FY2023 Ministry of the Environment commissioned project

Commissioned work for City-to-City collaboration Project FY 2023 to realize a decarbonized society (Support project for the formation of a decarbonized city in the Iskandar Region through the realization of decarbonized transportation and the promotion of renewable energy)

# **Study Report**

March 2024

Japan NUS Co., Ltd.

**Toyama City** 

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List	of Abbreviations

Abbreviation	English
ADB	Asian Development Bank
AIM	Asia-pacific Integrated Model
AZEC	Asia Zero Emission Community
BaaS	Battery as a Service
BAU	Business As Usual
BRT	Bus Rapid Transit
EEV	Energy Efficient Vehicle
EPC	Engineering, Procurement and Construction
EV	Electric Vehicle
FIT	Feed in Tariff
GHG	Green House Gas
IM	Iskandar Malaysia
IRDA	Iskandar Region Development Association
IRT	Integrated Rapid Transit
JANUS	Japan NUS Co., Ltd.
JB	Johor Bahru
JCM	Joint Crediting Mechanism
ЛСА	Japan International Cooperation Agency
KTM	Keretapi Tenah Melayu (Malay Land Train)
LCMB	Low Carbon Mobility Blueprint
LCSBIM2030	Low Carbon Society Blueprint Iskandar Malaysia 2030
LCV	Low Carbon Vehicle
LRT	Light Rail Transit

Abbreviation	English	
MaaS	Mobility as a Service	
MITI	Ministry of Investment, Trade and Industry	
MOSTI	Ministry of Science, Technology and Innovation	
МОТ	Ministry of Transport	
MoU	Memorandum of Understanding	
MRV	Measurement, Reporting and Verification	
NAP	National Automotive Policy	
NDC	Nationally Determined Contributions	
NETR	National Energy Transition Roadmap	
RM	Ringgit Malaysia	
RTS	Rapid Transit System	
SDGs	Sustainable Development Goals	
VES	Vehicular Emission Scheme	

# Chapter 1. Background and Purpose of this Work

### 1.1 Background of work

Toyama City, an "Environmental Future City" and "SDGs Future City", has been recognized by the United Nations as Japan's only "city with improved energy efficiency" for its achievements in compact urban development based on public transportation, including "Toyama Light Rail", the first full-scale LRT in Japan, and utilization of renewable energy such as small-scale hydroelectric power that takes advantage of regional characteristics. On March 1, 2021, Toyama City announced its "Zero Carbon City Declaration", aiming to achieve zero greenhouse gas emissions by 2050. The "Toyama City Energy Vision" was also announced at the same time, which sets forth a policy of deploying technology and know-how from Toyama City and local companies as a package to overseas cities and regions, mainly in Southeast Asia, to promote international contributions and solve local issues.

The Iskandar region, on the other hand, is an area where large-scale urban development is progressing as one of the priority regional development projects promoted by the Malaysian government. The population is increasing year by year along with urban development. If no measures are taken, CO2 emissions from the transportation sector will reach 8.58 million t-CO2 in 2025, which is expected to account for 27% of the total emissions from Malaysia's transportation sector. Given this background, the Iskandar Regional Development Authority (IRDA), with support from this City-to-City collaboration Project (Phase 1), has declared the "Low Carbon Society Blueprint Iskandar Malaysia 2030 (LCSBIM2030)", which sets a goal of carbon neutrality in 2050.

To realize these goals, IRDA requested cooperation from Toyama City, which has a proven track record of compact urban development based on public transportation, for its "Future City" concept, including revitalization of public transportation and promotion of renewable energy, and concluded a cooperation agreement in February 2015, establishing a cooperative relationship aimed at building a decarbonized city through City-to-City collaboration. A good cooperative relationship between the two cities continues to this day.



#### 1.2 Purpose of work

In addition to the Iskandar region, our company was working with Kota Kinabalu City, Sabah, under the City-to-City collaboration Project (Phase 1) until FY 2022. As specific initiatives to achieve carbon neutrality in 2050 in both cities, we studied an urban development project centered on decarbonized public transportation using biofuels and electric buses in the Iskandar region and a renewable energy promotion project centered on small-scale hydroelectric and solar power generation and an electrification project for non-electrified areas using renewable energy in the Kota Kinabalu city. Furthermore, as mentioned above, one of the outcomes of this City-to-City collaboration Project is the declaration of carbon neutrality in the Iskandar region by 2050. The projects studied in Phase 1 have now moved to the detailed study stage, where private businesses will take the lead based on the study results. In particular, the biofuel utilization project studied in the Iskandar region was discussed at the Asian Zero Emission Community (AZEC) Public-Private Investment Forum, where Gas Malaysia, the largest local gas supplier, JGC Holdings, our group company, and our company signed an MoU. The companies are now making significant progress toward the commercialization of biofuel infrastructure.

As mentioned above, the projects studied in Phase 1 have moved to the detailed study stage led by private businesses. Therefore, in Phase 2, to realize the "Low Carbon Society Blueprint Iskandar Malaysia 2030", which is one of the outcomes of Phase 1, we decided to newly study projects that have not yet been studied in detail from the menu of decarbonization measures outlined in the plan. Specifically, as a result of repeated discussions with IRDA, we have decided to study the following projects in the transportation sector, where Toyama City has abundant knowledge and experience, (1) BaaS (Battery as a Service) project for battery-swappable motorbikes, (2) Project to support the construction of green field areas, which IRDA plans to develop newly, and (3) Organization of an energy management project using solar power generation, as a power source to be utilized for both projects, to realize carbon neutrality in the urban area through international collaboration between the two cities and to deploy the package in other regions.

#### 1.3 System of implementation of this work

The system of implementation of work for this fiscal year is shown in Figure 1-1. Under the framework of City-to-City collaboration, Toyama City and the Iskandar region concluded a cooperation agreement, and the Iskandar Regional Development Agency served as the point of contact for discussions regarding the projects to be considered in this study and support for policy planning.

In the study of the commercialization, we collaborated with Nihon Kucho Hokuriku Co., Ltd., a company in Toyama City with experience in engineering design of solar power generation, as well as related Japanese and local companies. In addition, Japan NUS Co., Ltd. managed the entire project, including information gathering on City-to-City collaboration, support for various surveys, and liaison and coordination with related organizations and companies.



Figure 1-1 Overview of this work and system of implementation

# Chapter 2. Transportation Sector

In the Iskandar region, the population increases yearly due to urban development. If no measures are taken, CO2 emissions from the transportation sector will reach 8.58 million t-CO2 in 2025, accounting for 27% of the total emissions from the transportation sector in Malaysia. The LCSBIM2030 uses the Asia-Pacific Integrated Assessment Model (AIM) of the National Institute for Environmental Studies to simulate future GHG emissions. It shows that emissions from the transportation sector are second only to the industrial sector in any scenario. In the BaU scenario, GHG emissions account for nearly 30% of the total emissions in 2030 and 2050 (Figure 2-1).

Furthermore, in terms of GHG emission reduction potential (%) calculated from the simulation results using the AIM model, the emission reduction potential of the transportation sector is the largest, at approximately 33% in 2030 and approximately 37% in 2050 (Figure 2-2). This percentage is large compared to other regions, indicating that among the measures to reduce greenhouse gas emissions in the Iskandar region, measures to reduce emissions from the transportation sector are given a high priority.



Figure 2-1 Simulation of greenhouse gas emissions in the Iskandar region



GHG Emission Reduction Potential (2030) in Iskandar Malaysia by Sector

Source: LCSBIM2030



IRDA's policies for reducing greenhouse gas emissions in the transportation sector include (1) reducing the number of automobiles owned and (2) switching to public transportation. Regarding the latter, we have been working on promoting public transportation, switching the fuel used for public transportation (biofuel), and building infrastructure as part of Phase 1 of this City-to-City collaboration Project. However, there is a limit to the extent to which public transportation can be used, making it difficult for residents to switch to the use of public transportation from all other means of transportation. In particular, the Iskandar region is adjacent to Singapore and the borders are connected by a bridge, due to which many residents living in the Iskandar region use motorcycles to go to Singapore for work. In addition, in recent years, the use of motorcycle taxis through Grab, a food delivery service and taxihailing app, has been rapidly spreading, and GHG emissions from motorcycles have become one of the major challenges to decarbonization.

Therefore, in Phase 2, we will study the "BaaS (Battery as a Service) project for battery-swappable motorbikes", targeting motorbikes, a pressing issue especially in the Iskandar region. BaaS (Battery as a Service) means providing batteries as a service. Batteries are the most important component of electric vehicles. However, it is also true that the long charging time, battery deterioration, and high cost have proven to be a challenge to the spread of EVs. In the BaaS business model, users do not own the batteries as in the past but instead use them while swapping with charged batteries at swapping stations (Figure 2-3). This revolutionary system simultaneously solves the issue of stopping EVs from spreading and has been rapidly developing in recent years, mainly in Asia. In the BaaS business, the BaaS provider owns batteries, and the user rents the batteries, which keeps the cost of purchasing a new vehicle low. Also, since batteries already charged can be swapped at a battery station, the user does not need to manage battery deterioration. Furthermore, the placement of many battery stations in a distributed manner has the potential to contribute to stabilizing the grid system as a storage battery.

Specifically, it will enable further introduction of renewable energy, including solar power generation, in areas where it has been difficult to introduce more renewable energy due to the availability of the grid capacity or the supply/demand balance of electricity.



Source: https://news.mynavi.jp/techplus/article/qunie-baas-1/

Figure 2-3 Business model of BaaS project

In this City-to-City collaboration Project (Phase 2), we will examine the feasibility and GHG emission reduction effect of the BaaS project for battery-swappable motorbikes in the Iskandar region. From the perspective of policy transfer, we will utilize the experience and knowledge of Toyama City, which has long worked on introducing new transportation systems and providing policy support in collaboration with private companies to build a system suitable for the Iskandar region and to provide support for formulating a master plan for the BaaS project.

The roadmap for the realization of the project is shown in Figure 2-4. Based on the results of this City-to-City collaboration Project, we aim to conduct a demonstration project starting from FY 2026 at the latest and disseminate the project by 2030. Figure 2-5 shows the overall picture of this City-to-City collaboration Project and the goals and implementation details for each fiscal year. Based on this, as an outcome of the three-year City-to-City collaboration Project, we aim to conclude an MoU with the relevant parties and formulate specific demonstration details and a roadmap for the demonstration project starting from FY 2026.







Figure 2-5 Overall picture of the BaaS project in the City-to-City collaboration Project, goals to achieve, and implementation details

The contents of the surveys conducted in FY 2023 are given below, including the current status and issues of the transportation sector in the Iskandar region, the survey results of preceding cases of BaaS project, and the establishment of a vision, including specific targets for the project, based on the results of the surveys.

2.1 Current status and issues of the transportation sector in the Iskandar region

This section summarizes the current status and issues of the transportation sector in the Iskandar

region as basic information necessary for setting targets for the project.

#### 2.1.1 Transportation policy

The Malaysian government has been formulating action plans to reduce energy and GHG emissions as part of its environment-related policies. It has announced the National Automotive Policy 2020, Low Carbon Mobility Blueprint 2021-2030, and the National Energy Transition Roadmap 2050. In the Iskandar region, IRDA has been playing a central role in formulating the Low Carbon Society Blueprint 2030 Climate Action Plan. The following sections summarize the policies related to efforts to promote the introduction of environmentally advanced vehicles in Malaysia, the Iskandar region, and Singapore, which is adjacent to the Iskandar region.

- 1) Entire country of Malaysia
- ① National Automotive Policy 2020 (NAP)

The National Automotive Policy 2020 (NAP) stipulates measures to promote the automobile industry in Malaysia. NAP 2020 was announced in February 2020 as a revised version of NAP 2014 announced in 2014. The objectives of NAP are shown in Table 2-1. For environmentally advanced vehicles, in addition to the existing regional hub for producing energy-efficient vehicles (EEV), NAP also provides a direction of "developing a technology ecosystem for next-generation vehicles". However, currently, no specific numerical targets have been specified for EVs.

#### Table 2-1 Overview of the National Automotive Policy 2020

Purpose of NAP2020			
(1) Develop an ecosystem for next-generation vehicle technologies and make Malaysia a regional			
hub for next-generation vehicle production.			
(2) In the field of MaaS, expand the participation of the domestic automobile industry, not only in			
technology development but also in the entire transportation ecosystem.			
(3) Help Malaysian players adapt to the new paradigm in the automobile industry, which is closely			
related to the development of Industry 4.0.			
(4) Maximizing the ecosystem's benefits, including consumers, domestic industry and government,			
will derive from introducing next-generation vehicles.			
(5) Reduce carbon dioxide emissions from automobiles by 2025 through improved fuel efficiency			

- levels, in line with the ASEAN Fuel Economy Roadmap with a target of 5.3 L Ge (gasoline)/ 100 km.
- (6) Consider tax incentives for investments and projects that align with the NAP 2020 approach.

# ② Low Carbon Mobility Blueprint 2021-2030 (LCMB)

The Low Carbon Mobility Blueprint 2021-2030 (LCMB) is a 10-year action plan for reducing GHG emissions in the transportation sector, announced by the then Ministry of Environment and Water (now Ministry of Natural Resources, Environment and Climate Change) in 2021. The plan sets four priority areas and ten initiatives, as shown in Table 2-2, based on which specific reduction measures are being

considered.

Blueprint goals	Reducing greenhouse gas emissions through four priority areas			
Four priority areas	A: Reduction in transportation fuel use	B: Introduction of EVs	C: Introduction of alternative fuels	D: Transformation of means of transport
Ten initiatives	1: Promote the introduction of low- emission vehicles 2: Reinforce eco- driving programs	3(i):Electric vehicles 3(ii): Electric buses 3(iii): Electric motorbikes	<ul><li>4: Promote the use of biofuels in road transportation</li><li>5: Build an ecosystem for the growth of alternative fuels and their industries</li></ul>	<ul> <li>6: Switch from direct transportation to public transportation 7:</li> <li>Promote public transportation through land use development</li> <li>8: Improve transportation</li> <li>9: Convert freight transport from roads to railways</li> <li>10: Promote micro- mobility</li> </ul>

<b>Table 2-2 Priority</b>	areas and	initiatives in	the L	CMB	2021-2030
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For "B: Introduction of EVs", according to the goals set, 50% of new vehicles to be introduced for government use and 20% of new vehicles to be introduced for use by government-affiliated enterprises should be battery-powered EVs by 2025, and 9,000 AC charging points and 1000 DC charging points should be installed. Other specific measures are as follows:

- Adopt electric vehicles in taxi fleets as part of modernization and rebranding of taxi services
- Provide EV incentives in the market
- Secure EV charging infrastructure necessary for the spread of private EVs
- · Provide research and development grants and support to local EV manufacturers
- Utilize electric motorbikes for home delivery services

The cost of introducing electric motorbikes for home delivery service has been solved by introducing tax incentives under the Green Technology Asset Program to purchase electric motorbikes.

#### ③ National Energy Transition Roadmap 2050 (NETR)

This is a roadmap for energy transition led by the Ministry of Economy. In the first phase, it has been announced that ten core projects in six sectors will be identified, and 25 billion ringgit (approximately 775 billion yen) will be invested in them. In addition, the second phase includes specific measures and goals for implementing these projects, focusing on establishing a fund and governance by the National Energy Council. The green mobility sector is set forth for the transportation sector, the specific details are shown in Table 2-3.

Green mobilityNext generation mobilityEV charging stationMITIIn collaboration with strategic partners such as TNB, Plus Malaysia Berhad (PLUS), Permodalan Nasional Berhad (PNB), Gentari and Sunway Group, 10,000 EV charging stations will be installed along highways and in selected commercial establishments by 2025.MOSTIMobile hydrogen station NanoMalaysia Berhad, PETRONAS, United Motor Works (UMW) and MGTC will jointly introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.MOT	Sector	Flagship	Specific Approach	Sponsorship
mobilityIn collaboration with strategic partners such as TNB, Plus Malaysia Berhad (PLUS), Permodalan Nasional Berhad (PNB), Gentari and Sunway Group, 10,000 EV charging stations will be installed along highways and in selected commercial establishments by 2025.Mobile hydrogen station NanoMalaysia Berhad, PETRONAS, United Motor Works (UMW) and MGTC will jointly introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.MOSTI	Green	Next generation	EV charging station	MITI
TNB, Plus Malaysia Berhad (PLUS), Permodalan Nasional Berhad (PNB), Gentari and Sunway Group, 10,000 EV charging stations will be installed along highways and in selected commercial establishments by 2025.Mobile hydrogen station NanoMalaysia Berhad, PETRONAS, United Motor Works (UMW) and MGTC will jointly introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.MOSTIPublic transportationMOT	mobility	mobility	In collaboration with strategic partners such as	
Permodalan Nasional Berhad (PNB), Gentari and Sunway Group, 10,000 EV charging stations will be installed along highways and in selected commercial establishments by 2025.Mobile hydrogen station NanoMalaysia Berhad, PETRONAS, United Motor Works (UMW) and MGTC will jointly introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.MOSTIPublic transportation elastrificationMOT			TNB, Plus Malaysia Berhad (PLUS),	
and Sunway Group, 10,000 EV charging stations will be installed along highways and in selected commercial establishments by 2025.Mobile hydrogen station NanoMalaysia Berhad, PETRONAS, United Motor Works (UMW) and MGTC will jointly introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.Multiple hydrogen station MOSTIMotor Works (UMW) and MGTC will jointly introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.Multiple hydrogen station MOT			Permodalan Nasional Berhad (PNB), Gentari	
stations will be installed along highways and in selected commercial establishments by 2025.       Mobile hydrogen station       MOSTI         NanoMalaysia Berhad, PETRONAS, United       MOOT       MOSTI         Motor Works (UMW) and MGTC will jointly introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.       MOT			and Sunway Group, 10,000 EV charging	
selected commercial establishments by 2025.         Mobile hydrogen station       MOSTI         NanoMalaysia Berhad, PETRONAS, United         Motor Works (UMW) and MGTC will jointly         introduce the first mobile hydrogen refueling         station for transportation in Peninsular         Malaysia.         Public transportation electrification			stations will be installed along highways and in	
Mobile hydrogen station       MOSTI         NanoMalaysia Berhad, PETRONAS, United       Motor Works (UMW) and MGTC will jointly         introduce the first mobile hydrogen refueling       station for transportation in Peninsular         Malaysia.       Motor			selected commercial establishments by 2025.	
NanoMalaysia Berhad, PETRONAS, United         Motor Works (UMW) and MGTC will jointly         introduce the first mobile hydrogen refueling         station for transportation in Peninsular         Malaysia.			Mobile hydrogen station	MOSTI
Motor Works (UMW) and MGTC will jointly         introduce the first mobile hydrogen refueling         station for transportation in Peninsular         Malaysia.			NanoMalaysia Berhad, PETRONAS, United	
introduce the first mobile hydrogen refueling station for transportation in Peninsular Malaysia.			Motor Works (UMW) and MGTC will jointly	
station     for     transportation     in     Peninsular       Malaysia.     MOT			introduce the first mobile hydrogen refueling	
Malaysia.       Public transportation electrification			station for transportation in Peninsular	
Public transportation electrification MOT			Malaysia.	
r ubic transportation electrification MOT		Public transportation electrification		MOT
The project will electrify first- and last-mile Prasarana			The project will electrify first- and last-mile	Prasarana
public transportation and improve bus depot			public transportation and improve bus depot	
infrastructure and charging wires.			infrastructure and charging wires.	
Maintenance, repair and overhaul (MRO)			Maintenance, repair and overhaul (MRO)	
opportunities will be provided to local SMEs.			opportunities will be provided to local SMEs.	
Photovoltaic (PV) installation for railway MOT			Photovoltaic (PV) installation for railway	MOT
business			business	
The Energy Management and Renewable			The Energy Management and Renewable	
Energy (EMRE) action plan for the railway			Energy (EMRE) action plan for the railway	
sector includes installing photovoltaic (PV)			sector includes installing photovoltaic (PV)	
systems for non-traction power use in railway			systems for non-traction power use in railway	
operations such as stations and depots.			operations such as stations and depots.	
Next conception <b>Disfuel bub</b>		Next concertion	Disfuel huk	DETRONAS
fuel A big refinery will be developed in Dengerong		fuel	A his refinent will be developed in Dengerong	PEIKONAS
Identified A bio-refinery will be developed in refigerang,		1401	Lobor to catalyze the creation of a hub to	
meduce vericus his based products including			solution to catalyze the creation of a hub to	
produce various bio-based products, including			produce various bio-based products, including	
sustainable aviation fuer (SAF), nydrogenated			sustainable aviation fuel (SAF), hydrogenated	
$v$ egetable on $(\pi v O)$ , advanced sustainable fuels (ASE) and biochemical products			$f_{\rm reg}$ (ASE) and biochemical products	

 Table 2-3 Overview of the green mobility sector in NETR

④ Incentives for introducing environmentally advanced vehicles

Regarding incentives for introducing environmentally advanced vehicles, the draft of the National Budget 2022, passed in December 2021, includes incentives to encourage the switch to EVs, as shown in Table 2-4.

#### Table 2-4 Incentives for the introduction of EVs in the 2022 draft of the National Budget

- · Customs duties and excise taxes on imported EVs will be exempted until 2023 year-end.
- Complete knockdown (CKD) \* EVs will be exempt from excise and sales tax until 2025 yearend.
- Up to 100% road tax credit for EV vehicle owners.
- Up to 2,500 ringgit (approximately 80,000 yen) reduction in personal income tax against the cost of purchase, installation, rental, and monthly use of EV charging equipment.

\*Complete knockdown: A production method in which the assembly of main components and all processes from chassis welding to body painting, except parts manufacturing, are performed on-site.

Malaysia Automotive, Robotics & IoT Institute (MARii), the agency responsible for rolling out plans to promote the use of electric motorbikes, has also announced the launch of a rebate scheme for electric bike purchases or subscription fees in December 2023. Under this rebate scheme, users can receive a rebate of RM2,400 on purchasing an electric bike or a rebate of RM200 per month for 12 months on the electric motorbikesubscription applications.

- 2) Iskandar Development Area
- ① Low Carbon Society Blueprint 2030 Climate Action Plan (LCSBPIM 2030 CAP)

To develop into a sustainable international city, IRDA released an official planning document, "Low Carbon Society Blueprint Iskandar Malaysia 2025: LCSBIM2025", in November 2021 to reduce greenhouse gas emissions, with support from the Japan Science and Technology Agency (JST) and the Japan International Cooperation Agency (JICA). Since the signing of the Paris Agreement, the trend toward decarbonization has accelerated. With the support of this City-to-City collaboration Project (Phase 1 project), the plan has been updated to release the "Low Carbon Society Blueprint Iskandar Malaysia 2030 (LCSBIM2030)", which sets the carbon neutrality target for 2050.

Since further congestion is expected in the Iskandar region as the region grows, it is necessary to develop an efficient and sustainable infrastructure to meet public, commercial and logistics demands while reducing fossil fuel consumption. To this end, the plan's priority initiatives for the transportation sector include the development of a comprehensive rail network, ride-sharing transportation services, and the promotion of public transportation.

Specific targets for the transportation sector are shown in Table 2-5. According to interviews with IRDA, the government is planning to accelerate the target for the utilization rate of electric buses, aiming to reach 100% by 2030.

Item	2010	2030	2050
Percentage of public transportation users (%)	15	35	50
Passenger electric vehicle utilization rate (%)	0	10	60
Electric bus utilization rate (%)	0	10	70
Electric freight vehicle utilization rate (%)	0	10	40
High-efficiency freight train (electric) (%)	0	20	50

Table 2-5 LCSBPIM2030 targets for the transportation sector in 2030 and 2050

Specific measures are being discussed for each of the three categories to achieve the above targets: (A) development of green transportation infrastructure, (B) transition to low-carbon energy, and (C) introduction of next-generation technologies and digitalization in the transportation sector. The details of the electrification of vehicles related to this City-to-City collaboration Project are given in Table 2-6.

Classification	A-3. Improving efficiency and connectivity of existing transportation			
inirastructure				
Purpose	Improve the efficiency and connectivity of the existing transportation infrastructure in the Iskandar region to facilitate a modal shift to public transportation and meet citizens' demands.			
Action plan	<ul> <li>Reduce the parking lots on roadsides and in urban areas in conjunction wit "Park &amp; Ride" facilities.</li> <li>Add bike lanes, covered pedestrian walkways, and bridges to public transiterminals and commercial hubs.</li> <li>Explore options to utilize existing roads by adding bus routes for IRT, Ba Muafaka, and Stage Bus.</li> <li>Expand bus network connectivity, especially to rural areas of Pasir Gudang Pontian and Kulai.</li> <li>Develop interactive information systems, multi-sensory wayfinding, Footfall power generation, and electronic ticketing systems.</li> <li>Develop an app that integrates various transportation services, such as reserved parking lot app and an itinerary suggestion app.</li> <li>Establish a public transport systems</li> </ul>			
	SVSTRA: French transportation company			
Preceding cases	SYSTRA's smart train stations offer excellent accessibility, amenities, comfort, and design. For example, natural light is incorporated to create a sense of comfort in the lighting of the premises, and LED lights are creatively used to stimulate the senses of travelers by changing colors to change the atmosphere of the premise and design flow lines. In addition, the quality of traffic and communication is improved through an acoustic management system. Many sensors are installed on the premises, and the data collected is connected to a hypervisor to make announcements, lighting, ventilation, and information displays more appropriate in			

 Table 2-6 Details of electrification of vehicles according to LCSBPIM2030

	real time. A dedicated interface helps identify and predict failures, and dynamic		
	station management facilitates maintenance and efficient operation.		
	6		
Classification	B-1. Development of incentives and subsidies to promote the use of low-carbon		
Clussification	vehicles LCV		
Dumporo	Incentives/subsidies for LCVs to increase the adoption of LCVs by the public and		
Purpose	private sectors in the Iskandar region		
	· Establish special lanes for easier and more convenient procedures for		
	businesses applying for green investment tax incentives.		
	· Consider additional incentives for LCVs, such as incentives for		
	importing, local assembly, and ownership of EVs, including cars,		
	motorcycles, vans, buses, and trucks.		
	Develop a subscription-based service for FV batteries to reduce the cost		
	of ownership of batteries which accounts for 40% of the total cost of an		
Action plan	FV		
Action plan	Develop incontives with the delivery and a heiling industries to promote		
	the EV ecosystem		
	<u>Ine Evecosystem.</u> Create additional increations such as commuting an addition of tall and		
	Create additional incentives such as exemption or reduction of toll and		
	parking fees for hybrid vehicle and EV users in the Iskandar region.		
	• Encourage the development of new renewable fuel technologies and		
	intrastructure to produce and supply low-carbon fuels such as biodiesel,		
	cellulosic ethanol, and electricity.		

Classification	B-2. Improving support infrastructure for low-carbon vehicles		
Purnose	Promote the use of low-carbon vehicles in the region to reduce GHG emissions.		
	• Increase the number of charging stations in IM as proposed in PIPAJ21 (52 in		
	Johor Bahru, 12 in Kulai, 4 in Pontian)		
	• Encourage government agencies to partner with private companies to		
	build more charging stations, e.g., along the IRT bus network.		
	· Allocate EV charging stations to future high-rise/story residential and		
	<u>commercial hubs.</u>		
Action plan	• Ensure that government buildings have sufficient charging stations and		
	parking for EVs.		
	· Conduct research to improve technology for faster charging and battery		
	swapping.		
	• Conduct research and development on the adoption potential of solar power		
	generation equipment.		
	Research vehicle-to-home power distribution technologies.		

#### 3) Singapore

① Singapore Green Plan 2030

Singapore has formulated its Green Plan 2030 to reduce peak emissions from land transportation by 80% by 2050. To achieve this target, Singapore encourages its citizens to walk, cycle, and use public transportation and also recognizes the need to reduce greenhouse gas emissions through electric mobility. The plan sets the targets in Table 2-7 for vehicle use.

Targets for 2025
- Abolition of new diesel vehicles (personal and taxis)
- Installation of EV charging stations in all parking lots in areas owned by the Housing and Development Board of Singapore (HDB) (approximately 2,000 vehicles expected)
Targets for 2030
- 40,000 EV charging stations in public parking lots
- 20,000 EV charging stations in private parking lots
Target for 2040
- All vehicles running on clean energy

Table 2-7 Transportation sector targets in Singapore Green Plan 2030

#### ② EV roadmap

Singapore has created an EV roadmap to achieve the above goals and promote the introduction of EVs. Tax credits have been announced in the roadmap for vehicle ownership, incentives for purchasing EVs, government policies for regulations and standards, etc. The initiatives that are already underway are described below.

#### $\diamond$ Tax credit and incentives for vehicle ownership

When purchasing an EV, customers can receive up to 45,000 Singapore dollars (approximately 4.9 million yen) in tax credits and subsidies. A new car in Singapore costs approximately 13 million yen for a conventional ICE and almost double for an EV. Through this incentive, the government aims to gradually close the gap between the purchase cost of a conventional vehicle and an EV.

♦ Establishment of related equipment standards

The Electric Vehicles Charging Act (EVCA), enacted in November 2022, is the policy for maintaining the safety, stable supply, and accessibility of EV charging networks in Singapore. Under the Act, all charging stations must comply with the technical standard "TR25:2022" established by the Land Transport Authority (LTA), and each charging station must be certified and registered by the LTA.

The Act also imposes obligations on charging station operators, such as regular maintenance, public liability insurance contracts, and data release.

#### ③ Vehicular Emissions Scheme (VES)

The Vehicular Emissions Scheme (VES) has been in effect for vehicles operating in Singapore since 2020, and the LTA gives a rebate or charges a surcharge on vehicle registration tax depending on the amount of air pollutants and GHG emissions from exhaust gases. The emission standards are becoming stricter year by year. The standards updated in 2023 are shown in Table 2-8. Currently, motorcycles are exempt from the standards, but similar restrictions will apply to motorcycles soon. These

regulations are expected to apply also to motorcycles used by workers from the Iskandar region.

Dand	CO2	UC (alim)	$CO(\alpha/lrm)$	NOx	$DM(\alpha/lrm)$	0	Car	]	Гахі
Dand	(g/km)	HC (g/km)	CO (g/km)	(g/km)	Pivi (g/km)	Rebate	Surcharge	Rebate	Surcharge
A1	≤90	≤0.02	≤0.15	$\leq 0.007$	=0	\$25,000	N.A.	\$37,500	N.A.
A2	90	0.02	0.15	0.07	A2≤0.3	\$15,000	N.A.	\$22,500	N.A.
В	90	0.036	0.19	0.013	0.3	N.A.	N.A.	N.A.	N.A.
C1	160	0.052	0.27	0.024< C1≤0.03	0.5	N.A.	\$15,000	N.A.	\$22,500
C2	C2>185	C2>0.075	C2>0.35	C2>0.03	C2>2.0	N.A.	\$25,000	N.A.	\$37,500

Table 2-8 VES rate chart (Unit: SGD)

### 2.1.2 Transportation situation

### 1) Transportation infrastructure development status

Figure 2-6 shows the routes of railways and major highways in the Iskandar region and future development plans (Legend for arterial roads, railway routes, bus routes, etc.: Table 2-9 and Table 2-10). The Iskandar region has highways, including seven expressways. The West Coast Line of the KTM Malayan Railway extends from the northwest to the southwest. The JB Sentral station in Johor Bahru connects to the capital, Kuala Lumpur and Singapore. A Bus Rapid Transit (BRT) bus stop is scheduled to be installed at Komtar, a shopping mall adjacent to JB Sentral Station, and three bus routes are planned to start from this bus stop. There is also a plan to build a high-speed rail line in the west that would extend to Singapore, but the plan has been suspended due to a cost review, and there is no prospect of completion. According to interviews with local stakeholders, there are plans to prohibit the entry of four-wheelers into the area near the Persada Johor International Convention Center (Figure 2-7), located in the center of Johor Bahru, in the future, to reduce traffic congestion and give consideration to the environment.



Source: IRDA

Figure 2-6 Railway and highway routes in the Iskandar region

Legend	Name	Remarks
_	North – South Expressway	Connects Kuala Lumpur and Johor Bahru
	Southern Route	
	Singapore – Johor Bahru Ring	
	Road	
_	Second Link Expressway	Connects Senai International Airport to Second Link
_	Senai Link Expressway	Connects Senai to Desaru in the east
_	Coastal Highway	Connects Iskandar Puteri to Eastern Johor Bahru
_	Eastern Dispersal Link	Connects the end point of E2 to Causeway
	Bakar Batu – Pasir Gudang	Connects Bakar Batu to Pasir Gudang in the east
	Coastal Road	

Legend	Name	Remarks
++++	KTM Malayan Railway Line	Conventional lines, including freight lines to ports
	Rapid Transit System	Under construction, it connects Johor Bahru to Singapore (scheduled to open by the end of 2026)
	Gemas-JB electrified double- tracks and commuter trains	Railroads connecting Gemas to Johor Bahru. Commuter trains will operate. It is scheduled for completion in 2025.
	Bus Rapid Transit (BRT)	An urban mass transit system based on buses. The first phase will be operational in 2025.
	High Speed Rail (HSR)	The plan was reviewed in 2021, and there is no prospect of completion.

Table 2-10 Routes and development plans for KTM, BRT, RTS, etc. in the Iskandar region



Figure 2-7 Persada Johor International Convention Center

# 2) Traffic congestion situation

Traffic congestion in the Iskandar region mainly originates from the Causeway Bridge and the Second Link Bridge, which connect Singapore and the Iskandar region, and the situation is becoming more serious year by year. After the various movement restrictions introduced during the pandemic were lifted, the number of people using the bridges was 71 million in 2022 and approximately 98 million as of September 2023, expected to reach 136 million at the end of 2023.<sup>1</sup>

The Malaysian government provides traffic congestion forecasts for the next three hours on major roads on its information portal site for traffic congestion. The congestion forecast for Monday,

<sup>&</sup>lt;sup>1</sup>The Straits Times "Malaysia to spend \$48.8m to address traffic congestion at both Johor checkpoints. 2023/10/11"

https://www.straitstimes.com/asia/se-asia/malaysia-to-spend-485m-to-address-traffic-congestion-at-both-johor-checkpoints

December 25, 2023, from 4:00 p.m. to 7:00 p.m. is shown in Figure 2-8 and Figure 2-9; it predicts that congestion will occur on the major highways of both Johor Bahru and Singapore. Heavy traffic congestion is expected, especially near the checkpoints at both ends of the Causeway Bridge. Crossing the 1 km long Causeway Bridge on weekdays takes one to two hours, and it is said to be even more crowded on weekends and holidays.



Figure 2-8 Traffic congestion forecast from 4:00 p.m. to 7:00 p.m. on the information portal site for traffic congestion (wide area)



Figure 2-9 Traffic congestion forecast from 4:00 p.m. to 7:00 p.m. on the information portal site of traffic congestion (near Causeway Bridge)

The traffic congestion situation between Johor Bahru and Singapore has been summarized by Singapore's independent media, TheSmartLocal, and is shown in Table 2-11. Congestion is caused by commuters and day-trippers from Johor Bahru to Singapore.<sup>2</sup>



 Table 2-11 Changes in traffic congestion between Johor Bahru and Singapore by day of the

<sup>2</sup>TheSmartLocal: "When Is The Best Time To Go To JB? We Break It Down By Car, Bus & KTM To Avoid Jams. 2023/07/22"

https://thesmartlocal.com/read/best-time-to-go-jb/



## 2.1.3 Motorcycle usage

According to Transport Statistics Malaysia 2021<sup>5</sup> published by the Malaysian Ministry of Transport, the number of motorcycles owned in Malaysia in 2021 was approximately 15.51 million (Figure 2-10). The number of vehicles owned by type in Malaysia is shown in Figure 2-11. Approximately 46% of all vehicles are motorcycles, about the same percentage as cars. The number of motorcycles owned is increasing yearly, which is expected to continue for some time. Although information on the number of motorcycles owned by each area could not be confirmed, the total number of vehicles in each province is shown in Figure 2-12. Since approximately 11.3% of all vehicles are owned in the state of Johor, it is estimated that the number of motorcycle users in Johor state is approximately 1.3 million.<sup>3</sup>

<sup>3</sup>Ministry of Transport Malaysia: Statistik Pengangkutan Malaysia 2021

https://www.mot.gov.my/my/Statistik%20Tahunan%20Pengangkutan/Statistik%20Pengangkutan%20Malaysia%2020 21.pdf



Source: Transport Statistics Malaysia 2021





Source: Transport Statistics Malaysia2021

Figure 2-11 Number of vehicles owned by type in Malaysia (2020, 2021)



Source: Transport Statistics Malaysia 2021

Figure 2-12 Comparison of total number of vehicles by state (2020, 2021)

Table 2-12 also shows the percentage of residence types and means of transport for each household in the Iskandar region. Kulai had the highest rate of ownership of both cars and motorcycles, at 95.2% and 74.1%, respectively, while Johor Bahru had the lowest rate of ownership of motorcycles among the three regions, at 58.8%.

		Johor Bahru	Kulai	Pontian
Residence	Owned (%)	69.7	75.4	81.8
type	Rent (%)	28.4	21.3	17.5
Ownership rate (by household)	Cars (%)	90.4	95.2	83.6
	2-wheelers (%)	58.8	74.1	68.8
	Bicycles (%)	22.5	36.5	36.6

 Table 2-12 Type of residence and rate of ownership of each means of transport by households

 in Iskandar region

In August 2023, an interview was conducted with the Motorcycle Association of the Iskandar region to understand the actual usage of motorcycles in the Iskandar region. In addition, in October 2023, a field survey was conducted on using motorcycles in the central part of the Iskandar region.

1) Interview with Motorcycle Association (August 2023)

Table 2-13 Summary of the results of the interview with the Motorcycle Association

Date and time	August 2, 2023		
Location	Motorcycle Association		
	<ul> <li>Status of motorcycle sales</li> <li>The number of motorcycles sold by dealers is around 200 per month.</li> <li>The breakdown of sales is Yamaha 50% and Honda 20-30%.</li> <li>Kuala Lumpur has the highest number of motorcycle users, followed by Johor Bahru.</li> <li>Maintenance cost is 200 RM per month, and other maintenance costs include taxes of 2 RM per year and insurance of about 250 RM per year, which is approximately 3,000 RM per year.</li> <li>Fuel cost is approximately 2 RM per liter.</li> </ul>		
Interview contents	<ul> <li>Motorcycle usage in the Iskandar region</li> <li>In the Iskandar region, motorbike users can be broadly classified into three categories: (1) commuters to Singapore, (2) users in Johor Bahru, and (3) users in the vicinity of their residence.</li> <li>(1) Commuters to Singapore</li> <li>Approximately 50,000 motorbikes travel to and from Singapore every day.</li> <li>Since the distance traveled exceeds 100 km/day, many users must refuel almost daily.</li> <li>People tend to replace their motorbikes every five years on average because of the huge costs incurred in dealing with motorcycle breakdowns in Singapore.</li> <li>(2) Users in Johor Bahru</li> <li>Vehicles are often used for commuting within Johor Bahru, traveling approximately 30 to 40 km/day.</li> <li>The average replacement cycle is 10 years.</li> <li>(3) Users in the vicinity of their residence</li> <li>Vehicles are often used to transport children to and from school.</li> </ul>		
	<ul> <li>About EV motorbikes</li> <li>Currently, demand for EV motorbikes in the motorcycle sales market is unclear, and we are currently considering the introduction of EV motorbikes at dealers.</li> <li>We believe that the biggest issues to be solved to popularize EV motorbikes are the spread of battery stations, the distance traveled per charge, and the time required for charging.</li> <li>We expect the price to be the same as conventional internal combustion motorbikes. However, if the price is the same as that of internal combustion motorbikes, it is unlikely that customers will be motivated to purchase EV motorbikes with the unforeseeable risk of breakdowns, etc. There is a need for incentives such as lower prices than internal combustion motorbikes or lower maintenance costs, at the very least.</li> </ul>		



2) Motorcycle usage in the central part of the Iskandar region (October 2023)

In October 2023, a field survey was conducted in the central part of the Iskandar region. Table 2-14 shows the survey results on traffic congestion, bike parking, etc., along with photographs.



Table 2-14 Motorcycle usage in Iskandar region



### 2.1.4 Other relevant information

## 1) Population trends and demographics in Malaysia

It is important to understand the future population trends and their dynamics to estimate the future use of motorcycles. The following figure summarizes the population trends and demographics in Malaysia and the Iskandar region.

Figure 2-13 shows the population trends for Malaysia as a whole. According to the Malaysian Bureau of Statistics, the population is expected to increase by 2.1% in 2023, approximately 32.45 million as of 2020 and 33.45 million in the third quarter of 2023. The main factor behind the recent increase in population growth is the influx of immigrants, and the population of immigrants without citizenship is expected to increase from 2.5 million in 2022 to 3 million in 2023.



Source: Malaysian Bureau of Statistics Figure 2-13 Population trends in Malaysia (1980-2023)

Secondly, the population of the Iskandar region has been increasing at an annual growth rate of 2.91% from 2005 to 2020, from an initial 1.3 million to over 2 million in 2020 and about 2.27 million at present. (Figure 2-14). It is estimated that by 2030, the number will reach 2.5 million, accounting for approximately 57% of the population of Johor. Within the Iskandar region, the population of Johor Bahru district is growing significantly, increasing from approximately 990,000 in 2000 to approximately 1.76 million in 2023 (Figure 2-15). As a result, the population density of the Johor Bahru area has increased from 928.8 persons per square meter in 2000 to 1,652.7 persons per square meter in 2023.



Source: IRDA

Figure 2-14 Population trends in Johor and Iskandar region (CAGR: Compound Annual Growth Rate) 1


Source: IRDA

Figure 2-15 Population trends in each area comprising the Iskandar region

Table 2-15 and Table 2-16 show Malaysia's monthly household income and percentage of people by income bracket. According to the Malaysian Bureau of Statistics, Johor Bahru had the highest average monthly household income in the Iskandar region at 9,315 RM, followed by Kulai at 8,602 RM. The median income of Kulai was 194 RM, higher than Johor Bahru. On the other hand, Pontian had a median income of up to 1,951 RM and a mean income of up to 1,826 RM lower than the other two regions. Kulai had the highest percentage of M40 and the lowest percentage of B40. Johor Bahru had the highest percentage of T20, while Pontian had the highest percentage of B40 among the three regions.

		Johor Bahru	Kulai	Pontian
Household	Median (RM)	7,342	7,536	5,585
income	Average (RM)	9,315	8,602	6,776
	Under 5.000RM	29.7	25.8	43.8
Income aroup	5,000-10,000RM	38.9	45.7	39.6
rate (%)	10,000-15,000RM	17.7	16.5	10.2
	Above 15,000RM	13.7	12.0	6.4

 Table 2-15 Monthly household income and percentage of people by income bracket in Iskandar

 region (2019)

Source: Malaysian Bureau of Statistics

Tab	Table 1: Income Share, Median, Mean Household Income and Income Threshold by Household Decile Group, 2019				
De Gre	cile oup	Income Share (%)	Median Household Income (RM)	Mean Household Income (RM)	Income Threshold (RM)
T20	T2	27.9	18,676	22,341	More than 14,629
120	T1	15.6	12,467	12,539	10,880 - 14,629
	M4	12.3	9,808	9,824	8,930 - 10,879
MAO	M3	10.2	8,186	8,197	7,550 - 8,929
1140	M2	8.7	6,996	6,992	6,430 - 7,549
	M1	7.4	5,870	5,888	5,400 - 6,429
	B4	6.2	4,961	4,961	4,540 - 5,399
P40	B3	5.1	4,091	4,097	3,680 - 4,539
640	B2	4.0	3,181	3,192	2,740 - 3,679
	B1	2.6	2,247	2,117	Less than 2,740

 Table 2-16 Classification of income groups in Malaysia (2019)

Source: Malaysian Bureau of Statistics

The breakdown of average monthly household consumption expenditure in Johor (Figure 2-16) shows that in 2022, each household spent approximately 11.7% (622 RM) on transportation.



Source: Malaysian Bureau of Statistics

Figure 2-16 Breakdown of average monthly household consumption expenditure in 13 administrative districts of Johor

#### 2) Project for installation of battery swapping stations in Johor state

The executive division of Johor Bahru District (MBJB), located in the heart of the Iskandar region, is considering the introduction of motorbikes with replaceable batteries as vehicles for use by its staff. As a proof of concept, the selection of candidate sites for battery stations is underway. Candidate sites are being selected based on the following two factors.

- Land with few barriers
- Can receive electricity supply
- The area must be within the Johor Bahru Inner Ring Road, which is under the jurisdiction of MBJB.

In October 2023, MBJB interviewed Johor state officials and inspected the candidate sites for installing battery swapping stations. Table 2-17 shows an overview and photographs of the candidate sites for installation. The stations will be installed at around ten locations, mainly at gas stations and facilities owned by Johor Bahru City (Figure 2-17).



Source: Google Maps

Figure 2-17 Candidate sites for battery swapping stations

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Table 2-	1/1	Uverview	OI	candidate	sites	IOr	batterv	swapping	stations
					~~~~~~				~ * * * * * * * * * *

Site Name	Overview	Photograph

1.	Menara MBJB	<ul> <li>Johor Bahru City Hall New Building</li> <li>Facing the main road, with good access to Singapore</li> <li>A facility under the jurisdiction of the city, installation permits are easy to obtain</li> </ul>	
2.	Petronas Bukit Chagar	<ul> <li>Pertonas gas station</li> <li>The closest point to the checkpoint before Singapore</li> <li>Unused land</li> <li>Possible to install solar panels on the roof</li> <li>A state-owned company, approval of the King is required for land use permission</li> </ul>	
3.	Petronas Jalan Lingkaran Dalam	<ul> <li>Pertonas gas station</li> <li>Unused land</li> <li>Possible to install solar panels on the roof</li> <li>A state-owned company, approval of the King is required for land use permission</li> </ul>	
4.	Dataran MBJB	<ul> <li>Playground owned by Johor Bahru City</li> <li>A facility under the jurisdiction of the city, installation permits are easy to obtain</li> <li>Playgrounds, hospitals, and schools are nearby, and a lot of local traffic</li> </ul>	
5.	MBJB Jalan Dato Onn	<ul> <li>Johor Bahru Old City Hall</li> <li>Facing the main road, with good access to Singapore</li> <li>A facility under the jurisdiction of the city, installation permits are easy to obtain</li> <li>There are banks, post offices, hospitals, and government facilities nearby.</li> </ul>	
6.	Persiaran Tun Sri Lanang	<ul><li>Park</li><li>Close to tourist spots and easy access</li></ul>	No photo
7.	Persada Johor	<ul> <li>Convention center</li> <li>A facility under the jurisdiction of the city, installation permits are easy to obtain</li> </ul>	

8.	CIQ (Optional) JB Central Motor Parking	<ul> <li>Bike parking lot at JB Sentral Station</li> <li>High demand since the site serves as the gateway to Iskandar</li> </ul>	
9.	Plaza Angsana	<ul> <li>Large shopping mall</li> <li>High demand due to a large number of users</li> <li>The site for installation is available, and solar panels can be installed</li> </ul>	
10.	Petronas Southern	Office building of Petronas Southern	No photo

#### 2.2 Survey of preceding cases

BaaS business using battery-swappable motorbikes is being promoted in Taipei, Taiwan, and other places. The following sections summarize the incentives in Taipei in Taiwan, Kuala Lumpur in Malaysia, Makassar in Indonesia, and Ishigaki in Okinawa Prefecture.

## 2.2.1 Taipei City, Taiwan

Taiwan has set a goal of becoming carbon neutral in 2050 and has announced Taiwan's Pathway to Net-Zero Emissions by 2050 in 2022 to help achieve the goal. The plan indicates reduction targets for greenhouse gas emissions in each sector, with the transportation sector targeting a reduction in emissions from approximately 35 Mt-CO2 in FY 2019 to 3.3 Mt-CO2 in 2050. The city aims at the following targets for the share of EVs in annual sales of all passenger vehicles, including motorcycles: 30% in 2030, 60% in 2035, and 100% in 2040, to achieve this goal.

In Taiwan, as of 2023, the number of registered motorcycles is 14.5 million per 23.42 million people, and the number of motorcycles owned per 100 persons is 62.1, making Taiwan one of the most motorcycle-populated countries in the world. (Figure 2-18).



Figure 2-18 Number of motorcycles owned per 100 persons in each country (2022)

Taipei City is promoting a shift to EVs to achieve the abovementioned goals. Taipei City has been working to popularize the sharing economy for about 10 years, creating an environment where the concept of sharing batteries and motorcycles is easily accepted. In 2019, electric motorbikes accounted for 18% of all new motorcycle registrations in Taiwan. One of the triggers for this is the rise of Gogoro.

Gogoro is a Taiwanese company that operates an energy service business centered on manufacturing and selling battery-swappable EV scooters and developing battery charging stations. The company started its BaaS business for EV motorcycles in 2015 and had over 500,000 subscribers for battery swapping service in August 2022. New subscribers have increased to 100,000 annually since 2018 (Figure 2-19).



Source: Nikkei XTECH

Figure 2-19 Number of subscriptions for Gogoro's battery-swapping service

Companies other than Gogoro, such as KYMCO's ionex, are developing the BaaS business for EV motorcycles in Taiwan. As of August 2022, ionex battery stations have been installed at 1,533 locations in Taiwan.

The following section summarizes the business of Gogoro, a representative case study in Taiwan. In October 2023, we visited Taipei City with IRDA, conducted interviews with Gogoro and the Taipei Computer Association, which promotes smart city projects in Taipei City and exchanged opinions, the contents of which are summarized below.

#### 1) Initiatives by Gogoro

Gogoro is a pioneer in the business of battery-swappable motorbikes in Taiwan. The company was founded as an energy company specializing in software services (SaaS: Software as a Service) for energy management, etc. In the beginning, the company provided EV charging services; however, later, the company decided that the spread of EV motorbikes is essential to solving the issue of reducing greenhouse gas emissions in the transportation sector in Taiwan, and is now engaged in the EV motorbikesharing business "Go Share", in parallel with the development and sales of EVs and EV bike bodies. As of 2023, Gogoro operates in nine countries (Taiwan, China, South Korea, Japan, the Philippines, India, Indonesia, Singapore, and Israel).

The biggest reason for the success of the BaaS and MaaS models in Taiwan is that the rapid spread of battery stations has overcome the biggest drawback of EV motorbikes, which is their cruising range.

In Taiwan, more than 2,700 battery stations are in place as of 2023, with more than 1.09 million batteries deployed (Figure 2-20). When the business started, battery stations were first introduced on a trial basis, mainly at gas stations, followed by supermarkets, convenience stores, and eventually public facilities, reaching the current state of installation.



Figure 2-20 Installation status of battery swapping stations in Taipei

Another factor contributing to the spread of battery stations is that Taipei City has relaxed regulations and standards related to the installation of EV stations. Specifically, until now, space was required to park a motorcycle for battery swapping temporarily, but now, a new standard has been established for motorcycles that require battery swapping to expand the area where battery stations can be set up. In addition, while road construction in Taiwan can be carried out from March to September, regulations related to the installation of stations have been relaxed to allow installation outside of this period. Furthermore, government-owned land is often used to install battery stations.

The conditions currently in place for installing battery stations are shown in Table 2-18.

#### Table 2-18 Necessary conditions for installing battery swapping stations in Taiwan

- Since the input voltage of the Gogoro station is 30 kV, the site must allow access to a high-voltage power supply (such as convenience stores and gas stations)
- Must have the Internet connectivity for connection to PBGN described below
- Must have space for temporarily parking the motorcycle for battery swapping
- The ground at the installation site must be strong enough since the station weighs 1 t/unit, including batteries
- Measures against electrical leakage must be in place
- The power supply must automatically shut off in the event of a flood

Gogoro aims to popularize batteries of Gogoro's proprietary standard, Powered by Gogoro Network (PBGN). As of 2022, PBGN has 10 member companies, and participating bike manufacturers receive drivetrains, controllers, components, and smart systems from Gogoro. As of September 2023, a total of 55 types of EV motorbikes are being sold by bike manufacturers who are members of PBGN, all of which can use Gogoro's battery station (Table 2-19, Figure 2-21).

Deployed	Gogoro	7 series 18 models		
model	PBGN	55 models		
Output		Gogoro 2 Delight: 7.0 kW (3,000 rpm) horsepower equivalent 9.5		
		HP		
		Gogoro VIVA: 3.0 kW (500 rpm) horsepower equivalent to 4.1 HP		
Cruising range	Cruising range Gogoro Delight: 150 km			
		Gogoro VIVA: 85 km		
Maximum speed		Gogoro Delight: 90 km/h		
		Gogoro VIVA: 45 km/h		
Battery type		Type: Lithium iron phosphate (LiFePo4) manufactured by		
		Panasonic		
		Capacity: 1.7 kWh		
		Weight: 9 kg		
Water resistance: Unknown		Water resistance: Unknown		

Table 2-19 Overview of motorbikes developed by Gogoro

	Usable number of times: Unknown	
	Price: US\$3,150 per unit	
Security	Face recognition/encrypted key card	
	Remote lock	
	Location-based service linkage	
	Unlocking method: Card key, Smartphone, Apple Watch	
Price	Gogoro 2 Delight: NT\$82,350 (approximately 390,000 yen)	
	Gogoro VIVA: NT\$61,830 (approximately 290,000 yen)	
Vehicle types in the subsidy	Heavy (5 <hp) <math="" and="" light="">(1.34 \le HP \le 5)</hp)>	
scheme		
Other features	Reverse mode	
	When rain is detected, output is controlled to prevent slippage.	



Figure 2-21 Overview of motorbikes developed by Gogoro

Gogoro is also developing software called Gogoro Network Operational Platform (GNOP) to manage battery and battery station operations. All Gogoro motorbikes are assigned an ID, and a system has been established to pay the fare and verify the driver each time the motorbikestops. When a battery is changed, it is recorded by a surveillance camera at the battery station. This makes it possible to check the information the camera records in the event of a traffic accident or incident, providing an advantage in terms of security.

Regarding the environment, according to interviews with Gogoro, 540,535 motorcycles are in use as of the end of 2022, contributing to a reduction in oil consumption equivalent to 287,000 kL and a total reduction of 603,000 t-CO2 in greenhouse gas emissions.



Figure 2-22 Interview with Gogoro

Regarding the power supply and demand system and power supply in the event of a disaster, two spare batteries built into the station can be used as UPS for parking meters and traffic lights. The power supply is connected to 200 signals in Taipei, which can be used for 2 hours without replacing the batteries. The lifespan of a battery is approximately 10 years; hence, there are currently no batteries that have reached the end of their lifespan, but Gogoro intends to use them for power supply and demand adjustment in the future, for which the company has announced a plan to incorporate all 2,500 stations in Taiwan into the VPP by mid-2023 in cooperation with Enel X of Italy.<sup>4</sup>

## 2) Interview with Taipei City and Taipei Computer Association

The Taipei Computer Association supports promoting the smart city concept in Taipei City, including spreading the BaaS business. It is working on a variety of initiatives in collaboration with Taipei City. Table 2-20 shows the results of interviews and exchanges of opinions we held in October 2023 with the Taipei Computer Association and Taipei City, along with IRDA and Toyama City, on important points related to the spread of the BaaS business.

Date and time	October 13, 2023
Location	Taipei Computer Association
Interview contents	<ul> <li>Transportation policy in Taipei City, Taiwan</li> <li>ICE motorbikes to be banned by 2040</li> <li>All public buses to be converted to electric vehicles by 2030</li> <li>Promoting a sharing economy, where one shared bike will replace 9 to 15 privately owned motorbikes</li> <li>Policy support is being provided to promote the adoption of the sharing economy, such as standardization of licensing systems, road traffic laws, and station standards</li> </ul>

Table 2-20 Summary of the results of interviews with Taipei Computer Association

<sup>&</sup>lt;sup>4</sup>electrive "Gogoro battery-swapping stations now form virtual power plant in Taiwan. 2023/04/19" <u>https://www.electrive.com/2023/04/19/gogoro-battery-swapping-stations-now-form-virtual-power-plant-in-taiwan/</u>



2.2.2 Kuala Lumpur, Malaysia (Initiatives by Blue Shark)

In Kuala Lumpur, Blue Shark has started working on a project to popularize battery-swappable motorbikes and battery stations. Blue Shark is a Chinese start-up that sells and maintains battery-swappable EV motorbikes and battery-swapping stations, and was established as a Malaysian subsidiary of Sharkgulf Technologies Group of China. Currently, the company is expanding its business in Kuala Lumpur. However, there are plans to expand into the Iskandar region, targeting commuters to Singapore, and the company hopes to expand its business in Malaysia and internationally. As of September 2023, the company has sold 500 motorcycles in Malaysia and expects to sell 9,600 in 2024 and 16,800 in 2025.

Battery stations are currently installed at five locations as shown in Figure 2-23, with plans to expand to 35 locations.



Figure 2-23 Battery station locations (left) and potential future sites for installation (right)

Table 2-21 and Figure 2-24 provide an overview of the battery-swappable motorbikes sold by Bleu Shark.

Deployed model	Blueshark R1, R1 Lite		
	Plans to deploy multiple models in the future		
Output	5.0 kW (5,500 rpm) horsepower equivalent to 6.8 HP		
Cruising range	R1: 160 km		
Maximum speed	R1: 80 km/h		
Battery type	Type: Lithium iron phosphate (LiFePo4)		
	Capacity: 1.44 kWh (48 V/30 Ah)		
	Weight: 11 kg		
	Water resistance: IP67		
	Usage: 2000 + cycles		
	Price: US\$3,000 per unit		
Security	Face recognition/encrypted key card		
	Remote lock		
	Location-based service linkage		
	Unlocking method: Card key, Smartphone, Apple Watch		
Price	BaaS model: RM7,190 (R1 Lite)		
	If the battery is purchased: RM12,600 (R1 Lite)		
Vehicle types in the subsidy	11 bike manufacturers and 12 electric bike models designated by		
scheme	the Malaysia Electric Motorcycle Use Promotion Scheme		
	(MARiiCas)		
Other features	<ul> <li>Advanced driving assistance system</li> </ul>		
	• 74 sensors		
	Fingerprint unlocking		
	Reverse mode		
	Predicted driving range		

 Table 2-21 Overview of battery-swappable motorbikes deployed by Blue Shark



Figure 2-24 Overview of the battery-swappable motorbikes developed by Blue Shark

The usage fee of deployed motorbikes is shown in Table 2-22.

## Table 2-22 Blue Shark service usage fees

Plan	Cycle Count	Usage Fee
BlueSwapLite	36 cycles	Monthly fee: RM59 (approx. 1,800
		yen)
BlueSwap Standard	70 cycles	Monthly fee: RM99 (approximately
		3,100 yen)
BlueSwapPro	120 cycles	Monthly fee: RM139 (approx. 4,300
		yen)
BlueSwapFlex	-	RM1.95 (approximately 60 yen) per
		exchange

Blue Shark has independently calculated the GHG emission reductions for gasoline-powered motorbikes and EV motorbikes, and the results are shown in Figure 2-25. According to this calculation, the annual GHG emission reduction per bike is 1.4 t-CO2 for normal use and 2.9 t-CO2 for home delivery use. Further reductions are expected by using electricity derived from renewable energy.



#### Figure 2-25 Comparison of GHG emissions between conventional and Blueshark motorbikes

In August 2023, we visited Blue Shark's showroom in Kuala Lumpur and conducted an interview. Table 2-23 shows a summary of the interview.

Date and time	August 3, 2023
Location	Blue Shark Kuala Lumpur Showroom
Interview	Number of battery-swappable motorbikes in use
contents	• There are 150 battery-swappable motorbikes in use as of August 2023,

	<ul> <li>and the number is expected to reach 500 by September 2023. The company also plans to manufacture 2,400 motorbikes in 2023, 9,600 in 2024, and 16,800 in 2025.</li> <li>Future business development</li> <li>We have introduced EV motorbikes on a trial basis at Fish Club, a seafood distributor in the Iskandar region, to collect information on usage while having the company use the EV motorbikes to deliver their products. During the trial introduction at Fish Club, data showed that they traveled 4,500 km in two months.</li> <li>The company plans to expand into the Iskandar region, targeting commuters to Singapore.</li> <li>A memorandum of understanding was signed in November 2022 with Petronas Dagangan Berhad (PDB) to develop a battery-swapping business for electric motorbikes. As part of this agreement, battery memories extended at the product at the product of the section o</li></ul>
Photograph	swapping stations manufactured by Blueshark will be installed at nine stations in Petronas in phases.

2.2.3 Makassar City, Indonesia (Initiatives by Santomo Resources)

In Makassar City, initiatives are being implemented by Santomo Resources, a Japanese company developing renewable energy businesses in Indonesia. In addition to the BaaS business, the company is also involved in the biomass and solar power generation businesses.

In the BaaS business, the company is currently involved in the sales and maintenance of electric motorbikes, including those manufactured by Smoot in Eastern Indonesia (Sulawesi, West Nusa Tenggara, East Nusa Tenggara, Maluku, and Papua) starting from Makassar City, South Sulawesi Province. The company also invests in swappable batteries and battery swapping stations. Swap Energi Indonesia, an affiliate of Smoot, manufactures them. In addition to individuals, EV motorbikes manufactured by Smoot have been introduced on a trial basis to 20 drivers of Gojek and Grab as target users. The company also offers an EV bike rental service.

Table 2-24 shows the results of our interview with the company in December 2023.

indic a a countinuity of the results of the intervention suffering itesource	<b>Fable 2-24 Summary</b>	of the re	sults of the	interview	with	Santomo	Resources
------------------------------------------------------------------------------	---------------------------	-----------	--------------	-----------	------	---------	-----------

Date and time	December 6, 2023
Company	Santomo Resources (online)

interviewed	
	Number of battery-swappable motorbikes in use
	• As of the end of 2022, 56 motorbikes are in use.
	• The company aims to sell 500 motorbikes in the eastern region of
	Indonesia by March 2023.
	Number of battery stations installed
	• As of 2022, there were 53 battery stations in Makassar city, with plans
	to increase the number to 150 by March 2023.
	· Battery stations are available with either three or eight battery charging
	slots, with the eight-slot type currently the most popular.
Interview content	· Battery stations are installed at Alfamart, PLN, Gojek, and Grab
Interview content	locations.
	■ Target groups
	• Sales are targeted at individual users and delivery service drivers.
	• In collaboration with delivery service companies Gojek and Grab, the
	EV motorbikes manufactured by Smoot are being introduced to 20
	drivers each On a trial basis.
	<ul> <li>GHG emission reduction effect</li> </ul>
	• Calculations show that one EV bike traveling 10,000 km can reduce
	GHG emissions by 828 kg-CO2 compared to an internal combustion
	bike.



Figure 2-26 EV motorbikes sold by Santomo Resources



Figure 2-27 Types and locations of battery stations



Figure 2-28 Collaboration with Gojek and Grab

## 2.2.4 Ishigaki City, Okinawa

Ishigaki City in Okinawa has introduced the battery-swappable EV motorbikes and battery stations from the Taiwan-based Gogoro mentioned above.

The impetus for the project came from a strategic partnership signed by Sumitomo Corporation in 2017 to jointly develop an open platform business utilizing Gogoro's sustainable energy network infrastructure in Japan and other parts of the world. Based on this partnership, a sharing service utilizing battery-swappable motorbikes and battery stations on Ishigaki Island was started in Japan in February 2018 in cooperation with Ishigaki City. Currently, the service is operated by e-SHARE Ishigaki, a subsidiary of Sumitomo Corporation, which is developing a rental business for tourists in collaboration with Okinawa Tourist, Inc.

Considering the demand on the island, 200 motorbikes were introduced, and five battery stations were installed on the island (Figure 2-29). Since the motorbikes and battery stations are directly imported from Taiwan, they are of the same standard as those used in Taiwan.



Figure 2-29 Motorbikes introduced in Ishigaki City and locations of battery stations

Another feature of this project is that some battery stations are powered by carport-type solar power generation (Figure 2-30).



Source (figure on the right): e-SHARE's website

Figure 2-30 System for supplying power to a battery station using solar power generation

Table 2-25 shows the results of our interview in November 2023 with Sumitomo Corporation, which was involved in introducing the project.

Date and time         November 29, 2023           Location         Sumitomo Corporation (online)           •         Sumitomo Corporation's ivestment in Gogoro brought the impetus to start the project. Ishigaki Island was selected as a candidate site for the project because many Taiwanese tourists visit the island, and the BaaS business of Gogoro was highly recognized in Taiwan then. The number of users did not increase immediately after the project was started because Taiwanese tourists did not have international driver's licenses. However, increased awareness among domestic tourists led to a gradual increase in users. In addition, use by visitors coming from Iriomote and Taketomi Islands to shop began to account for a certain percentage of the total number of users.           •         The current user groups are: (1) Japanese tourists, (2) Taiwanese		
Location         Sumitomo Corporation (online)           ·         Sumitomo Corporation's ivestment in Gogoro brought the impetus to start the project. Ishigaki Island was selected as a candidate site for the project because many Taiwanese tourists visit the island, and the BaaS business of Gogoro was highly recognized in Taiwan then. The number of users did not increase immediately after the project was started because Taiwanese tourists did not have international driver's licenses. However, increased awareness among domestic tourists led to a gradual increase in users. In addition, use by visitors coming from Iriomote and Taketomi Islands to shop began to account for a certain percentage of the total number of users.           ·         The current user groups are: (1) Japanese tourists, (2) Taiwanese	Date and time	November 29, 2023
<ul> <li>Sumitomo Corporation's ivestment in Gogoro brought the impetus to start the project. Ishigaki Island was selected as a candidate site for the project because many Taiwanese tourists visit the island, and the BaaS business of Gogoro was highly recognized in Taiwan then. The number of users did not increase immediately after the project was started because Taiwanese tourists did not have international driver's licenses. However, increased awareness among domestic tourists led to a gradual increase in users. In addition, use by visitors coming from Iriomote and Taketomi Islands to shop began to account for a certain percentage of the total number of users.</li> <li>The current user groups are: (1) Japanese tourists, (2) Taiwanese</li> </ul>	Location	Sumitomo Corporation (online)
tourists, (3) tourists from other countries, and (4) residents. The	Interview content	<ul> <li>Sumitomo Corporation's ivestment in Gogoro brought the impetus to start the project. Ishigaki Island was selected as a candidate site for the project because many Taiwanese tourists visit the island, and the BaaS business of Gogoro was highly recognized in Taiwan then. The number of users did not increase immediately after the project was started because Taiwanese tourists did not have international driver's licenses. However, increased awareness among domestic tourists led to a gradual increase in users. In addition, use by visitors coming from Iriomote and Taketomi Islands to shop began to account for a certain percentage of the total number of users.</li> <li>The current user groups are: (1) Japanese tourists, (2) Taiwanese tourists, (3) tourists from other countries, and (4) residents. The</li> </ul>

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Table 2-25 Summary	y of the results	of miler view	with Sumitomo	COLDOLATION

of Japanese, Taiwanese, and residents is around 30% each.
· Ideally, targeting users who drive 10,000 km per year would be
desirable.
• The motorbikes and stations are directly imported from Taiwan.
• The battery standard is also Taiwanese, but Gogoro's battery is 42V,
whereas the typical battery voltage in Japan is 48V. Hence, some
adjustments were necessary.
• There are five battery stations on the island, and a solar power
generation system has been installed at City Hall Parking Lot 2 and
Funakoshi Fishing Port in the north.
• Although the possibility of using the batteries to supply emergency
power to disaster prevention centers is being examined in the event of
a disaster, there is currently no record of batteries being used as an
emergency power source.
• Compared to a typical rental car the CO2 reduction effect of a battery-
swappable bike is 79t-CO2 for a total distance of 1 314 450 km
• If this project is to be introduced in the Iskandar region commuters to
Singapore will be an attractive mass target However, a model that
combines solar power generation is not realistic because there is a lag
between the neck of commuter traffic and the neck of nower
generation
generation.
• On the other hand, the introduction of solar power generation in
government facilities is more likely to be feasible in terms of stable
use.

2.3 Anticipated future vision for the Iskandar region

## 2.3.1 Anticipated future vision

Based on the results of the surveys mentioned above, we discussed with IRDA a possible vision for disseminating the BaaS project in the Iskandar region in the future. The results of the discussion are summarized below.

The usage of motorbikes in the Iskandar region can be broadly classified into four categories, as shown in Table 2-26.

No.	Classification	Number of Users	Distance Travelled	Government Involvement
1	Commuters to Singapore	Many Approximately 50,000 vehicles	Long distance 100 km/day	Direct involvement is difficult
2	Users in the Iskandar region	Many	Short distance 30-40 km/day	Direct involvement is difficult
3	Private delivery service	Few	Long distance	Possible depending on the company
4	Public services (police, post, etc.)	Few	Short distance	Possible

Table 2-26 Classification of bike users in Iskandar region

From the perspective of reducing GHG emissions, since the user group of commuters to Singapore in 1. has the largest number of users and longest distance traveled, the reduction is expected to be significant. There is no accurate data on the current estimated emissions. However, based on the results of interviews, it is assumed that approximately 50,000 vehicles x 100km x 300 days x 103g/km = 155,000 t-CO2 is emitted. Also, direct government involvement in the project would be difficult. As in the case of Taipei, it would be more realistic to provide policy support such as deregulation and financial support. On the other hand, for public services, IRDA can be directly involved in the project, although from the perspective of reduction in GHG emissions, the number of users and the distance traveled would be small.

Based on the above considerations, it was agreed that the anticipated vision for the dissemination of the BaaS project in the Iskandar region, which is the ultimate aim for the Iskandar region, would be as shown in Table 2-27 and Figure 2-31, which we will continue to discuss with IRDA in the future.

No.	Classification	Vision for Dissemination of BaaS Project
1	Commuters to Singapore	<ul> <li>It is assumed that project development will be done by private companies (such as Blue Shark)</li> <li>The government (IRDA) will refer to the case of Taipei City, formulate a roadmap, and consider specific policy</li> </ul>
2	Users in the Iskandar region	<ul> <li>support methods such as unification of standards, relaxation of regulations, and support for purchases, aimed at dissemination.</li> <li>Examination of candidate sites for battery stations and the use of renewable energy sources such as solar panels will be considered ahead of time.</li> <li>The final phase of dissemination is aimed at around 2030.</li> </ul>
3	Private delivery service	<ul> <li>While analyzing the data from the preliminary demonstration project at Fish Club, other companies will be encouraged to deploy horizontally.</li> <li>In particular, IRDA will organize the information necessary for horizontal deployment after organizing the advantages and disadvantages of introducing battery-swappable motorbikes. In addition, IRDA will also consider policy support such as tax for companies that introduce the motorbikes.</li> </ul>
4	Public services (police, post, etc.)	<ul> <li>We will aim at project development led by IRDA while cooperating with institutions implementing various public services.</li> <li>The motorbikes will be introduced to other targets in advance by referring to the case of Taipei City to identify issues in promoting battery-swappable motorbikes.</li> </ul>

Table 2-27 Vision for the dissemination of the BaaS project in the Iskandar region



Figure 2-31 Vision for dissemination of BaaS project in Iskandar region

## 2.3.2 Implementation in the next fiscal year (draft)

As mentioned above, IRDA envisions working on policy support to realize the future vision, including formulating a dissemination roadmap (blueprint) and implementing a preliminary demonstration project. Based on the results of surveys conducted in this fiscal year, we plan to implement the items shown in Table 2-28 in the next fiscal year.

Classification	Items to be Implemented
Policy support	<ul> <li>Checking the latest status of initiatives by private businesses</li> <li>Discussion on policy support methods with private businesses (including an introduction to the case of Taipei City)</li> <li>Examining the overall structure of the roadmap</li> </ul>
	<ul> <li>(blueprint)</li> <li>Examining the contents of the demonstration project</li> <li>Selection of business partners</li> </ul>
Implementation of a preliminary demonstration project	- Examining the specific number of vehicles to be introduced and locations to install battery stations
	<ul> <li>Study of business model</li> <li>Examining reduction in greenhouse gas emissions</li> </ul>

Table 2-28 Details of the implementation of the BaaS project in the next fiscal year (draft)

## Chapter 3. Green Field Sector

Iskandar Region is Malaysia's first economic region, established in 2006. Five flagship zones have been set up from Flagship A to Flagship E and are proceeding with development. In addition, Flagship F has been set up as a new greenfield area to revitalize the economy and develop by combining decarbonization technology such as renewable energy and primary industry using IT technology, etc. (Figure 3-1).



Figure 3-1 Development areas and themes in Iskandar region

On the other hand, the area's development is currently at the concept stage, and specific details will be considered from now on. For this, as we discussed during the City-to-City collaboration project (Phase 1) held last year, we received a request for assistance in introducing sustainable technologies and systems being promoted in Japan, including business matching, future collaboration, and methods of supporting policy for developing Flagship F.

Further, in LCSBIM2030, IRDA has set "Sustainable Smart Farming" as Action 02 to achieve longterm goals for reducing greenhouse gas emissions. The introduction of rotation-type agricultural systems and modern agriculture aimed at decarbonization are being considered (details will be discussed later).

In light of this situation, as part of the construction support project for the green field area, in this

City-to-City collaboration project (phase 2), efforts that are being promoted in Toyama City and Japan to make primary industries smarter and decarbonize them using renewable energy etc., will be introduced and match them with businesses. At the same time, ways to provide policy support for practical application and commercialization will be considered.

The overall picture of this City-to-City collaboration project, its goals and implementation details for each year are shown in Figure 3-2. Based on this and the three-year City-to-City collaboration project results, we will conclude an MoU with the relevant parties and aim to formulate specific demonstration content and roadmap for the demonstration project from 2026 onwards.



Figure 3-2 Overall picture of the construction support project for the greenfield area, goals and implementation details

Contents of the survey conducted in 2023, which include the current status and issues of the primary industry sector in the Iskandar region, results of the survey on preceding cases of smart technology, and our vision of setting basic business targets based on these etc., are described below.

3.1 Current status and challenges of the primary industry sector in Iskandar region

3.1.1 Overview of primary industry field

The agriculture, forestry and fisheries industry of Malaysia as a whole increased from 82.2 billion ringgit in 2020 to 101.3 billion ringgit in 2021, with a growth rate of 23.2%, making it a growing industry. The percentage of the top three regions in terms of production value is 30.2% in Sarawak, 20.3% in Sabah, and 12.3% in Johor, where the Iskandar region is located. (Figure 3-3).



Source: Ministry of Economy, Department of Statistics, Malaysia

# Figure 3-3 Production value and growth rate of agriculture, forestry and fisheries sector in

## Malaysia (2020-2021)

## 1) Agricultural sector

In Malaysia, the estimated number of farming households in the agricultural sector is approximately 470,000, of which the state of Johor has 64,501, the highest for any state in Malaysia (Figure 3-4).

Negeri	Padi sawah	Sayur- sayuran	Buah- buahan	Tanaman kontan/lad ang	Rempah- ratus	Herba	Kelapa	Florikultur	JUMLAH
Johor	845	12,020	36,655	2,110	1,112	182	10,130	1,447	64,501
Kedah	56,900	735	7,126	308	298	125	1,354	40	66,886
Kelantan	21,492	3,421	15,567	992	413	115	8,729	36	50,765
Melaka	952	523	4,111	247	72	10	2,301	38	8,25
N. Sembilan	1,070	1,253	4,458	277	242	13	1,138	23	8,474
Pahang	5,271	14,959	19,950	586	767	117	2,214	389	44,253
Perak	21,001	4,687	8,459	2,870	305	325	5,899	148	43,694
Perlis	15,668	380	1,654	39	13	5	439	3	18,201
P. Pinang	6,272	481	1,852	98	25	-	9	4	8,741
Selangor	9,734	1,654	1,439	376	164	59	7,272	268	20,966
Terengganu	5,982	748	5,244	257	119	88	1,837	11	14,286
Sem. Malaysia	145,187	40,861	106,515	8,160	3,530	1,039	41,322	2,407	349,02
Sabah	9,986	3,044	15,272	923	321	4	14,223	63	43,836
Sarawak	33,595	3,675	26,568	2,301	342	452	9,237	76	76,246
W.P Labuan	-	51	137	-	-	-	54	8	250
Malaysia	188,768	47,631	148,492	11,384	4,193	1,495	64,836	2,554	469,353

ANGGARAN	BILANGAN	PETANI	MENGIKUT	NEGERI.	2022

Source: Malaysian Ministry of Agriculture Crop Statistics

Figure 3-4 Estimated total number of farmers by state and the number of farmers by product

In addition to rice cultivation, Johor's main products are all agricultural products, including fruits, vegetables and cash crops, such as potatoes and palms.

Among fruits, papaya, langsat, durian, pineapple, and banana are grown more than in other states. The area where durian, pineapple, and banana are cultivated is large, and pineapple production is 402,555 tons, more than 10 times that of Pahang, the second largest in growing pineapples. Within Johar, the Kluang district, located in the state's interior, is the production center (Figure 3-5).

Although the area of vegetable production is decreasing in Johor's state, the production volume is increasing, and the production efficiency is improving. (Figure 3-6) Production of spinach, okra, long beans, Chinese kale, water spinach, cucumbers, etc., is popular in Johor, and leafy vegetables such as spinach, Chinese kale, and water spinach are particularly popular in Johor Bahru district. (Figure 3-7)

Johar is the second largest producer of cash crops among the states after Perak (Figure 3-8), and within the state, Kluang district has the highest production volume. However, Johor Bahru district has the highest production volume of tapioca. (Figure 3-9)

Negeri	20	21	20	2022		2023e	
	Keluasan bertanam (ha)	Pengeluaran(mt)	Keluasan bertanam (ha)	Pengeluaran(mt)	Keluasan bertanam (ha)	Pengeluaran(mt	
Johor	50,232	631,711	50,217	772,317	60,341	796,215	
Kedah	9,734	73,093	9,762	96,010	12,743	98,980	
Kelantan	19,760	145,161	21,327	134,277	19,530	138,432	
Melaka	2,862	19,134	5,632	28,519	5,182	29,401	
N. Sembilan	5,572	68,549	6,108	68,199	7,604	70,309	
Pahang	25,679	244,209	27,331	271,798	31,455	280,208	
Perak	11,439	121,458	11,589	101,488	11,794	104,629	
Perlis	1,486	6,575	2,266	7,744	3,260	7,984	
P. Pinang	2,525	22,688	2,537	23,911	3,430	24,651	
Selangor	5,288	35,605	1,972	41,376	2,330	42,656	
Terengganu	7,653	49,650	7,184	27,279	5,014	28,123	
Sem. Malaysia	142,230	1,417,834	145,924	1,572,918	162,683	1,621,589	
Sabah	20,301	123,132	20,922	106,700	14,489	110,002	
Sarawak	36,814	145,573	36,398	147,922	26,118	152,499	
W.P. Labuan	75	336	188	452	157	466	
Malaysia	199,420	1,686,876	203,431	1,827,992	203,446	1,884,556	

Johor is the largest producer of coconuts, herbs, spices, flowers, etc. (Figure 3-10)

Source: Malaysian Ministry of Agriculture, Crop Statistics

Figure 3-5 Area of fruit production and production volume by state

	20	19	2020		
Negeri	Keluasan bertanam (ha)	Pengeluaran (mt)	Keluasan bertanam (ha)	Pengeluaran (mt)	
Johor	15,359	203,996	14,844	208,260	
Kedah	1,631	16,823	1,555	12,791	
Kelantan	4,640	132,188	4,512	128,327	
Melaka	1,059	15,062	941	13,222	
N. Sembilan	1,751	24,419	1,757	23,393	
Pahang	15,181	335,935	15,967	361,971	
Perak	6,628	116,984	7,192	120,424	
Perlis	320	2,350	266	2,023	
P. Pinang	935	10,986	813	10,324	
Selangor	2,683	38,796	2,338	31,660	
Terengganu	1,140	15,264	981	11,874	
Sem. Malaysia	51,329	912,804	51,165	924,270	
Sabah	4,542	46,227	4,364	43,272	
Sarawak	6,098	61,349	6,058	62,163	
W.P. Labuan	57	334	27	359	
Malaysia	62,026	1,020,714	61,614	1,030,064	

#### KELUASAN BERTANAM DAN PENGELUARAN SAYUR-SAYURAN MENGIKUT NEGERI, 2019-2020

Sumber : Jabatan Pertanian Malaysia

Source: Malaysian Ministry of Agriculture, Crop Statistics

## Figure 3-6 Vegetable production area and production volume by state

Negeri	Keluasan bertanam (ha)	Pengeluaran (mt)	Daerah utama	Keluasan bertanam (ha)	Pengeluaran (mt)
Pahang	21,391	455,641	Cameron Highlands	15,953	394,103
Johor	17,188	245,330	Johor Bahru	4,064	61,010
Kelantan	4,892	137,913	Kecil Lojing	925	77,895
Perak	6,702	116,765	Kinta	3,881	69,372
Sarawak	5,255	53,191	Sarikei	703	7,711

#### NEGERI DAN DAERAH UTAMA BAGI PENGELUARAN SAYUR-SAYURAN, 2022

Sumber : Jabatan Pertanian Malaysia

Source: Malaysian Ministry of Agriculture Crop Statistics

Figure 3-7 States with high vegetable production and major districts in each state

	20	19	2020		
Negeri	Keluasan bertanam (ha)	Pengeluaran (mt)	Keluasan bertanam (ha)	Pengeluaran (mt)	
Johor	3,008	38,567	3,056	42,963	
Kedah	612	5,341	579	3,318	
Kelantan	1,469	16,658	1,727	20,771	
Melaka	388	3,193	315	2,547	
N. Sembilan	438	4,919	290	3,622	
Pahang	943	6,447	1,013	6,452	
Perak	5,187	92,392	5,072	89,081	
Perlis	18	189	10	87	
P. Pinang	168	1,656	170	1,675	
Selangor	1,108	16,707	1,062	13,330	
Terengganu	468	3,825	388	3,329	
Sem. Malaysia	13,807	189,893	13,683	187,174	
Sabah	1,483	14,580	1,298	11,210	
Sarawak	1,789	16,806	4,108	25,115	
W.P. Labuan	3	31	1	8	
Malaysia	17,082	221,310	19,091	223,507	

#### KELUASAN BERTANAM DAN PENGELUARAN TANAMAN LADANG/KONTAN MENGIKUT NEGERI, 2019-2020

Sumber : Jabatan Pertanian Malaysia

Source: Malaysian Ministry of Agriculture, Crop Statistics

# Figure 3-8 Area of cash crop production and production volume by state

Jenis tanaman	Negeri	Daerah utama	Pengeluaran (mt)
Jagung Manis	Perak	Kampar	8,849
	Johor	Pontian	5,853
	Sarawak	Sarikei	607
Kacang tanah	Kelantan	Tanah Merah	38
	Terengganu	Hulu Terengganu	50
	Perak	Kinta	48
Ubi kayu	Johor	Johor Bahru	5,738.0
	Sarawak	Kuching	1,727
	Selangor	Kuala Langat	3,094
Ubi keladi	Johor	Kulaijaya	3,356
	Sarawak	Samarahan	348
(W)	Sabah	Lahad Datu	1,294

#### NEGERI DAN DAERAH UTAMA BAGI PENGELUARAN TANAMAN LADANG/KONTAN TERPILIH, 2022

Sumber : Jabatan Pertanian Malaysia

Source: Malaysian Ministry of Agriculture, Crop Statistics

Figure 3-9 Major crop-producing states and major crop-producing areas within those states

	20	19	20	20
Negeri	Keluasan bertanam (ha)	Pengeluaran (mt)	Keluasan bertanam (ha)	Pengeluaran (mt)
Johor	10,763	99,375	11,887	106,723
Kedah	996	5,131	2,155	10,046
Kelantan	9,979	77,807	10,399	79,953
Melaka	1,530	9,196	2,923	19,376
N. Sembilan	1,290	12,768	1,347	12,841
Pahang	4,205	24,263	3,997	26,916
Perak	7,594	78,644	7,523	71,589
Perlis	430	3,405	400	3,360
P. Pinang	40	263	45	246
Selangor	15,076	99,761	10,239	105,129
Terengganu	4,992	16,144	4,658	15,514
Sem. Malaysia	56,895	426,758	55,573	451,693
Sabah	17,041	55,337	17,275	57,392
Sarawak	12,401	54,023	12,003	51,490
W.P. Labuan	129	487	91	409
Malaysia	86,466	536,606	84,942	560,984

#### KELUASAN BERTANAM DAN PENGELUARAN KELAPA MENGIKUT NEGERI, 2019-2020

Sumber : Jabatan Pertanian Malaysia

Source: Malaysian Ministry of Agriculture, Crop Statistics

Figure 3-10 Area of coconut, herbs and spices, flower production and production volume by state

Malaysia's palm oil production has gradually increased over the past 10 years. (Figure 3-11) The main palm oil-producing states in Malaysia and their percentage of production are Sabah 24%, Sarawak 21%, and Johor 16%. In Johor, palm oil refineries are distributed mainly from the inland area around Kluang district to the coastal area of Kota Tinggi district. (Figure 3-12)

Johor is a major producer of crops other than paddy rice. The Johor Bahru district, which comprises most of the Iskandar region, is a major producer of vegetables and tapioca.



Source: USDA Foreign Agricultural Service

Figure 3-11 Production volume and area of palm oil, rice, and corn in Malaysia



Malaysia: Palm Oil Production

Source: USDA Foreign Agricultural Service Figure 3-12 Main palm oil producing states and palm oil refineries

## 2) Fishing industry

As of 2019, the total production value of Malaysia's fisheries industry was RM15.26 billion, of which fishing accounted for 77.7%, aquaculture 22.0%, and inland fisheries 0.3%. (Figure 3-13) In particular, 56% of the catch is from the west coast of the Malay Peninsula, which includes the Pontian

area. (Figure 3-14)



Source: Annual Fisheries Statistics 2019

Figure 3-13 Overview of Malaysian fisheries production



Source: Annual Fisheries Statistics 2019

Figure 3-14 Percentage of Fish catch in Malaysia by region

In Johor state, which includes the Iskandar region, the fish caught is 65,149 tons, and aquaculture production is 15,720 tons. The amount of fish caught is greater than the amount produced by aquaculture. In aquaculture, production in brackish waters is 10,555 tons, and production in freshwater areas is 5,166 tons, with the largest amount produced in brackish waters. The major marine products of Johor are whiteleg shrimp, freshwater catfish, white tuna, and sardine. (Figure 3-15)



Source: Annual Fisheries Statistics 2019

Figure 3-15 Overview of the fisheries industry in Johor state

Regarding aquaculture in Malaysia, the production volume in ponds in freshwater and brackish waters is high and low using tanks. However, in freshwater areas, although the production volume in ponds is decreasing, the number of ponds made from mining sites, cement tanks, and cloth tanks has increased since 2016 (Figure 3-16). It is expected that intensive, high-tech aquaculture will increase.

PENGELUARAN (TAN METRIK) Production (Tonnes)	2014	2015	2016	2017	2018	2019
Kolam Ponds	79,112.83	76,812.40	63,736.18	59,122.68	58,480.34	55,705.91
Bekas Lombong Ex-mining Pools	7,336.62	15,463.49	18,682.94	21,147.78	23,158.91	27,791.50
Sangkar <i>Cages</i>	14,376.25	13,667.82	15,559.02	16,537.18	13,993.90	13,836.18
Tangki Simen Cement Tanks	4,918.46	5,749.66	5,121.87	5,251.29	5,031.10	6,454.92
Tangki Kanvas Canvas Tanks	837.25	133.05	76.07	191.54	183.30	220.82
Kandang Ikan Pen Culture	149.99	318.72	172.13	346.36	386.97	566.73
Estet <i>Estet</i>	-	-	-	-	35.37	25.51

Source: Annual Fisheries Statistics 2019

#### Figure 3-16 Changes in production volume by type of freshwater aquaculture

3.1.2 Policy policies related to the primary industry sector

As mentioned, IRDA has organized future development policies for the primary industry sector in the Low Carbon Society Blue Print for Iskandar Malaysia 2030 Climate Action Plan (LCSBPIM 2030 CAP). In addition, it also clarifies the vision and comprehensive development framework for the Iskandar region. In the plot management plan, the Agriculture Production Zone (APZ), as shown in Figure 3-17, is to be maintained as a plot suitable for agriculture and fisheries in the Comprehensive Development Plan II (2014-2025), which indicates the promotion of development and strategic direction.



Figure 3-17 Comprehensive Development Plan ii Plot management plan (Green area: Agricultural area)

In addition, within LCSBIM2030CAP, the policy direction for the primary industry sector is to set "Sustainable Smart Farming" as Action 02 to achieve long-term goals regarding greenhouse gas emission reduction. The goals include introducing rotation-type agricultural systems and modern agriculture aimed at decarbonization. The Sub Actions indicated in Sustainable Smart Farming are shown in Table 3-1. Sub Action SSF 2.2 advocates precision agriculture (smart agriculture) and precision aquaculture (smart aquaculture).

Sub Action	<b>Contents of Sustainable Smart Farming</b>
SSF 2.1	Building a rotation-type agricultural system to reduce agricultural
	waste
	Establishment of sustainable livestock manure management systems, exploration of new livestock feed materials, use of biofuel energy, policy formulation for efficient use of water, and sustainable use of water resources.
SSF 2.2	Introduction of modern agriculture with a focus on decarbonization
	Promotion of initiatives for precision agriculture, precision livestock farming, and precision aquaculture
SSF 2.3	Promoting urban agriculture to improve food security
	Promotion of vertical farming, promotion of Hügelkultur (Hügel bed cultivation)

Table 3-1 Summary of LCSBIM2030CAP Action02 Sub Actions

Specific actions are shown in Table 3-2 and Table 3-3. Examples include reducing the amount of

pesticides used by utilizing relevant data acquired using remote sensing and drones, variable work technology, and automation in each agricultural work process for all farms and crops in the region, as well as palm and rubber tree plantations. In addition, the precision aquaculture industry targets all aquaculture businesses in the region. It includes optimal and accurate feeding examples, ascertaining growth density and feeding conditions, and establishing a monitoring program for GHG emissions. Further, concerning reducing GHG emissions, they also mention collecting data and considering LCA, suggesting a high level of awareness towards reducing GHG emissions.

SSF 2.2a Promoting P	recision Agriculture
Definition	Precision agriculture is a management theory incorporating modern technology to increase yields while saving labor and resources.
Purpose	To modernize agriculture to obtain higher yields with fewer resources by maximizing farm resources, thus reducing GHG emissions.
Target	All farms and crops in the area, palm tree and rubber tree plantations
Action plan	• Precision pest management system for using minimal amounts of pesticides
	• Introducing variable work in technology fields with uneven fertilization according to the condition of soil microorganisms
	· Introducing remote sensing technology, such as collecting
	characteristic data using unmanned aerial vehicles (drones), sensors,
	<u>etc.</u>
	• Exploring the feasibility of automation at all stages (harvesting, processing, packaging)
	• Introducing financial incentives and adequate long-term training to select precision farming techniques effectively
	• Introduction of agroecological approaches such as agroforestry to existing farms
SSF 2.2b Promotion o	f precision animal husbandry
Definition	Precision animal husbandry is a collection of technologies that continuously and automatically monitor animals' health and welfare, enabling increased productivity and early detection of health problems. Further, precision animal husbandry is an approach based on scientific data, including real-time monitoring and understanding of data on food intake, production, welfare, etc., enabling better management decisions and leading to reductions in GHG emissions such as methane gas.
Purpose	Aiming to modernize livestock farming to promote the production of animal products to enhance efficient and sustainable local food supplies
Target	All animal husbandry farms in the area

Table 3-2 Contents of LCSBIM2030CAP Action02 Sub Action2.2

Action plan	• Livestock population tracking and data collection using RFID tags for resource management and waste reduction
	Monitoring technology, like using cameras to reduce human stress
	• Exploring the feasibility of accurate, low-cost sensor and projection technologies to enable real-time monitoring of data
	• Introducing financial incentives and adequate long-term training for the effective selection of precision livestock techniques
	• Establishment of a monitoring program for GHG emissions in large- scale dairy, poultry, and pig farms to establish basic data for
	precision animal husbandry
SSF 2.2c Promotion of	of precision aquaculture
Definition	Precision aquaculture applies to a controlled, interconnected aquaculture operation along similar principles to precision livestock farming. Precision aquaculture contributes to improved, accurate, precise management, automatic monitoring of fish numbers, reliable management decisions, and labor savings.
Purpose	Aim to increase fish production and reduce fishing, greatly affected by overfishing and climate change.
Target	All aquaculture farms in the area
Action plan	• Implementation of precision feeding programs that match nutritional needs to growth rates
	• Exploring the feasibility of accurate, low-cost sensor and projection technologies to enable real-time monitoring of data
	• Exploring the feasibility of tracking and collecting data on fish density, welfare and diet by using surface and underwater cameras for resource management and potential waste reduction
	• Establishment of a monitoring program for GHG emissions at large-
	scale fish farms to establish basic data
	• Introducing financial incentives and sufficient long-term training for effective selection of precision aquaculture techniques
	• <u>Launch of a Pilot study to document the impact of rising sea</u> temperatures on fisheries and aquaculture in the Iskandar region

# Table 3-3 Contents of LCSBIM2030CAP Action02 Sub Action2.3

SSF 2.3a Promoting	Vertical Farming
Definition	Vertical farming is a controlled environment where crops are grown in vertical stacks using indoor farming techniques such as hydroponics, aquaponics, and aeroponics. Compared to traditional agriculture, it uses less land and water. As it is produced locally, transportation costs are also reduced.
Purpose	Promoting vertical farming in the region aims to increase food production through sustainable methods while addressing food security and rising prices. It will also be less susceptible to climate change, pollution, pests, and diseases, making stable food production possible.
Target	Underutilized and abandoned land and buildings, uneconomic land within the area

Action plan	• Establishing a pilot vertical farm as a research and demonstration site in the region
	• Establishing cooperation between industrial parties for the establishment of vertical farms
	• Exploring domestic and international investment opportunities for vertical farming
	• Creating incentives for key players to adopt vertical farming to produce and supply local food
	• Exploring the possibility of introducing solar panels to address energy consumption and LEDs as indoor light sources
	• Establishing LCA to assess GHG emissions and reductions accurately

Based on these development plans and in consultation with IRDA, this City-to-City collaboration project selected the Pontian district, on the west side of the Iskandar area, to be prioritized for consideration in this City-to-City collaboration project. The results of organizing the situation in the Pontian district are given below.

#### 3.1.3 Situation of Pontian district in Iskandar region

Pontian District is one of the three districts comprising the Iskandar region and is located on the west side of the Strait of Malacca (Figure 3-18). The main industry in the Pontian District is power generation-related, but it is not big enough to be called a primary industry. On the other hand, the fishing industry is famous because of the abundance of marine resources. Palm oil and pineapple are the main crops in agriculture.

In the Low Carbon Society Blueprint Iskandar Malaysia 2025, only a part of the Pontian district (highlighted in dark blue in Figure 3-18) was targeted for decarbonization. However, in the 2030 edition, Iskander's Pontian district (Figure 3-18Figure 3-18) was designated a development priority area. IRDA intends to develop this area as a candidate site for smart farming and modern aquaculture projects.



Source: LCSBIM2030CAP Figure 3-18 Location of the Pontian district and its relationship with the Iskandar area

Based on the background mentioned above, discussions were held with IRDA and Pontian district Office officials in October 2023, and it was confirmed that in this City-to-City collaboration project, Pontian district would be selected as the target area for constructing a greenfield area and formulation of a specific project will be aimed at.

In this City-to-City collaboration project, to examine the business feasibility of the aquaculture industry in Pontian district, including land-based aquaculture, which was particularly in high demand, we conducted on-site surveys of two fish farms after understanding the supply chain and energy usage structure of the fisheries industry in Pontian District (Figure 3-19). One is a seafood processing and sales company, and the other is a seafood market in the Pontian district. The results of each field survey are summarized below.


Figure 3-19 Status of Fisheries supply chain and GHG emissions in Pontian District

	Name	<b>Business type</b>	Address	
1	Kukup	Marine aquaculture	Jalan Kukup Laut, 82300 Kukup, Johor	
2	Pekan Nanas	Land-based aquaculture (Freshwater/Free flowing)	Kampung Sawah Dalam, 81500 Pekan Nanas, Johor	
3	Pontian public market	Sales of marine products and agricultural products	Pontian Kecil, 82000 Pontian, Johor,	
4	Fish Club	Processing and sales of frozen fish	20, Jalan Hijauan 4, Horizon Hills, 79100 Iskandar Puteri, Johor	

## Table 3-4 Overview of field survey points in the Pontian district



Source: Google Maps Figure 3-20 Map of field survey locations in Pontian district

# 1) Kukup Sea Aquaculture farm

Kukup, located on the west coast of Pontian district, is an area where marine aquaculture is popular due to the gentle ocean currents and rich nutrients from the mangrove forests in the adjacent sea area and islands made of mangrove forests. Figure 3-21 shows the location of Kukup and an aerial photograph of marine aquaculture.

In Kukup, coastal aquaculture was traditionally carried out using fishing boats, but fishermen are said to have started aquaculture due to a crisis as the catch decreased. Kukup is a region famous for its rich seafood; on weekends, it is a tourist destination that tourists from Malaysia and neighboring Singapore visit in search of the "rustic fishing village scenery." For this reason, there are many restaurants and accommodation facilities located near the fish farms, and in recent years, sightseeing boats for sightseeing around the mangroves have become popular. Hence, sightseeing boats are also operating in addition to fishing boats for aquaculture (Figure 3-22).

In recent years, due in part to the impact of COVID-19, the number of fishermen has been reduced to half of what they were, but aquaculture is still thriving. At the same time, the government has suspended the issuance of new aquaculture licenses to protect the environment, and it is currently difficult to imagine that the number of aquaculture sites will increase.



Source: Google Maps Figure 3-21 Location of Kukup marine aquaculture farm and how marine aquaculture looks



Figure 3-22 Tourist boats around Pulau Kukup

Figure 3-23 shows the flow of aquaculture carried out in Kukup.



and aeration.

Figure 3-23 Kukup Marine Aquaculture Farm Supply Chain

The fish species grown here are large fishes in local demand, such as Red Snapper and Grouper. The farming method involves purchasing young fish and raising them in cages on the sea surface. The reared fish are shipped when orders are received from affiliated wholesalers or to markets such as the Pontian public market described below. The shipping size varies depending on the fish species, as some fish species can be over 1 meter long. The Business operators can raise any fish species, and no species has been specified.

Regarding aquaculture, the method involves floating cages at least 20 meters deep on the sea surface (Figure 3-24). The current aquaculture site has calm waves and almost no red tide. So, the water quality is not a problem, and the nutrients provided by the mangrove forest make it a suitable location for aquaculture. Feeding and unloading are done manually.

The main costs are feed and labor costs. They are fed small live fish caught in nearby waters, and artificial feed such as pellets are almost unused. It is believed that feeding on small live fish contributes to maintaining the quality of the Kukup brand. In addition, since it is marine aquaculture, there is no need for pumps or aeration, so there is almost no electricity demand. The only demand is for CCTV and lighting to prevent the theft of farmed fish. Greenhouse gases emitted from aquaculture are low. (Figure 3-25).

The landed fish are shipped from this farm to the Fish Club processing plant and the Pontian public market, which will be described later. When fish are unloaded at a farm, they are transported by boat to a port in plastic containers, packed with ice, and overland by truck (Figure 3-25).



Figure 3-24 Kukup marine fish farm



Figure 3-25 Photos related to the transportation of landed fish

At Kukup Marine Aquaculture Farm, Pulau Kukup, which is adjacent to the farm, is a Ramsar Convention-registered wetland<sup>5</sup>, and in recent years, the environmental impact of marine aquaculture has become a global issue, so we are considering marine aquaculture for locally farmed fish. By introducing smart technology that understands the water environment and sizes of the fishes, and optimizes feeding amounts, it is believed that costs and environmental impact will be reduced and further increase the sustainability of the aquaculture industry in Kukup.

Additionally, from the perspective of reducing greenhouse gas emissions, the energy used in the aquaculture process is currently very small. On the other hand, Kukup's marine aquaculture farm requires transportation from the port by boat. However, as the distance is short and does not require much speed, it is considered relatively easy to convert the boat to an electric vehicle.

## 2) Pekan Nanas land farm

Pekan Nanas is an inland region of Pontian where pineapple production and palm tree plantations are popular. Figure 3-26 shows the location of Pekan Nanas and how the land-based fish farm looks. Only land ownership and business licenses are required; aquaculture and water usage permits are not required.

<sup>&</sup>lt;sup>5</sup>Ramsar Site Information Service https://rsis.ramsar.org/ris/1287



Source: Google Maps

Figure 3-26 Location and aerial photo of Pekan Nanas land farm

The overall layout of the Pekan Nanas land-based aquaculture project is shown in Figure 3-27, and the flow of aquaculture is shown in Figure 3-28.



Figure 3-27 Overall layout of Pekan Nanas land farm



Figure 3-28 Pekan Nanas Land Farm Supply Chain

Pekan Nanas land-based fish farm raises neon tetra and edible crayfish. Neon tetra is the main product, and crayfish is being raised experimentally (Figure 3-29). Neon tetra is an ornamental fish mainly shipped to Singapore, while crayfish is shipped to Chinese restaurants in Johor Bahru. The neon tetra is sold at 0.1 to 0.2 SGD/per fish in sizes S-XL. Eventually, the neon tetra will be packed with oxygen and water in plastic bags and shipped by road to Singapore. Once a week, the company ships 20 bags of 300 fish in its truck. The company also delivers crayfish using its trucks.



Figure 3-29 Fish species cultivated

The shipping time for neon tetras varies depending on their size. They are reared in an indoor plastic aquarium for about a week, then moved to an outdoor aquarium and shipped in 2 to 3 months (Figure 3-30).

As an outdoor aquaculture method, free flowing aquaculture is used. The water source is a waterfall near the facility, and water is taken directly from a pond downstream from the waterfall, stored in a water tank on the premises (Figure 3-31), filtered, and then distributed to each tank. The water temperature is approximately 29°C, and the pH is 6.8. There are no special charges for water use, and no notification is required when water is taken.

After use, there is no filtration process. The water is stored in a purification reservoir and then drained into external agricultural water sources as appropriate (Figure 3-31).



Figure 3-30 Neon tetra farming and shipping



Figure 3-31 Water sources used in aquaculture

Regarding aquariums, there are a total of 17 outdoor aquariums measuring 7.3 m x 9.7 m x 1 m, all of which are covered with black nets to avoid direct sunlight (Figure 3-32). 10,000-20,000 neon tetras are kept in each outdoor tank. Fish feed purchased from local companies as protein powder or pellets accounts for most of the overall cost.



Figure 3-32 Outdoor aquarium

The cost incurred is electricity purchased and used for various pumps and aeration. Adjusting the water temperature as long as the water flow and volume are maintained is unnecessary. The electricity bill for the entire farm is approximately 600 RM/month (18,600 yen/month). The amount of electricity used is estimated from the electricity bill to be approximately 1,250 kWh/month. No water usage fees are required, and notification is not required when water is drawn. In addition, the total cost, including oxygen cylinders for packing and the labor costs of four employees, is 3,500-5,000 RM/month (108,400-154,900 yen/month).

Outdoor aquariums are covered to avoid direct sunlight for the growth of fish species. However, it is thought that by replacing the cover with solar panels, it is possible to benefit from the renewable energy supply and blocking of direct sunlight. When we interviewed business operators about installing solar panels, they said they had never considered it but would consider installing it if there was a reduction in cost after installation. Currently, the amount of electricity used is small compared to the amount that can be generated by the entire farm (see 4.2 for details). It may be possible to consider utilizing these renewable energies, introducing smart technology and cold water equipment, and expanding the number of fish species that can be raised.

#### 3) Pontian public market

The Pontian district has a public agricultural, livestock, and marine products market. The scale of marine products is particularly large. Since the market does not face the sea, fishermen bring their products in by truck from various ports. The location and aerial photograph of the Pontian public market are shown in Figure 3-33.



Source: Google Maps

Figure 3-33 Location and aerial photo of Pontian public market

Figure 3-34 shows that the Pontian public market has three buildings and an outdoor ice machine, freezer, unloading area and parking lot. The building is divided into three parts: a newly built road-side building, a former market building currently unused and scheduled to be renovated, and a sea-side building where marine products are traded.



Figure 3-34 Schematic drawing of Pontian public market

In addition to fishery, small shops sell livestock and agricultural products, and some stores have ice, refrigerators, and freezers. There are no walls. A fan and lights are installed on the ceiling, and no air conditioning equipment, such as an air conditioner, exists. The building has just been renovated, and solar panels will be installed in the future. We were able to see the panels being delivered to the market. The old market building was under renovation and not in use.

The building on the seaside is mainly used for trading marine products, and auctions are also held there. Seafood products are packed in plastic containers with ice and brought in by truck from the fishing port. They are traded directly by keeping them on the floor or in some containers or plastic bags filled with ice water. Those who purchase the ice pack it in a plastic bag or container with ice and take it home by truck. An ice machine is installed next to the facility and supplies ice.

In Japan, marine products are generally distributed through two major markets. Fishermen first bring their catch to the wholesale market in the production area (where fishermen collect, sort, and sell the catches close to the landed area). After that, they are brought to the wholesale market of the consuming region (where various marine products shipped from the wholesale markets of various production regions are collected, sorted by use, and sold at retail stores) through wholesalers and purchasers, and then sold to consumers through retailers, etc. The Pontian public market combines Japan's wholesale market in the place of origin and consumer wholesale market. The building on the seaside, where many seafood auctions were held, seemed to play the role of the wholesale market for the place of origin area, and the building on the roadside, lined with shops selling small quantities of seafood, seemed to play the role of the wholesale market for the consumption area. In addition, it looks like a market in the center of the Iskandar region functions as a wholesale market for consumption other than the buildings on the road, but this was unclear in this study.

The Pontian public market had an ice machine supplying ice for cooling and several forklifts. In the roadside buildings, each shop has its freezer or refrigerator, and these facilities are expected to be the main target of the market's electricity demand. Plans have already been made to install solar panels on roadside buildings, and we think that in addition to selling the electricity, using it to meet the electricity demand within these markets will also increase the value of the market as a decarbonized market.

However, since the market starts early in the morning and the number of users decreases in the afternoon, it is expected that electricity usage will begin before the solar panels start generating power. By the time the power generation is high, the peak of demand may have passed. Therefore, to meet electricity demand completely with renewable energy before sunrise, it is thought that it will be necessary to introduce storage batteries. In addition, if air-conditioned training rooms are provided for fishermen to train and socialize, it will improve the skills of fishermen and provide a place to use electricity in the afternoon, leading to an increase in the value of the market as a public market.



Figure 3-35 General distribution channels for marine products in Japan and corresponding channels in the Pontian public market

4) Fish Club

Fish Club is a company based in Johor dealing with frozen fish processing and sales. Fish Club provides direct delivery service for frozen fish to individuals and restaurants and handles everything

in-house, from purchasing raw materials to processing, freezing, and selling. Approximately 40% of the customers are residents of the Iskandar area, and 60% are residents of Singapore. They have 5 stores in Johor and deliver within a radius of approximately 10 km. They deliver with their delivery service (motorcycles) or through food delivery services such as Grab and Food Panda.

The main supplier is the Pontian district. As mentioned above, fishing was once popular in the Pontian district, but in recent years, the catch and fish species have declined. There are various theories as to why this is the case, but overfishing and changes in water temperature due to climate change are among the factors. As a result, Fish Club has begun actively working on environmentally friendly businesses. It is also working to reduce food loss by introducing EVs and introducing and improving cold chains as part of the effort to reduce greenhouse gas emissions. These efforts are being actively announced to consumers.

During the on-site survey, we visited stores selling processed products and conducted interviews regarding the marine products processing supply chain and the motorcycle business with replaceable batteries mentioned above.

From the resource management perspective, the company does frozen processing, and as its business format involves direct delivery to consumers, energy consumption within the scope of its business has more opportunities for GHG emissions than traditional marine product distribution. If renewable energy can be used to power their cold chains, such as transporting marine products from local fishermen to processing plants, power supply to processing plants, and store freezers, we think that this will improve environmental awareness, which is a priority for business operators, and appeal of the story.



Aluminum packs and ice packs for shipping

Figure 3-36 Fish Club store

## 3.2 Examination of preceding cases

In this section, we examined preceding cases in Japan and abroad that combined renewable energy and primary industries when constructing greenfield areas and identified issues to be addressed to realize the project. Regarding overseas cases, we focused on preceding cases in Taiwan. In Taiwan, aiming for energy self-sufficiency, the introduction of renewable energy, particularly solar power generation, wind power generation, and some underground thermal power generation, is in progress. The introduction of solar power generation is progressing, with 9GW installed across Taiwan.

As part of the efforts to promote the introduction of solar power generation, "Symbiosis of fishing and electricity" has been advocated, and activities that combine solar power generation and aquaculture are being promoted. In "Symbiosis of Fishing and Electricity", the priority is to keep the fishing industry afloat, and the government has set the sun shading rate at 40% or less. This figure is the value at which 70% of fish will survive if solar panels are installed. The advantages of introducing solar power generation in the fishing industry are that FIT electricity can be sold, providing a stable income for fishermen and promoting and assisting fish growth by protecting the fish farm from winter north winds and maintaining water temperature. The Taiwanese government provides subsidies for introducing solar power generation to aquaculture farms (Figure 3-37), and more than 100 farms in Taiwan alone have introduced solar power generation. In addition to the site visit mentioned above to an advanced BaaS business site, this article describes the results of a visit to land-based aquaculture facilities and plant factories that utilize renewable energy in Taiwan.

In addition, examples of advanced initiatives being implemented within Toyama City will also be described.



Figure 3-37 Summary of subsidies received by fish farms that engage in symbiosis with fishing and electricity and their Japanese translations

#### 1) Taiwan: Semi-closed rotation type land-based aquaculture business

Gyeongzhu Aquaculture Co., Ltd. is conducting advanced semi-closed rotation type land-based aquaculture using solar power and rainwater in hopes of getting young people interested in fishing. They have received a subsidy from the Taiwanese government as a fishing-electric symbiosis demonstration site and have installed equipment. They are currently constructing a new land-based aquaculture facility. In October 2023, we inspected and interviewed facilities in Tainan City. (Figure 3-38).



Source: Google Maps

#### Figure 3-38 Location and aerial photo of Jingyu Aquaculture Company's place of business

#### $\succ$ Fish species

They grow Goby Fish and crabs. Goby Fish is reared to sell as fish called fry, and 70% of this species is reared in Taiwan. Due to the high monopoly rate, production adjustments are made to suppress price fluctuations. They can survive up to 40 hours if their skin is wet, making them easier to handle during transport. While crabs are of high quality, they are difficult to grow, so this farm has established a hatching method and has improved the hatching rate. Shrimp will be grown on a new farm currently under construction.

## Cultivation method

The project flow is shown in Figure 3-39. A solar panel is installed above the indoor aquarium functions as a roof. The house has no walls and is well-ventilated, and there is no air conditioning system -

The installed solar panels have a capacity of 500kW. Surplus electricity is sold preferentially to factories near the farm for NT\$5.6/kWh. When the factory is not operating, the company sells FIT

electricity to the electric power company at NT\$4.3/kWh.



Figure 3-39 Business flow of Jingyu Aquaculture Company



Figure 3-40 Land-based aquaculture facility of Jingyu Aquaculture Co., Ltd.

The cultivation method is semi-closed rotation type land cultivation. The water source is rainwater, first stored in a tank and purified to remove impurities before use. After use, it is filtered through coarse sand, purified in a septic tank, and reused. Some water is drained, and the wastewater is 1t per week. Aeration is performed in one place, and the water is distributed to each tank, so each tank is not equipped with aeration. In addition, pelleted feed is purchased.

Electricity is used only for water intake pumps, etc., for aeration, and does not control water temperature. Each pump pumps 60t/h of water. The electricity used is 60,000 kWh/month, entirely powered by sunlight during the day and purchased at night. Batteries have not yet been installed at the moment; they are planning to do so at the new farm under construction, and the plan is to store surplus electricity so that the farm's electricity will be completely covered by solar power alone.

#### 2) Taiwan: Large-scale mega solar terrestrial aquaculture business

Mr. Yang operates a facility in the Tainan region that combines large-scale mega-solar power generation and land-based aquaculture operations (Figure 3-41). The farm we visited has an area of 4.8 ha, and together with the other farms, the farm has an area of 10ha and is managed by four employees. The farm has a long history and has been run by three generations. With the desire to contribute to the environment and society, the third generation has introduced solar power generation.



Source: Google Maps

Figure 3-41 Location and aerial photo of land-based aquaculture facility with mega solar

## Cultivation method

The fish species reared is called milk fish, which is very common in Taiwan and Southeast Asia. The business and energy flow is shown in Figure 3-42. Solar panels are installed on the banks of the outdoor aquaculture pond and above the reservoir. Because the pillars of the panel foundations get in the way when landing fish, solar panels are not installed above the aquaculture ponds but only on the banks and reservoirs (Figure 3-43).

The water used is seawater, agricultural water, and rainwater. A water wheel is installed in each aquaculture pond to create water flow. Feed is supplied regularly by an automatic feeder. The electricity used is limited to the water turbines and automatic feeding machines installed in each aquaculture pond, and the water temperature is not controlled.



Figure 3-42 Business and energy flow of land-based aquaculture facility with mega solar



Figure 3-43 Land-based aquaculture facility with mega solar

➢ Energy utilization

The installed solar power generation capacity is 2.4 MW, and there is still room for more to be

installed. However, the grid is small, and output is curtailed, so there are no plans for additional installations. In addition to using the electricity at the farm, surplus electricity is sold to Taiwan Power Corporation (TPC). The shielding rate of aquaculture ponds by solar panels is 26%, far below the government standards. One optimizer is installed for every two solar panels, and the status of each panel can be checked using an app, making it possible to detect failures immediately. In Taiwan, it is used for maintenance as it is greatly affected by typhoons (Figure 3-44).Figure 3-44 Solar panel management app (left) and optimizer (right)



Figure 3-44 Solar panel management app (left) and optimizer (right)

3) Taiwan: Example of an Artificial light plant factory

Unimicron Technology Corp.'s main industry is electronic infrastructure development, and by applying its technology, it has been operating a plant factory based in Taoyuan City since 2012 and running restaurants and bakeries. Among the plant factory businesses operated by the company, we visited the Metro Fresh business in this project, which is operated inside subway stations.

Agricultural products grown using hydroponics or other plant factories are uncommon in Taiwan, so the people are unfamiliar with them. Therefore, in this project, we will set up a demonstration plant factory inside Nanjing Fuxing Station on the subway to provide an opportunity to learn what a plant factory is like and how the vegetables we eat daily are grown. By doing so, the plant factory will become familiar to passersby (Figure 3-45).



Source: Google Maps

Figure 3-45 Metro Fresh project implementation site

The business outline is that salad greens, herbs, fruits, etc., are grown using solar power installed at the station. The cultivation status of various plants is displayed by changing the type of LED light according to the variety being cultivated and by changing the cultivated plants regularly (Figure 3-46)



Figure 3-46 Metro Fresh business situation

All indoor environments are computer-controlled. LEDs, air conditioning, etc., consume electricity, but most of the cost is labor. When grown under artificial light, the growth rate of the salad greens is faster than normal, and they can be harvested in four weeks.

Eventually, a shop inside the station will sell salads and sandwiches made with vegetables grown at the plant factory. Another factory manufactures and sells cosmetics using ingredients extracted from its crops. Since plant factories are a costly cultivation method, it isn't easy to make a profit just by selling fruits and vegetables as is, so it is important to maximize profits by processing and adding value.

#### 4) Toyama City: Agricultural revitalization project by using renewable energy

Toyama City has established a Farm Management Support Center to deepen citizens' understanding of agriculture, promote the training of new agricultural leaders, and contribute to the promotion and development of agriculture in Toyama City. The Farming Support Center holds agricultural technology courses, etc., while providing information on farming with the "Agriculture Revitalization by Utilizing Renewable Energy" project, which is positioned as an initiative of the Toyama City Environmental Future City Plan and as a regional revitalization model case. They are implementing a project called "Visualization of Renewable Energy by Using Support Centers." By disseminating renewable energy to rural areas to reduce carbon emissions in rural areas, the center serves as a showroom where visiting farmers and others can experience the effectiveness of renewable energy first-hand.

Renewable energy equipment has been introduced in the "Visualization of Renewable Energy Using Farming Support Centers" project. This electricity will be used effectively for agricultural machinery and facilities, etc., and the effectiveness of improved energy efficiency, cost reduction, etc., by the introduced equipment will be visualized. The renewable energies introduced are small hydroelectric power generation facilities that utilize agricultural water, solar sharing that utilizes farmland, and heat pumps that utilize underground water heat. They are considering using these renewable energies not only for agriculture but also for disaster prevention. They are also establishing a self-sufficient model for self-sufficient rural and mountain villages. Solar power generation of 30kW, small hydropower generation of 40W, geothermal heat pump of 20kW, and storage battery of 44kWh have been introduced, and 10kW of the solar power generation is used for "solar sharing" installed on farmland. An outdoor training building utilizes geothermal heat pumps and the heating and cooling equipment for greenhouses. The storage battery will be connected to solar and small hydropower generation. It will be used to store electricity as a disaster prevention power source during a disaster.

# Toyama-type rural low-carbon model project (agricultural revitalization using renewable energy)

By the introduction of of small-scale hydroelectric power generation equipment that utilizes agricultural water, solar sharing system that in agricultural fields, and heat pumps exploiting geothermal heat to make renewable energy visible and utilize it widely in agriculture. This model also enables to establish a self-sufficient rural village for disaster prevention and to serve as a "showroom" for farmers and others to experience and lead to the spread and expansion of renewable energy in rural areas.



Source: Toyama City homepage

## Figure 3-47 Facility overview of agricultural revitalization project using renewable energy

5) Toyama City: Smart technology introduction project in the primary industry field

Toyama City is conducting a smart agricultural technology demonstration project to address various issues in the primary industry field. Mainly targeting perilla cultivation, pear cultivation, and firefly squid fixed net fishing, it aims to understand and predict growth conditions, pass on the knowledge and techniques of experts, save labor, and add high value through remote sensing and apps.

The smart agriculture business includes using work recording apps, growth diagnosis using drone images, and predicting the appropriate harvest time based on climate information. The smart fruit tree business uses remote sensing data for pear cultivation and pruning diagnosis using AI. The smart fish industry collects data through remote sensing and monitoring fish catch using fish finders (Figure 3-48).



Figure 3-48 Overview of the project to introduce smart technology to primary industries in Toyama City

6) Toyama City: Toyama Smart Agriculture next-generation greenhouse horticulture project Toyama Kankyo Seibi Co., Ltd.. is a waste treatment company based in Toyama City. This business processes waste and manufactures raw materials and products using recycled materials generated from waste, operates greenhouse horticulture using heat and electrical energy, and manufactures processed foods. (Figure 3-49) The purpose of this facility cultivation project is year-round cultivation using ICT technology, rotation-type agriculture that effectively uses local resources and energy, to create a 6th industry that involves processing, distributing, and selling the fruits and vegetables produced. These efforts have been planned and implemented through a council centered around Toyama Prefecture as Toyama Smart Agriculture's next-generation greenhouse horticulture base.

The cultivated items and area are 2.8ha for fruit tomatoes, 1.2ha for bellflower, and 0.25ha for strawberries. Substandard tomatoes are frozen, processed into purees, and sold to restaurants. They also manufacture and sell their bread using tomatoes and strawberries. Tomato cultivation uses Imec farming (hydroponic cultivation), a farming method that stresses the growth of tomatoes, which is said to increase the nutritional value of tomatoes. During tomato cultivation, data such as temperature, humidity, moisture content, carbon dioxide, and outside temperature are measured with mobile and fixed sensors. Based on the accumulated data, high-quality tomatoes are cultivated efficiently and stably. We are analyzing and extracting the optimal conditions for this. Cultivation based on this analysis is carried out efficiently by visualizing the cultivation environment and recording work using devices such as smartphones.

The house has a generator boiler (approximately 1,500 kW) that uses solid fuel derived from waste to supply heat and electricity (Figure 3-50).



Source: Toyama Environmental Maintenance Company Homepage

Figure 3-49 Business areas of Toyama Environmental Management Company



Figure 3-50 Facility overview of Toyama Environmental Maintenance Company

7) Toyama City: Carbon offset project in the agricultural field

Shonouwa Co., Ltd., headquartered in Toyama Prefecture, develops and provides smart agricultural technology, and in recent years, it has also been actively working on carbon offset projects in the

agricultural field.

Paditch, provided by the company, is a water gate-shaped device that uses a smartphone, tablet, or PC to manage water in rice fields. Water management is important in rice cultivation as it has a major impact on cultivation. However, it is extremely labor-intensive work, requiring inspecting each paddy field individually, using Paditch's water level adjustment function, and remotely managing water after rice planting becomes possible. If the water level and temperature are set in advance, it will automatically open, close, and adjust appropriately. The introduction of Paditch has a proven track record of reducing the burden associated with water management by 80%.

In addition, the company has developed a system to quantify the reduction value of greenhouse gas (methane) generated from rice fields (patented: patent application 2022-108787). It has introduced the system into the existing product Paditch and announced the "Paditch Carbon Offset," a service that allows people to obtain reduction value data. This also corresponds to quantifying the reduction required when applying for the J-Credit system "Extension of the mid-drying period through wet rice cultivation".



Source. Shohouwasha i ress Ker

Figure 3-51 Overview of Shonouwasha's carbon offset project

#### 3.3 Possible future vision for the Iskandar region

#### 3.3.1 Estimated future vision and challenges

Based on the results of the previous case studies and inspections mentioned above, discussions were held with IRDA regarding constructing a greenfield area in the Iskandar region. As a result, IRDA confirmed that it aims to implement related demonstration projects in the short term. In particular, it has confirmed a strong interest in land-based aquaculture and the introduction of smart technology as a seafood business in the Pontian District.

It has also been confirmed that parallel to the implementation of the demonstration project, IRDA intends to formulate a blueprint for the construction of greenfield areas in the medium to long term.

In this City-to-City collaboration project, we plan to continue leveraging Toyama City's administrative experience, etc., in terms of both support for the realization of short-term demonstration projects and the formulation of medium-to-long-term blueprints. Below, we will describe the vision and image of future demonstration projects discussed with IRDA based on this year's City-to-City collaboration project results.

## 1) Future vision

As mentioned above, marine aquaculture businesses are actively being carried out in the Pontian district, and some terrestrial aquaculture businesses are also being implemented. Behind this is the issue of food security. In particular, fishermen are highly concerned about the marine aquaculture business, as a decline in offshore fishing production has triggered it. Under these circumstances, aquaculture is becoming important in the future, and the amount of aquaculture is increasing worldwide, with inland water aquaculture, in particular, experiencing remarkable growth and becoming a global trend. (Figure 3-52)



Source: FAO. 2022. The State of World Fisheries and Aquaculture 2022 Figure 3-52 World fisheries production

As mentioned above, the issuance of new aquaculture licenses has been suspended in the Kukup area, where marine aquaculture operations are conducted. Further, the survey revealed that currently overfishing is a problem in Pontian. One of the reasons for this is that the cold chain is not well developed, so businesses cannot survive unless they catch enough fish to include the amount of fish that can no longer be sold. On the other hand, excessive fishing will reduce the amount of fish caught and fish species in the area, and from a long-term perspective, it is thought to have a major impact on the fishing industry in the Pontian District. The sustainability of Pontian's fishing industry while maintaining the Pontian brand of natural fishing requires reducing the current excessive fishing and generating income from other sources. Although it will depend on the future regulations of marine aquaculture, since the environmental burden caused by marine aquaculture is also a problem worldwide, it is considered desirable to shift to land-based aquaculture in the future, with consideration given to expanding its use throughout the Iskandar region.

Land-based aquaculture allows for a stable supply with uniform quality because the environment can be controlled to a certain extent. In addition to contributing to food security, export can also be considered depending on the type of fish. In addition, new industries will be born in the area, and employment will be created. Depending on the marketing strategy, fish species that are more expensive than those normally caught can be handled, leading to increased income. All of these will likely contribute to the goals of the LCSBPIM 2030 CAP.

In addition, with compatible use of renewable energy and depending on the structure of the business,

it is possible to consider it as a demand response target and contribute to increasing the amount of renewable energy that can be disseminated throughout the region, making a significant contribution to carbon neutrality.

Therefore, the big vision for the Iskandar region is to ensure food security, promote exports, create new jobs, increase fishermen's income, and realize fishing that utilizes renewable energy. While working on a land-based aquaculture business that utilizes water, we have set a big vision to widely develop this initiative as a feature of the Iskandar region.

#### 2) Consideration of demonstration project in Pontian district

When considering land-based aquaculture businesses that utilize renewable energy in particular, it is necessary to consider various factors (Figure 3-53).



Figure 3-53 Elements to consider for a model of land-based aquaculture using renewable energy

In this project, as an example of an easy-to-implement demonstration project, we first envisioned introducing solar panels and smart technology to the land-based aquaculture business of Pekan Nanas, which is already running a land-based aquaculture business. In conjunction with this, it is envisaged that the entire Pontian district could be considered for development as a fishing village tourist destination that utilizes renewable energy. Below are the respective images.

Land-based aquaculture business model using renewable energy in Pekan Nanas
 As mentioned above, at the Pekan Nanas land-based fish farm, the outdoor aquariums are covered

with a black cover to prevent direct sunlight from hitting the water surface and raising the water temperature. By replacing those covers with solar panels, it will be possible to carry out aquaculture operations while supplying electricity with renewable energy.

On the other hand, the electricity consumed by the Pekan Nanas land-based aquaculture farm is extremely low, with only pumps and lights needed for aquaculture. Therefore, we considered introducing new equipment to increase fishermen's income and energy management for the entire region.

Specifically, the following can be considered equipment to increase fishermen's income, depending on the purpose.

- Stable production of products and high added value: Adjustment of water quality using remote sensing technology
- Labor saving: Automatic feeding device, cleaning device

By introducing new water temperature control equipment, it will be possible to grow new fish species in high demand by consumers locally and in neighboring Singapore. Furthermore, since there is a lot of unused land in the vicinity, it is possible to consider introducing a new renewable energy plant factory using containers, etc. By skillfully combining these, we can treat land-based aquaculture facilities and plant factory facilities themselves as "electricity demand", and by implementing a response to this demand, it is possible to envisage a model that will lead to the expansion of renewable energy introduction throughout the region (Figure 3-54).



Figure 3-54 Fishing-electric symbiosis model at Pekan Nanas land-based aquaculture farm

Sustainable fishing village model using renewable energy in the Kukup area

As mentioned above, the Kukup area has a thriving marine aquaculture business. It is also visited by many tourists who come to enjoy the scenery of the fishing village. Also, during an on-site inspection, it was confirmed that electric motorbikes were being introduced as a means of



transportation within the Kukup area for tourists (Figure 3-55).

Figure 3-55 Electric motorbikes used for transportation within the Kukup area

Based on these backgrounds, it is possible to consider building a sustainable fishing village model in the Kukup area based on fishing, tourism, and environment concepts. The concept image is shown in Figure 3-56. It is envisaged that the present concept of the respective fisheries, tourism, and environment will be linked together as a single model.



Figure 3-56 Concept image of sustainable fishing village model in Kukup area

As a reference for this model, there is a preceding case at Tsuchiyu Onsen in Fukushima City, Fukushima Prefecture. In this area, fishing ponds utilizing the heat of hot springs and using land-farmed giant shrimp have been introduced as recreational facilities for tourists (Figure 3-57).



Figure 3-57 Regional development model using aquaculture in Tsuchiyu Onsen Town, Fukushima Prefecture

While referring to these preceding cases, Kukup may be able to consider a model like the one shown in Figure 3-58. As renewable energy sources that can be introduced, solar power generation and the use of biomass can be considered. These will be used as energy for sightseeing motorcycles and sightseeing boats. Regarding fishing, an experience-based tourism service can be conceived by providing fishing pond services using marine fish farms and cooking the fish at nearby restaurants and accommodations. In recent years, there has been a rise in the awareness of environmental considerations, especially in Europe and the United States, which is considered to have directly led to an increase in the number of tourists. This has the potential to decarbonize the entire region and increase income.



Figure 3-58 Sustainable fishing village model using renewable energy in the Kukup area

## 3.3.2 Implementation details for next year (draft)

As mentioned above, after discussions with IRDA, it was confirmed that the outcome of this Cityto-City collaboration project would be support for realizing demonstration projects in the short term and formulation of blueprints for related fields in the medium to long term.

Based on this year's survey results, next year, we will consider the feasibility of the two projects shown in 3.3.1, the policy support measures for local governments to increase the feasibility of these projects, and examine the outline of medium to long-term blueprints. Specifically, policy is assumed according to Table 3-5.

Item	Implementation content		
	• Detailed study of business model (specific technologies to		
	be introduced, etc.)		
Daltan Nanas madal	<ul> <li>Implementation of business feasibility evaluation</li> </ul>		
Fekali Nalias model	Estimation of greenhouse gas emission reductions		
	Considering business partners		
	Extracting issues for the business realization		
	Detailed study of business model (specific technologies to		
	be introduced, etc.)		
Kultur model	Implementation of business feasibility evaluation		
Кикир Шойег	Estimation of greenhouse gas emission reductions		
	Considering business partners		
	<ul> <li>Extracting issues for the business realization</li> </ul>		
Doliou support	· Sharing knowledge and issues from previous cases in		
Policy support	Toyama City		
	<ul> <li>Sharing Toyama City's long-term roadmap, etc.</li> </ul>		
Blueprint formulation	• Examining the outline of the blueprint (proposed table of		
	contents and contents to be included)		

Table 3-5 Implementation details for next year (draft)

# Chapter 4. Energy Management Field

As mentioned above, after discussions with IRDA, it was confirmed that the outcome of this Cityto-City collaboration project would be support for realizing demonstration projects in the short term and formulation of blueprints for related fields in the medium to long term. The realization of the two projects mentioned in the previous chapter and achieving carbon neutrality in 2050, which is the longterm goal of LCSBIM2030AP, requires introducing zero-emission power sources such as renewable energy as a power supply method. In Malaysia, including the Iskandar region, solar power generation is becoming widespread as a form of renewable energy. However, from the perspective of grid stabilization, future policies, such as a feed-in tariff system for electricity generated from solar power generation, have not been determined. Therefore, IRDA wants to consider self-consumption type solar power generation and new energy management businesses. Hence, in this City-to-City collaboration project (Phase 2), we will consider a new energy management project using solar power generation.

#### 4.1 Investigation of preceding cases

In this project, we investigated the introduction of solar power generation systems for battery stations in BaaS projects. We investigated domestic and international cases of solar power generation systems being introduced in the primary industry field. The survey results, including the field survey, have already been described in Chapter 2, Section 2.2 and Chapter 3, 0, so they will not be described in this chapter.Chapter 22.2Chapter 30

# 4.2 Consideration of energy management system and design

This section describes the results of considering the design and amount of power generated when a solar power generation system is introduced to the land-based aquaculture business being implemented in Pekan Nanas, based on preceding cases and local conditions. We will also organize the proposed content for consideration for the next year.

#### 4.2.1 Design study of solar power generation system

Two installation cases were considered: one in which the system was installed in the entire possible area of the farm and another in which it was installed in a way that matched the current power consumption.

1) Case where installation is done in all possible ranges

Figure 4-1 shows an aerial view of the installation design for the case in all areas.



Figure 4-1 Pekan Nanas land farm solar installation design (from above)

Figure 4-2shows the situation from another perspective.



Figure 4-2 Pekan Nanas land farm solar installation design

The detailed panel installation drawing is shown in Figure 4-3. One block consists of 24 550 W panels (13.2 kW), which can be installed in 38 blocks. The total installed capacity is 501.6 kW. This can be addressed by installing eight 50kW power conditioner systems.



Figure 4-3 Pekan Nanas land farm solar installation drawing

#### 2) Case where installation is done to match power consumption

When installing solar panels to match the amount of electricity consumed, if the above 24 550 W panels (13.2 kW) are considered one block, a total of 5 blocks will be installed, which means a total of 66 kW of solar panels will be installed. It is assumed that this will cover the power consumption. In the drawing, the part shown in the red frame in Figure 4-4 can be installed at any location on the land-based aquaculture farm.



Figure 4-4 Pekan Nanas land-based aquaculture farm solar installation drawing (case compatible with power consumption)

## 4.2.2 Consideration of the estimated amount of power generated

Figure 4-5 and Table 4-1 show the results of a power generation simulation for the case of installing in all possible installation areas (501.6kW) in the installation drawings mentioned above. There were no major fluctuations throughout the year. Total power generated 595,660kWh, and the facility utilization rate was 13.56%. If an installation is made to match the power consumption, it would be 78,376kWh, which is 13.2% of the above value.



Figure 4-5 Results of Power generation simulation at Pekan Nanas land farm

January	54,984.85
February	50,302.63
March	55,817.46
April	49,497.44
May	48,073.93
June	46,081.12
July	48,263.51
August	51,017.65
September	49,938.21
October	50,611.45
November	43,256.05
December	47,815.81
total	595,660.10

Table 4-1 Estimated power generation (unit: kWh)

# 1) Cost consideration

Table 4-2 shows the results of examining the cost of each equipment based on the solar panel drawings mentioned above. For actual installation, construction costs, transportation costs, etc., will be required in addition to the equipment cost.

Contont	Unit price [USD]	full installation case		Power consumption compatible case	
Content		quantity	Amount [USD]	quantity	Amount [USD]
Solar module	300	912	273,600	120	36,000
Inverter	6,900	5	34,500	1	6,900
Junction box	800	5	4,000	1	800

Table 4-2 Equipment cost

Remote monitoring system	1,000	1	1,000	1	1,000
Total	-		313,100	-	44,700
## Chapter 5. City-to-City collaboration Activities

This year's City-to-City collaboration project has a new theme based on the results of Phase 1. In addition to traveling to the site and conducting field surveys, we will also conduct a field trip to Taiwan, an advanced BaaS business area. We could carry out a wide range of activities that we could not otherwise have done, such as inviting people to Japan and holding business matching meetings with Japanese companies. Below, we will summarize each initiative.

### 5.1 Visit to Iskandar region (October 2023)

In October 2023, the kick-off of the Phase 2 project was held by both cities, the policies of the Phase 2 project were confirmed, and the goals to be achieved were reconciled. Furthermore, as an initiative related to the BaaS business, Toyama City introduced an overview of the shared cycle business being implemented in Toyama City and how the local government can get involved (7.1) and exchange opinions. Regarding the green field area construction project, we invited officials from the Pontian district, considered a development target within the Iskandar region, and held discussions. Toyama City introduced the eco-town project as an area development project (7.2). Based on these considerations, IRDA and Pontian district exchanged views regarding how local governments should participate in the realization of carbon-neutral urban development. A summary of the proceedings is shown in Table 5-1.

Date and time	Monday, October 9, 2023 10:50-12:10			
Place	Pontian District Hall Conference Room			
Partici	IRDA	Kamisah Bin, Ong Hwa Chong, Hamizah A. Rahman		
pants (title on	Toyama	Kobayashi, Muramoto		
	Pontian district Hisyamudin Bin Amat, Muniri Bin Arsad			
nitted	JANUS	JANUS Yamase, Hirasawa, Uenaka, Tadano		

Table 5-1 Summary of kick-off meeting by IRDA, Toyama City, and Pontian district

	• We were introduced to eco-town and shared cycle business by Toyama City, and advanced examples of land-based aquaculture were introduced by JANUS.
Agenda summary	<ul> <li>Eco town</li> <li>This is a very interesting initiative regarding food waste recycling. Biogas business is also widespread in Malaysia. We would like to know the difference between the biogas and the food oil recycling businesses. (Pontian)</li> <li>→ The biogas business produces gas by collecting food residue and waste from households and supermarkets and fermenting it. In the food oil recycling business, raw materials derived from food are collected from supermarkets, food processing factories, and school lunches at elementary schools. In addition, the latter can produce oil fuel instead of gas (Toyama City)</li> <li>Are there any improvements you have made in implementing this project? (IRDA, Pontian)</li> <li>→ To let as many citizens as possible know about Eco Town activities, we have set up an education center on the premises and held workshops (Toyama City).</li> <li>→ We would also like to promote environmental awareness activities in the Iskandar region (IRDA, Pontian).</li> </ul>
	<ul> <li>Share cycle</li> <li>Iskandar also has experience in developing a shared cycle business several years ago. However, there were cases where bicycles have been discontinued due to rapid deterioration or loss of bicycles due to inappropriate renting of bicycles, bicycle theft, or rough handling. In Japan, we assume that there are no problems caused by bicycle share users, but are there any unexpected deteriorations in bicycles? (IRDA)</li> <li>→Aville, introduced in Toyama City, is characterized by its sturdiness, and even when walking around the city, there are always bicycles lined up in good condition. It is regularly maintained, and there are almost no reports of tire punctures. I believe this is due to the bicycle's design. (Toyama City)</li> </ul>
	Overall Pontian expressed their intentions as follows. Pontian district has a strong interest in aquaculture and agricultural business, and based on on-site inspections of existing projects scheduled to be carried out as part of future City-to-City collaboration projects, we think that we would like to advance our business with the support of IRDA. (Pontian)



5.1 Invitation to Toyama City (February 2024)

In February 2024, IRDA officials were invited to Toyama City, where they met with the mayor of Toyama, exchanged opinions, and toured related facilities in the city. The schedule for interviews, opinion exchanges, and inspections is shown in Table 5-2.

Date and time	Time	Content		
Wednesday,	morning	<ul> <li>Explanation regarding Toyama City SDGs initiatives and Toyama Station North area Redevelopment</li> <li>Explanation and inspection of the Aville project</li> </ul>		
February 28th	afternoon	Courtesy call with Toyama Mayor Fujii Visit to farming support center Visit to Eco town project		
Thursday,	morning	Visit to Doyuno Micro-Power Plant Visit to large-scale solar power geenration site		
February 29th	afternoon	• Visit to plant factory		
Friday Marah	morning	• Toyama business matching meeting event		
1st	afternoon	Wrap-up (Looking back on this fiscal year's and confirmation of next fiscal year's City-to- City collaboration project)		

Table 5-2 Invitation schedule to Toyama City

The outline of each site visited and the outline of the exchange of opinions, etc., are shown below.

The business matching meeting is summarized in 5.3, and the content of this year's review and next year's policy confirmation is summarized in Chapter 6., part 5.2.

## 1) Interview with Toyama Mayor Fujii

A summary of the interview with Toyama Mayor Fujii is shown in Table 5-3.

Date and time	Wednesday, February 28, 2024 13:30-14:00		
Place	Toyama City Hall		
Partic o	IRDA	Kamisah Mohd Ghazali, Ong Hwa Chong	
pipants mitted	Indonesia	Idabagus Setiawan	
(title )	JANUS	(Ishiguro,) Hirasawa, Tadano	
Agenda summary	<ul> <li>Greetings from Toyama City</li> <li>We have a long history of relations with the Iskandar region, and we would like to continue our cooperation in the future with the same goal of decarbonization.</li> <li>Toyama City has experience in compact city planning and SDGs future city planning, and is highly praised by the government. I hope to make use of this experience and apply it to cities overseas.</li> <li>We hope you enjoy your stay in Toyama.</li> <li>Greetings from IRDA</li> <li>The friendly relationship between Toyama City and Iskandar began in 2015, and to date we have collaborated on resilient, low-carbon initiatives and projects on themes related to small hydropower generation, compact cities, transportation, sustainable agriculture, and renewable energy.</li> <li>In Phase-1 of the City-toCity collaboration, we have been coordinating the feasibility study of using biofuels in transportation systems.</li> <li>For Phase-2, we are currently considering the BaaS project and primary industry project, but IRDA has the same vision for the basic "compact city concept" and will continue to utilize Toyama City's technology and knowledge based on that vision. IRDA wishes Toyama to keep sharing the know-how and support IRDA by making use of the framework provided by the Ministry of the Environment of Japan.</li> </ul>		

### Table 5-3 Summary of interview with Toyama Mayor Fujii



2) Explanation regarding Toyama City SDGs initiatives and Toyama Station North area redevelopment

Toyama City was selected as an "SDGs Future City" in 2018 as one of 29 cities that are proposing outstanding initiatives toward achieving the SDGs. In addition, in the same year, Toyama City has been selected as a "Municipal SDGs Model project", being one of the 10 projects with particularly leading initiatives in Japan.

Specific initiatives from Toyama City include updating the compact city plan, launching a smart city promotion platform, introducing green slow mobility, supporting a walking lifestyle, developing a "Machinaka Medical Complex", collecting plastic waste, and improving the environment. This includes a wide range of activities for sustainable urban development, such as education and awareness rising activities.

In addition, the Toyama Station North area redevelopment plan was started the following year with the completion of the tram connecting the north and south of the station in 2020, and has included refurbishment and improvement of the buildings ageing and dim lighting to create a pleasant environment available to the citizens.

The redevelopment of the space has been divided into three areas: (1) Lively space, (2) Relaxing space, and (3) Coordination space with surrounding facilities. The design comprehends replantation of trees, design of a space to introduce new mobility, organization of events to promote the space and serve the

users. Improvements included installing benches and tarps, and replacing lighting has been put in place. An overview of this initiative and plan is shown in **Figure 5-1** and Figure 5-2. In addition, questions and answers on the day of the explanation are listed in Table 5-4.



Figure 5-1 Overview of Toyama City's compact city plan (from 2021)



Source: Toyama City homepage

Figure 5-2 Overview of Toyama Station North area redevelopment plan

Table 5-4 Summary of questions regarding Toyama City's SDGs initiatives and Toyama Station North area redevelopment plan

	After Toyama City gave an explanation of the relevant initiatives and plans, the following
	question and answer session was held.
	• Question: I heard that there are citizens and organizations that support SDGs activities,
	but are they volunteers? (IRDA)
	$\rightarrow$ Answer: That's right. The SDGs are basically made up of volunteer organizations other than
	city employees.
	We are putting effort into promoting the. (Toyama City)
	$\rightarrow$ Comment: I would like to increase the number of such people in Malaysia. I believe that
	education has a big role to play, and I would like to raise awareness of the SDGs in schools and other places (IRDA)
	• Ouestion: It is said that an SDGs curriculum has been set for elementary and junior high
	school students. Is this a domestic initiative in Japan, or is it solely for Toyama City? (IBDA)
	$\Rightarrow$ Answer: This is a national level initiative and it is being introduced at elementary and
õ	Answer. This is a national level initiative, and it is being initiatived at elementary and
λγ λ	• Ouestion: Are there many vending machines installed in Malaysia? (Toyama City)
sum	$\rightarrow$ Answer: I don't have the image of them being installed along reads like in Ionan but they
mar	Answer. I don't have the image of them being instance along roads like in Japan, but they
<	those in Toyama City, that provide relatively low-cost food items for people on low incomes
	(IRDA)
	• Question: How did you involve private companies in implementing the redevelopment
	plan north of Toyama Station? (IRDA)
	$\rightarrow$ Answer: This project has been talked about for some time, and many companies
	announced their participation when the redevelopment actually took place. The city is
	always in close communication with businesses in the city through councils and other
	means. (Toyama City)
	$\rightarrow$ Comment: In Iskandar, there is a plaza next to a soccer court that is similar to the
	basketball and skateboard area that Toyama City has redeveloped, but there aren't that many
	people using it, so we would like to make it more popular. (IRDA)
	→Comment: It might be a good idea to hold promotional events. (Toayama City)

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#### 3) Aville project

Aville is a bicycle-sharing system started in 2010 as part of Toyama City's Environmental Model City Action Plan. The realization of Toyama City's compact city plan at the time required eliminating vehicles for short-distance travel and revitalizing urban areas, which led to the introduction of shared bicycles. A feature of this project is that Cyclocity, a subsidiary of JCDecaux, a French advertising company, operates it. The operating costs are covered by advertising revenue from bulletin boards installed in conjunction with bicycle parking stations throughout the city.

All stations are unmanned, and bicycles can be rented 24 hours a day, 365 days a year. The first 30 minutes is rent-free, and the fee is 500 yen for 24 hours, making it easy to use. The city center has 23 bicycle share stations, providing 255 bicycles (Figure 5-3). A new smartphone app is scheduled to be available from April 2024 to support the use of Aville.



Source: Toyama City homepage

Figure 5-3 Aville project and bicycle installation diagram

Table 5-5 shows the inspection overview and questions and answers.

	Tuble e e summing of inspection of the first project		
	Toyama City provided an overview of Aville's introduction and how to use it, and IRDA		
Q&A si	actually operated it to retrieve bicycles. The question and answer session is as follows.		
	• Question: Is it possible to return the bicycle rented to any station in the city?		
	(IRDA)		
	$\rightarrow$ Answer: That's right. There are 23 stations in the city, and you can return your vehicle		
Imn	to any of them. (Toyama City)		
nar	• Question: What happens if I rent a bicycle for a long period of time? Also, what		
~	happens if the bicycle is not returned (in case of theft)? (IRDA)		
	$\rightarrow$ Answer: The first 30 minutes can be used for free, but after that, the rental is linked to		
	your credit card, so you will be charged for the rental period. (Toyama City)		
Photograph	<image/>		
	<image/>		

## Table 5-5 Summary of inspection of the Aville project

## 4) Toyama Municipal Agricultural Support Center

As mentioned above, the Farming Support Center is part of the "Agriculture Revitalization Utilizing Renewable Energy" project, positioned as an initiative of the Toyama City Environmental Future City Plan and regional revitalization model case. The purpose of starting this project is to have farmers and others who visit the facility experience the effectiveness of renewable energy, etc., which will lead to the dissemination of renewable energy to rural areas and reduce carbon emissions in rural areas.

This project will integrate small-scale hydroelectric power generation equipment that utilizes agricultural water, solar sharing that utilizes farmland, heat pumps that utilize underground water heat, etc., to visualize renewable energy and prevent disasters. We have established an independent rural self-sufficiency model that functions as a base. In addition, since the facility is widely open to the public as a showroom, it was selected as a tour destination as it can be used as a part of this City-to-City collaboration project, allowing local stakeholders to be invited and share an image of realizing regional development like Flagship F.

Table 5-6 shows the inspection overview and questions and answers.

#### Table 5-6 Overview of inspection of farm management support sensor

 Toyama City provided an explanation of the purpose and equipment outline of the Farm

 Management Support Center. Questions and answers are listed below.

 • Question: Are there any points to be careful about when implementing solar sharing?

 (IRDA)

 →Answer: Installing solar panels will reduce the amount of sunlight by one-third, so it is

 necessary to grow plants that are suitable for such an environment. Additionally, when it

 rains, rainwater falls from the edges of the panels, so plants are not planted there. (Toyama City)

 →Comment: The Japanese government is promoting the introduction of solar sharing for

 domestic farmers whose income is decreasing, but there is also the point that it cannot be approved unless farming operations continue stably. , the hurdles are not low. (JANUS)

• Question: Are these facilities connected to the grid? (IRDA)

 $\rightarrow$ Answer: All power generation equipment is not connected to the grid and is used to provide electricity for farming support. (Toyama City)



## 5) Eco town project

Toyama City Eco Town was developed by Toyama City in 2002 based on the "Zero Emission Concept", which aims to eliminate all kinds of waste and is the first facility in the Hokuriku region to receive Eco Town Business Certification. The project was established as an eco-town industrial park of approximately 18 hectares in Toyama City, and the first phase of the project included a garbage and pruned branch recycling facility, a hybrid waste plastic recycling facility, a wood waste recycling facility, and an automobile recycling facility. We have established four facilities and are promoting regional resource circulation initiatives, prioritizing material recycling. As part of the second phase of the project, construction of facilities for recycling difficult-to-process fibers and mixed waste plastics, waste cooking oil recycling facilities, waste energy recycling facilities, and the opening of the Toyama City Eco-Town Exchange Promotion Center are also being carried out (Figure 5-4).



Source: Toyama City homepage Figure 5-4 Overview of Toyama City Eco Town Project

Table 5-7 shows the inspection overview and questions and answers.



Q&A summary	<ul> <li>After receiving an explanation from Toyama City about the history and general outline of the establishment of the Eco Town Industrial Park, the participants were given an introduction to Eco Mind Co., Ltd.'s waste plastic recycling and RDF manufacturing brand, and Isaac Co., Ltd.'s industrial waste disposal facility. I toured the area.</li> <li>The content of the questions and answers for each explanation is shown below.</li> <li>Eco-town in general <ul> <li>Question: Was the establishment of an eco-town in Toyama consistent with the Japanese government's plans at the time? (IRDA)</li> <li>→Answer: That's right. The eco-town system in 1997 and the Basic Law for Establishing a Sound Material-Cycle Society in 2000 were the government's moves at the time. (Toyama City)</li> <li>Question: Please tell us how resources and waste are circulated within the eco-town.</li> </ul> </li> <li>(IRDA)</li> <li>→Answer: Not everything is recycled, but for example, waste plastic generated from other improvements is used to produce waste solid fuel (RDF) at an Eco Mind plant. In addition,</li> </ul>
	$\rightarrow$ Answer: Not everything is recycled, but for example, waste plastic generated from other improvements is used to produce waste solid fuel (RDF) at an Eco Mind plant. In addition, the RDF is being burned in other equipment to generate electricity. (Tovama City)

RDF manufacturing plant of Eco Mind Co., Ltd.

• Question: Is it possible to produce fuel using materials other than plastic? (IRDA)

 $\rightarrow$ Answer: In addition to waste plastic, paper, wood chips, fibers, etc. are also mixed into the manufacturing process. However, metals and nonflammable materials cannot be used. (Eco Mind)

• Question: How is RDF used? (IRDA)

 $\rightarrow$ Answer: Basically, it is possible to burn coal, oil and gas as an alternative to fossil fuels. Therefore, in addition to reducing the use of new resources, the CO2 emission coefficient is also low, making it possible to reduce CO2 emissions and reduce pressure on final disposal sites. (Eco Mind)

Combustion plant of Izak Co., Ltd.

• Question: Is the waste burned in its entirety? (IRDA)

 $\rightarrow$ Answer: That's right. This plant disposes of waste materials that are difficult to remove from containers, such as paint. This facility handles industrial waste that cannot be disposed of normally, as the container can be crushed. (Isaac)

• Question: How high does the inside of the kiln go up? (IRDA)

 $\rightarrow$ Answer: Generally 1,000degreesC to 1,200degreesC (Izak)

• Question: I understand that exhaust gas from chimneys is constantly monitored, but if it exceeds the emission standards, do you shut down the plant? (IRDA)

 $\rightarrow$ Monitoring is always carried out. In the unlikely event that emissions standards are exceeded, the plant will be shut down, but before such a situation occurs, we have set internal standards that are approximately 1/10 lower than the values set by national standards. If the standards are exceeded, desulfurization measures are taken first, so it is basically unthinkable that the national standards will be exceeded. (Izak)





Overall explanation of Eco Town

Inside the Eco Mind plant



RDF manufactured by Eco Mind (2 pellet sizes)



Waste disposed by Izak



Bag filter attached to Izak's combustion equipment



RDF pellets before shipping



Izak's power generation



Stack of Izak's combustion equipment

Photograph

### 6) Doyuno Power Plant and Small Hydropower Plant

Doyuno Power Plant is a project aimed at household-scale energy self-sufficiency using microhydroelectric power generation technology. It is a private power generation off-grid facility that proves that sufficient power can be generated using simple materials (Figure 5-5).



Figure 5-5 Overview of Doyuno Power Plant

Table 5-8 shows the inspection overview and questions and answers.

## Table 5-8 Summary of inspection of Doyuno Power Plant and small hydropower plant

After the overview presentation of local agricultural activities and power generation equipment from the farmer living in Doyuno and Professor Uesaka of Toyama International University, who assisted in installing the power generation equipment, the following Q&A session was held. · Question: Have you ever felt inconvenience while living in a mountainous area? Road maintenance, commuting to school, access to hospitals, garbage collection, etc. are likely to be problems in Malaysia. (IRDA) Answer: It only takes about 15 to 20 minutes to get to the city by car, so I haven't felt it too inconvenient in the past. In addition, some parts of the road were damaged in the January earthquake, and we contacted the government for maintenance. It took some time to respond, but there were no major problems. For electricity, we have introduced solar panels and micro-hydro power equipment to avoid relying on the grid as much as possible. Also, since we have the Internet connection, I have not experienced any inconvenience in terms of agricultural activities or daily life. (Farmer) • Question: Are water turbines regularly maintained? (IRDA)  $\rightarrow$ Answer: The maintenance method is easy and I taught it to the farmer, so he can do it on

 $\rightarrow$  Answer: The maintenance method is easy and I taught it to the farmer, so he can do his own and does is regularly. Also, since it is set up in nature, weed removal is more necessary than maintenance. (Professor)

Q&A summary

• Question: What is the generated electricity used for? (IRDA)

 $\rightarrow$ Answer: It is used for farmers' daily lives. It is also equipped with a battery to charge electric vehicles. However, due to the nature of the installed inverter, charging will take overnight. (Farmer)

• Question: Why did you introduce an overshot water wheel? (IRDA)

 $\rightarrow$ Answer: Actually, the design of the overshot water wheel was requested by the farmers, who wanted it to look good. Most of the electricity generated by this facility comes from the Turgo turbine installed in front of it, and the water wheel can be considered as a decoration. (Professor)

• Question: Can turbines be purchased easily over the Internet? (IRDA)

 $\rightarrow$ Answer: This was experimentally designed at Toyama International University, and the parts were purchased and assembled, so it cannot be purchased as is, but similar turbines can generally be purchased. (Professor)



Q&A summary

Photograph

Doyuno farm house (photovoltaic panel on roof)



Micro hydroelectric power generation equipment



Power control connected to micro hydropower facility



Inverter



## 7) Large-scale mega solar site

Nihon Kucho Hokuriku Co., Ltd. has built and operates its mega solar power plants at five locations in Toyama Prefecture (Figure 5-6). During this project, we visited Joganji Solar.



Figure 5-6 Mega solar site operated by Nihon Kucho Hokuriku Co., Ltd.

Table 5-9 shows the inspection overview and questions and answers.

## Table 5-9 Overview of inspection of large-scale mega solar site

A&D	After a presentation of the overview of the site, the following questions and answers were exchanged.
A summary	• Question: How did you acquire the land? (IRDA) →Answer: We received an inquiry from the landowner of the site and decided to install solar panels as a way to make use of this hybrid land. (Nihon Kucho Hokuriku)



#### 8) Plant factory

In this project, we toured the facilities of Toyama Kankyo Seibi Co., Ltd.., which operates a largescale plant factory in Toyama City. As mentioned, this facility promotes efforts to create a regional circulation and symbiosis zone centered on waste treatment based in hilly and mountainous areas. In addition, the electricity and heat energy generated at the waste treatment facility is used to grow tomatoes and other crops in greenhouses. It is a rotation-type agriculture model that can be used for various purposes.

Table 5-10 shows the inspection overview and questions and answers.

### Table 5-10 Summary of plant factory inspection

The participants received an overview of the regional circulation and symbiosis model, which includes plant factories, waste final disposal site management projects, and incineration facilities that also combine power generation, from Toyama Kankyo Seibi, and then asked the following questions.

- How are nutrients and pesticides given to tomatoes? (IRDA)

 $\rightarrow$ Nutrition is impregnated into the cloth at the bottom of the hydromembrane installed under the tomato stems. Pesticides are also given regularly. (Toyama Kankyo Seibi)

• I would like to know about the tomato cultivation cycle. (IRDA)

 $\rightarrow$ Grow in the first 3 months and harvest in the remaining 9 months. Once the year is over, clean everything up and grow new tomatoes. (Toyama Kankyo Seibi)

• Are there any plants other than tomatoes that are grown using the Imec method? (IRDA)  $\rightarrow$  We are currently cultivating hazelnuts and bananas on a trial basis. (Toyama Kankyo Seibi)



Q&A summary

Photograph



Facility overview of Toyama Kankyo Seibi

Membrane used for tomato cultivation



Tomatoes grown with LED lighting



Strings to make harvesting easier



5.2 Business matching meeting to be held (March 2024)

On March 1, 2024, a business collaboration and matching event between related companies and IRDA has been held in Toyama City to support the overseas expansion of companies with renewable energy and smart primary industry technology located in Toyama City.

The business matching program is shown in Table 5-11.

Program:			
Time	Content		
10:00-10:10	(1) Opening speech		
10.00 10.10	<ul> <li>Toyama City Environmental Policy Division Manager</li> </ul>		
10.10.10.25	(2)Report on the results of the 2023 intercity collaboration project		
10.10 10.25	<ul> <li>Japan N.U.S. Co., Ltd.</li> </ul>		
	(3) Overview of Iskandar region and introduction of low carbon		
10:25-10:40	society blueprint		
	Iskandar Regional Development Authority (IRDA)		
10:40-11:00	[Question-and-answer session]		
	(4) Introduction of decarbonization-related technologies from		
	companies related to Toyama City		
	<ul> <li>Solar power generation project</li> </ul>		
11.00-11.30	<ul> <li>Japan Air Conditioning Hokuriku Co., Ltd.</li> </ul>		
11.00-11.00	<ul> <li>Decarbonization projects</li> </ul>		
	<ul> <li>NiX JAPANCo., Ltd.</li> </ul>		
	<ul> <li>Smart agriculture related project</li> </ul>		
	Enowa Co., Ltd.		
11:30-12:00	[Q&A/Panel discussion]		
12.00 12.10	(5) Closing remarks		
12:00-12:10	IRDA Resilient Environment Department Manager		
(6) Group photo session and business card exchange			

## Table 5-11 Business matching meeting program

Table 5-12 shows the outline and Q&A of the business matching meeting.

	After each participant gave greetings and made presentations on their projects, the session moved on to a question and answer time.
Q&A summary	<ul> <li>Question: Currently, in the Iskandar region, there are dams built to prevent disasters (floods) and for water supply, and there are plans to build more in the future. Is it possible to utilize them to implement a hydroelectric power generation project? (IRDA)</li> <li>→Answer: It's hard to say without seeing the site, but if we were to utilize a dam, it would be a fairly large-scale hydroelectric power project, and it would be necessary to consult with the local power company before conducting technical considerations. In any case, it is hard to tell now, and a sufficient feasibility study will be needed. (Nix JAPAN)</li> <li>Question: Is there a minimum scale for solar panel installation projects? (IRDA)</li> <li>→Answer: Basically, we believe that anything over 50kW is profitable. (Nihon Kucho Hokuriku)</li> <li>Question: Are you considering implementing a BaaS project or solar power generation project in Malaysia? (IRDA)</li> <li>→Answer: We would consider it internally, but we would like to take such opportunity. (Nihon Kucho Hokuriku)</li> <li>→Answer: Regarding the BaaS project, we would like to first set a stable project by establishing a track record in Indonesia. (Nix JAPAN)</li> <li>Question: Is it possible to grow rice indoors using paditch? In Iskandar, several factories have closed after the coronavirus outbreak, and unused factory buildings and ruins remain. (IRDA)</li> <li>→Answer: I have never conducted it, but I heard such an experiment was conducted underground in Tokyo. (Enowa)</li> </ul>
Photograph	

## Table 5-12 Overview of the business matching meeting



5.3 Exchange with Taipei City (October 2023)

As mentioned above, in October 2023, we visited Taipei City and exchanged opinions with IRDA and Toyama City officials (Interview details: Table 2-20).

During the trip to Taiwan in October 2023, we deepened our interactions with local stakeholders, including Taipei City. Among them, TCA (mentioned above), an industry organization whose goal is to promote the growth of the ICT industry, is working on smart city collaboration on an international level, and there was a high level of interest in this City-to-City collaboration project.

We have continued to interact with TCA, and TCA recommended that IRDA, Toyama City, and this company jointly apply for an international smart city contest called the "Go SMART Award."

The contest is sponsored by a smart city-related organization called Go SMART, of which TCA serves as the secretariat and has been held every year since 2019. Go SMART has strong ties to Taiwan; it aims to become a platform that connects all public and private stakeholders to help spread smart cities worldwide. Ninety-four cities, 11 NPOs, and 117 private businesses participate in Go SMART. The registered cities include Taiwan, Fukuoka City, Darwin City, and the EU. On the business side, participants include IoT companies that provide software and services that utilize AI, companies in the smart mobility field, and precision equipment manufacturers.

The "Go SMART Award" is part of Go SMART's smart community promotion activities and is an event where smart city projects are solicited every year and the outstanding ones are recognized. Past

award-winning projects include the following:

- 2019: Low-speed autonomous mobility business (UK)
- 2020: IoT sensors used for waste recycling (Taiwan)
- 2021: Sidewalk waste recognition camera (Netherlands)
- · 2022: Traffic management system (Indonesia)

Businesses that aim to increase the recognition of their technology and services apply to this contest, and by receiving an award, they expect to gain recognition and connect with collaborators to proceed with subsequent dissemination activities smoothly.

In addition, starting from FY2023, the following five items (Figure 5-5) will be set as selection criteria. Until now, projects with strong innovation elements have tended to be selected, but elements of social contribution, such as comprehensiveness and cross-domain, are also being evaluated.

• Cross-domain: The target business incorporates elements from one industry and multiple industries.

• Impact: In addition to the degree of contribution of the business, there is a high possibility of horizontal expansion, comprehensiveness, and sustainability.

- Functionality: It solves a clear problem and can be demonstrated to be superior when compared to other alternative solutions.
- · Innovation: Creativity of ideas
- · Comprehensiveness: Designed to be easily used by all citizens



# Selection Criteria

Figure 5-7 Go SMART Award 2023 evaluation criteria

Although this project was not selected as a candidate for the 2023 award, the experience of jointly applying to this contest with IRDA, deepened mutual trust and allowed us to build a good relationship

with the Taiwanese side. We want to continue considering new businesses and relationships in the smart city and decarbonized city fields while maintaining the relationships we have built.

# Chapter 6. Summary

6.1 Results of this year's City-to-City collaboration project

Table 6-1 shows the results of this year's City-to-City collaboration projects.

Table 6 1 Summany	of maguilta of this	a waarla City ta Ci	ty collaboration	municata
Table 0-1 Summary	of results of the	s year s City-to-Ci	ty conaboration	projects

project	Achievement		
BaaS business	• Researched and organized transportation policies in Malaysia and the Iskandar		
	region		
	· Investigated and organized the traffic conditions and motorcycle usage in the		
	Iskandar region		
	· Investigated and organized the background and issues of businesses in Taipei,		
	Kuala Lumpur, Makassar, and Ishigaki as preceding cases of BaaS businesses.		
	· Among these, in Taipei City, we conducted on-site inspections, interviews, and		
	exchange of opinions with IRDA and Toyama City. We gained an understanding		
	of key points for promoting the BaaS business and how the government should		
	be involved.		
	· Based on these survey results, we considered a vision for spreading BaaS		
	business in the Iskandar region and held discussions with IRDA.		
Construction support	• Researched and organized the current status and issues of the primary industry		
project for the green	sector in Malaysia and the Iskandar region		
field area	• Researched and organized future development plans for the primary industry		
	sector in the Iskandar region		
	· Organized the issues, including a field survey, for the Pontian district, which		
	IRDA envisions as a future development area for primary industries.		
	• Based on the results, we shared an image of the future construction of greenfield		
	areas in the Iskandar region.		
Energy management	• We studied the design and installation drawings for installing solar panels at		
business using solar	Pekan Nanas land-based aquaculture farm.		
power generation	• The estimated power generation amount was calculated from the installation		
systems	drawings.		
	We considered specific equipment costs.		
City-to-City	• Together with Toyama City, we visited IRDA, reported the achievements so far,		
collaboration activities	and confirmed the study policy for Phase 2, etc.		
	• In addition, as a reference for the Phase 2 project, we explained the bicycle share		
	project (Aville), eco-town policy, and how the government should be involved.		
	· Visited Taipei City with Toyama City and IRDA and exchanged opinions		
	regarding government involvement in BaaS projects and in realizing carbon-		
	neutral policy.		
	• Invited IRDA officials to Toyama and held a business matching meeting with		
	companies in the city.		

#### 6.2 Policy for next year and beyond

Figure 6-1 and Figure 6-2 show the overall goals for the BaaS business and the Construction Support Project of the Greenfield Area and the implementation details for each fiscal year, respectively. Since we have cleared the implementation content and achievement targets that we had envisioned at the beginning of the fiscal year, we plan to move to a phase of considering more detailed project content and conducting a feasibility study in the next fiscal year.



Figure 6-1 Achievement goals and implementation details (BaaS business: Reposted)



Figure 6-2 Achievement goals and implementation details (Greenfield area construction support project: Reposted)

Specifically, as shown in Table 6-2 and Table 6-3, we will support the formation of specific projects such as demonstration projects. Regarding the method of involvement, such as administrative support,

it is assumed that further consideration will be made regarding Toyama City's knowledge, etc. Regarding energy management business using solar power generation systems, we will proceed with specific consideration as part of the demonstration project of BaaS business and construction support business for the green field area.

As a result of the three years, we will continue to aim to conclude an MoU, formulate a roadmap (blueprint) for the realization of the demonstration project, and plan to continue working on it while involving related parties as necessary.

	1					
Classification		Implementation content				
	•	Checking the latest status of initiatives by private businesses				
Policy development	•	Discussions on policy support methods with private				
support		businesses (including introducing the case of Taipei City)				
	•	Consider the overall structure of the roadmap (blueprint)				
	•	Consideration of demonstration project details				
Implementation of the advance demonstration	-	Selection of business partners				
	-	- Examining the specific number of units introduced and				
		battery station installation locations				
project	-	Consideration of business model				
	•	Consideration of greenhouse gas emission reductions				

Table 6-2 Next year's implementation details regarding BaaS business (reposted)

Table 6-3	Implementatio	n details for	the next year	regarding the	e construction	support p	project
	1		•	8 8			

#### for the green field area (reposted)

Item	Implementation content				
	Detailed study of business model (specific technologies to				
	be introduced, etc.)				
Daltan Manag madal	Implementation of business feasibility evaluation				
Pekan Nanas model	Estimation of greenhouse gas emission reductions				
	Considering business partners				
	Extracting issues for the business realization				
	• Detailed study of business model (specific technologies to				
	be introduced, etc.)				
Kulun model	Implementation of business feasibility evaluation				
Кикир тодет	Estimation of greenhouse gas emission reductions				
	Considering business partners				
	Extracting issues for the business realization				
Dalian gunnant	· Sharing knowledge and issues from previous cases in				
Policy support	Toyama City				
	Sharing Toyama City's long-term roadmap, etc.				
Blueprint formulation	• Examining the outline of the blueprint (proposed table of				
	contents and contents to be included)				

Chapter 7. Attachment7.1 Attachment 1: Introduction of Aville project by Toyama City









Spec of Aville

## The same type of bikes used in community cycles widely introduced in Europe

Developed by JCDecaux for the bike sharing business
More robust and durable than a commercially available bike
No GPS is installed but can check in the system for bike under rental.



Configuration of Bike Station

Rugged station equipment that can withstand long-term use

Number of rack for fixing the bike to be lent/returned are 12 to 45
Station system operated 24 hours a day with unattended.
New app will be introduced in April 2024.








	Weekday		Weekend	
	Number of times	Ratio	Number of times	Ratio
Early Morning (6AM – 10AM)	17,055	34.4%	1,666	17.0%
Daytime (10AM – 5PM)	13,440	27.1%	5,346	54.7%
Night Time (5PM – 10PM)	18,137	36.5%	2,383	24.4%
Midnight (10PM – 6AM)	1,010	2.0%	379	3.9%
Total	49,642	100%	9,774	100%

TOYAMA CITY



















