FY2020 Project for Ministry of the Environment Japan

FY2020
City-to-City Collaboration Programme for Zero-Carbon Society

Zero Carbon Promotion Project toward Sustainable Urbanization in Yangon City

Report

March 2021

Nippon Koei Co., Ltd.
Kawasaki City

FY2020
City-to-City Collaboration Programme for Zero-Carbon Society

Zero Carbon Promotion Project toward Sustainable Urbanization in Yangon City

Report

Table of Contents

Page

List of Tables

List of Figures

List of Attachments

List of Abbreviations

BOO	Build Operate and Own
CAPEX	Capital expenditure
CO2	Carbon Dioxide
COP	Conference of Parties
C/P	Counterpart
EMS	Energy Management System
EPC	Engineering, Procurement and Construction
EPGE	Electric Power Generation Enterprise
EPR	Extended Producer Responsibilities
GHG	Greenhouse Gases
GIC	Green Innovation Cluster
INDC	Intended Nationally Determined Contributions
IRR	Internal Rate of Return
JCM	Joint Crediting Mechanism
JPY	Japanese Yen
LNG	Liquefied Natural Gas
MCCSAP	Myanmar Climate Change Strategy and Action Plan
MIC	Myanmar Investment Commission
MOEE	Ministry of Electricity and Energy
MOE	Ministry of the Environment, Japan
MOU	Memorandum of Understanding
MRV	Monitoring, Reporting and Verification
MSDP	Myanmar Sustainable Development Plan
NAPA	National Adaptation Programmes of Action
NCV	Net Calorific Value
NDC	Nationally Determined Contributions
NSDS	National Sustainable Development Strategy
OPEX	Operating Expense
PCCD	Pollution Control and Cleaning Department
PV	Photovoltaics
SDGs	Sustainable Development Goals
UECC	Urban Environmental Conservation and Cleansing
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
YCDC	Yangon City Development Committee
ZEB	Net Zero Energy Building
ZEH	Net Zero Energy House

CHAPTER 1 BACKGROUND AND OBJECTIVE

1.1 BACKGROUND OF THE PROJECT

In December 2015, all countries participated in United Nations Framework Convention on Climate Change (UNFCCC)'s 21st Conference of the Parties (COP21) which was held in Paris, France. In COP21, Paris Agreement was adopted as a legal framework of fair and practical countermeasures to climate change after 2020. Paris Agreement aims at keeping global warming below 2 degrees Celsius above pre-industrial level, and it requires efforts to keep it below 1.5 degrees Celsius by promoting activities for realization of zero carbon. In FY2020, the activities of the Paris Agreement are gradually being implemented, such as the submission of the Nationally Determined Contributions (hereinafter called "NDC") by the end of 2020. In addition, at COP26 in November 2021, rules such as the market mechanism that was left unloaded will be decided, and the implementation stage of the full-fledged Paris Agreement is approaching.

As it is expected that not only central governments but non-governmental bodies including regional municipalities and cities accelerate their climate change policies, cities and municipalities are key players to consider and implement concrete regional climate actions and projects. In addition, it was decided that activities by non-state actors (including cities) and efforts by all non-governmental entities (cities and other local governments, etc.) are acknowledged and encouraged to be scaled up in COP21. Cities are the places to support social and economic growth since a lot of people live there. Although the total of urban areas is only 2% of all land in the world, approximately half of world population live in urban areas and the percentage is predicted to increase to 70% by 2050. Also, it is estimated that more than 70% of global CO2 emissions are emitted from cities as of 2006; hence, cities have important roles for mitigation of climate change. Thus, implementation of countermeasures to climate change and greenhouse gas (hereinafter called "GHG") emission reduction in cities are important for achievement of the goal of Paris Agreement. To realize zero carbon society, it is important to accelerate actions to develop sustainable and zero-carbon society and low-carbon society as a passing point especially in Asia, the area of prominent economic growth. International supports for activities for zero-carbon and low-carbon society have been enforced in cities, the place for activities to support socio-economic development.

In Yangon City, Republic of the Union of Myanmar (hereinafter called "Myanmar"), rapid urbanization is progressing with the recent economic growth. Currently 33 industrial parks have been built in the city, and new developments are still ongoing. On the other hand, Myanmar is blessed with water resources and depends on hydroelectric power generation for more than 70% of its total power generation. Therefore, in the dry season, there are often blackout due to the sudden decrease of the amount of power generated by hydroelectric power generation. Blackout caused by water shortages prevent continuous and stable production activities, which has become a major issue of factory operations.

In industrial parks which consume a large amount of electricity, it is considered that the introducing of power supply facilities independent on the grid and the active introduction of energy-saving facilities are important points for stable factory operation. The introduction of energy saving facilities and renewable energy into the basic infrastructure in the industrial park also impresses the environment friendly industrial activities of companies considering moving into a new industrial park. It is also very attractive to tenants who expect sustainable factory operation.

In the various aspects in rapidly urbanizing Yangon City, support and cooperation by local governments are indispensable, but such knowledge cannot be obtained overnight. On the other hand, Kawasaki City,

which has been solving the environmental issues for a long time and leading the industrial sector as a core city of the Keihin industrial zone, can have solutions and advice to the urgent issues that Yangon City has. Therefore, it is expected that Kawasaki City can be a valuable partner of Yangon City and contribute to the realization of an environmentally friendly zero carbon industrial sector in Yangon City.

1.2 OBJECTIVE OF THE PROJECT

The objective of "FY2020 City-to-City Collaboration Programme for Zero-Carbon Society" is to realize zero-carbon society in overseas cities through the City-to-City collaboration between overseas cities and Japanese cities which have experiences and know-how to develop low/zero-carbon city, and also implementation of a feasibility study for installing private companies' technologies in overseas cities contributing to low/zero-carbon society.

Based on the above, "Realization of Zero Carbon society in Yangon City" was set as overall goal and "Promotion of Zero Carbon toward Sustainable Urbanization in Yangon City" was set as project goal in "Zero Carbon Promotion Project toward Sustainable Urbanization in Yangon City" (hereinafter called "the Project").

In addition, assuming that zero carbon business will be expanded in Yangon City, a feasibility study for Joint Crediting Mechanism (hereinafter called "JCM") Model Project formulation in Yangon City (and its suburbs), a capacity building for industrial park development through the City-to-City Collaboration, and a cooperation for achieving Sustainable Development Goals (hereinafter called "SDGs") in both cities were set as implementation policies in the Project.

The goals and activity policies of the Project are shown in the figure below.

Source: Prepared by Nippon Koei

Figure 1-1 Goals and implementation policies of the Project

1.3 CITIES OF THE PROJECT

Yangon City is the previous capital of Myanmar and the largest city with population of 5 million. The city is rapidly urbanizing by foreign funds and public development because of recent democratization. While urban development and infrastructure development are proceeding, power shortage is one of the issues due to dramatic increase in electricity demand. As a result, importance of saving energy and introduction of renewable energy for low-carbon development are increased.

Kawasaki City, in Kanagawa prefecture. is located next to Tokyo Metropolitan Government. Kawasaki City serves as one of the hub cities for the Keihin industrial zone, and the city has experience and expertise in pollution control at citizen level, company level and government level. Many companies in the city use superior environmental technologies. To utilize such experience, expertise, and technologies for developing sustainable cities, Kawasaki City promotes "Green Innovation". Also, the city organized "Kawasaki Green Innovation Cluster" (hereinafter called "GIC") in 2015 which is a platform of industry-academia-government-citizen collaboration for contributing to environmental improvement and industrial development.

1.4 IMPREMENTATION STRUCTURE OF THE PROJECT

The International Economic Affairs Office of Kawasaki City and Urban Environmental Conservation and Cleansing (hereinafter called "UECC"[1]) of Yangon City Development Committee (hereinafter called "YCDC") mainly implemented the Project.

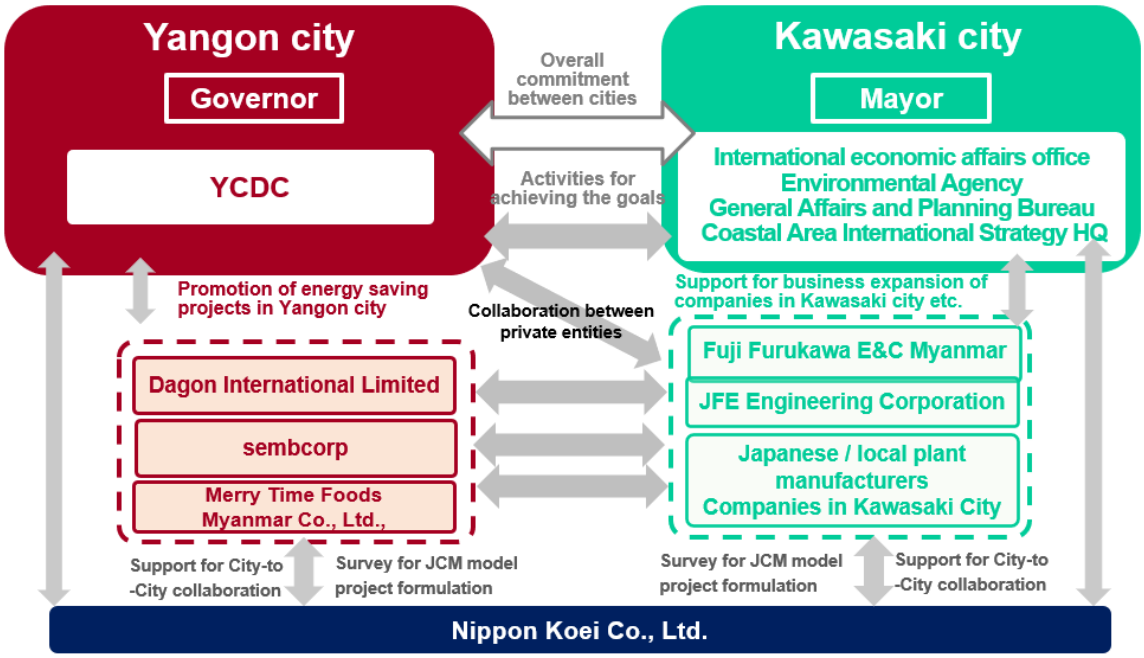
UECC has experience of participating in the JCM Model Project and has sufficient knowledge and achievements regarding JCM. International Economic Affairs Office in Kawasaki City has provided appropriate support for the interests of Yangon City toward solving urban issues and realization a zero carbon society in Yangon City. Both cities have built a good relationship so far.

In addition to this counterpart (hereinafter called "C/P"), other departments of Kawasaki City participated in the Project by the request of the International Economic Affairs Office. Specifically, the General Affairs Planning Bureau, which is in charge of SDGs, the Environment Agency, which is in charge of waste management and air pollution control, and the Coastal Area International Strategy HQ, which is in charge of the management of KING SKYFRONT[2] have attended.

Private companies such as JFE Engineering Co., Ltd. (hereinafter called "JFE Engineering") also participated in the survey with the aim of formulating projects in Yangon City by applying JCM. Nippon Koei Co., Ltd. (hereinafter called "Nippon Koei") supported all activities of the City-to-City Collaboration and feasibility studies for JCM Model Project formulation.

[1] UECC has been renamed from Pollution Control and Cleaning Department (PCCD) due to the organizational change of Yangon City in 2019, and UECC is in charge of the entire environmental sector.

[2] An open innovation base that creates new industries from the world's highest level of research and development, located in the Tonomachi district of Kawasaki City (southwest of Haneda Airport, opposite the Tama River)



Source: Prepared by Nippon Koei

Figure 1-2 Implementation structure of the Project

1.5 PROJECT SCHEDULE

After the conclusion of the contract in September 2020, the Project officially started.
Schedule of the Project is presented below.

Survey Items		2020				2021	
		Sep	Oct	Nov	Dec	Jan	Feb
Energy Saving							
(1)JCM Model Project Formulation							
1-1)	Consideration of specification of introduced technology	■	■	■			
1-2)	Formulation of project plan & project evaluation			■	■	■	■
1-3)	Formulation of monitoring plan			■	■	■	■
1-4)	Coordination for international consortium			■	■	■	■
(2)	Support for the development of eco-town in Yangon City under the City-to-City Collaboration			■	■	■	■
Renewable Energy							
(1)JCM Model Project Formulation							
1-1)	Consideration of specification of introduced technology	■	■	■			
1-2)	Formulation of project plan & project evaluation			■	■	■	■
1-3)	Formulation of monitoring plan			■	■	■	■
1-4)	Coordination for international consortium			■	■	■	■
(2)	Support for the promotion of introduction of renewable energy in Yangon City under the City-to-City Collaboration	■	■	■	■	■	■
Others							
(1)City-to-City collaboration aimed at achieving SDGs							
1-1)	Sharing of Kawasaki City's knowledge and experience regarding	■	■	■	■		
<Field surveys, meetings with related parties, reports, etc.>							
1)	Field work						
2)	Workshop				☆		☆
3)	Business seminar between GIC members and UECC					☆	
4)	City-to-City Collaboration seminar						☆
5)	Domestic meeting with Kawasaki City and related companies	☆	☆	☆	☆	☆	☆
6)	Progress report with MOE	☆			☆		☆
7)	Final Report					■	☆

★ : Implemented in Yangon City ☆ : Implemented in Japan

Source: Prepared by Nippon Koei

Figure 1-3 Project schedule in FY2020

CHAPTER 2 OVERVIEW OF THE CITIES

2.1 YANGON CITY

2.1.1 Overview of Yangon City

Yangon City, old capital of Myanmar, is located in the delta of the Ayeyarwady River and is the largest city with population of 5 million.

Yangon City is divided into 4 districts, which are further divided into townships, and there are 33 townships in Yangon City. In addition, the Thilawa Special Economic Zone is located about 20km southeast of downtown in Yangon City, and is an area where many foreign companies, including Japanese companies, are developing their businesses.

The outline of Yangon City is as shown in the table below.

Source: Prepared by Nippon Koei

Figure 2-1 Map of Yangon City

Table 2-1 Overview of Yangon City

#	Item	Statistical data
1	Area	About 580 [km2]
2	Population	About 5.2 million (as of March, 2014)
3	Population density	About 6,272 [people/km2] (as of March, 2014)
4	Number of households	About 1.1 million [households]
5	Gross city product (nominal)	About 8.00 [billion USD] (FY2016/FY2017)

Source: Prepared by Nippon Koei based on "The 2014 Myanmar Population and Housing Census Yangon Region (Census Report Vol.3)"

2.1.2 Countermeasures for climate change

At present, no original plans and policies have been formulated of countermeasures for climate change by YCDC, and YCDC is in accordance with the climate change policy and plan of National one.

Myanmar ratified UNFCCC in 25 November 1994 and Kyoto protocol in 13 August 2003. In 2016, Myanmar Climate Change Strategy and Action Plan (hereinafter called "MCCSAP") 2016-2030 were formulated in order to precede action plan for global warming. In 2015, the Intended Nationally Determined Contributions (hereinafter called "INDC") in Myanmar was submitted to the UNFCCC, but as of February 2021, the long term low GHG emission development strategy[3] has not been submitted yet. As the target for 2030, it is stated to increase hydropower by 9.4GW, increase renewable energy by 30% for rural electrification, and save 20% of the estimated power consumption of the manufacturing industry in the INDC.

At the "Climate Ambition Summit 2020" held in December 2020 prior to the COP 26, Myanmar has announced that it will cover 39% of its power source composition with renewable energy. The national policy on global warming is summarized in the following table.

[3] The COP21 decision requires submission of a long-term low emission development strategy by 2020.

Table 2-2 National Countermeasures for Climate Change

Action	Year	Summary
National Environment Policy in Myanmar	1994	- Environmental protection and prevention of deterioration - Promotion of economic development - Achievement of sustainable development in priority of environmental protection - Harmony between environment and development
Myanmar・Agenda21	1997	- Use of natural resource for sustainable development - Development of society, economy, and institution
National Sustainable Development Strategy (NSDS)	2009	- Strategy for sustainable development in three sectors such as society, economy and environment
Environment Protection Law	2012	- Management of natural resource - Promotion of social awareness - Cooperation to environmental program
National Adaptation Plan for Action (NAPA)	2012	- Selection of 32 priority actions from 8 sectors - Implementation of adaptation action for global warming
Participation to JCM	2015	- Conclusion of JCM
Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2016-2030	2016	- Target year is 2030 and plans to implement 6 priority projects for global warming policy
Myanmar Climate Change Master Plan	2019	- Formulated with the view toward mainstreaming a series of prioritized sectoral short, medium and long term actions identified in the Myanmar Climate Change Policy and Strategy.
Myanmar Climate Change Policy	2019	- Provide long term direction and guidance to: (a) Take and promote climate change action on adaptation and mitigation in Myanmar; (b) Integrate climate change adaptation and mitigation considerations into Myanmar's national priorities and across all levels and sectors in an iterative and progressive manner; and Take decisions to create and maximise opportunities for sustainable, low carbon, climate resilient development, ensuring benefits for all.

Source: Prepared by Nippon Koei based on 11th Workshop on GHG inventories in Asia and the published Information by the UN prepared by the JICA Study Team

In Myanmar, based on MCCSAP, a solar power generation plant with an output of 40 MW started operation in the Central Magway District in November 2019. In May 2020, the Ministry of Electricity and Energy (hereinafter called "MOEE") developed a large-scale solar power generation plant of 1,000 MW at 30 locations in Myanmar.

In addition, a bid was conducted for the selection of multiple operators. The successful bidder will operate the solar power generation plant in a 20-year BOO (Build Operate and Own) system and sell it to Electric Power Generation Enterprise (hereinafter called "EPGE") under the MOEE. Regarding the bid results, MOEE reported in August 2020 that they have received 155 bids for projects at 30 locations nationwide and is attracting a great deal of interest from overseas[4].

[4] Of the 155 bidders, 85 were Chinese companies, 22 were Thai companies, 21 were Myanmar companies, 10 were European companies, and 4 were in Japan and the United States.

MCCSAP is summarized below.

Table 2-3 Summary of MCCSAP

Vision	The action plan aims to implement low carbon development in order to pursue sustainable development of Myanmar
Goal	Goal of the plan is low carbon development and adaptation of climate change with the target year of 2030
Priority Action Area	Basic action plan a) Conter masure for climate change is reflected into development plan b) Development of organization and institution for cilmage change strategy c) Preparation of budget for climage change strategy d) Consideration of techniqhes for climate change strategy e) Developmetn of knowledge and organization for cliamge change f) Promotion of cooperation with several organizations for project investment Priority action plan are selected from the following sectors. 1)Agriculture and Fishery, 2) Environment, 3) Energy, Transportation and industry, 4) Urban city, 5) Welfare, 6) Education

Source: Myanmar Climate Change Strategy and Action Plan2016

2.1.3 Trends related to industrial park development

Since 1990s, the Myanmar government has established designated areas for manufacturing facilities with the aim of increasing foreign capital investment and creating local employment opportunities, and industrial park development has progressed in and around Yangon City. Currently, 33 industrial parks are in operation in Yangon City, and the development of new industrial parks is still in progress.

The following is an overview of the new industrial parks in and around Yangon City that are currently ongoing.

Table 2-4 Overview of new industrial parks in and around Yangon (as of January 2021)

#	Industrial Park/ Owner	Area	Location Info	Current Stage	Other Information
1	Yangon Amata Smart & Eco City (Amata Corporation Public Co., Ltd,)	2000 acres	No.2 High way near Lay Htaunt Kan Village, East Dagon	Construction Stage	The project will be developed in five phases over a period of five years in order to enjoy tax exemptions granted under the Myanmar Investment Law. The total project area is proposed at 2000 acres.
2	Thilawa SEZ (Zone A Phase 3 and Zone B extension) (MJTD)	101 hectares & 195 hectares	Thilawa SEZ	Construction Stage	The Thilawa SEZ is divided into two zones free zone and promotion zone.
3	Myanmar Singapore (Hlegu) Industrial Park (Sembcorp Singapore)	465 hectares	Hlegu	Construction Stage	Memorandum of Understanding (hereinafter called "MOU ") signed in 2019 July.
4	Korea Myanmar Industrial	556 acres	Hlegu,Near Nyaung Na Pin	Construction State	Expected to hold 200 businesses

#	Industrial Park/ Owner	Area	Location Info	Current Stage	Other Information
	Complex				
5	South Korea-based Myanmar Company Wooree	1,500 acres	Dala	MoU project Signed	An estimated 1,500 acres will be needed
6	Golden Myanmar Investment Consortium (Htantabin Township)	2200 hectares	0.4 km north of 9han Ta Pin	Planning Stage	The Htantabin Industrial Zone will be set up in three phases. An Industrial Zone, Development Zone, and Residential and Green Zone will be constructed under each phase.
7	Kawhmu	1000 acres	2.7 km east of Kawmhu	Planning Stage	The size of each industrial zone will be 1,000 acres. However, their exact locations were not revealed to prevent speculation in land and property within the area.
8	Kungyangon	1092 acres	1.6 km south of Kaungyangon	Planning Stage	The size of each industrial zone will be 1,000 acres. However, their exact locations were not revealed to prevent speculation in land and property within the area.
9	Twantay	850 acres	Approx. 1.6 km southeast off Twantay	Planning Stage	The size of each industrial zone will be 1,000 acres. However, their exact locations were not revealed to prevent speculation in land and property within the area.
10	Taik Kyi	1000 acres	North of Taik kyi	Planning Stage	The regional government has approved the land acquisition proposal. As soon as union government approved the project, regional government will invite bit applications transparently.
11	Khayan	1000 acres	North of Khayan	Planning Stage	The regional government has approved the land acquisition proposal. As soon as union government approved the project, regional government will invite bit applications transparently.
12	Thongwa	1871 acres	0.5 km north of Thongwa	Planning Stage	The regional government has approved the land acquisition proposal. As soon as union government approved the project, regional government will invite bit applications transparently.

Source: Prepared by Nippon Koei based on public information

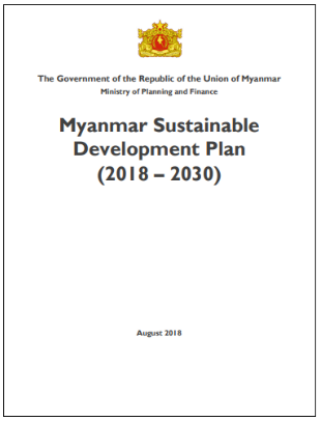
In May 2020, the Industrial Zone Law was formulated in Myanmar. In the law, it requires to formulate an environmental conservation plan and stipulates that the land use ratio should include green areas (9 to 10%).

In addition, Myanmar Investment Law stipulates that development over a certain scale such as industrial parks must be approved by the Myanmar Investment Commission (hereinafter called "MIC")[56]. It takes several months to obtain approval because it requires preparation of application documents and an interview with MIC.

2.1.4 Activity of SDGs in Yangon City

Myanmar Sustainable Development Plan (hereinafter called "MSDP"), a national development plan, was formulated August 2018 in Myanmar. MSDP guides the country's economic development by 2030, in line with the target year of the SDGs. MSDP is composed of three pillars: (i) peace and stability, (ii) prosperity and partnership, and (iii) people and planet. Under the three pillars, MSDP has five goals, 28 strategies, and 251 action plans. The action plan is summarized which of the 169 targets of the relevant ministries and SDGs are aiming to contribute.

UECC has prioritized the four action plans by MSDP's 251 action plans. UECC hasn't had specific plans related to these action plans yet.



Source: Provided by Yangon City

Figure 2-2 MSDP

Table 2-5 Action Plans prioritized by UECC

Pillar3：People & Planet					
Goal5：Natural Resources & the Environment for Posterity of the Nation					
Strategy 5.1：Ensure a clean environment together with healthy and functioning ecosystem					
Action Plans		**Strategic Outcomes**	**Relevant Agencies**	**12 Point Economic Policy**	**Relevant SDGs Targets**
5.3.6	Practice effective and environmentally safe waste management and disposal in industrial, commercial, household, and public sector use contexts	Domestic solid waste and effectively disposed to promote healthy communities	MoNREC, MoLIP, MoALI, MoH, LG	EP9	6.2
5.4.2	Scale-up use of renewable energy resources such as wind, solar, hydro, geothermal and bio-energy in partnership and with agreement of local	Climate-resilient and low-carbon energy, transport and industrial systems promoted	MoEE, MoIND, MoPF, MoALI, MoCON	EP4	7.2

5 A committee organized by Directorate of Investment and Company Administration (DICA) to convene investment-related ministers

6 Investment that requires MIC approval under the Investment Law Enforcement Regulations: Investment in businesses in the fields of communication technology, information technology, medical technology, biotechnology and other technologies, energy infrastructure, urban development, natural resource extraction, media and logistics infrastructure. Investment over $ 20 million

Pillar3：People & Planet					
Goal5：Natural Resources & the Environment for Posterity of the Nation					
Strategy 5.1：Ensure a clean environment together with healthy and functioning ecosystem					
Action Plans		**Strategic Outcomes**	**Relevant Agencies**	**12 Point Economic Policy**	**Relevant SDGs Targets**
	populations				
5.6.3	Design and/or assess and retrofit urban infrastructure to improve resilience to natural and man-made disasters and other shock events, with a focus on reducing carbon emission and producing greater savings from reduced energy consumption	Climate-resilient and low-carbon energy, transport and industrial systems promoted	MoHA, MoPF, MoTC, MoCON, MoNREC, MoEE	EP4, EP9	11.c
5.6.6	Provide efficient public municipal services including solid waste collection and management systems combined with public education on recycling and waste minimization practices.	Urban environment with more public spaces, improve public services, and preservation of cultural heritage	LG, MoTC, MoCON, MoPF	EP9, EP4	11.6

Source: Prepared by Nippon Koei based on MSDP

2.2 KAWASAKI CITY

2.2.1 Overview of Kawasaki City

Kawasaki City is a government ordinance city located in the northeast part of Kanagawa Prefecture, next to Tokyo across Tama River.

The city underpins Japan's economic growth as the core city of waterfront Keihin Industrial Zone. Kawasaki City, with a history and experience on solving environmental

Source: Kawasaki City

Figure 2-3 Map of Kawasaki City

Table 2-6 Statistical data of Kawasaki City

#	Item	Statistical data
1	Area	144.35km2
2	Population	1,539,657 (as of June 1, 2020)
3	Number of households	750,256 (as of June 1, 2020)
4	Gross city product (nominal)	6,158.4 billion yen (2016)

Source: Kawasaki City

In addition to activities for environmental improvement and preservation, recently Kawasaki City was appointed to be the ambassador of "RE100 Declaration RE Action", a new framework for small and medium-scale companies, municipalities, and educational and medical institutions who do not meet the standard for joining RE100[7] (the standard of RE100 is over 10 GWh energy consumption a year) to commit to 100% renewable energy. Through the activities as the ambassador, the city is expanding renewable energy initiatives across Japan. In July 2019, as a result of experience of solving various issues together with citizens and business operators and initiatives for sustainable society were highly evaluated, Kawasaki City was selected by the Regional Revitalization Promotion Office of Cabinet Office as a "SDGs Future City [8]". Through such activities and awards, Kawasaki City has been actively promoting climate change countermeasures and SDGs.

7 RE100 is international business initiative to promote 100% renewable energy consumption by companies, operated by The Climate Group and CDP. RE100 visualizes 100% renewable energy use by companies and aims at promotion of renewable energy. Influential large companies in the world are participating in RE100.

8 SDGs Future City cities and regions with high potential to achieve sustainable development and create new values, especially economic, social and environmental values are chosen from cities and regions promoting the basic and comprehensive activities based on SDGs philosophy, these. In 2019, 31 cities were newly selected (total 60 cities).

2.2.2 Policy for climate change countermeasures of Kawasaki City

(1) Kawasaki City Basic Plan to Promote Global Warming Countermeasures

In 2010, based on Kawasaki City Ordinance for Promotion of Global Warming Countermeasures released in 2009, Kawasaki City enacted the Basic Plan to Promote Global Warming Countermeasures (hereafter "Plan 2010") to drive actions against global warming in a comprehensive and systematic manner, and to set reduction target for FY2020. Plan 2010 was revised in 2018 (hereafter "Plan 2018") to set new reduction target for FY2030, and to illustrate plans to achieve the target.

The overview of Plan 2010 and Plan 2018 is shown in Table 2.7. Plan 2018 is currently being revised in line with the declaration of 2050 Zero Carbon City and release of Kawasaki Carbon Zero Challenge 2050.

Source: Kawasaki City

Figure 2-4 Basic Plan to Promote Global Warming Countermeasures

Table 2-7 Overview of Plan to Promote Global Warming Countermeasures (Plan 2010 and Plan 2018)

Item	2010 Plan	2018 Plan
Period	FY2011-2020	FY 2018-2030
Basic concept	To develop a sustainable low-carbon society based on harmonization and positive cycle of the environment and economy and to preserve positive environment for the next generations.	To develop a low-carbon society with multi-benefit measures against global warming.
Basic policy	(1) To develop a social and economic system leading to reduction of GHG emissions effectively. (2) To use locally available energy resources such as renewable and unutilized energy efficiently and effectively. (3) To reduce GHG emissions by business operators, citizens and the city in their respective capacity. (4) To encourage joint activities. (5) To contribute to reduction of GHG emissions worldwide. (6) To contribute to countermeasures to heat island phenomenon.	(1) To proceed reduction of GHG emissions. (2) To implement of introduction of renewable energy and optimization of energy consumption. (3) To promote adaptation measures for climate change. (4) To contribute with environmental technologies and industries. (5) To encourage collaboration among citizens, business operators and public sector.
Reduction target	To aim at 25% reduction of GHG emissions compared with FY1990, by FY2020.	To aim at 30% reduction of GHG emissions by FY2030, compared with FY1990 (or 20% compared with FY2013).

Source: Prepared by Nippon Koei based on Kawasaki City Plan to Promote Global Warming Countermeasures

(2) Zero carbon strategy "Kawasaki Carbon Zero Challenge 2050"

On February 17, 2020, the Governor of Kawasaki City Norihiko Fukuda announced 2050 Zero Carbon City, stating that by the end of the year, the city will show a future image and a strategy toward zero carbon city. In November, "Kawasaki Carbon Zero Challenge 2050" was released as a starting point for zero carbon initiatives, which illustrates 2030 milestones (medium-term targets), basic concept, and leading activities to reduce 100% of net CO2 emission by 2050.

2030 milestone was calculated by back casting the figures required to achieve zero carbon by 2050. It includes targets from the Basic Plan (reduction of about 2.5 million tCO2 by FY2030 (26% reduction compared with FY2013) and 80%

Source: Kawasaki City

Figure 2-5 Kawasaki Carbon Zero Challenge 2050

of the emissions by FY2050 compared with FY2013) and aims to reduce additional one million tCO2 in the 10 years to FY 2030.

The strategy lists images of achievements of zero carbon society in Kawasaki as shown below.

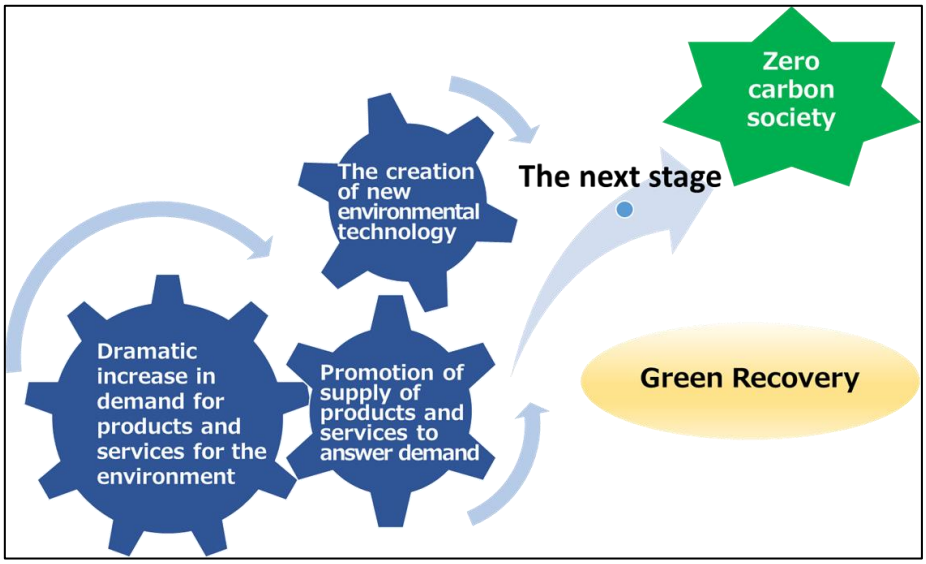
Table 2-8 Images of zero carbon society in Kawasaki in 2050

Sector	Images
Private sector (households and business operations)	(1) Zero-energy buildings (shifting to Net Zero Energy Building (ZEB) and Net Zero Energy House (ZEH)) become general. (2) Power sources based on renewables are widespread, as well as local power supply and consumption by utilizing the potential of the region. (3) Realization of compact city, decarbonization of buildings and realization of urban forest by generalizing wooden buildings. (4) 100% renewable energy utilization for the city's activities and minimization of energy consumption in public facilities.
Transportation	(1) Replacement of vehicles including cars, buses, taxis and trucks with Zero Emission Vehicle (ZEV). (2) Replacement of all official cars with ZEV.
Waste	(1) Transformation of lifestyle such as to stop using single-use plastics, transformation to biomass materials, generalization of behaviors for food loss by generalizing environmentally friendly manners of citizens and companies.
Industry	(1) More companies in Kawasaki turn to decarbonization voluntarily. (2) Innovation and business model of environmental and energy sectors generated in Kawasaki lead industries inside and outside the city. (3) Promotion of renewable energy as main energy. (4) Realization of technological innovation and industrialization to contribute to zero carbon and contributions to zero-carbon lifestyle of citizens by collaborating with companies in Kawasaki. (5) Development of society based on hydrogen energy networks. (6) Generalization of sustainable finance to contribute to decarbonization.

Source: Prepared by Nippon Koei based on Kawasaki Carbon Zero Challenge 2050

The basic approach of Kawasaki City for realization of zero-carbon society is "to realize zero-carbon society by that consumer activity movement influences on the society. This is based on the role of municipality, "to encourage citizens and companies to act in environmentally friendly manner as a familiar existence in the community" and characteristics and advantages of Kawasaki City "accumulation of environmental technologies, industries and research institutes and existence of a lot of citizens and companies with high awareness on the environment".

"Consumer activity movements" means that consumers select environmentally friendly products and services and dramatically boost their needs (demand). Also, "Influencing society" means to accelerate supply of products and services for zero carbon and to develop new innovations. Furthermore, the city has set three pillars as drivers of these three cogwheels to achieve zero-carbon society by 2050.



Source: Kawasaki Carbon Zero Challenge 2050

Figure 2-6 Image of the approach to zero-carbon society

Table 2-9 Three activity pillars and unique activities

Activity pillars	Initiatives led by the city (unique activities)
Pillar I (Participation and collaboration of various stakeholders)	Establishment of zero-carbon model district (as a familiar zero-carbon model
Pillar II (Kawasaki City takes initiative)	Introduction of renewable energy to public facilities, thoroughness of energy saving and change of awareness of officers. - To reduce 10% energy consumption in city halls by 2030, by thoroughness of energy saving. - To achieve RE100 in main public facilities such as city halls and ward offices by local generation of renewable energy and procurement of renewable energy.
Pillar III (Promotion of green innovations from Kawasaki)	To consider evaluation supports and evaluation measures for companies implementing activities for decarbonization.

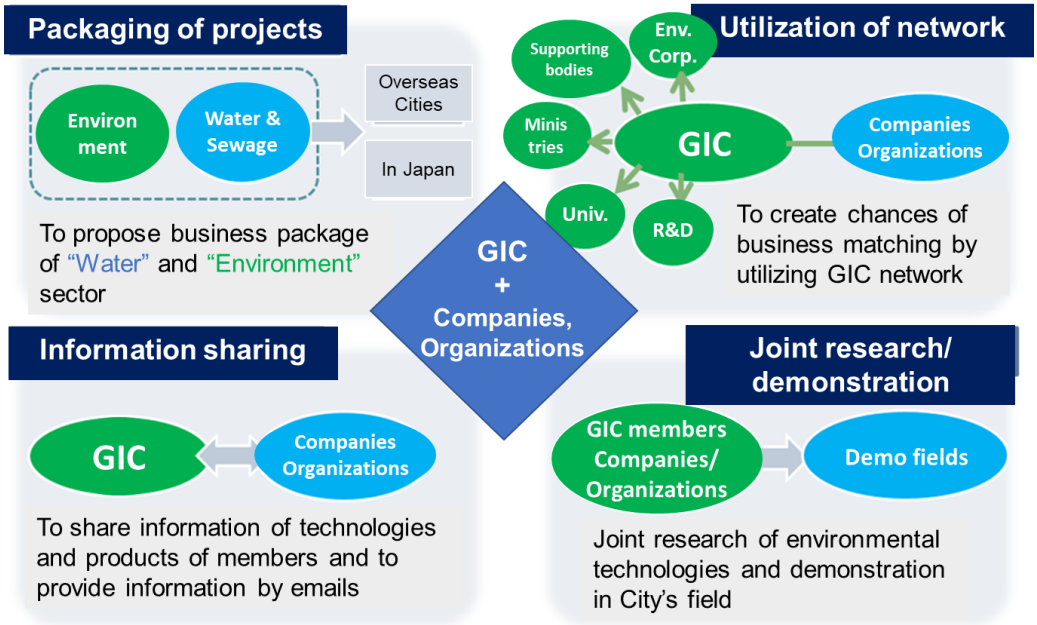
Source: Prepared by Nippon Koei based on Kawasaki Carbon Zero Challenge 2050

(3) Kawasaki Green Innovation Cluster (GIC)

In 2014, Kawasaki City released its Promotion Policy on Kawasaki Green Innovation. It describes basic policies and practices on how to create sustainable cities by taking an advantage of environmental technologies and industries and to develop and extend Green Innovation initiatives more. The four pillars for Green Innovation are:

- To revitalize local economy by creating and supporting environmental technologies and industries
- To apply competitive environmental technologies and industries to city life
- To collaborate with diverse parties to utilize environmental technologies and industries
- To contribute to international communities with Kawasaki's environmental technologies and industries

In 2014, GIC was established as a structure to promote these four pillars. It is a network for collaboration among industries, academia, and private and public sectors to improve the environment and to promote industrial development and international contributions. GIC functions to provide "access to utilization of schemes of Kawasaki City and supporting organizations", "promotion and information sharing opportunities" and "support of business development by utilizing environmental technologies, and know-how of public services".



Source: Kawasaki City

Figure 2-7 Image of activities utilizing GIC

(4) Kawasaki Eco-Town

Kawasaki City positions "Zero-Emission Concept" as the basic concept for creating a local circular economy and recognize it as the basis for revitalizing the local community. In 1997, the city developed "the Kawasaki Eco-Town Plan" targeting the entire coastal area of Kawasaki (about 2,800 hectares) and received approval from the government as the first eco-town in Japan. The target areas are working on resource circulation activities, with companies circulating and reusing resources and waste emitted

in the city among themselves by taking an advantage of the high concentration of companies and environmental technologies in the coastal area. Also, resource circulation activities are carried out not only in the city, but in wider in Japan and overseas.

Shown below are the four pillars and concrete measures based on the Kawasaki Eco-Town Concept.

Table 2-10 The four pillars and concrete measures based on the Kawasaki Eco-Town

Pillars of the activities	Measures
Promoting eco-friendly measures by each company	- To organize advanced recycling facilities - To encourage resource circulation based on characteristics and strengths of companies - To realize zero-emission of industrial waste and wastewater
Promoting eco-friendly measures with other companies	- To develop Kawasaki Zero-Emission Industrial Park - To implement joint recycling in the district
Undertaking researches for environment-based, sustainably developing districts	- To research on effective energy usage - To research on advancing Eco-Town initiatives - To vitalize the research and development industry
Documenting the achievements of the companies and districts and contributing to developing countries	- To provide study tours - To hold Kawasaki International Eco-Tech Fair

Source: Prepared by Nippon Koei based on Kawasaki City website

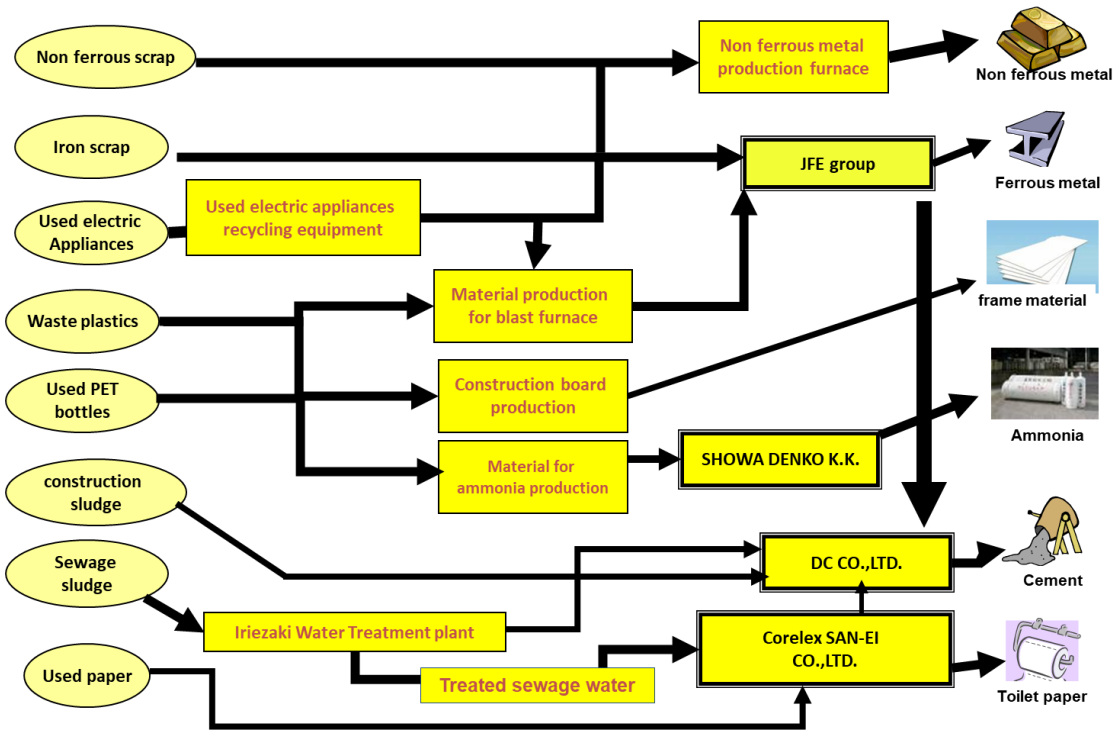
In 2002, in Kawasaki Eco-Town target areas, Kawasaki Zero-Emission Industrial Park started operation as a model facility of the Kawasaki Eco-Town Concept. It saves waste from business activities and aims to minimize environmental burden by reusing and recycling resources and utilizing circulated energy.

The concept and concrete measures of the Zero-Emission Industrial Park are as follows.

Table 2-11 The concept and concrete measures of Zero-Emission Industrial Park

Concept	Measures
- To set own basic environmental policies by each company. - To set a higher goal (zero-emission) than the emission criteria. - To work together with other companies in the industrial park to make the activities more efficient. - To integrate factors of environmental burden into processes by cooperation among companies. - To realize total zero emission by linking things, difficult to be made zero emission in the industrial park, - with surrounding circulation function	- They set waste reduction targets for and actively save internally generated waste - The industrial park's union collects all paper waste from the companies to be recycled - To reuse waste heat energy from incineration plants - To reuse highly treated water from Kawasaki Iriezaki Water Treatment Center in the industrial park, as well as water treated in the plants - To recycle as much water as possible and reduce the work of waste treatment facilities - To reuse incineration fly ash as a raw material for cement - To compost organic waste from the companies and use as a fertilizer for communal green area in the industrial park - To use rainwater as fire protection water and irrigation water - To share each self-generated power among companies

Source: Prepared by Nippon Koei based on Kawasaki City website



Source: Kawasaki City

Figure 2-8 Resources circulation in Kawasaki Eco-Town including Zero Emission Industrial Park

2.2.3 Activities for achieving SDGs

Kawasaki City made public announcement of "Action Policy for Sustainable Development Goals (SDGs) in Kawasaki City" in February 2019, and has started their activities for achieving SDGs. In addition, Kawasaki City has been selected as "SDGs Future City" in July 2019, which is selected by the Regional Revitalization Promotion Office of Cabinet Office/

Kawasaki City aims to be "the happiest city with full of joy for everyone" by 2030. To achieve this goal, the city is implementing several actions in three areas: "economy", "environment", and "social".

Table 2-12 SDGs actions in Kawasaki City

Item	SDGs	Issue	Action	
Economic	3,8,9,17	Adaptation to environmental changes of industrial economy	Strengthening of global competitiveness and creation of new industry	• Creating "Green Life welfare Innovation" • Strengthening of research infrastructure
			Promotion of strategic industry accumulation at waterfront area and development infrastructure	• Enforcement of international competitiveness in industrial complex • Development "king sky front" as an international strategy hub
Social	5,10,11,17	Dealing with impact of the falling	Making the city comfortable to live, and	• Diffusing a vision of "Kawasaki Para

Item	SDGs	Issue	Action	
		birthrate, the aging population, and population decrease	providing opportunities to the citizens for great success	Movement" and creating legacy • Promotion of wood utilization by collaboration with suburban cities • Formulation of regional comprehensive care system for all citizens
			Formulation of urban community by the citizens	• Solving local issues by establishing "Machino hiroba (open space for citizens)" • Utilizing "Social design center" for solving local issues by citizens
Environment	7,12,13,17	Effort for solving global issues regarding to environment and energy etc.	Realization of low-carbon and circulatory city	• Promotion of actions for GHG emission reduction by citizen, companies, and local government • Installing hydrogen energy into waterfront area
			International contributions by utilizing knowledge on environmental technologies and administration	• Solving environmental issues in developing countries by utilizing JCM

Source: Prepared by Nippon Koei based on Kawasaki City's website

In addition to the above actions, Kawasaki City made "Kawasaki City's Strategy on Hydrogen Energy (set in March 2015)" as one of the actions to achieve SDGs. This strategy aims to realize "Future-oriented environmental/ industrial city" by installing hydrogen energy and utilizing this energy.

CHAPTER 3 CITY-TO-CITY COLLABORATION FOR ZERO-CARBON SOCIETY

3.1 BACKGROUND OF THE CITY TO CITY COLLABORATION

"Project for formulation of JCM Model Project through City-to-City Collaboration in Yangon" has been implemented through City-to-City Collaboration between Kawasaki City and Yangon City since FY2015. The Project in FY2016 was implemented with themes of "Installation of high efficiency once-through boiler to food processing factory" and "Introduction of Solar PV into Yangon City facility". During the Project in FY2017, "Introduction of High-efficiency Pumps into Existing Pumping Station" and "Low Carbonization of Waste Management" were conducted. The Project in FY2018 was implemented with themes of "Utilization of Energy and Energy Saving in Fruits and Vegetables Wholesale Market". Finally, the Project in FY2019 was implemented with themes of "Support on Low Carbon Mega Park through City-to-City Collaboration".

In March 2016, both cities concluded MOU on collaboration of the low carbon development.

Source: Prepared by Nippon Koei

Figure 3-1 MOU between Kawasaki City and Yangon City(March,2016)

Although Yangon City is rapidly urbanizing, there is no policy regarding climate change. That is why, Draft Low Carbon Action Plan (hereinafter called "LCAP") was prepared in FY2016, as one of the outputs of City-to-City collaboration, in cooperation with Kawasaki City which has knowledge and experience for low carbon plan's development and the basic policy. Basic concept of LCAP is to contribute to development of sustainable and low carbon society of Yangon City based on i) harmonization of green environment and economy and ii) creation of their good cycle, so that the good

natural environment can be maintained for the next generation and basic policies for 8 sectors described below were set.

Table 3-1 Basic policy for Low Carbon Action Plan

Sector	Basic Policy
Industry	***I. Reduction of GHG emission from industrial activities*** 1 Establishment of a business model towards "low-carbon Yangon City" 2 Fostering eco-friendly industries 3 Creation of eco-friendly model for industrial complexes
Energy	***II. Utilization of renewable energy resources*** 1 Promotion of Solar-city Project 2 Creation of a system for making an effective use of energy 3 Making a wider use of renewable energy resources, considering the regional characteristics
Urban City	***III. Creation of low-carbon city*** 1 Encourage construction of highly energy efficient buildings 2 Introduction of energy efficient technology into public sector 3 Promotion of energy efficient technology to private sector
Transportation	***VI. Introduction of Low carbon technique in the transportation Sector*** 1 Establishment of eco-friendly transportation network 2 Enhance convenience of public transportation 3 Promotion of measures for GHG emitted from automobiles
Waste Management	***V. Creation of recycling-oriented society*** 1 Promotion of 3R activities of non-industrial wastes and industrial wastes 2 Introduction of low-carbon waste incineration facility Reduction of GHG emission from collection and transportation of wastes
Education	***VI. Environmental education and study on global environmental issues*** 1 Promotion of environmental education and study 2 Promotion of human resource development
International Corporation	***VII. Introduction of international technology through city to city corporation*** 1 Contribution to reduction of global GHG emission by introducing international technology through city to city corporation 2 Supporting and cooperating international environmental conservation activities
MRV	***VIII. Research and development of environmental technologies*** 1 Research and development of environmental technologies, and promotion of scientific measures 2 Conducting MRV in order to promote introduction of saving energy technology

Source: Prepared by Nippon Koei

The results of other activities and contributions other than the action plan in City-to-City collaboration are shown in the table below.

Table 3-2 Achievements of the City-to-City Collaboration

#	Year	Outline
1	July, 2015	City-to-City Collaboration between Kawasaki City and Yangon City started
2	July 2015~	JCM Model Project formulation was stared 1) Study for the introduction of energy-saving brewing systems to beer factory 2) Study for the introduction of high-efficiency once-through boiler in instant noodle Factory 3) Study for the introduction of high-efficiency pumps into existing pumping station 4) Study for the utilization of energy and energy saving in fruits and vegetables wholesale market
3	January, 2016	JCM workshop was hold in Yangon City (at Yangon City government building)
4	March, 2016	MOU for formulation of low carbon city between Kawasaki City and Yangon City
5	September, 2016	Adoption of JCM Model Project Formulation supported by City-to-City Collaboration 1) Introduction of energy-saving brewing systems to beer factory 2) Introduction of High-efficiency once-through boiler in instant noodle Factory
6	April, 2019	City-to-City Collaboration (support on low carbon mega park through city-to-city collaboration) was stared

Source: Prepared by Nippon Koei

3.2 RESULTS OF CITY-TO-CITY COLLABORATION

3.2.1 Overview of the City-to-City Collaboration

The details of this fiscal year's activities such as meetings and workshops with YCDC are summarized in the table below.

Table 3-3 Activities for City-to-City Collaboration

Activities	Date	Overview
Kick-off meeting with MOE	14 September, 2020	MOE, Kawasaki City, and Nippon Koei held a face-to-face kick-off meeting. Nippon Koei reported on the progress since pre-kick-off meeting in May and explained the Project schedule. In consideration of the COVID-19 pandemic and more chances for online activities, it was agreed with MOE to amend the contract.
Kick-off meeting between YCDC and Kawasaki City	20 November, 2020	A kick-off meeting related to the Project was held as an online meeting. YCDC and Kawasaki City explained the outline of both cities and Nippon Koei outlined the current fiscal year's activities and schedule.
1st progress report meeting with MOE	18 December, 2020	MOE, Kawasaki City and Nippon Koei held the first progress report meeting online. Kawasaki City and Nippon Koei reported the progress after the kick-off meeting in September and study schedule.
Workshop for	23 December,	Due to the COVID-19 pandemic and the state of affairs in

Activities	Date	Overview
YCDC officers (making knowledge sharing videos)	2020 26 February, 2021	Myanmar, making knowledge sharing video were shot as an online workshop by YCDC and Kawasaki City. The videos are related to the explanation of waste management, SDGs, air monitoring, and urban redevelopment in Kawasaki City, which were planned to be shared at the workshop. Each videos were translated into Myanmar language and watched by YCDC staff.
Online business seminar between GIC member companies and YCDC	26 January, 2021	An online meeting was held between GIC member companies and YCDC during the Kawasaki International Eco-Tech Fair (January 21-February 5). Four GIC companies joined the meeting and introduced their technologies and products to YCDC representatives.
City-to-City Collaboration Seminar held by MOE	1 February, 2021	"Seminar on City-to-City Collaboration for Creating a Zero-carbon Society" was held online by MOE. A total of over 100 representatives attended the meeting from Japanese and overseas cities carrying out City-to-City Collaboration Programme, and its representative entities and partner companies. Presentations on City-to-City Collaboration Programme and JCM Model Project trends and a panel discussion on how to execute projects in the COVID-19 pandemic.
Final report meeting with MOE	1 March, 2020	This fiscal year's activities and plans for the next fiscal year's activities were reported to MOE

Source: Prepared by Nippon Koei

3.2.2 Kick-off meeting between Kawasaki City and YCDC

On 20th November 2020, a kick-off meeting between Kawasaki City and YCDC was held online meeting. At the kick-off meeting, in addition to explaining the outlines of both cities, YCDC explained the activities of waste management, and Kawasaki City mainly explained the activities related to SDGs. In addition, Nippon Koei explained the activities of the Project in this fiscal year and discussed with both cities.

At this kick-off meeting, it was confirmed that YCDC was interested in the air pollution monitoring system and SDGs in Kawasaki City. There was also a request for knowledge sharing regarding the management of industrial parks in Kawasaki City. In response to these YCDC requests, it was decided to share the knowledge from Kawasaki City through the workshops.

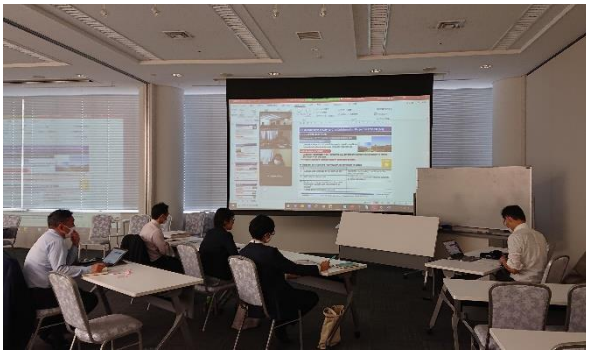
The kick-off meeting agenda is as follows.

Date: 20th November 2020 (Fri), 12:30-14:30 (Japan time)
Location: Online meeting
Participants: YCDC：UECC
Kawasaki City (International Economic Affairs Office)
Nippon Koei
Myanmar Koei International Ltd. (Nippon Koei's local subsidiary)
2 interpreters (Japanese - Myanmar)
Total: approximately 15 participants

Table 3-4 Agenda of kick-off meeting between Kawasaki City and YCDC

#	Agenda	Time	Speaker
1	Opening remark	5 min	Yangon City
2	Opening remark	5 min	Kawasaki City
3	Introduction of Yangon City	15 min	Yangon City
4	Introduction of Kawasaki City	15 min	Kawasaki City
5	Introduction of proposed activities of the Programme in FY2020 – Objectives of City-to-City Collaboration – Overview of activities in FY2020 – Expected benefits on Yangon City – Schedule	15 min	Nippon Koei
6	Q&A / Discussion for the next step	30 min	All
7	Closing remarks	5 min	Yangon City
8	Closing remarks	5 min	Kawasaki City

Source: Prepared by Nippon Koei



A scene from Kick-off meeting (Kawasaki City)

Zoom Screen in Kick-off meeting

3.2.3 Workshop for YCDC officer

Based on the kick-off meeting, it was decided to hold the online workshops for YCDC staff on December 2020 and February 2021. The first workshop would be aimed at sharing the knowledge of waste management and SDGs activities in Kawasaki City, which are of great interest to YCDC (particularly UECC, C/P of the Project). The second workshop would be aimed at sharing the knowledge of the development and management of industrial parks mainly and conducting a public-private joint workshop in which Dagon International Limited (hereinafter called "Dagon Industrial"), a player of study for JCM Model Project formation, also would participate.

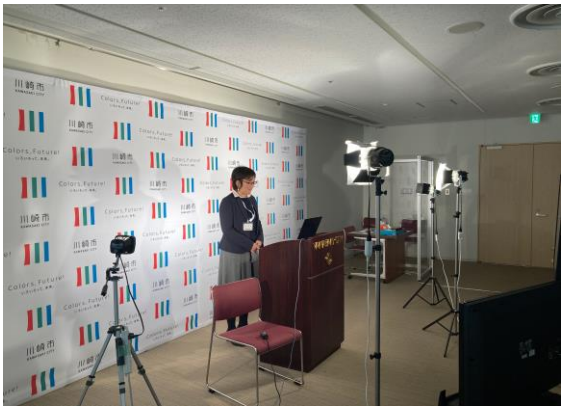
However, due to the COVID-19 pandemic in Yangon City[9] and the occurrence of a military coup d'etat in Myanmar, it was impossible to hold the workshop by online with YCDC. Therefore, the presentations of knowledge sharing by Kawasaki City, which was planned to be explained at the workshop, were shot as knowledge sharing videos with Myanmar language translation and the videos were watched by YCDC staff. The created knowledge-sharing videos are as follows.

[9] December 14, 2020 Yangon Mayor Maung Maung Soe and three escort staff were reported to be infected with COVID-19.

Table 3-5 Outline of knowledge sharing video

Video Contents	Outline	Presenter	Video time
Remarks from Kawasaki City (For 1st workshop)	Explained the created video as an alternative to the 1st workshop.	International economic affairs office, Kawasaki City	About 2 min
Solid waste management in Kawasaki City	Shared the knowledge about the efforts such as the basic plan for general waste treatment and the implementation plan formulated in Kawasaki City, and the inspection and evaluation by the PDCA cycle.	Environmental Agency, Kawasaki City	About 15 min
SDGs activity in Kawasaki City	Shared the knowledge about the relationship between Kawasaki City SDGs action plan and the Kawasaki City comprehensive plan, and the evaluation method and performance indicators in the Kawasaki City comprehensive plan.	General Affairs and Planning Bureau, Kawasaki City	About 20 min
Remarks from Kawasaki City (For 2nd workshop)	Explained the created video as an alternative to the 2nd workshop.	International economic affairs office, Kawasaki City	About 2 min
Environmental management on air pollution	Shared the knowledge about air pollution monitoring conducted at Kawasaki Environment Research Institute.	Environmental Agency, Kawasaki City	About 20 min
Explanation of development of KING SKYFRONT	Shared knowledge about the background of urban revitalization and attracting companies taking KING SKYFRONT as an example.	Coastal Area International Strategy HQ, Kawasaki City	About 10 min

Source: Prepared by Nippon Koei



A scene from shooting video

Part of the created video

3.2.4 Online business seminar between GIC members and YCDC

An online business seminar was held between GIC member companies and YCDC on 26th January 2021, during the 13th Kawasaki International Eco-Tech Fair (21 January -5 February, 2021). Four GIC member companies with technologies related to waste management, air pollution control, and renewable energy, which are issues of YCDC (especially UECC), participated in this business seminar. Participating companies explained their technology to YCDC and exchanged opinions on the possibility of using it in Yangon City. Kawasaki City International Economic Affairs Office gave a brief summary of the Kawasaki International Eco-Tech Fair and how to visit the fair to encourage participants from YCDC to visit the Fair.

The companies participating in the online exchange meeting and the technical outline are shown below.

Date: 26th January 2021 (Tue), 12:30-14:30 (JPT)
Location: Online meeting
Participants: YCDC：UECC
Kawasaki City (International Economic Affairs Office)
GIC member companies: J&T Recycling Corporation, RECOTECH Co., Ltd, CSD Co., Ltd and GREEN BLUE Co., Ltd
Tepia Corporation Japan (GIC administrative office)
Convention Linkage, Inc. (Kawasaki International Eco-Tech Fair's administrative office)
Nippon Koei
2 interpreters (Japanese - Myanmar)
Total: approximately 25 participants

Table 3-6 Agenda of online business seminar between GIC members and YCDC

#	Company	Introduction technology overview	Main Question and Comment form YCDC
1	J&T Recycling Corporation	Collective waste management	・ Questions about the legal system and administrative guidance related to the recycling law and Extended Producer Responsibilities (EPR) in Japan ・ Questions about recycled products
2	RECOTECH Co., Ltd	Waste management application	・ Questions about the outline of GOMiKO system and material pool system ・ YCDC is also planning to introduce an app like GOMiKO in the future. (comment)
3	CSD Co., Ltd	Solar power management system	・ Questions about customer solutions provided by CSD
4	GREEN BLUE Co., Ltd	Air quality monitoring system	・ Questions about surveys such as by walking and motorcycles ・ YCDC is interested in the cases in Vietnam conducted by Green Blue Co., Ltd. and observations using drones. In addition, YCDC would like to exchange opinions on air pollution mitigation measures, action plans, monitoring, etc. in the future. (comment)

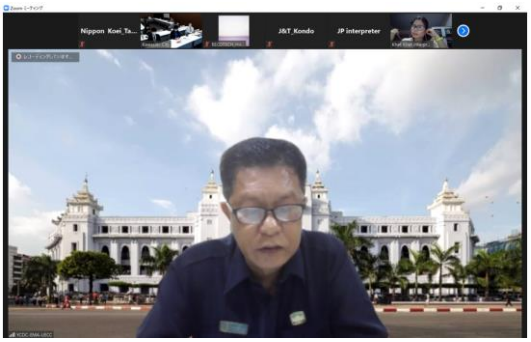
Source: Prepared by Nippon Koei

Table 3-7 Agenda of business seminar between GIC members and YCDC

#	Agenda	Speaker
1	Opening remark （Yangon City）	Yangon City
2	Opening remark （Kawasaki City）	Kawasaki City
3	Explanation of Kawasaki International Eco-Tech fair （Kawasaki City）	Kawasaki City
4	Introduction of companies of Kawasaki Green Innovation Cluster （Presentation 5min、Q&A 15min）* 4 companies • J&T Recycling Corporation （Collective waste management） • RECOTECH Co., Ltd （Waste management application） • CSD Co., Ltd （Solar power management system） • GREEN BLUE Co., Ltd （Air quality monitoring system）	J&T Recycling Corporation RECOTECH Co., Ltd CSD Co., Ltd GREEN BLUE Co., Ltd
5	Closing remark	Yangon City
6	Closing remark	Kawasaki City

Source: Prepared by Nippon Koei

A scene from the online business seminar



Opening remarks by Head of UECC

3.2.5 The City-to-City Collaboration seminar held by MOE

On 1st February 2021, MOE organized “Seminar on City-to-City Collaboration for Creating a Zero-carbon Society” online, with over 100 participants from Japanese and overseas cities carrying out City-to-City Collaboration Programme, and its representative entities and partner companies

After the organizer gave an opening speech, International Cooperation and Sustainable Infrastructure Office of MOE, Office of Market Mechanisms of MOE, and Asian Development Bank gave presentations entitled “Overview of support menus for development of zero carbon society”, on developments and trends of City-to-City Collaboration Programme, JCM Model Project, and Japan Fund for the Joint Crediting Mechanism. In the following panel discussion, City of Kitakyushu, Oriental Consultants Co., Ltd. and Nippon Koei discussed how to carry out the City-to-City Collaboration Programme during COVID-19 pandemic, and on the approaches and means required for overseas business development.

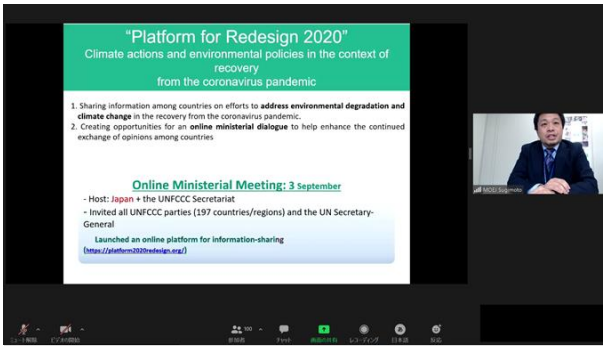
Principal Deputy Director of International Cooperation and Sustainable Infrastructure Office of MOE made a closing speech, saying that Japan will enhance its alliances and support the new needs arising from green recovery activities, and how it is important for Japan and other countries to share each other’s experiences.

The overview of the seminar is shown in the table below. And, presentation materials of this seminar are attached as Attachment 4.

Table 3-8 Outline of the City-to-City Collaboration seminar

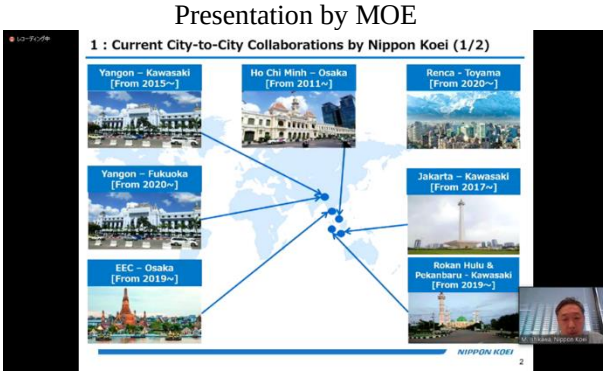
#	Date & Time	Contents	Participants (viewers)
1	27th January (Wed) - 3rd February (Wed)	1. Introduction of the 20 collaboration projects for FY2020 ■On-demand video viewing	Project members & Public (registered people only)
2	1st February (Mon), 14:00-16:00	2. Closed online seminar (Zoom meeting) ■Information sharing on the Japanese government support and open call for the next fiscal year ■[Panel discussion] How can we proceed projects in the corona era?	Project members only

Source: Quoted from a material created by IGES

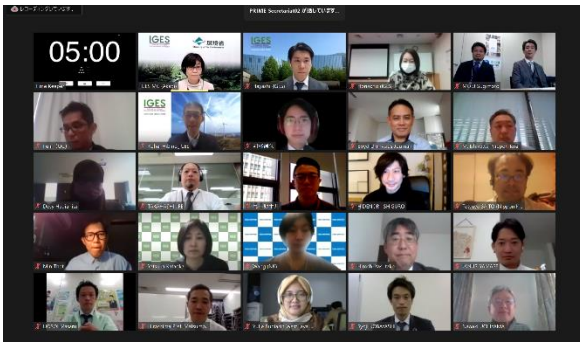


Presentation by MOE

Panel discussion



Presentation by Nippon Koei



Participants in the seminar

CHAPTER 4 FORMULATION OF JCM MODEL PROJECT

4.1 OUTLINE OF THE STUDY FOR JCM MODEL PROJECT FORMULATION

In the Project, the basic study on installing energy-saving and renewable energy equipment in the new industrial park Ywar Thar Gyi East Dagon Industrial Zone (hereinafter called "Dagon Industrial Park") of the owner of Dagon International has been under consideration since last year. Based on the results of the study in last year, the study for JCM Model Project formulation was implemented in FY2020 for a cogeneration system that can be expected to meet the constant energy demand expected from the beginning of industrial park development.

In addition to the above study, the study for JCM Model Project formulation related to energy saving and renewable energy facilities in industrial parks and factories in Yangon City (and its suburbs) has started with a view to realize zero carbon in the entire Yangon City and forming a sustainable city.

The studies for JCM Model Project formulation conducted this year are as follows.

- Study of introducing cogeneration system in Dagon's industrial park
- Study of introducing solar power system in foreign developer's industrial park
- Study of introducing energy saving equipment in food processing factory
- Study of introducing solar power system in Htein Pin disposal site

4.2 CONSIDERATION FOR THE INTRODUCTION OF COGENERATION SYSTEM IN DAGON INDUSTRIAL PARK

In the study conducted in last fiscal year, focusing on the utility infrastructure such as electricity, water and sewage, and waste, a basic study was conducted on the capacity of each infrastructure with the basic plan of this industrial park. In addition, taking into consideration of applying for JCM Model Project, calculation of amount of GHG reduction and JCM subsidy were examined. As a result of discussions with Dagon International about the consideration of various infrastructures, there was a great deal of interest in the cogeneration system, which also contributes significantly to realize low carbon. Therefore, the detailed study was conducted on the feasibility of the cogeneration system on the premise of the JCM Model Project formulation in this fiscal year.

In addition, in order to secure tenant companies that require electricity and steam, which are prerequisites for ensuring business profitability of the cogeneration system, Kawasaki City shared the knowledge on attracting tenant companies using KING SKY FRONT. Furthermore, as an idea to accelerate the attraction of excellent tenant companies, reviewed the cases of industrial parks in each country with the concept of "Eco-friendly" and shared them with Dagon International.

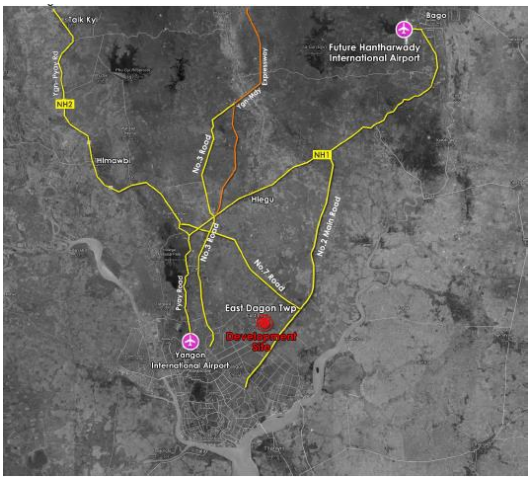
Continuing from last year, JFE Engineering[10]which has a track record and expertise in the cogeneration systems, examined the details of the system and evaluated its feasibility.

[10] In July 2019, JFE Engineering conducted the MOU about the cooperation in this industrial park.

4.2.1 Overview of the industrial park

This industrial park is a new industrial park owned by Dagon International, a conglomerate company in Myanmar of which main business fields are real estate and construction businesses. The site is a few minutes' drive from the new highway linking Yangon City to Mandalay, with good access to the Southeast area towards Thilawa SEZ and future planned international airports. Therefore, this industrial park is expected to be the first food industrial park in Myanmar to overcome the issues of logistics and cold chain in Myanmar.

This industrial park will be a large-scale industrial and commercial complexed facility. Organic market, hotel and other houses will be constructed in the industrial park.



Source：Dagon International

Figure 4-1 Planned site

The planned site of the industrial park has already been acquired and it is 100% owned by Dagon International. This site is utilized for the farmland now. Therefore, land conversion is required, and the cost will be paid by Dagon International (20%) and Myanmar government (80%). Thus, it can be said that this is a government-required project.

In December 2020, the industrial park received the Best Industrial Development of the 2020 Myanmar Property Awards sponsored by Property Guru.

Received Myanmar Property Awards 2020

Myanmar Property Awards 2020

The basic information of industrial park and land use planning are shown as follows.

Table 4-1 Basic information of Dagon Industrial Park

Item	Overview
Name	Ywar Thar Gyi East Dagon Industrial Zone
Place	9.2km from Yangon Expressway (NH2), 7.2km from No.7 Road
Scale	228ha (about 42 times larger than Tokyo Domes, about 4 times larger than Tokyo Disneyland)
CAPEX	11-16 billion
Main facilities	Food processing plant, organic market, refrigeration/freezing facility, wholesale market, safety and quality testing laboratory, power supply facility, waste treatment / recycle facility, hotel, dormitory (apartment), medical facility, administration building, retail store, etc.
Main infrastructures	Water treatment facility, Wastewater treatment facility, Distribution bases, Roads in the industrial park, Lighting facility, etc.

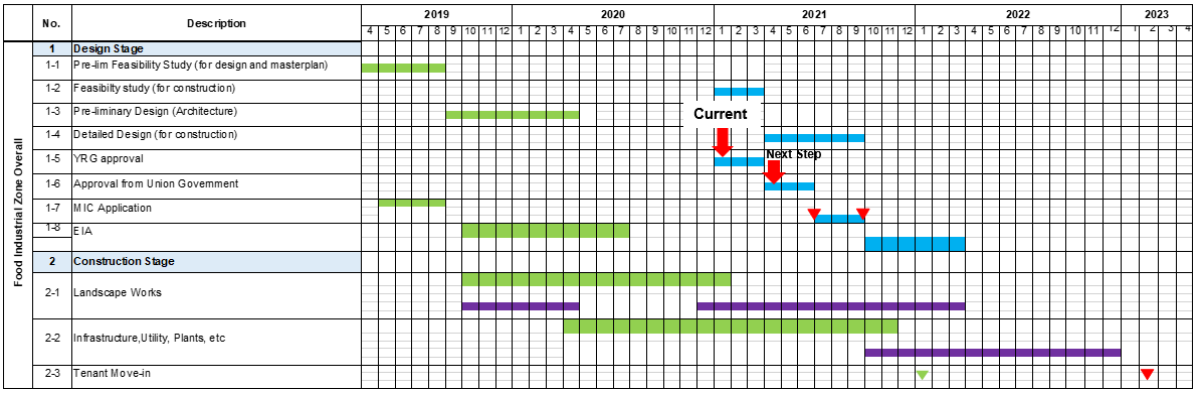
Source: Prepared by Nippon Koei based on Dagon International

Source: Dagon International

Figure 4-2 Land use planning in Industrial Park

Regarding the implementation schedule of this industrial park, due to the COVID-19 pandemic and the election in Myanmar held in November 2020, acquisition of investment approval from MIC has been delayed and the industrial park development schedule has also been delayed. Dagon International had an online meeting with the Chief Minister of Yangon Region in December 2020 and is waiting for the approval from Yangon Region as of January 2021. In addition, after the approval from Yangon Region, it is necessary to obtain approval from the government (MIC). Therefore, the development of a full-scale industrial park is scheduled for the fall of 2021 after obtaining approval from MIC.

The overall schedule of this industrial park as of January 2021 is shown below.



Source:Dagon International

Figure 4-3 Overall schedule of the Industrial Park

A master plan considering the infrastructure, which is the foundation of the industrial park, was prepared in 2017 by a foreign design company. The followings is the outline of main infrastructure facilities of the industrial park confirmed by reviewing the master plan and the meeting with Dagon International.

Table 4-2 Outline of the main infrastructure facilities

#	Item	Overview of the Infrastructure (Master plan)
1	Power Supply	Electricity is received from grid power, transformed from 66 kV to 33 kV in the industrial park, and supplied to factories, hotels and commercial facilities.
2	Water Supply	Residential area, commercial area and factory area, respectively, will be supply 2,453m3/day, 585m3 / day, and 5,250m3 / day. It is planned to take water from Lagunpyin water treatment plant
3	Wastewater Treatment	Wastewater discharged from residential areas and commercial area is treated with a semi-collective treatment system. On the other hand, Wastewater discharged from the factory area is treated by each tenant owner.
4	Waste Treatment Management	Waste disposed from each factory and commercial facility will be carried to Htawe Chaung landfill site under YCCD. The amount of waste from the industrial park has not been estimated.

Source: Prepared by Nippon Koei based on Dagon International

The development of the basic infrastructures such as power supply, water supply and wastewater treatment in the industrial park will be developed separately in three (3) phases. In the 1st phase, the construction of the factory area, the common facilities and hotel will be constructed. In the 2nd phase, in addition to the factory area, residential area will be constructed. The commercial facilities such as an organic market will be constructed in the 3rd phase.

There three development phases for the construction of the industrial park are presented below.

Source: Dagon International

Figure 4-4 Three development phases for the construction

The volume of power supply, water supply and wastewater treatment of each phase are presented below.

Table 4-3 Volume of power/water supply and wastewater treatment

Phase	Area (ha)	Power Supply (MVA)	Water Supply (m3/day)	Wastewater Treatment (m3/day)
Phase1	140.59	30	2,700	2,430
Phase2	39.42	28	6,420	5,770
Phase3	46.98	33		
Total	226.99	100	9,120	8,200

Source: Prepared by Nippon Koei based on Dagon International

Regarding the attraction of tenant companies in this industrial park, it is planned to start as soon as approval is obtained from the Yangon Region, which is expected to be around March 2021 (as of January 2021). In addition, Dagon International intends to attract foreign companies such as Japanese companies.

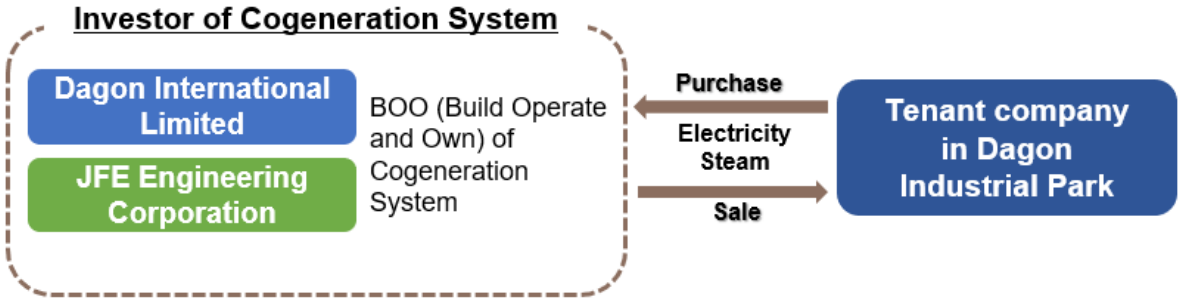
4.2.2 Study of the considerations for the introduction of cogeneration system

1) Assumed specifications of installed equipment

By the meeting with Dagon International, the information such as location conditions and system operating hours, and specifications of the cogeneration system, etc. were confirmed. The business model, operating conditions, and fuel costs in this study are as follows.

(1) Business model

In this survey, the business model assumed that JFE Engineering and Dagon International invest as businesses to construct, own, and operate a cogeneration system and sell the generated power and steam supplied by the cogeneration system to users.



Source:JFE Engineering

Figure 4-5 Planned business model

(2) Operating conditions

In this study, the amount of demand steam was not decided because the tenant (user) has not been determined yet. Therefore, based on the introduction record of JFE Engineering, the equipment specifications were assumed to be the following conditions and assumed that the user consumes (purchases) all the power and steam generated by the cogeneration system.

(3) Fuel costs

The fuel for the cogeneration system is Liquefied Natural Gas (hereinafter called "LNG"). Demand for LNG fuel has been increasing in Myanmar these days, and it is planned to import any shortfall from overseas in the future. But, the market has not yet been formed and its price trend is unknown.

Therefore, the highest, average, and lowest prices from the transaction prices of Japan imported from overseas for the past 10 years were picked up and examined in the calculation (fuel cost sensitivity analysis).

The specifications of the installed equipment are shown below.

Table 4-4 Specification of installation equipment

Items		Condition
Installed Capacity	Electricity	7,610 [kW] (Energy Efficiency 33.1%)
	Steam	17.1 [ton/h] (Energy Efficiency 52.1%)
Operation Period		20 [years]
Operation hours		8,000 [hours] (335days x 24hours)
CAPEX (Rough Estimation)		8,182,000 [USD] (JCM subsidy: 40%)
LNG price (*1)	Max	18.11 [USD/mmBtu]
	Ave	12.04 [USD/mmBtu]
	Min	5.98 [USD/mmBtu]
Tariff	Electricity	180 [Ks/kWh]
	Steam	Settlement of actual fuel costs (charge 52.1% of fuel used)

(*1) Max, average and min LNG prices in Japan for the last 10 years
World bank (https://www.worldbank.org/en/research/commodity-markets)
Source: JFE Engineering

Gas Turbine of Kawasaki Thermal Engineering
Source: HP of Kawasaki Thermal Engineering

Figure 4-6 Examined equipment

2) Examination of business feasibility evaluation

Under the above conditions, the results of calculating the investment recovery, Internal Rate of Return (IRR) and profit are shown below.

Table 4-5 Calculation result of business feasibility evaluation

(Unit: $ 1 million)

LNG Price (USD/MMBtu)		Min	Ave	Max
		5.98	**12.04**	**18.11**
Sales (*1)	Electricity price	7.9	7.9	7.9
	Steam price	1.9	3.9	5.9
	Total	**9.8**	**11.8**	**13.8**

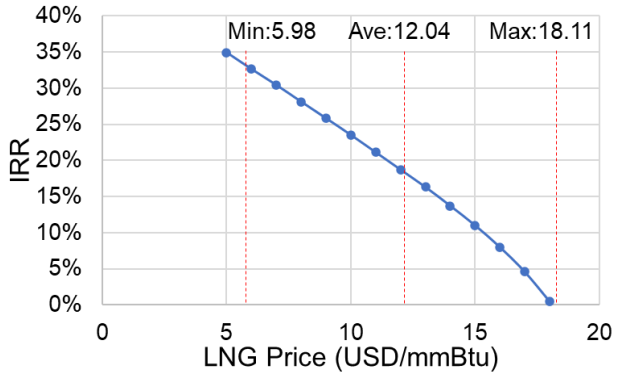
LNG Price (USD/MMBtu)		Min	Ave	Max
		5.98	**12.04**	**18.11**
Operating Expense (OPEX) (*2)	LNG Price	3.7	7.5	11.3
	Maintenance	1.9	1.9	1.9
	Miscellaneous	0.4	0.4	0.4
	General Administrative	0.3	0.3	0.3
	Depreciation	0.5	0.5	0.5
	Total	**6.7**	**10.5**	**14.3**
Profit		**3.2**	**1.4**	**- 0.4**
Investment Recovery [Year]		**2.4**	**4.0**	**15.1**
IRR [%]		**42.0**	**24.2**	**2.5**

(*1), (*2) Trial calculation results based on JFE Engineering internal materials
Source: JFE Engineering

From the results of this calculation, it was recognized that it is necessary to consider the following points for the feasibility of the business.

(1) Revenue fluctuation due to fuel costs

When the fuel cost is the lowest and the average, the profit can be obtained with sufficient business feasibility. However, it is clear that the business feasibility cannot be obtained when the fuel cost rises to the highest value. The correlation between fuel costs and IRR is shown in Figure 4-7.



Source: JFE Engineering

Figure 4-7 Correlation between fuel cost (LNG price) and IRR

Therefore, when implementing this project, it is necessary to hedge the fuel cost fluctuation risk by the following methods.

① A long-term fixed-price contract for fuel cost

A long-term fixed-price contract for fuel costs could raise the unit fuel purchase price by a certain amount. However, if the investment can be recovered during the fixed-price contract period, the feasibility of the business is secured.

② Change of business model (sales of cogeneration system to steam users)

If the cogeneration system is not being introduced as a common infrastructure facility in the industrial park, steam users will have to install boilers and purchase fuel (including transportation costs) by themselves. Even if the cogeneration system is sold to a steam user (tenant company that moves in) instead of Dagon International, the owner of the industrial park, the user will be able to

purchase a power source with a low environmental load, steam, and secure fuel. It will be a proposal with merit.

(2) Confirmation of steam demand by users

In general, the cogeneration system selects specifications according to the user's steam consumption to minimize steam loss. If there is not enough steam, install an auxiliary boiler to cover the shortage.

In this calculation, since the user of this industrial park has not been determined, the calculation was conducted under the condition that the user consumes (purchases) all the generated power and steam. Therefore, it will be necessary to recalculate as soon as the user and the steam demand are confirmed by the user.

3) Examination of the amount of GHG emission reduction and JCM subsidy

The amount of GHG emission reduction by introducing cogeneration system and JCM subsidy were examined. The calculation method and results are shown below.

Calculation method of the amount of GHG emissions reduction

$$GHG emissions\ reduction = Reference\ emissions\ - Project\ emissions$$

$$Reference\ emissions = Gey \times Egf + \left(\frac{Qs}{\eta s}\right) \times Esf$$

$$Project\ emissions = Gey \times (3600/\eta g) \times \left(\frac{1}{NCV}\right) \times Egf$$

Gey [MWh/year]: Annual power generation of gas engine
Egf [ton-CO2/MWh]: Grid Emission Factor
Qs: [GJ/year]: Amount of steam heat supplied and consumed by heat recovery equipment from a gas engine
ηs: Boiler efficiency
Esf [ton-CO2/GJ]: CO2 emission factor of fossil fuels used in boilers
ηg:Power generation efficiency of gas engine
Net Calorific Value (NCV) [MJ/Nm3]: True calorific value of the gas used

The conditions are shown below.

Table 4-6 Calculation condition

#	Items	Condition
1	Condition	Introduce cogeneration system for support of electricity from grid power.
2	Operation hours	24 [hours/day]
3	Grid Emission Factor	0.3
4	Legal durable years	15 years

Source: Prepared by Nippon Koei

Calculation results of the amount of GHG emissions reduction and JCM subsidy

As a result of calculation, 10,077 [tCO2] per year of GHG emission reduction is expected by the introduction of the cogeneration system. The JCM subsidy was 40% of the initial cost and the cost effectiveness was 3,969 [JPY / tCO2].

The calculation results are shown below.

Table 4-7 Calculation results of GHG emission reduction and JCM subsidy

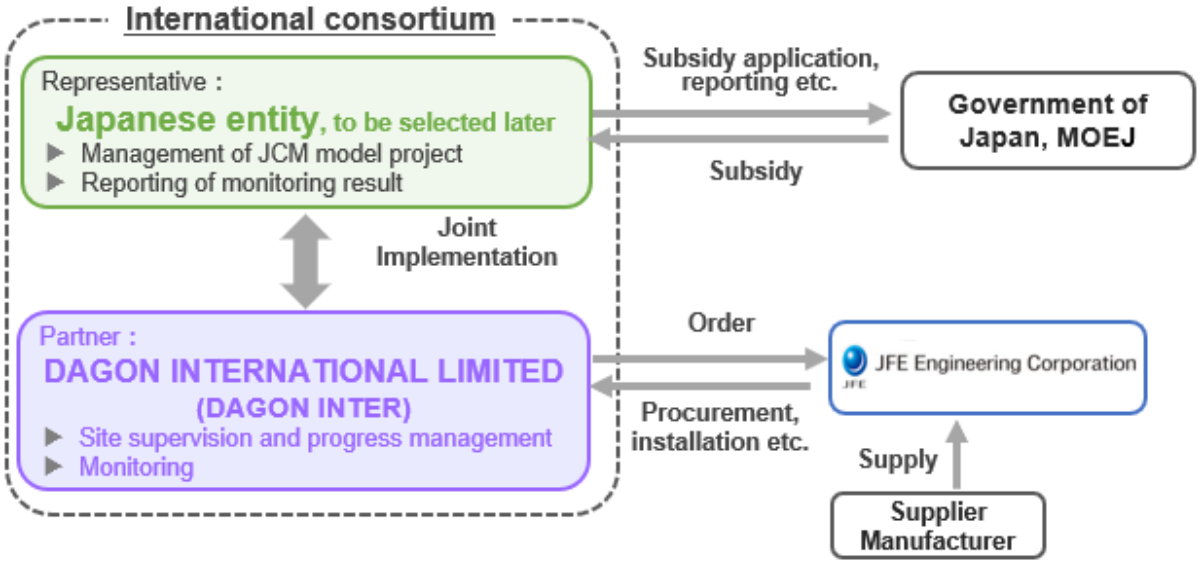
#	Items	Result
1	Total GHG emission reduction	151,158[tCO2/year]
2	Annual GHG emission reduction	10,077 [tCO2/year]
3	Cost-effectiveness	3,969[JPY/tCO2]
4	Estimated initial cost (without subsidy)	13,636,000 [USD]
5	Estimated initial cost (with subsidy)	8,182,000 [USD]
6	JCM Subsidy amount (% of Initial cost)	5,454,000 [USD] (40%)

Source: Prepared by Nippon Koei

4) Coordination for International Consortium

In this study, after determining the technologies to introduce in Dagon Industrial Park, representative participant (Japanese entity) will be selected. Representative participant will manage JCM Model Project and will confirm and report the monitoring result. Also, JFE Engineering, a local EPC, will procure equipment from Japanese manufacturer and install the equipment in Dagon Industrial Park.

The International Consortium for the proposed project is presented below.

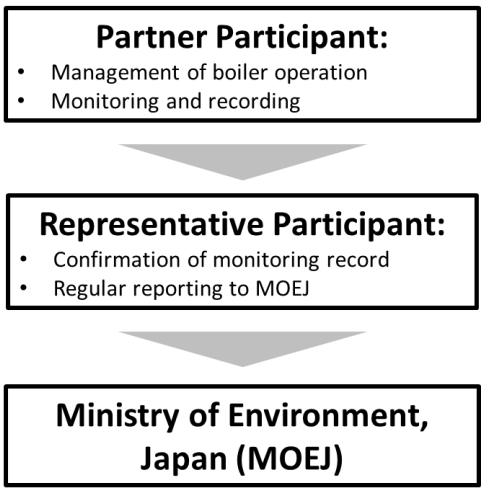


Source: Prepared by Nippon Koei

Figure 4-8 International consortium for the proposed Project

5) Monitoring Plan

The monitoring system is shown in the figure below. The data recorded by the monitoring equipment will be reported to MOE from the partner participant through the representative participant.



Source: Prepared by Nippon Koei

Figure 4-9 Monitoring structure

In this project, candidate monitoring items are assumed to be general items (power consumption, power generation, fuel consumption, etc.), and regular checks should be conducted under appropriate management and operation by Dagon International. It is expected that there is no problem to acquire MRV data. In addition, the measuring instrument shall conform to international standards such as IEC standards.

6) Potential of JCM Model Project formulation

Regarding the results of this study, Dagon International commented that it was a reasonable result and that the amount of electricity and steam was also appropriate. Although the concrete plan for attracting tenant companies that require electricity and steam in the Dagon Industrial Park has not been finalized yet, there were comments suggesting that it would be applied to other industrial parks owned by Dagon International.

Based on the results of this calculation, it is expected that the system will be deployed horizontally as a low-carbon energy source by formulating of JCM Model Project at an early stage.

4.2.3 Knowledge sharing of eco-friendly industrial parks

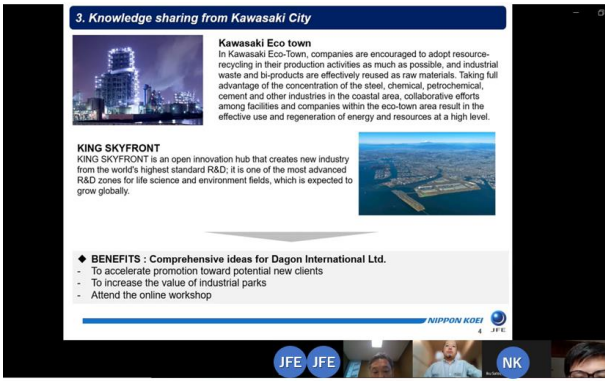
In order to introduce the cogeneration system, it is necessary for a certain number of tenants who need electricity and steam to move into the industrial park. Therefore, as a knowledge sharing related to attracting tenant companies, Kawasaki City explained the case of KING SKYFRONT. In addition, as one of the ideas for developing attractive industrial parks that are the key to attracting tenant companies, reviewed the cases of eco-friendly industrial parks in each country and shared them with Dagon International.

The outline of the content of knowledge sharing regarding eco-friendly industrial parks is as follows.

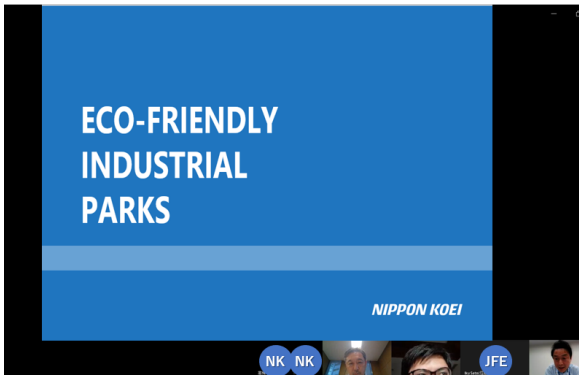
- **OVERVIEW**
  - Eco-Industrial Park concept
  - Benefits of Eco-Industrial Park
  - Examples of companies going ‘green’

- General components of Eco-Industrial Park (UNIDO)

- **CASE STUDIES**
  - Energy
  - Water
  - Wastewater
  - Solid Waste
  - Pollution
  - Traffic
- **PROMOTION FOR "ANCHOR TENANT"**



Online meeting with Dagon International



Online meeting with Dagon International

4.3 STUDY FOR THE INTRODUCTION OF SOLAR POWER SYSTEM IN FOREIGN DEVELOPER'S INDUSTRIAL PARK

A foreign developer "Company A" has plan to introduce the solar power generation system in new industrial park owned by Company A.

This industrial park obtained an approval from MIC in 2020. However, the introduction of solar power generation system in the industrial park scheduled for 2020 will be implemented from next fiscal year. Therefore, it is desirable to carry out the survey from next fiscal year.

4.4 STUDY FOR THE INTRODUCTION OF ENERGY SAVING EQUIPMENT IN FOOD PROCESSING FACTORY

Merry Time Foods Co., Ltd (hereinafter called "Merry Time Foods"), a Japanese food processing factory company, has a food processing factory (mainly seafood processing) in Yangon City, and the contract of rental factory will expire at the end of July 2021. Currently, it has started operation at another factory in Yangon City, and they produced at two factories. After August 2021, when the rental factory contract expires, the new contracted factory will be integrated and operated, but the boiler, heating equipment, freezing equipment, etc. used in the current rental factory will be newly installed and replaced. Merry Time Foods is also considering supplementing electricity by introducing solar power generation.

Source：Merry Time Foods Co., Ltd

Figure 4-10 MERRY TIME FOODS MYANMAR

In this survey, based on the results of interviews with the company regarding installed capacity the amount of GHG emissions reduction related to freezing facility and solar power generation was examined. From the examination results, it was confirmed that the total amount of GHG emissions reduction by introducing the freezing facility and solar power generation was 4,260 [tCO2] and there was a certain amount of GHG emissions reduction by them. For the next step, following the impact of COVID-19 pandemic, consider the timing of replacement and the select the manufacturers of the facilities.

The examination results of the amount of GHG emissions reduction for each facility are as follows.

Table 4-8 Calculation results of GHG emission reduction and JCM subsidy

#	Items	Condition/Result
Freezer		
1	Energy consumption per year	12,000 [MWh/year]
2	Emission factor	0.3 [tCO2/MWh]
3	Legal durable years	10 [years]
4	Estimated GHG emission reduction	3,600 [tCO2]
PV System		
1	Capacity	1.0 [MW]
2	Emission factor	0.319 [tCO2/MWh]
3	Legal durable years	12 [years]
4	Estimated GHG emission reduction	660 [tCO2]

Source: Prepared by Nippon Koei

In addition, Merry Time Foods conducted a survey "Feasibility Survey for Shrimp Hatchery Technologies in Myanmar" by JICA scheme in FY2018. Since hatchery consumes a large amount of electricity, it is desirable to generate electricity by renewable energy such as solar power generation and wind power generation.

This site is the Ayeyarwady region located west of Yangon City, but from the next fiscal year, it is desirable to consider the formation of JCM Model Projects related to renewable energy.

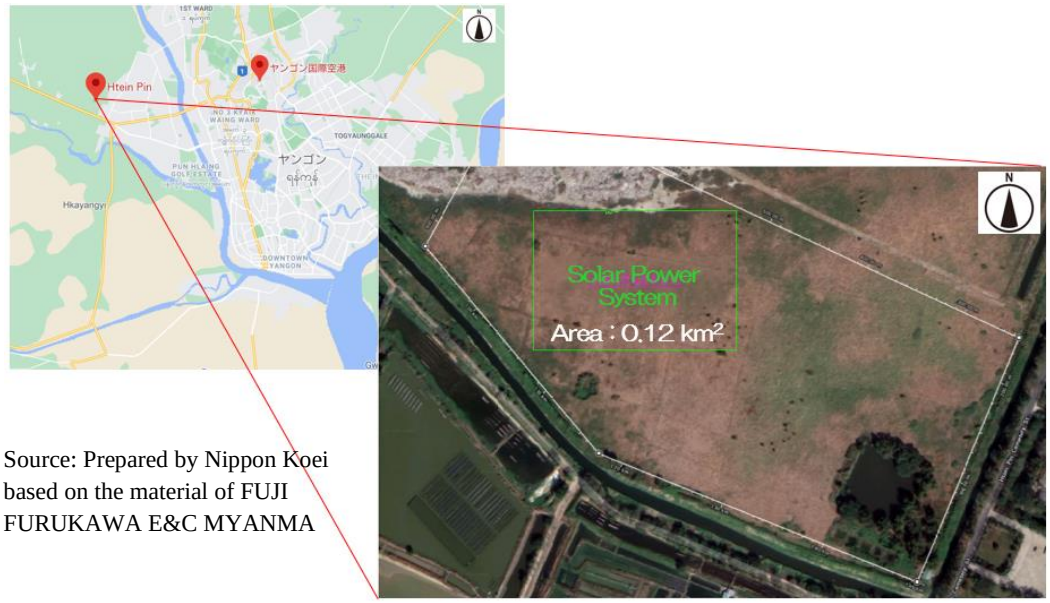
4.5 STUDY FOR THE CONSIDERATION OF THE INTRODUCTION OF SOLAR POWER SYSTEM IN HTEIN PIN DISPOSAL SITE

The study considers the introducing the solar power generation facility (3 MW scale) for the surplus space of the Htein Pin disposal site, which is one of the final disposal sites of YCDC. This survey was started in November 2019 after receiving a proposal from UECC to the JCM Model Project as one of the effective utilization methods of unused land owned by UECC.

This survey was conducted with the support of FUJI FURUKAWA E&C MYANMAR, a Myanmar subsidiary of Fuji Furukawa Engineering & Construction Co., Ltd. which has a large track record of introducing solar power generation systems in Southeast Asia. It was difficult to carry out a field survey due to the COVID-19 pandemic in Myanmar, but it was examined with reference to the information from the field visit conducted last year and similar cases in the past.

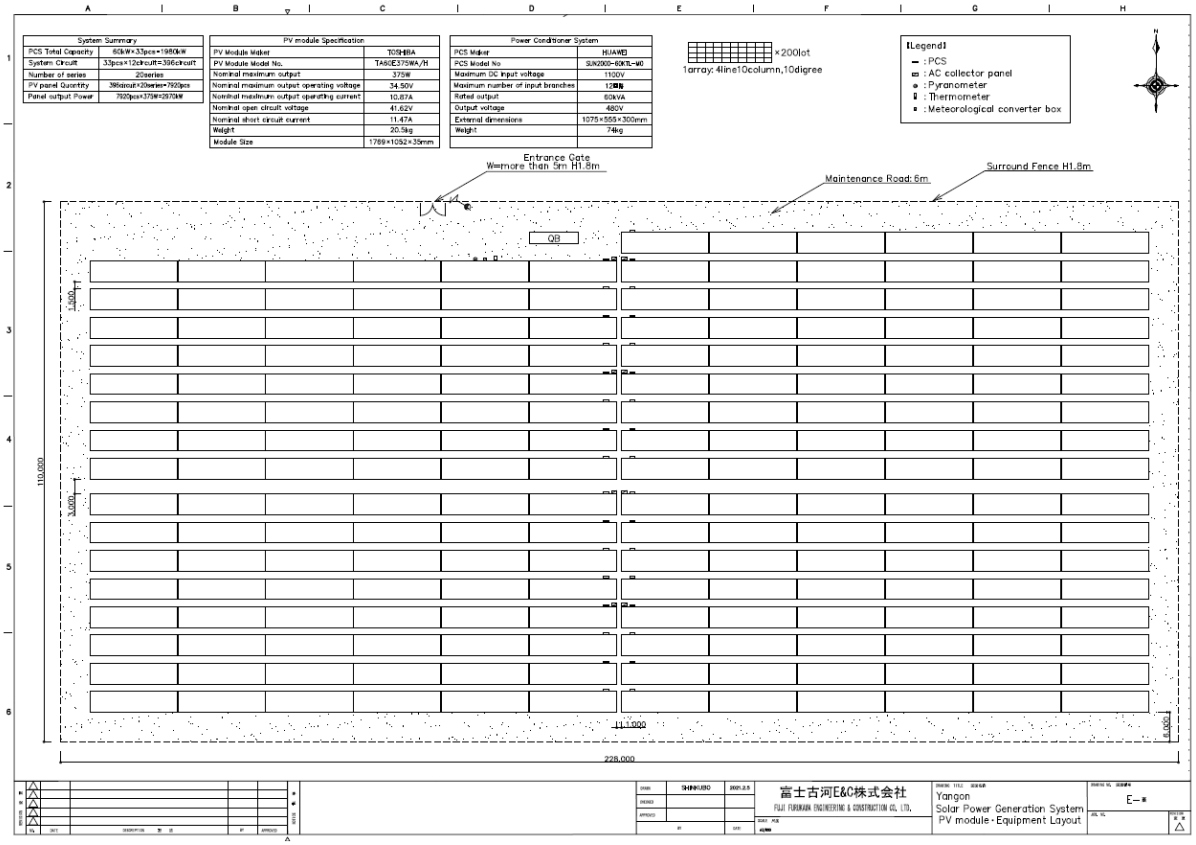
The electricity generated by the solar power generation system at this site will not be supplied to the existing grid, but it will be consumed at the YCDC facility that will be constructed on the site in the future.

Candidate sites, system images and system outlines are as follows.



Source: Prepared by Nippon Koei based on the material of FUJI FURUKAWA E&C MYANMA

Figure 4-11 Location of candidate site



Source: FUJI FURUKAWA E&C MYANMAR

Figure 4-12 System overview

Solar power　　Power Conditioner

Source: FUJI FURUKAWA E&C MYANMAR

Figure 4-13 Examined equipment

Table 4-9 System overview and specifications

#	Items	Condition
System Summary		
1	Power Conditioner Total Capacity	60kW×33pcs=1,980kW
2	System Circuit	33pcs×12series=396circuit
3	Number of series	20series
4	Solar power panel Quantity	20circuit×396series＝7,920pcs
5	Solar power panel output Power	375W×7,920pcs＝2,970kW
Solar Power Module Specification		
1	Module Maker	TOSHIBA
2	Module No.	TA60E375WA/H
3	Nominal maximum output	375W
4	Nominal maximum output operating voltage	34.50V
5	Nominal maximum output operating current	10.87A
6	Nominal open circuit voltage	41.62V
7	Nominal short circuit current	11.47A
8	Weight	20.5kg
9	Module Size	1,769×1,052×35mm
Power Conditioner System		
1	Power Conditioner Maker	HUAWEI
2	Power Conditioner Model No	SUN2000-60KTL-M0
3	Maximum DC input voltage	1,100V
4	Maximum number of input branches	12
5	Rated output	60kVA
6	Output voltage	480V
7	External dimensions	1,075×555×300mm
8	Weight	74kg

Source: FUJI FURUKAWA E&C MYANMAR

Under the above conditions, the amount of GHG reduction by introducing this system was estimated, and the amount of GHG emission reduction was 16,599 [tCO2] and the subsidy was 22%.

For the next step, it needs to discuss with UECC regarding the formulation of JCM Model Projects, including the schedule for introducing this system and the formation of an international consortium.

Calculation results are as follows.

Table 4-10 Calculation results of GHG emission reduction and JCM subsidy

#	Items	Condition/Result
1	Capacity	3.0 [MW]
2	Emission factor	0.319 [tCO2/MWh]
3	Legal durable years	12[years]
4	Subsidy	22 [%]
5	Cost effectiveness	3,880 [JPY/tCO2]
6	Estimated GHG emission reduction	16,599 [tCO2]

Source: Prepared by Nippon Koei

4.6 OTHER PROJECTS

It was confirmed that Company B, a major local cement company, is considering the introduction of a solar power generation system, storage battery, and energy management system (hereinafter called "EMS") in its factory. In the Project, an overview of JCM was explained to Company B, and the Company B was interested in JCM.

From the next fiscal year, it will be planned to hold discussions with Company B to formulate of JCM Model Projects.

CHAPTER 5 ISSUES AND INGENUITY IN CONDUCTING THE PROJECT AGAINST THE BACKDROP OF COVID-19

Since January 2020, COVID-19 was a pandemic all over the world. In Myanmar, the number of infected people has increased sharply since August 2020, and the lock down in the city has been announced. As of the end of January 2021, over 1.4 million people have been infected and as of the end of January 2021, there were hundreds of people infected per day.

Regarding the impact of COVID-19 pandemic on Myanmar's economy, the World Bank announced in December 2020 that the economic growth rate (estimated value) of Myanmar in 2019/2020 (October 2019 to September 2020) was 1.7%, which is much lower than 6.6% in the previous year. It is pointed out that the COVID-19 pandemic and the accompanying movement restriction have affected consumption and investment, and the stagnation of business activities and the supply of raw materials and labor.

In this situation, field work, discussion between YCDC and Kawasaki City, workshop and City-to-City collaboration seminar, etc., which are usually major activities, were conducted completely online in this year.

By holding online activities, some advantages were confirmed. For example, since the number of participants is not limited online, the number of C/P staffs involved in this project has expanded. Also, it is possible to supply training materials to C/P by shooting videos.

On the other hand, there was concern that gaps and time differences in attitudes toward business would occur because both C/P could not talk face-to-face. In addition, YCDC's activities seems to be increased for the new work related to COVID-19. Therefore, it was difficult to keep in touch with YCDC remotely from Japan.

In this project, we tried to implement the project smoothly by taking the following measures to deal with the problems caused by COVID-19 pandemic.

Promotion of cooperation with local staff

From previous experience, telephone follow-up and face-to-face negotiations are indispensable for collaboration with YCDC, in addition to the online meetings. In response to this point, the local staff of Myanmar Koei International Ltd., a local subsidiary of Nippon Koei, stayed in close contact with YCDC to share information and foster communication. As a result, even when YCDC was busy, it was possible to keep track of the local situation. In addition, the requests from YCDC could be confirmed at any time, contributing to the smooth implementation of this project.

Active utilization of online meeting

By holding an online meeting and actively providing a place for C/P personnel to have face-to-face dialogue even through computers, it was able to confirm the timely needs and seeds of both cities for this project. In addition, by narrowing down the themes in the meeting and clarifying it in advance, clear and efficient discussions were able to be conducted on high-priority themes.

Furthermore, by utilizing the simultaneous interpretation function of the online meeting tool, intensive discussions were held in a limited time. The following is an example of the transition to an online meeting related to the activities of the Project.

#	Activity Plan under City-to-City Collaboration	Activity plan (Not considering the effect of COVID-19)	Changed plan (Considering the effect of COVID-19 pandemic)
1	Workshop with YCDC	• 1 time/year, Half-day to one-day WS • Holding by face-to-face in the conference room in YCDC	• **Method: Making video and distribution** • **Video contents: 10-20 min/video Knowledge sharing from Kawasaki City about solid waste management, SDGs, Air pollution management and urban revitalization** • **Interpretation: Japanese⇔Myanmar**
2	City-to-City Collaboration Seminar by MOE	• 1 time/year • About 2 staffs will be invited from YCDC (implemented with No. 3)	• **Participate in the online meeting**
3	Training in Japan (Implementation in Kawasaki City)	• 1 time/year and 6 days training • About 2 staffs will be invited from YCDC (About 8 days)	• **Method: Online** • **Time: 1day/1.5-2 hours** • **Interpretation: Japanese⇔Myanmar** • **Introduction of Kawasaki International Eco-Tech Fair, Outline of GIC and GIC member companies**

Source: Prepared by Nippon Koei

Figure 5-1 Example of the transition to an online meeting

Knowledge sharing with videos

A presentation by Kawasaki City for knowledge sharing was recorded and created as videos with Myanmar language translation. Due to the high internet penetration rate in Myanmar, the knowledge sharing videos were released on the internet so that many YCDC staffs could watch them at any time from their homes, workplaces, or other locations. The presentation of knowledge sharing by Kawasaki City, which was previously only available to a limited number of staff who can participate in the workshop, will be released as a video so that it can be watched to by a wide range of staff, from young staff to managerial staff.

Source: Prepared by Nippon Koei

Figure 5-2 Image of knowledge sharing using videos

Support for JCM Model Project formation in anticipation of medium- to long-term impact

Due to the influence of COVID-19 pandemic, the approval from MIC was delayed, and the schedule for industrial park development was delayed. Dagon Industrial Park is one of them, and the knowledge was shared with Dagon International about how to attract tenant companies, which will be necessary

after approval is obtained. By smoothly conducting of attracting tenant companies, it is expected that the introduction of the cogeneration system which was examined in the Project will become more feasible and the potential for JCM Model Project formulation will increase.

CHAPTER 6 FUTURE PLAN

A military coup d'etat in Myanmar on 1st February 2021 has caused confusion such as the issuance of a national emergency declaration.

This chapter summarizes future plans on the premise that City-to-City Collaboration projects will continue in the next fiscal year in Myanmar, where domestic confusion is expected in addition to the impact of COVID-19 pandemic. It is proposed based on the local information as of the end of January 2021.

6.1 APPLICATION OF JCM MODEL PROJECT

As a result of the above study in FY2020, the candidate projects of the application for JCM Model Project in FY2021 are presented below.

Table 6-1 Candidate projects of the application for JCM Model Project in FY2021

#	Project	Feasibility	JCM Application
1	Consideration of introducing cogeneration system in Dagon Industrial Park	After obtaining development approval from the Yangon Region, which is scheduled for around March 2021, the attraction of tenant companies will begin. If the tenant companies that move in can be expected and the demand for steam gas can be expected to a certain extent, an application for JCM Model Project can be expected.	Late period FY2021
2	Consideration of introducing of energy saving equipment in food processing factory	If fluctuations in production volume due to COVID-19 pandemic have settled down, and the selection of the manufacturer of the equipment to be introduced and the timing of the introduction meet the requirements of JCM, an application for the JCM Model Project can be expected.	Middle period FY2021
3	Consideration of introducing of solar power system in foreign developer's industrial park	Since the approval by MIC of this industrial park has already been obtained, application for JCM Model Project can be expected by conducting the study for JCM Model Project formulation.	Late period FY2021
4	Consideration of introducing solar power system in Htein Pin disposal site	By continuing discussions with YCDC (UECC) in FY 2021, application for JCM Model Project can be expected by conducting the study for JCM Model Project formulation.	Late period FY2021
5	Consideration of introducing solar power system, storage battery, EMS for local cement companies	By considering the capacity of the solar power generation system and utilization method of the storage batter, an application for the JCM Model Project can be expected.	Late period FY2021

Source: Prepared by Nippon Koei

【Reference】
Under new construction investment such as industrial park/urban development, development of road traffic/communication infrastructure, electricity/energy field, revival of manufacturing industry, improvement of productivity by utilizing digital technology, etc. the World Bank predicts that Myanmar's economic growth will recover to an average of 7%.
Source: Myanmar Economic Monitor: Coping with COVID-19 (December 2020)

Although there are some concerns about the impact of external factors such as delays in the approval process of government agencies due to COVID-19 pandemic, it is expected that JCM Model Projects will be formulated in the middle or late period in FY2021, centred on companies such as industrial park and food processing factories. Therefore, in the first period in FY2021, it will be continued to follow up on the formulation of JCM Model Projects to local and Japanese companies which have been in contact so far and provide support for applications.

6.2 PROPOSED PTOJECT FOR FY2021 CITY-TO-CITY COLLABORATION

As a result of the Project in FY2020, the activities of the City-to-City Collaboration project in FY2021 are proposed below.

Menu in FY2020		Result in FY2020
#	City-to-City Collaboration in FY2020	City-to-City Collaboration in FY2020
1	Support for industrial park development by City-to-City Collaboration	• Implementation of knowledge sharing using KING SKYFRONT as an example • Knowledge sharing related to air pollution monitoring • Knowledge sharing related to waste management
2	Activities related to SDGs cooperation	• Implementation of knowledge sharing related to monitoring and evaluation methods related to the achievement of SDGs
#	Study for JCM model project formulation in FY2020	Study for JCM model project formulation in FY2020
1	Considering the introduction of a cogeneration system in the Dagon Industrial Park	• Examination of business feasibility evaluation related to cogeneration system
2	Consideration of introducing a solar power generation system in a new industrial park of a foreign developer	• Conducted a full-scale survey after FY2021 (confirmed the postponement of the introduction time of the solar power generation system)
3	Considering the introduction of energy-saving equipment in food processing factories	• Examination of GHG emission reduction amount by introducing freezer and solar power generation system
4	Consideration of introducing solar power generation system at the Htein Pin disposal site	• Examination of system and civil condition, etc. and examination of GHG emission reduction amount

Propose in FY2021	
#	City-to-City Collaboration in FY2021
1	• **Strengthening knowledge sharing related to air pollution control (with the cooperation of GIC member company Green Blue, regarding technologies that can be used for YCDC)**
2	• **Support for the implementation of SDGs initiatives in UECC**
#	**Study for JCM model project formulation in FY2021**
1	• **Examination of application for JCM model project related to introduction of cogeneration system** • **Continued implementation of JCM model project formulation survey for tenant companies**
2	• **Continued implementation of JCM model project formulation survey (continuation of discussions with YCDC)**
3	• **Examination of application for JCM model project related to introduction of freezer and solar power generation systems** • **Start of the study on renewable energy introduction**
4	• **Continued implementation of JCM model project formulation survey**
5	**Study of Solar power generation system introduction at a local cement factory (New)** **Start of the study for JCM model project formulation**

Source: Prepared by Nippon Koei

Figure 6-1 Proposed project for FY2021 City-to-City Collaboration

In FY2021 City-to-City Collaboration between Yangon City and Kawasaki City, it will be strengthened the sharing of knowledge related to air pollution control, which confirmed high interest from YCDC in the business seminar between GIC members and YCDC held in the Project.

Regarding air pollution control, the monitoring system implemented in Kawasaki Environment Research Institute was shared through a video in the Project. Next fiscal year, as more specific support, it will be to collaborate with GIC member companies to consider introduction technology and cooperation methods that meet local needs. For example, an air pollution monitoring system that uses constant monitoring sensors at fixed points and movement survey by vehicles, motorcycles and pedestrians at any point and any period, etc.

Cooperation on SDGs stared last fiscal year. In FY2019, the tatus of efforts on SDGs were reported by both cities, and the evaluation method and performance indicators related to SDGs in Kawasaki City were shared through a video in FY2020. Therefore, in FY2021, it will be planned to carry out activities aimed at embodying efforts related to SDGs in YCDC (especially UECC).

Regarding the study for JCM Model Project formulation in FY2021, consideration of introducing solar power generation system in a new industrial park owned by foreign developer Company A, consideration of introducing of renewable energy related to aquaculture business by Merry Time Foods (although it is outside Yangon City) and consideration of introducing of solar power generation systems at Company B, a major local cement company is planned to start. Regarding the introduction of the solar power generation system at the Htein Pin disposal site implemented in this fiscal year, it will be continued to be considered in cooperation with GIC member companies that have EMS technology.

Consideration of introducing the cogeneration system in the Dagon Industrial Park and the energy-saving equipment in the food processing factory will continue to be supported for the formulation of the JCM Model Project.