
			Residential	Commercial	Industrial	Mixed waste
1.	Food Waste		**32.4**	**33.2**	**5.2**	**24.2**
		Avoidable Food Waste	11.3	15.8	2.8	10.4
		Unavoidable Food Waste	21.1	17.4	2.4	13.8
2.	Fruit Husk	-	2.0	0.0	0.0	0.4
3.	Yard Waste	-	0.3	0.1	0.6	0.0
4.	Paper		**14.6**	**22.1**	**19.6**	**11.1**
		Mixed Paper	2.1	6.4	0.8	1.4
		Newsprint	0.0	0.0	0.0	0.0
		Corrugated Paper	0.1	3.7	11.6	3.9
		Non-recyclable Paper	12.4	12	7.2	5.8
5.	Tetrapak	-	0.8	0.2	0.2	0.8
6.	Plastic		**23.3**	**22.3**	**34.5**	**29.4**
		Rigid	7.2	6.6	9.5	7.7
		Foam	0.8	1.5	12.8	3.0
		Film	15.3	14.2	12.2	18.7
7.	Dry Wood	-	0.4	8.2	27.3	3.8
8.	Textile	-	2.6	1.1	1.7	5.6
9.	Rubber and Leather	-	0.4	0.4	0.3	8.0
10.	Metal*	-	1.9	1.6	2.7	2.5
11.	Glass*	-	3.6	5.7	0.2	1.5
12.	Nappies	-	13.7	2.2	0.1	4.2
13.	Face Mask	-	0.4	0.1	0.3	0.2
14.	Hazardous Waste related to COVID-19*	-	0.0025	0.0	0.0	0.0
15.	Other Hazardous Waste*	-	0.4	1.1	0.4	0.4
16.	Others*	-	3.3	2.0	7.2	8.1

* Not included in laboratory analysis

①サンプリング場所でのごみ排出

②ごみサンプリング

③ごみ種類組成への分別作業

④ごみ種類組成への分別作業

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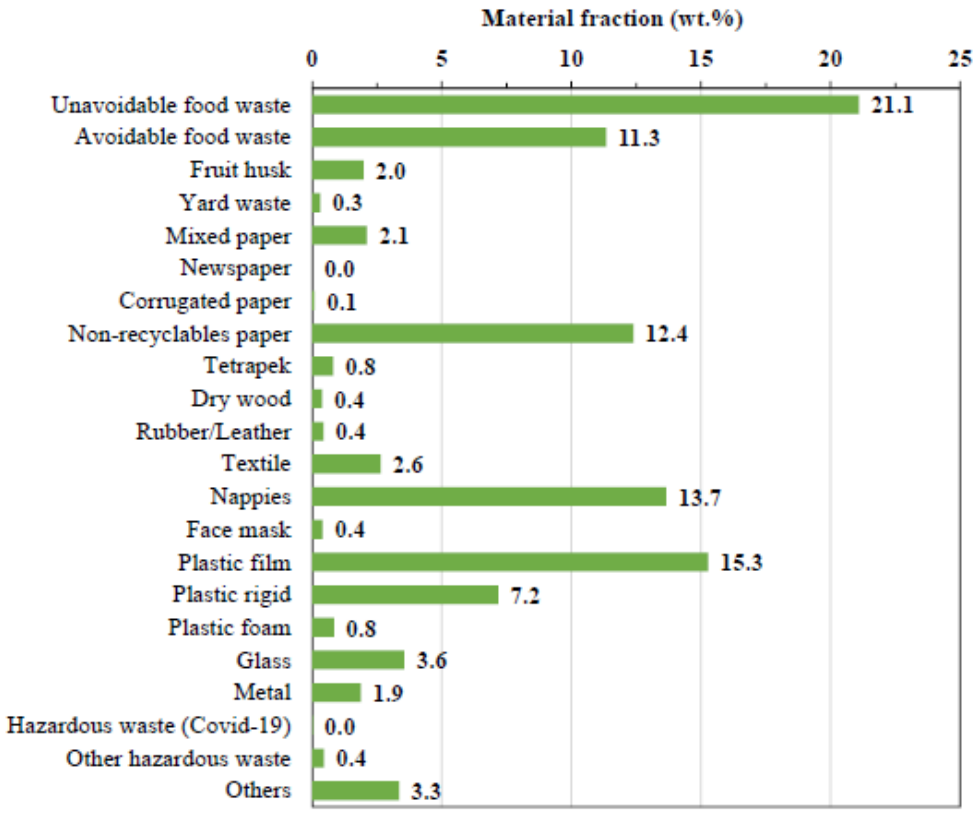
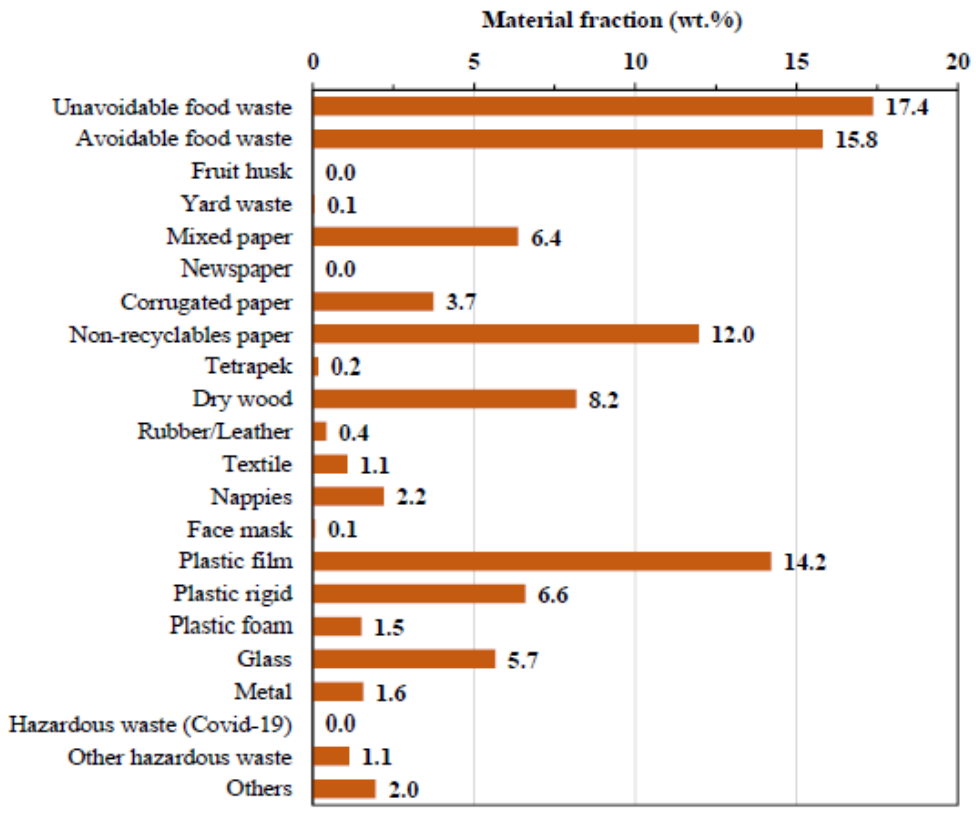
2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

（参考）家庭ごみ・商業系ごみの種類組成

家庭ごみの種類組成



商業系ごみの種類組成



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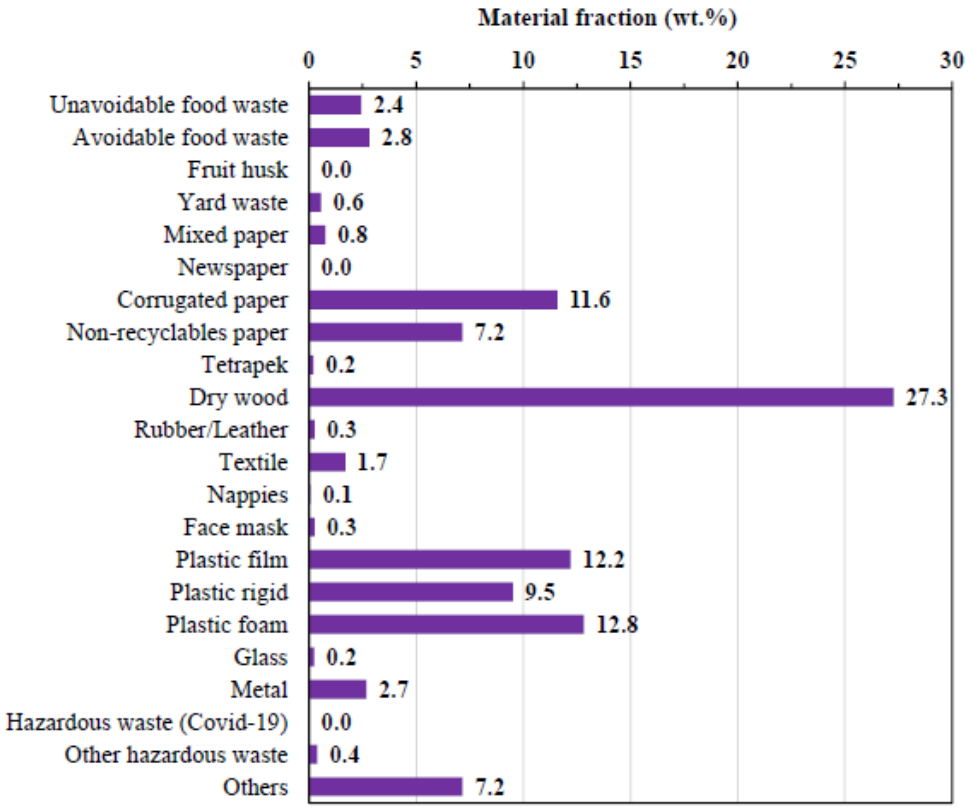
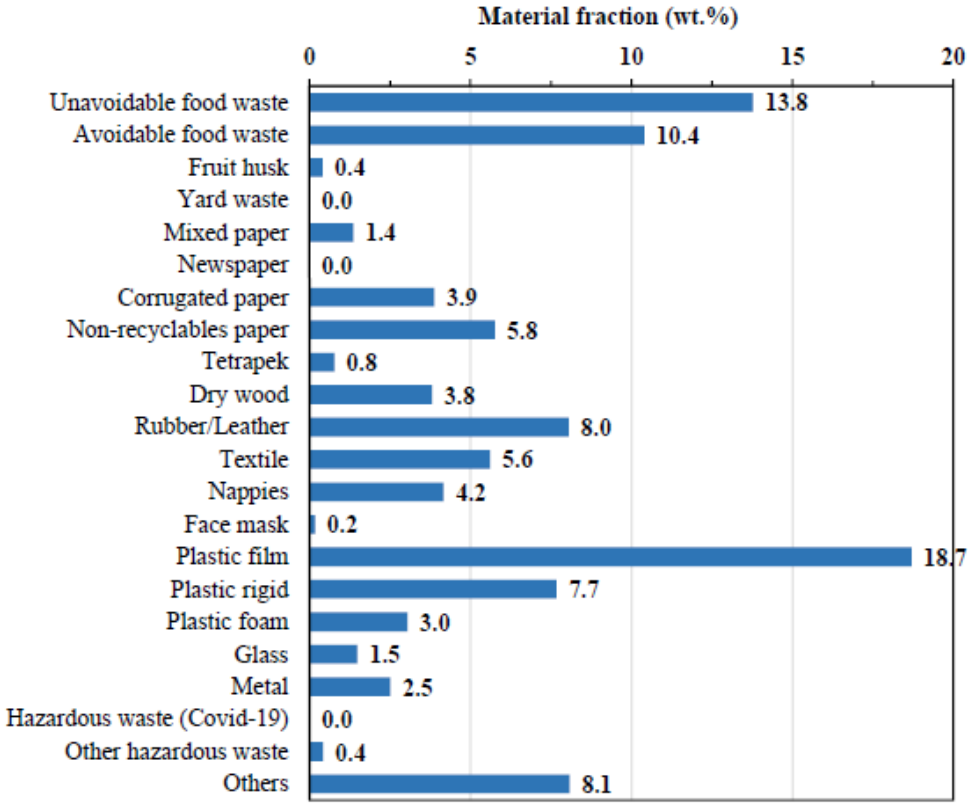
2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

（参考）産業系ごみ・混合ごみの種類組成

産業系ごみの種類組成



混合ごみの種類組成



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2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

ごみ種類組成分析結果

北九州市の家庭ごみ（2019年度調査）の種類組成と今回Seelong最終処分場でサンプリングした家庭ごみを比較すると、"Kitchen waste/Food waste"の割合は両者で同程度であった一方で、"Plastic, Synthetic resin, Rubber and Leather"の割合は今回サンプリングごみ（23.7%）の方が日本のごみ（7.9%）よりも3倍程度多いことが分かった

	Material Fraction (wt% wet)				Reference	
	Residential	Commercial	Industrial	Mixed waste	SWM data *1	Japanese waste data *2
Papers	15.4	22.3	19.8	11.9	13.4	24.0
Textiles	3.0	1.2	2.0	5.8	5.4	
Plastics, Synthetic resin, Rubber and Leather	23.7	22.7	34.8	37.4	24.9	7.9
Wood, Bamboo, Grass and Straw	0.7	8.3	27.9	3.8	9.3	
Kitchen waste/Food waste	48.1	35.4	5.3	28.8	38.5	46.9
Non-combustibles	5.5	7.3	2.9	4.0	8.7	
Residue (fines <5 mm)						
Others	3.7	3.1	7.6	8.5		21.2
Total	100	100	100	100	100	100

*1: SWME社にて2022年に実施した自主分析結果

*2: 北九州市における家庭ごみの組成調査結果（2019年度）[北九州市環境審議会, 2021]

- ここで高水分ごみである"Nappies"（紙おむつ）については"Kitchen waste/Food waste"に分類することとした。
- 今回のUni-Technology社の分析においては、"Residue (fines<5mm)"（5mm以下の雑物）の種類組成項目の設定がなかったため、空欄としていることを付記する。
- 日本（北九州市）の家庭ごみはプラスチック製容器包装を家庭分別し別回収しているためにプラスチックの割合が低くなっている。また逆に、"Papers"は今回サンプリングごみ（15.4%）の方が日本のごみ（24.0%）よりもやや少なかった。

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2.2 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

ごみ嵩比重とごみ三成分、可燃物元素組成および発熱量のラボ分析の結果

イスカンダル地域における廃棄物発電施設の計画にあたっては、今年度および来年度実施予定のごみ質調査の結果を踏まえて、前提ごみ質を見直す必要があることが示唆された

			Waste Category				Weighted Average
			Residential	Commercial	Industrial	Mixed waste	
嵩密度		kg/m^3	225	202	133	171	212
三成分	水分	%,wet	41.2	27.7	32.6	35.1	39.5
	灰分	%,wet	13.0	14.1	9.2	7.6	12.6
	可燃分	%,wet	45.7	58.2	58.2	57.3	47.8
可燃分元素組成	炭素	%,wet	24.35	31.21	29.29	29.16	25.28
	水素	%,wet	3.45	4.42	4.18	4.04	3.59
	窒素	%,wet	0.50	1.09	0.45	0.50	0.52
	酸素	%,wet	16.70	20.18	23.47	22.87	17.69
	硫黄	%,wet	0.44	0.52	0.50	0.47	0.45
	塩素	%,wet	0.28	0.82	0.34	0.23	0.31
発熱量	高位発熱量（実測）	kcal/kg	2,470	3,614	2,965	3,122	2,584
	低位発熱量（実測）	kcal/kg	2,026	3,192	2,544	2,690	2,144
	低位発熱量（推定）（*1）	kcal/kg	2,231	3,045	2,690	2,639	2,325

*1: 元素組成分析結果を基にSteuerの式により推定

- 令和3年度事業にて文献値（2011年、2013年の調査結果）を参考に設定した計画ごみ質に比べて、今回の分析結果では水分が低く低位発熱量は高い結果であり（実測値の加重平均値2,144kcal/kgでは1,591kcal/kgの1.35倍）、約10年の間にごみ発生エリアにおける市民生活様式の変化によるごみの低水分化、高プラスチック化が進行したと思料。
  - ごみ中灰分はいずれのごみ種でも極端に高い数値は見られず、7.6%～14.1%の範囲。
  - 家庭ごみ中の塩素は0.28%,wetであり、これは日本の北九州市の計画ごみ質（新日明清掃工場）の0.28%,wetと同程度の水準であり、極端に高い数ではない。
  - 一方、硫黄の含有量は0.44～0.52%,wetであり、これも商業系ごみにおいて最も高い数値が見られた。家庭ごみ中の硫黄は0.44%,wetであり、日本の北九州市の計画ごみ質0.11%,wetに比べて際立って高い水準であった

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1. 本年度事業の概要

2. 各活動の成果

   1. 活動①：産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討

   2. 活動②：民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入

3. 今後の展開

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3. 今後の予定

来年度以降に向けた検討方針は以下の通り。

活動	2023年度の成果・課題	2024年度の検討方針
活動① 産業部門の脱炭素化に向けた産業間連携プロジェクト創出検討	**成果** • AME DevelopmentとTPM Technoparkの運営する工業団地（i-park @ Senai airport city/Tanjung Langsat Industrial Complex）に入居する個別企業に対してアンケート及びヒアリングを実施。各企業が抱えるニーズや現状に関する情報を収集した	• 本年度調査を実施した2つの工業団地、特にアンケートやワークショップに参加して産業間連携のコンセプトに関心のある工場を中心に産業間連携コンセプトのコンソーシアムの形成・具体的な計画策定を実施する
活動②-2 民生部門の脱炭素化に向けたベースロード電源としての廃棄物発電設備導入	**成果** • Uni-Technology社と連携し、Seelong最終処分場におけるごみ質（果実季）分析を実施。廃棄物発電施設の計画にあたっては、ごみ質調査の結果を踏まえて、前提ごみ質を見直す必要があることが示唆された	• 今年度と同様にSeelong最終処分場においてUni-Technology社と共同で実施するが、今年度実施できなかった「非果実季」のごみを対象とした分析・評価を行う • ごみ質分析結果に基づき、令和3年度（2021年度）に実施した廃棄物発電施設の技術仕様の設定および事業性の試算について見直しを実施する

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（参考）非果実季を対象としてごみ質調査スケジュール

非果実季を対象としたごみ質調査・分析は8月～10月の約3か月間で実施する。

TASK	START DATE	END DATE	Year 2024											
			August				September					October		
			W1	W2	W3	W4	W1	W2	W3	W4	W5	W1	W2	W3
Site entry approval		11/8/2024												
Sampling preparation	14/8/2024	3/9/2024												
Waste sampling and waste sorting	4/9/2024	10/9/2024												
Sample preparation for lab analyses	4/9/2024	17/9/2024												
Lab analyses	11/9/2024	1/10/2024												
Data analyses	4/9/2024	7/10/2024												
Report preparation and submission	7/10/2024	14/10/2024											*	

*: Milestone

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月次報告書（令和５年６−７月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 (共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA))
期　　間	令和５年６月２３日（金）～令和５年７月３１日（月）

【実績概要】

① 環境省様とのキックオフミーティング及びヒアリングを実施。事前に日本側関係者間で資料を作成・準備を行った。キックオフミーティングでは本年度事業の実施内容に関して報告を行った。

② IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施した。（8月打ち合わせ実施予定）

【打合せ・現地渡航等】

① 環境省様とのキックオフミーティング（オンライン）を7月13日に実施。

② 環境省様からのヒアリング（オンライン）を7月14日に実施。

【来月以降の予定】

① 8月上旬にIRDAと打ち合わせ（オンライン）を実施予定。産業間連携に関する調査方法（アンケート実施方法等）や実施時期に関して議論する。

以上

月次報告書（令和５年８月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 (共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA))
期　　間	令和５年８月１日（火）～令和５年８月３１日（木）

【実績概要】

① IRDAとのキックオフミーティングを実施。今年度のIRDAの役割について確認し、産業間連携の活動におけるアンケートを含む情報収集の方法について議論した。

② アンケート実施対象となる工業団地に対してコンタクトを取り、対象となる企業の整理を開始。

③ IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施した。

【打合せ・現地渡航等】

① IRADとのキックオフミーティング（オンライン）を８月９日に実施。

【来月以降の予定】

① 工業団地へのアンケート実施内容を精査する。

② Uni-Technology社とSeelong最終処分場におけるごみ質調査に関する調整を開始。調査に必要なSite entry approvalをIRDAを通じて取得する。

以上

月次報告書（令和５年９月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 （共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA)）
期　　間	令和５年９月１日（金）～令和５年９月２９日（金）

【実績概要】

① Uni-Technologies社と日鉄エンジニアリング（株）の3社間でSeelong最終処分場におけるごみ質調査に関する調整を開始。

② 工業団地内企業リストをIRDAから受領。アンケート実施先である企業を整理・検討。

③ IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施した。

【打合せ・現地渡航等】

① 日鉄エンジニアリング（株）とSeelong最終処分場のごみ質調査の進め方について内部打ち合わせを実施。

【来月以降の予定】

① Uni-Technology社によるSeelong最終処分場におけるごみ質調査を開始。

② 工業団地運営会社及びアンケート実施先への現地訪問を調整。

以上

月次報告書（令和５年１０月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 (共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA))
期　　間	令和５年１０月２日（月）～令和５年１０月３１日（火）

【実績概要】

① １０月２３日にAME Development社が管理するi-park@ Senai airport city内の全企業へアンケートをメールで配布した。（１１月４日をアンケート回答締め切りとしている）

② TPM Technopark社が管理するTanjung Langsat Industrial Complexについては製造業を中心としたアンケート候補先をリスト化した。アンケート配布方法についてTPM Technopark社と調整中。

③ Uni-Technologies社と日鉄エンジニアリング（株）でSeelong最終処分場への現地訪問を調整した。（ごみサンプリングの立ち合いを実施）

④ IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施した。

【打合せ・現地渡航等】

① １０月１０日にIRDAと工業団地へのアンケートの実施方法に関する打ち合わせを実施。

【来月以降の予定】

① アンケート結果の収集、分析を実施。

② Uni-Technology社によるSeelong最終処分場でのごみサンプリングの際に日鉄エンジニアリング（株）が現地訪問を実施。（１１月７日頃を予定）

以上

月次報告書（令和５年１１月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 (共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA))
期　　間	令和５年１１月１日（水）～令和５年１１月３０日（木）

【実績概要】

① TPM Technopark社が管理するTanjung Langsat Industrial Complexへのアンケート配布方法についてTPM Technopark社と調整を実施。対象企業を集めたワークショップ実施に合意。当初は12月初めでの実施を想定していたが、都合が合わず年明けで再度調整予定。

② 日鉄エンジニアリング（株）がSeelong最終処分場への現地訪問を実施した。（ごみサンプリングの立ち合いを実施）

③ IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施した。

【打合せ・現地渡航等】

① １１月７日にUni-Technology社によるSeelong最終処分場でのごみサンプリングの際に日鉄エンジニアリング（株）が現地訪問を実施。

② １１月９日にIRDAと工業団地へのアンケートの実施方法に関する打ち合わせを実施。

③ １１月１４日に環境省様との中間報告を実施。

【来月以降の予定】

① Tanjung Langsat Industrial Complex でのワークショップ実施に向けて調整・準備を実施。

② Uni-Technology社によるSeelong最終処分場でのごみサンプリングの結果報告を受領予定。

以上

月次報告書（令和５年１２月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 (共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA))
期　　間	令和５年１２月１日（金）～令和５年１２月２８日（木）

【実績概要】

① IRDAを通じてTPM Technopark社とTanjung Langsat Industrial Complexの対象企業を集めたワークショップ実施に向けた調整を実施。１月１１日に実施で合意。

② Uni-Technology社からSeelong最終処分場でのごみサンプリングの結果を受領。

③ IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施した。

【打合せ・現地渡航等】

① １２月２７日に北九州市とNTTデータ経営研究所で現地渡航に向けた打ち合わせを実施。

【来月以降の予定】

① Tanjung Langsat Industrial Complex でのワークショップを実施（１月１１日）

② Uni-Technology社によるSeelong最終処分場でのごみサンプリングの結果報告を確認・分析。

以上

月次報告書（令和６年１月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 (共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA))
期　　間	令和６年１月４日（木）～令和６年１月３１日（水）

【実績概要】

① Tanjung Langsat Industrial Complexの対象企業を集めたワークショップを現地にて実施。

② ワークショップ参加者からアンケートを収集、分析を実施。

③ 日鉄エンジニアリング（株）を中心にUni-Technology社によるSeelong最終処分場でのごみサンプリングの結果報告を確認・分析を実施。

④ IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施。

【打合せ・現地渡航等】

① Tanjung Langsat Industrial Complex でのワークショップを実施（１月１１日）

② I-park@Senai airport cityへの見学を実施（１月１２日）

【来月以降の予定】

① ワークショップ参加者から追加打ち合わせの依頼があったためWeb打ち合わせを調整予定。

以上

月次報告書（令和６年２月）

業　務　名	令和５年度脱炭素社会実現のための都市間連携事業委託業務 （イスカンダル地域における脱炭素モデルエリア構築事業（フェーズ２）（北九州市-イスカンダル地域開発庁連携事業））
受　託　者	株式会社エヌ・ティ・ティ・データ経営研究所 (共同事業者：北九州市、日鉄エンジニアリング(株)、アミタ（株）、イスカンダル地域開発庁(IRDA))
期　　間	令和６年２月１日（木）～令和６年２月２９日（水）

【実績概要】

① Tanjung Langsat Industrial Complexのワークショップにてアンケートを回答いただいたMSM Sugar Refinery (Johor) Sdn. Bhd.から追加打ち合わせの打診があったため、オンライン打ち合わせを実施。JCM制度に関する意見交換を実施した。

② 日鉄エンジニアリング（株）を中心にUni-Technology社によるSeelong最終処分場でのごみ質分析の結果を整理。報告書を作成。

③ IRDAへ日本側の検討状況の報告、現地情報に関する確認等のフォローアップをメールベースで実施。

【打合せ・現地渡航等】

① 2月8日にMSM Sugar Refinery (Johor) Sdn. Bhd.とオンライン打ち合わせを実施。

【来月以降の予定】

① ３月４日に環境省との最終報告会を予定。

以上