FY2023 Project for Ministry of the Environment Japan

## FY2023 City-to-City Collaboration Programme for Zero-Carbon Society

Project to Promote Decarbonization and SDGs Dominoes through Participation in the Race to Zero by Renca, Santiago

## **Final Report**

March 2024

Nippon Koei Co., Ltd. Toyama City

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Presentation materials of Workshop

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- 2. Nippon Koei
- 3. Tehmco
- 4. Ryohshin

## **Abbreviations**

AI	Artificial Intelligence	
ART	Advanced Rapid Transit	
CCU	Carbon dioxide Capture and Utilization	
CGS	Co-Generation System	
CN	Carbon Neutral	
СОР	Conference of the Parties	
COVID-19	Coronavirus Disease of 2019	
CSR	Corporate Social Responsibility	
DDF	Diesel Dual Fuel	
DEL	Directorate of Local Economic Development	
DIDECO	Directorate of Community Development	
DIMAO	Directorate of Environment, Cleaning and Ornament	
DOM	Directorate of Municipal Works	
ESCO	Energy Service Company	
EV	Electric Vehicle	
FC	Fuel Cell	
FCEV	Fuel Cell Electric Vehicle	
GEC	Global Environment Centre Foundation	
GHG	Greenhouse gas	
HRS	Hydrogen Refueling Stations	
ICT	Information and Communication Technology	
JCM	Joint Creditting Mechanism	
JICA	Japan International Cooperation Agency	
KPI	Key Performance Indicator	
LED	Light Emitting Diode	
METI	Ministry of Economy, Trade and Industry	
MW	Mega Watt	
NDC	Nationally Determined Contribution	
OECD	Organisation for Economic Co-operation and Development	
PPA	Power Purchase Agreemen	
PV	Photovoltaic	
SDGs	Sustainable Development Goals	
SECPLAN	Communal Planning Secretary	
SMI	Sakai Mobility Inovation	
SPEC	Special Presidential Envoy for Climate	
SPEC	Special Presidential Envoy for Climate	
UK	the United Kingdom of Great Britain and Northern Ireland	
UNFCCC	United Nations Framework Convention on Climate Change	
VPP	Virtual Power Plant	
V2H	Vehicle to Home	
ZEB	Net Zero Energy Building	

## CHAPTER 1. BACKGROUND AND OBJECTIVES

## 1.1 BACKGROUND

As mentioned in the Sixth Assessment Report (AR6) released by the Intergovernmental Panel on Climate Change (IPCC) Working Group III in 2022 shows that cities generate approximately 70% of global greenhouse gas (GHG) emissions. Thus, it is essential to make cities accelerate climate action to meet the Paris Agreement goal of limiting the temperature increase to  $1.5^{\circ}$ C above pre-industrial levels. To achieve zero-carbon cities, the Japanese government and cities are working together to create more than 100 "decarbonization leading areas" under the Regional Decarbonization Roadmap formulated in June 2021 and promote expansion of these regions throughout Japan.

For the world to move toward zero-carbon society, it is necessary to accelerate the movement toward making a sustainable zero-carbon society, especially in Asia, where economic growth is remarkable. Support for cities' efforts is being strengthened internationally to zero-carbon cities, which are the places of activities that support social and economic development.

As an example, the Ministry of the Environment, Japan (MOEJ) launched the Clean City Partnership Program (C2P2) with JICA in February 2023 to address the challenges facing global cities from multiple perspectives, and this project is the main activities of C2P2. The C2P2 will provide comprehensive and synergistic support to partner cities to address urban challenges, including climate change, environmental pollution, circular economy, and nature positive issues through further mobilization of technology and funds in collaboration with Japanese local governments, private companies, and financial institutions. It will also promote collaboration with other key stakeholders, including G7 and other countries and international development banks.

In this City-to-City Collaboration Programme, Japanese research institutes, private companies, universities, etc., together with Japanese cities that have experience and know-how in the formation of decarbonized societies, conduct research projects to support overseas partner cities in forming decarbonized societies and introducing facilities that will contribute to forming decarbonized societies.

In 2020, the Government of Chile updated its nationally determined contribution (NDC) and set an interim target of 95 MtCO<sub>2</sub>eq of greenhouse gas (GHG) emissions by 2030, an emissions peak by 2025, and a carbon budget not exceeding 1,100 MtCO<sub>2</sub>eq from 2020 to 2030 with a vision to achieve carbon neutrality by  $2050^{1}$ . In 2019, Government also announced a plan to close all coal-fired power plants by 2040 and achieve carbon neutrality in the energy sector by 2050, and to aim at 70% of the energy mix to be based on renewable energy by  $2030.^{2}$  To achieve these government targets as well as green recovery from COVID-19 pandemics, there

<sup>&</sup>lt;sup>1</sup> https://mma.gob.cl/wp-content/uploads/2020/07/Ingles-21-julio.pdf

 $<sup>^2\</sup> https://www.gob.cl/noticias/presidente-pinera-presento-plan-para-cerrar-todas-las-centrales-energeticas-carbon-para-que-chile-sea-carbono-neutral/$ 

are high expectations for reduction of GHG emissions and financial support by JCM model projects mechanisms.

At the municipal level, Renca Municipality, located in the capital city of Chile, Santiago, is one of the municipalities where GHG emission sources such as thermal power plants and factories are concentrated. Renca has been actively committed to climate change issues and announced participation in Race to Zero campaign at COP26 in 2021, as a first municipality of Chile. As one of the solutions to achieve the target of Race to Zero, there are high expectations for knowledge and information sharing through city-to-city collaboration projects and financial support through JCM model projects.

## **1.2 OBJECTIVES OF THE PROJECT**

This project has mainly two purposes: i) support Renca municipality develop policies/plans to achieve their goals for Race to Zero, and ii) reduce GHG emission by formulation of JCM projects following the needs of the companies in Renca using the technology such as energy saving, renewable energy, and advanced technology, and implemented the following activities.

<City-to-city collaboration activities: Support for policy formulation>

- Implementation of planning to support the achievement of Race to Zero
- Study and implement specific actions on SDGs
- Implementation of the decarbonization and SDGs dominoes
- <JCM project formation activities>
- > Formulation of JCM model projects etc.

## **1.3** CITIES PARTICIPATING IN THE PROJECT

## 1.3.1 Toyama City

Toyama City is the capital and the largest city of Toyama Prefecture, located in the central and southeastern part of the prefecture, and is designated as a core city. The location map of Toyama City is shown in the following figure, and the main statistics of the city are shown in the following table.



Source: Toyama City

Figure	1-1	Location	map o	f Tovama	Citv
8		2000000	mp v		~-•,

#	Item	Overview
1	Area	1,241.70 km <sup>2</sup>
2	Population	406,093 (as of January 2024)
3	Population density	327 people/km <sup>2</sup> (as of January 2024)
4	Number of households	185,195 (as of January 2024)
5	Number of businesses	22,883 (Economic Census for Business Frame in 2019)
	6 Major industries	Wholesale and retail trade:348 establishments (18.6%)
6		Real estate and goods leasing:238 establishments (12.8 %)
		Construction industry:197 establishments (10.6%)
		(Basic Survey of Economic Census, 2019)

Table 1-1 Outline of Tovama City	Table 1-1	Outline o	f Tovama	City
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Source: Prepared by Nippon Koei based on the Toyama City

Toyama City has been actively publishing its efforts to build a sustainable city both in Japan and abroad (Table 1-2). Toyama City has experience of international cooperation in environmental and agriculture fields, including the Ministry of the Environment's City-to-City Cooperation Project, mainly in Southeast Asia, especially in Indonesia.

The major initiatives by Toyama are summarized as follows.

### Table 1-2 Activities of Toyama City for Sustainable Urban Development and City-to-City Collaboration

Year	Item	Overview
2008	ECO Model City	Efforts to shift to a "low-carbon society" and CO <sub>2</sub> reduction
		plan based on the compact urban development were highly
		evaluated.
2011	Environmental Future City	The strategic proposal for a compact city was considered to be
		a model for solving the problems faced by local cities. It also
		plays a role in disseminating Toyama City's knowledge and
		various initiatives both nationally and internationally.
2014	Sustainable Energy for All	A plan aimed at improving energy efficiency was formulated
		to achieve the targets proposed by the United Nations
0014	100 0 11 0 01	SE4ALL.
2014	100 Resilient City	Toyama City was selected by the Rockefeller Foundation as
		one of 100 Resilient Cities (RC100) that have resilience to
2016		risks and challenges faced by cities, such as natural disasters.
2016	G/ Ioyama Environment	Promoting city-to-city collaboration for development of
	Winisters Weeting	resident cities that have the best balance between quality of
		ummerized the discussions in the normalial session "The Dala
		of Cities" as the Chair of session
2016	Selected as a Participating	Selected as one of the world's top cities with world-class case
2010	City in the World Bank's	studies on various development issues facing cities around the
	"Cities Partnership Program	world the city signed a Memorandum of Understanding with
		the World Bank to conduct joint research, identify good
		practices, and share knowledge, and announced a cooperation
		plan.
2017	FY2017 City-to-City	Toyama City, as a diverse environmental city, shared their
	Collaboration Project	knowledge with Semarang, and examined the application of
	between Toyama City and	JCM model projects with low-carbon projects
	Semarang, Indonesia	(Transportation, renewable energy, etc.) in which companies
		in Toyama City have.
2018	FY2018 City-to-City	Toyama City, as a diverse environmental city, shared their
	Collaboration Project	knowledge with Bali, and examined the application of JCM
	between Toyama City and	model projects with low-carbon projects (energy saving,
	Bali, Indonesia	renewable energy, fuel conversion, etc.) in which companies
2010		in Toyama City have.
2018	SDGs Future Cities and	Toyama City was selected by the Cabinet Office as a
	model project for SDGs of	municipality that integrally commit to a wide range of social
2020	EV2018 City to City	and environmental issues.
2020	FY2018 City-to-City	Ioyama City, as a diverse environmental city, shared their linear of ICM
	between Toyama City and	model projects with low-carbon projects (small-scale
	Iskandar Development	hydraulic power generation, etc.) in which companies in
	Region Malaysia	Toyama City have
2020	FV2018 City-to-City	Toyama City as a diverse environmental city shared their
2020	Collaboration Project	knowledge with Bali and examined the application of ICM
	between Toyama City and	model projects with low-carbon projects (renewable energy
	Kota Kinabalu, Malavsia	etc.) in which companies in Tovama City have.
2020	FY2018 City-to-City	Toyama City, as a diverse environmental city, shared their
	Collaboration Project	knowledge with Bali, and examined the application of JCM
	between Toyama City and	model projects with low-carbon projects in which companies
	Male, Maldives	in Toyama City have.
2021	Declaration of "Zero	The city has declared itself a "Zero Carbon City" with the
	Carbon City" aiming for	goal of achieving virtually zero greenhouse gas emissions by

Year	Item	Overview
	virtually zero greenhouse	2050, and is promoting efforts to realize a decarbonized
	gas emissions by 2050	society.

Source: Prepared by Nippon Koei based on information provided by Toyama City.

The background of starting city-to-city collaboration between Toyama City and Renca Municipality is summarized in the following table.

 Table 1-3 City-to-City collaboration between Toyama City and Renca Municipality

#	Period	Overview
1	March 2019	Mayor of Toyama and Renca exchanged their opinions at OECD Meeting.
2	May 2019	Toyama and Renca signed a cooperation agreement.
		Discussions between Renca and Toyama in Madrid (during COP25 of
2	2 December 2010	UNFCCC) was made on renewable energy and city-to-city collaboration
3	December 2019	project. Toyama provided information on its initiative for SDGs. Mayor of
		Renca expressed his interest in city-to-city collaboration project with Toyama.
4	March 2020	Information sharing on the municipal response to Covid-19.
5	Soutombor 2020	Started the phase 1 of city-to-city collaboration project of Ministry of the
5 September 2	September 2020	Environment, Japan
6	August 2021	Started the second year of city-to-city collaboration project (Phase 1)
7	June 2022	Started the third year of city-to-city collaboration project (Phase 1)
8	June 2023	Started the phase 2 of city-to-city- collaboration project

Source: Prepared by Nippon Koei based on information from Toyama City

## 1.3.2 Renca Municipality, Santiago City

The partner city, Renca Municipality, is one of the 32 administrative municipalities of Santiago City, the capital of Chile, and has the following characteristics.

Estimated population: 162,854 (of which 11.5% is over 65) (as of 2023) Area: 24.20km<sup>2</sup> Population density: 6,729/km<sup>2</sup> (as of 2023) Climate: Mediterranean climate,

Annual rainfall about 281.0mm (Santiago City) Geology: Renca hill is the symbol of Renca Municipality, located on the border with Kilicula Municipality to the north.





Source: Prepared by Nippon Koei from Instituto Nacional de Estadísticas Figure 1-2 Location ap of Renca Municipality and Renca Hill

## 1.4 THREE-YEAR PLAN

In this project, based on the analysis of needs and issues of Renca Municipality, potential activities were examined as follows: 1) administrative support by city-to-city collaboration, 2) formulation of JCM model projects that contribute to the decarbonization of the city and 3) promotion of SDGs. The activities and targets for the three-year were planned as follows.

FY2023 City-to-City Collaboration Programme for Zero-carbon Society Project to Promote Decarbonization and SDGs Dominoes through Participation in the Race to Zero by Renca, Santiago

	2023	2024	2025		
	Formulation of Contributi in Renca Munic	on Plan for Race to Zero ipality by JCM			
Institutional Development	Implementation	of specific actions for SDGs in Re	nca Municipality		
Approach	Realization of Decarbonization & SDGs Domino				
	Information sharing with other municipalities	Planning in other municipalities	Implementation in other municipalities		
	Study and implementation biogas/hydrogen related projects				
Project	CCUS Survey		CCUS Demonstration Project		
Formation Approach	Implementation of adopted JCM Model Project				
	Horiz	ontal development of adopted	d JCM Model Project		

Source: Nippon Koei



## **1.5** IMPLEMENTATION STRUCTURE OF THE PROJECT

The implementation structure of this project is shown in the following figure. Under the umbrella of collaboration between the two local governments, companies of both cities carried out activities for JCM model project formulation, and Nippon Koei plays a role of supporting the whole process as a consultant.

Consider the approximate 12-hour time difference from Chile, implementation structure in Chile was strengthened to facilitate smooth discussions and conduct research activities with Renca Municipality and local companies, namely La fabrica and Sherpas, by subcontracting with public enterprises of Renca and local consultants.



Source: Nippon Koei

**Figure 1-4 Implementation structure** 

## 1.6 SCHEDULE

The schedule of this project is shown in the following figure.

#	調査内容	6月	7月	8月	9月	10月	11月	12月	1月	2月	3月
City	City-to-City Collaboration Project										
1	Meeting between Toyama and Renca										
	1)Sharign SDGs activities and technologies such as energy-										•
	saving and renewable energy and target settings										
	2)Sharing information regarding Zero Carbon City Declaration										
2	Visualization and improvement of SDGs initiatives by TSUMUG										
	1) Improvement efforts and progress monitoring based on the										
	results of TSUMUGI@										
	2) Spanish version demonstration										•
3	Collaboration with other support organizations				(Me	▼ eting with	JICA)				
JCN	I Formulation										
1	Meetings and survey for JCM formulation				(Survey/	web meeting	, etc. conduc	ed by local s	taff)		•
_	Discussions on the consortium for JCM application for this and										
2	next fiscal year					•					
3	Planning MRV draft for JCM application for this and next fiscal										•
4	Preparation for JCM formulation after next fiscal year										
5	Support for project implementation										•
Oth	ers (regulat meeting and events)		·	•	·		•	•	•	•	
1	Monthly progress report		▼	▼	▼	▼	▼	▼	▼	▼	▼
2	Report meeting to MoEJ (about 3 times)		▼ (к	ick-off me	eting)		▼	(Interim re	port)	▼ (Fi	nal report)
3	Workshop								▼		
	Meeting with Renca		▼		▼		▼		▼		
4	Meeting designed by MoEJ: Chile (online)									▼	
5	Meeting designed by MoEJ: Japan (online)										▼
Sur	Survey and report										
1	Survey in Chile and sharing information (about 3 times)				(s	wrvey/web n	neeting, etc. c	onducted by	local staff)	>	
2	Meeting in Japan (Toyama City or Tokyo)		▼		▼		▼		▼		
3	Final report							-			▼Submit

Source: Nippon Koei

### Figure 1-5 Project schedule

### 1.7 OVERVIEW OF THE SURVEY IN CHILE

The field trip to Chile was conducted from January to February 2024. During the trip, activities related to decarbonization and SDGs dominoes and discussions with local companies regarding JCM candidate projects were conducted.

On February 1, a ceremony was held to celebrate the completion of the "Energy Supply Project by 2.0MW Rooftop Solar Power System to Industrial Plastic Plant in Renca, Santiago Metropolitan Region," which was adopted last fiscal year. On February 2, a seminar on decarbonization and SDGs expansion for Chilean municipalities was held to introduce TSUMUGI@ and JCM projects. On the last day, discussions were held with La Fabrica for the continuation of the project in the next fiscal year, and future activities were discussed.

The outline of the activities in Chile is shown in the following table.

Data	Intervieweed meeting	Summary of the mostings
Date	participants	Summary of the meetings
29 Jan.	Embassy of Japan in Chile	Meeting with newly appointed Ambassador Ms. Ito and
		introduced Toyama City's activities, City-to-City
		Collaboration Projects, and JCM Model projects in Chile.
30 Jan.	JICA Chile Branch	Introduced City-to-City Collaboration project and discussed
		the possibility of future collaboration.
	Cmpany A	Discussion for JCM candidate project of hydrogen mobility
		project.
	Company C	Discussion for formulation of a new JCM model project by
		improvement of the efficiency of the equipment installed such
		as replacing the existing boiler with an electric boiler.
31 Jan.	Global compact	Discussions regarding TSUMUGI@ for collaborating in
		creating the Spanish version of the questionnaire.
	Company C	Discussion for JCM candidate project of waste-related
		technology of Ryohshin Co., Ltd., a company in Toyama City.
	Company H	Discussion for JCM candidate project of the bundling solar
		power generation project, which is scheduled to apply for next
1.5.1		year.
I Feb.	Tehmco ceremony, JCM	A completion ceremony of JCM Model Project "Energy
	model Project sucker-	Industrial Plastic Plant in Pance Sontiago Matropolitan
	application work	Region "which was adopted in EV2020 was held. After the
		ceremony ICM stickers were pasted on target equipment for
		the final GEC inspection on February 15, 2024
	Decarbonization/SDGs	With the aim of promoting decarbonization and SDGs City-
	domino seminar for	to-City Collaboration Project. TSUMUGI@. and JCM
	Chilean municipalities	projects were introduced to Chilean municipalities in Renca.
	Company P	Discussion for formulation of a new JCM model project by
	1 2	using CCU and other technology, and site visit.
2 Feb.	Company M	Discussion for JCM candidate project of the bundling solar
		power generation project, which is scheduled to apply for next
		year.
	Company C	Discussions for JCM candidate project of the bundling solar
		power generation project. Company C will participate as
		ESCO in the project scheduled to apply for next year.
	La Fabrica	Review of this fiscal year's activities and discussion regarding
		next fiscal year's activities.

## Table 1-4 Outline of the Activities in Chile

Source: Nippon Koei

### 1.8 CALL TO JAPAN

The Mayor of Renca Municipality was scheduled to visit Tokyo and Toyama Prefecture for the "Seminar on City-to-City Collaboration for Zero Carbon Society " on February 26-27, 2024 and a visit to Toyama City on February 28, 2024, but due to aircraft trouble on the day of the visit, the visits were cancelled and did not take place.

## CHAPTER 2. ACTIVITIES RELATED TO ENERGY CONSERVATION, RENEWABLE ENERGY, TRANSPORTATION INFRASTRUCTURE, AND HYDROGEN

#### 2.1 NEEDS OF RENCA MUNICIPALITY FROM VIEWPOINTS OF ENVIRONMENTAL, SOCIAL AND ECONOMIC VALUES

The needs of Renca Municipality identified in the phase 1 of CtC collaboration project are shown in the following figure. The needs were categorized into environmental, social and economic values related to SDGs, which refer to the "Toyama City SDGs Future City Plan". Needs by category are outlined in the next section.



Source: Nippon Koei

#### Figure 2-1 Direction of project formation based on the needs of Renca Municipality

### 2.1.1 Needs related to environmental values

### (1) Reforestation of the Renca hill and urban green space

Renca has a hill with an altitude of about 900m in the north, and occupies about 20% of the municipality's area. Reforestation and park development of the hill are listed as some of the measures in the Renca Municipality Climate Change Plan (2019). Renca developed the Master Plan for the area of 207 ha owned by the municipality in the hill in a participatory manner for involvement of the inhabitants. The plan includes activities such as plantation of native tree species, development of park facilities (parking lots, walkways, sightseeing platforms, gymnasium, etc.). Renca has started implementation of the Master Plan since 2017 together with contractors and residents. Technical needs related to implementation of the plan are presented by Renca as follows: i) development of sustainable irrigation facilities for tree plantation, and ii) introduction of solar power generation systems and lighting equipment to the park facilities (seedlings nursery, parking lots, and lookouts, etc.). The image of some of the facilities is shown in the following figure.

In FY2023, Based on the request from Renca Municipality, the project to install solar power in the parking lot of Renca Hill was considered and preparations were made to apply for the JCM Model Project in the coming year. Details are summarized in 2.2.1. Projects targeting urban green space were not advanced this year.



Renca Hill Foot



Image of eco-nursery of Renca hill Source: Renca Municipality, Nippon Koei



Renca Hill Overall



Image of lookout of Renca hill

Figure 2-2 Example of facilities in Renca Hill

## 2.1.2 Needs related to social values

## (1) Improvement of transportation for welfare of the elderly

In Chile, aging of the population has progressed significantly in recent years, and welfare of elderly people has become an important issue. In June 2019, Japan and Chile signed a Memorandum of Understanding on Cooperation for an Aging Society, and it is of high interest to provide technical assistance from Japan, which has a wealth of experience in the welfare of the elderly. Approximately 15% of Renca municipality's population accounts for over 60 years of age, of which 65% receive basic solidarity pensions which are supposed to be provided to the elderly people with lower pension income. Since it was found that the cost of transportation to hospitals and government offices is a significant burden for elderly people, Renca started to develop free transportation for the elderly as a part of welfare services. In 2020, an electric vehicle was introduced as a part of CSR activities from a private company, and pilot activity of this welfare service was started. In the future, in order to increase the number of buses for

expansion of the target area and increase of circulation routes, introduction of electric/hydrogen vehicles was presented as a need by Renca.

In FY2023, Toyama Hydrogen Energy Promotion Council was subcontracted for technical proposals related to the introduction of green hydrogen and hydrogen vehicles. The results of the study are summarized in 2.2.3.

## (2) Development of off-grid power sources for schools and social houses

Renca has more than 10 municipality schools and some social houses for low-income people. In order to strengthen sustainability of the facility, Renca presented the need for development of off-gird power sources through introduction of PV (PV) power generation systems for backup power source and reduction of electricity costs.

As a result of reviewing these needs, the feasibility of health centers and gym such as clinic and gymnasium was higher than that of schools and social houses. Thus, formulation of a JCM model project to install PV system to the prioritized facilities was promoted and prepared to submit to MoEJ in the next fiscal year. The details of the project are shown in Section 2.2.1.

## 2.1.3 Needs related to economic value

## (1) Decarbonization of Renca Municipality-related Companies

Since Arturo Merino BenIez International Airport is located just outside the western edge of Renca, there are many factories, warehouses, etc. of enterprises (e.g., beverage manufacturers, refrigerated warehouses, etc.) engaged in industrial activities within Renca for better access to distribution and transportation. These companies and facilities are the main sources of GHG emission of Renca, thus Renca presented its need for promotion of decarbonization of the companies/factories by formulation of JCM projects. As decarbonization technologies, the following potential technologies were presented: energy saving of factory buildings, energy saving in industrial processes (waste heat recovery power generation, etc.), and private power generation by PV system, etc.

This fiscal year, we received interest from several local companies for a roof-mounted solar power generation installation project, which we discussed in the bundling of solar power generation in the Renca, which is scheduled to apply for the JCM Model Project in the next fiscal year. Details are shown in 2.2.1. In addition, the JCM Model Project will continue to be considered as needs related to the introduction of hydrogen mobility have been identified.



\*Coloured circles: main industrial centres

Source: Renca Municipality

\* The color of the circle is the geographical classification of factories by region as a cluster by Lenca Municipality.

Figure 2-3 Location of Main Industrial Facilities in Renca

## 2.2 FEASIBILITY STUDY FOR FORMULATION OF JCM MODEL PROJECTS

Among the potential projects identified in the phase 1, feasibility study was conducted for the following four potential projects to apply for JCM model projects: (1) PV system installation to facilities and factories, (2) Introducing biogas technology, (3) Hydrogen mobility project and (4) CCU project.

Since the application for (1) was rejected last year due to the small scale of the solar power generation capacity, the bundling of multiple solar power generation projects was considered for reapplication in the next fiscal year.

The following section presents proposed project outlines for items (1), (2), (3), and (4).

## 2.2.1 Installation of rooftop PV system to the facilities of Renca Municipality and factories in Renca

### (1) **Overview of the project**

This project is installing 0.4 MW rooftop solar power system to five municipal facilities in Renca: two health centers, municipal gymnasium, Renca Metropolitan Park and municipality related facility, and factories in Renca.

Due to the limited scale of solar power generation (0.4 MW) and the potential amount of GHG emission reductions, this project was not selected as a JCM Model Project in FY2022. However, the use of clean energy generated by photovoltaic power facilities at public facilities in Renca Muniicipality, especially at health centers and gymnasiums, which are used by a wide range of citizens, is highly significant for Renca's efforts to achieve net-zero emissions by 2030. Municipality tries to expand the introduction of solar power generation facilities, it was considered bundling solar power generation projects to increase the scale of power generation and reapply for the JCM Model Project in the coming year.

## (2) Target facilities

Figure 2-4 shows the location and appearance of the target facilities in Renca Municipality: (1) CESFAM Bicentenario (Health center 1), (2) CESFAM Renca (Health center 2), (3) Gimnasio Poniente (Municipal gymnasium), (4) PARQUEMET Cerro Renca (Renca Metropolitan Park) and (5) Municipality related facility.



(1) Health Center 1 -Location



(2) Health Center 2 -Location



(1) Health Center 1 - Appearance



(2) Health Center 2 - Appearance



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(3) Municipal Gymnasium -Location



(3) Municipal Gymnasium -Appearance





(4) Renca Metoropolitan Park - Appearance

(4) Renca Metoropolitan Park -Location



(5) Solar panel layout for municipality related facility

Source: Nippon Koei

## Figure 2-4 Location and overview of the target facilities in Renca Municipality

## (3) Implementation structure

The implementation structure of the project is envisioned in the following diagram.



Source: Nippon Koei



The main roles of the international consortium members are listed in the following table.

I able 2-	Table 2-1 Wajor roles of the members of the international consortium				
Members	Major roles				
Representative participant	Responsible for the management of the JCM Model Project, payment of subsidies to Partner participants and report credits based on the data provided by the partner participants.				
Partner participant	Partner participant G, as a sponsor, will outsource EPC management to a solar power generation ESCO company, C, which will monitor the amount of solar power generated at customer facilities and report to the representative participant. Renca Municipality will support the necessary Chilean licensing procedures and publicity for the project implementation.				

Table 2 1	Maion	walas of th	a mambana	of the in	townational	aanaantium
1 abie 2-1	l wiajui	TOICS OF UI	e members	of the m	ternational	consor trum

Source: Nippon Koei

### (4) **Project schedule**

The project is expected to be implemented around October 2024, and preparations are underway with the aim of applying for the first round of JCM Model Project in the next fiscal year.

## 2.2.2 Feasibility study for introduction of biogas technology

### (1) Diffusion and potential of bioenergy in Chile

Diffusion of Bioenergy in Chile Bioenergy shares about 6% of the total power generation in Chile, which is the 2nd lowest among the renewable energy types. Between 2016 and 2021, electricity generation of solar and wind power has increased by more than two times in accordance with growing investment, while that of bioenergy has not increase significantly. In Renca municipality, bioenergy power generation plant has not yet been installed as of January 2024.



Source: IRENA Statistical profile of Chile, 2022

Figure 2-6 Profile of electricity generation in Chile (2016-2021)

Potential of bioenergy in Chile Chile has potential to generate bioenergy from waste for about 78 PJ/year, which corresponds to about 3.3% of the total national energy demand. Major sources of the waste are livestock manure (41%), crop residue (28%), horticulture residue (23%) , municipal solid organic waste (8%) (J.Ludlow et.al, 2021)3. Chile also produces 7.5 Mt/year of municipal solid waste, among which about 80% is sent to dumps or sanitary landfill4.

In Renca municipality, about 250 ton of solid waste is produced daily and transported to a landfill site 60 km away from the municipality, without separation by waste types, which is one of the sources of GHG emission of Renca munucipality. (La fabrica, 2022). In this connection, improvement of waste management is one of the prioritized action of Renca municipality to achieve its Race to zero target, and has needs for "Waste to Energy". Besides,

<sup>&</sup>lt;sup>3</sup> https://www.sciencedirect.com/science/article/abs/pii/S2352550921002487

<sup>&</sup>lt;sup>4</sup> Result of analysis of data available on Registro de Emisiones y Transferencias de Contaminantes(Ministry of Environment, Government of Chile)

in Renca municipality, there are various industrial manufacture/processing plants using natural gas, which have interest in energy consumption and GHG emission reduction. These plants operators could be the potential partners of biogas users and waste sources.

### (2) Methan fermentation and Bioenergy system

The following figure shows a bioenergy system by methane fermentation of livestock manure and municipal organic wastes, which has higher needs and potential of dissemination in Chile, and already installed in some regions. In Renca municipality, those companies which utilizes natural gas for thermal energy would have needs to use biogas itself in replacement of natural gas used for boiler in stead of electricity generation.



Source: Prepared by Nippon Koei based on Biogas promotion council "Biogas booklet 2019"

## Figure 2-7 Bioenergy system using livestock manure and municipal organic

### (3) Case study for feasibility study

This year, as a part of feasibility study, a case study of biogas system using industrial and municipal organic waste was conducted to assess the feasibility of the project to install bioenergy system.

Outline	Install and operate biogas plant using organic waste about 97,000ton/year from Company A (livestock processor) and municipal solid organic waste near the biogas plant, to generate electricity and thermal energy used by the facilities of Company A.
Calculation o emission reduction	Follows the methodology VN_AM004 Reference emission: CO <sub>2</sub> generated from consumption of fossil fuel of the facilities of Company A (livestock processor) and transportation of the waste to landfill site, and CH <sub>4</sub> generated from landfill of the same amount of the organic waste

#### Table 2-2 Overview of the proposed project

Expected bioges	Project emission : CO <sub>2</sub> generated from consumption of fossil fuel of the facilities of Company A (livestock processor)
production	5,040 toll year
Expected electricity generation	15,800 MWh/year
Expected	5,800 MWh/ year
thermal energy	
production	
Expected emission reduction	<ol> <li>6,758 tCO<sub>2</sub>/year (Emission reduction by reduction of consumption of fossil fuel by electricity and thermal energy generation by biogas plant installed)</li> <li>XX tCO<sub>2</sub>/year (Equivalent to reduced natural gas consumption by</li> </ol>
	consuming biogas production as gas)
	<ul> <li>Due to data deficiency, reduction of emission from transportation of the waste to landfill site, and CH<sub>4</sub> generated from landfill of the same amount of the organic waste is not included in the expected emission reduction.</li> </ul>

Source: Prepared by Nippon Koei based on data provided by a Chilean company

### (4) Implementation structure

The proposed implementation structure of the project in collaboration with Renca municipality is shown in the following figure.



**Figure 2-8 Proposed implementation structure** 

The main roles of the international consortium members and their stakeholders are shown in the following table.

Members	Major roles
Representative	Supervise installation and operation of the equipment, transfer subsidy to
participant	the partner participants, and submit reports to MOEJ and provide necessary
	information for audit based on data provided by the partner participants.
Partner Participant	Install a biogas plant in its or its partner's premise, and as the owner of the
	installed equipment, operate and monitor the operational status such as
	amount of biogas produced and used, and report to the monitored results to
	the representative participant.
	Under the guidance of the equipment manufacturer, responsible for the
	maintenance of the equipment installed.
	Request necessary permit to the government of Chile, promote public
	awareness raising on the hydrogen mobility for dissemination of bioenergy
	in Chile.
Private companies	Supply waste
Renca	Use of biogas/ electricity generated by bioenergy
municipality/private	
companies	

## Table 2-3 Roles of the international consortium members and their stakeholders Members Major roles

Source: Nippon Koei

### (5) Study plan in the next year

In order for formulation of JCM model project, the following study is to be conducted within the next 2 years;

- 1. Interview with the companies in Renca municipality which has potential as solid organic waste sources for bioenergy production, to identify their interests in installation of biogas plant and JCM project:
- 2. Analyze the data on waste amount and property, energy consumption, etc, of the potential partner companies in Renca municipality: and
- 3. Prepare application forms.

# 2.2.3 Feasibility study on technology introduction of green hydrogen production and hydrogen mobility.

In phase 1 of this project, the projects listed in the table below were considered and were scheduled to be proposed in this year's "Demonstration Project for Application of New Decarbonizing Technology". However, due to a change in the top management of the joint venture at the beginning of the fiscal year, the other party's policy changed, and the proposal could not be submitted. Although information gathering was conducted within the Renca regarding alternative projects to this one, we were unable to identify any promising collaborators at this time.

On the other hand, during the field trip to Renca, the information on the airport hydrogen cab project being planned in a neighboring municipality was gathered, and the local government expressed strong interest in the project. The details are not included in this report for confidentiality reasons.

Project title	Project to introduce hydrogen technologies in Renca complex for energy transition in the Republic of Chile
Structure	Representative participant: Company A of Toyama city Partner participants: Company F (Company operated jointly by a Chilean company and a French company)
Background	National policy [Chile] Government of Chile developed national green hydrogen strategy in 2020, in which it announced that it aims to become a green hydrogen exporting country by 2040. [Japan] Government of Japan promotes international collaboration to realize a hydrogen society. It considers hydrogen procurement from Latin America.
	[Renca Municipality] In step with the aging of the population, welfare services need to be improved and strengthened. It needs expansion of mobility services for the elderly (e.g. circulating buses/ sedan). Based on participation in the Race to Zero campaign, Renca municipality is accelerating decarbonisation to achieve the plan announced for Race to Zero.
	[Partner participant: Company F] Thermal power generation company in Renca Municipality. Company F is interested in hydrogen mixed-combustion and hydrogen burning plant for decarbonization. In order to learn about the technologies and regulations related to hydrogen production and use, Company F is interested in producing green hydrogen and use for FCV as a first step. As a company based in Renca Municipality, Company F would like to contribute to Renca Municipality through its CSR activities likewise its experience in the past, contribution to Renca by donation of an electric bus for mobility for the elderly.
	[Representative participant: Company A] Toyama City company participating in the project. It is interested in participating in the hydrogen import business in the future.
Activities	Installation of one unit of 1 MW on-site hydrogen refuelling system, which is composed of water electrolysis for hydrogen production and hydrogen station, and rooftop PV panel in Company F's facility in Renca Municipality. Company F makes a lease agreement of one FC sedan car with a provider, Toyota Chile. (In the future, in addition to the FC sedan, installation of FC folk lift and FC bus would be planned)

 Table 2-4 Draft outline of the project for Hydrogen Technology in phase 1

Source: Nippon Koei

## 2.2.4 Feasibility Study on CCU technology Introduction

The proposer of this project, Nippon Koei, conducted a JCM feasibility study on the production of chemicals/synthetic fuels from CO2 emitted from pulp mills in FY2023 under the "FY2023 Infrastructure Development & Study Project to Obtain JCM (JCM Feasibility Study)"

(Ministry of Economy, Trade and Industry project), jointly with Toyo Engineering Corporation. The study mainly targeted companies outside of Renca, but the CCU (carbon capture and utilization) technology was explained and discussed to cement companies and beverage companies related to Renca.

The cement companies responded that it will be necessary to adopt advanced technologies such as CCU (they have already participated in Race to Zero) in order to promote decarbonization efforts in the future, but that they would like to consider this in the long term, up to 2050, and that they would like to move forward with further discussions by 2030.

As for the beverage company, they are considering converting their natural gas boilers, which are their current source of CO2, to other technologies, and the feasibility of applying CCU will be conducted in conjunction with the study of introducing other decarbonization technologies.

## 2.3 IMPLEMENTATION AND HORIZONTAL DEVELOPMENT OF ADOPTED JCM MODEL PROJECT

## 2.3.1 Installation of rooftop PV system to the factories of a Renca-based company, Tehmcorp

## (1) **Overview of the project**

A new JCM model project to install rooftop PV systems to the factories of Tehmcorp, chemical manufacturer, based in Renca municipality, was proposed to MOEJ in the 3<sup>rd</sup> call for proposal in FY 2022 and adopted. Partner participant, namely Solarity SpA, ESCO company, supplies electricity generated by the PV system to Tehmcorp at lower price to contribute to its decarbonization. The overview of the project is shown in the following table.

Project title	Introduction of 2.0 MW Rooftop Solar Power System to Industrial Plastic Plant in Renca City
Implementation structure	Representative participant: Asia Gateway Corporation Partner participants: Solarity SpA
Background	Increase of renewable energy is one of the prior challenges for Renca Municipality to achieve Race-to-Zero. Renca municipality would like to lead acceleration of introduction of renewable energy starting with the Municipality's public facilities. Needs of decarbonization in energy of the private sector
Activities	Power generation capacity: total 2.002 MWp Project power generation: total 25 GWh/year Estimated emission reductions: 1,105 tCO <sub>2</sub>

Table 2-5	Overview	of the	JCM	model	project
	0.01.10.0	or the	00111	mouti	projece

Source: Compiled by Nippon Koei based on ESCO operators' proposals

## (2) Target facilities

The following photos show the location and appearance of the target facilities proposed by Tehmcorp, which started its business in the field of polymer production about 40 years ago and currently operates 24 group companies providing polymer and metal products and services to major mining and construction companies in Chile and abroad. Tehmcorp proposed to install rooftop PV system to some factories operated by CAINSA, one of the group companies, manufactures rubber products and plastic pipes for mining industry, and window frame of buildings.



Location of the project site



Target facilities for installation of rooftop PV system (area surrounded by orange frame)



Roof of one of the target factories Source: Nippon Koei



Roof of one of the target factories

## Figure 2-9 Location of the Project site and target facilities

## (3) Calculation of estimated GHG emission reduction

The GHG emission reductions from this project were estimated by using the JCM methodology CL\_AM001 "Installation of Solar PV System" as shown below.

 $\begin{array}{l} \mathrm{ER}_{p} = \mathrm{RE}_{p} - \mathrm{PE}_{p} \\ = \mathrm{RE}_{p} \\ \end{array}$   $\begin{array}{l} \mathrm{ER}_{p} & : \mathrm{Emission\ reductions\ during\ the\ period\ p\ [tCO/p_{2}].} \\ \mathrm{RE}_{p} & : \mathrm{Reference\ emissions\ during\ the\ period\ p\ [tCO/p_{2}].} \\ \mathrm{PE}_{p} & : \mathrm{Project\ emissions\ during\ the\ period\ p\ [tCO/p_{2}] = 0} \end{array}$ 

$$\operatorname{RE}_{p} = \sum_{i} \left( EG_{i,p} \times EF_{RE,i} \right)$$

 $RE_p$  : Reference emissions during the period p [tCO/p<sub>2</sub>].

 $EG_{i,p}$ : Quantity of the electricity generated by the project solar PV system *i* during the period *p* [MWh/p].

 $EF_{RE,i}$ : Reference emission factor of the project solar PV system *i* [tCO/MWh<sub>2</sub>].

Parameters	Descripti	Source	
EF <sub>RE,i</sub>	Reference emission factor captive power generator project solar PV system <i>i</i> . The value for $EF_{RE,i}$ is selec factors in the following mar <u>PV Case 1:</u> In case the solar project activity is connected through internal grid which power generator, $EF_{RE,i}$ is approached regional grid.	of the regional grid and/or which is displaced by the ted from the list of emission mer: PV system(s) in a proposed I to a regional grid including is not connected to a captive is set as follows per the	The default emission factor is obtained from a study of electricity systems in Chile and the most efficient diesel power generator (49% heat efficiency). The default value is revised if deemed necessary by the JC.
	Regional grid name: SEN (National System)	Emission factor for PV Case 1: 0.404 tCO/MWh <sub>2</sub>	

Aysén System 0.176 tCO/MWh <sub>2</sub>	
Magallanes System 0.361 tCO/MWh <sub>2</sub>	
<u>PV Case 2:</u> In case the solar PV system(s) in a propose	d
project activity is connected to an internal gri	d
connected to both a regional grid and a captive power	er
power generator, EF <sub>RE,i</sub> is set as follows per th	e
connected regional grid:	
Regional grid name: Emission factor for	
PV Case 2:	
SEN (National System) 0.404 tCO/MWh <sub>2</sub>	
Avsén System 0.176 tCO/MWh <sub>2</sub>	
Magallanes System 0.361 tCO/MWh <sub>2</sub>	
PV Case 3. In case the solar PV system(s) in a propose	d
project activity is connected to an internal grid which it	s
not connected to the regional grid EEpr; is set at 0.53	3
$tCO/MWh_{2}$	

Source: JCM Methodology CL\_AM001 "Installation of Solar PV System".

#### (4) Implementation structure

The implementation structure of the project is shown in the following figure. The representative participants, namely Asia Gateway corporation will form a JCM international consortium with the partner participant, Solartiy SpA, and implement the project in coordination with an off-taker, Reifox. Considering the concern of Tehmcorp/CAINSA for the payment of Capex, Solariy SpA, an ESCO company was involved to the international consortium to supply clean energy without initial cost to its client, Tehmcorp. The PV system is installed on the roofs of the factories of CAINSA, while Solarity SpA charges only the cost of electricity consumed by them.



Figure 2-10 Implementation structure

The main roles of the international consortium members are shown in the following table.

Members	Major roles				
Representative	Supervise installation and operation of the equipment, transfer subsidy to the				
participant (Asia	Partner Participant, submit credit reports to MOEJ, submit necessary information				
Gateway	for audits based on the data provided.				
Corporation)					
Partner Participant	Fund raising, design of the system, selection and procurement of the equipment,				
(Solarity SpA)	O&M of the installed system.				
	Provide the representative company with the date necessary for MRV.				

Table 2-6 Major roles of the members of the international consort	um
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Source: Nippon Koei

### (5) **Project schedule**

The following figure shows the schedule of the project from January FY 2022 to the end of FY 2023.

After adoption was announced in February 2023, a contract on subsidy was started, and procurement completed in about 2 months. Installation was completed within eight months, and operation of the installed equipment was started in December 2023.

Activities	FY2022 FY2023											
Year	2023											
Month	1	2	3	4	5	6	7	8	9	10	11	12
CtC collaborationproject FY2022												
Selection notification		$\triangle$										
Initiation of subsidy contract		$\triangle$										
Procurement												
Contract												
Start of commissioning										,	$\triangle$	
Start of commercial operation												$\triangle$

Source: Nippon Koei

#### Figure 2-11 Proposed implementation schedule

#### (6) **Project completion ceremony**

The project was implemented according to schedule, and a completion ceremony was held at the site on February 1, 2024. The ceremony was attended by the Vice Minister of Energy of Chile, the Japanese Ambassador to Chile, the COP Champion of Chile, the Mayor of Renca Municipality, the Toyama City, the Chilean JCM Secretariat (Ministry of Environment and Ministry of Energy), and many others.

The Vice-Minister of Energy stated that this project is a great achievement in Latin America, emphasized that it is an important initiative for promoting sustainable development, and called for further sustainable efforts in the future. The Japanese Ambassador to Chile praised the strong leadership of the Mayor of Renca Municipality and the cooperative relationship with Toyama City, and commended the concrete results of this project, and the cultural exchange between Chile and Toyama City and their shared commitment and cooperation in achieving the SGDs. The Mayor of Renca Municipality expressed his gratitude to the government agencies and stakeholders for their cooperation in this project, and emphasized their commitment to Race to Zero. The Toyama City expressed their joy and gratitude for the completion of the project, recalled their visit to Renca in November 2022, and thanked the participants for their contribution to building a sustainable society.

The JCM Model Project stickers were also affixed in preparation for the final GEC inspection scheduled for February 15, 2024.

The following table shows the ceremony agenda.

#	Time	Agenda	Speaker
1	9:40 - 10:00	Reception	_
2	10:00 - 10:07	Tehmcorp opening remark	Mr. Vector Petermann, President and Founder,

 Table 2-7 Project completion ceremony agenda

#	Time	Agenda	Speaker
			Tehmcorp
			Mr. Luis Felipe Ramos
3	10:07 - 10:10	Ministry of Energy, Chile	Deputy Minister of Energy,
			Chile
			Ms. Takako Ito
			Extraordinary and
4	10:10 - 10:13	Embassy of Japan in Chile	plenipotentiary
			ambassador, Embassy of
			Japan in Chile
			Mr. Jose Luis Carvallo
5	10:13 - 10:20	Solarity	Chief Growth Officer &
		-	Co-founder, Solarity
6	10.20 10.22	Toyama City	Ms. Keiko Kajikawa
0	10.20 - 10.23	Toyania City	Inspector, Toyama City
7	10.22 10.26	Worker	Mr. Mauricio Pizarro
/	10:23 - 10:26	WOIKEI	Worker, Cainsa
			Ms. Claudio Castro
8	10:26 - 10:33	6 - 10:33 Renca Municipality	Mayor of Renca
			Municipality
9	10:33 - 11:00	Facility visits	-

Source: Nippon Koei

The photos below show the ceremony and the JCM sticker-application work.



Visit of the Japanese Ambassador



Ceremony participants



Ceremony venue



Speech of Mr. Vector Petermann, Tehmco



Speech of Mr. Luis Felipe Ramos, the Vice Minister of Energy of Chile



Speech of Mr. Jose Luis Carvallo, Solarity



Speech of Mr. Mauricio Pizarro, Cainsa



Group photo of speakers



Speech of Ms. Takako Ito, Japanese Ambassador to Chile



Speech of Ms. Keiko Kajikawa, Toyama City



Speech of Mr. Claudio Castro, Renca Municipality



Facility visit 1





Facility visit 2

JCM Model Project sticker-application work

Source: Nippon Koei

## Figure 2-12 Pictures of the ceremony and JCM sticker-application work

## 2.3.2 Horizontal expansion of the solar power generation project

As mentioned in 2.3.1, it was considered to bundle together a roof-mounted solar power generation project at facilities in Renca and applying for JCM Model Project in the next fiscal year. In addition, a local warehouse service-related company, Company M, plans to develop a solar power generation installation project in a municipality area near Renca, and is considering JCM Model Project which contributes to the decarbonization dominoes.

## 2.4 OTHER JCM MODEL PROJECT FORMATION

The formation of a waste-related JCM project with Ryohshin, a Toyama City company, was considered. During the field trip in February, the waste-related technology was introduced to Company C, a local waste treatment company, and they expressed interest in RDF (Refuse Derived Fuel) and gypsum board recycling technology. It was planned to proceed with sharing the overview of potential project and selecting technologies to be introduced for the JCM Model Project in the next fiscal year.

## 2.5 POTENTIAL OTHER PROJECTS IDENTIFIED DURING THE SURVEY IN CHILE

As described in Section 1.7 of Chapter 1, interviews with some companies in Renca were conducted and several potential JCM model projects were identified as summarized in the table below. More companies have started i) setting its own target for energy saving and decarbonization, and ii) studying the relevant technology to achieve their targets. Among the technology for energy saving and decarbonization, new technology such as CCU attract their attention.

Company/ Organization name	Industry/Product/Service	Те	echnology of interest	overview
Company C	Beverage manufacturing	A A	Electric boiler CCU	The company is working to reduce its carbon footprint and considered upgrading its existing boilers to electric boilers. They were interested in CCU for carbonated beverage production.
Company C	Waste treatment	A	Alternative fuel	Participating in Race-to-Zero. Coke and alternative fuels are mixed as fuel for cement production. Waste is used as an alternative fuel, of which 25% is tires, and tire crushing is an issue. They were interested in RDF and gypsum board recycling technologies from Ryohshin, a company based in Toyama City.
Company A	Industrial gas production	A	Hydrogen mobility	The company is expanding its hydrogen business globally and owns hydrogen refueling stations (HRS). They have considered the use of hydrogen mobility in airport transportation project in Chile.
Company H	Bread making	A	Solar power	The company operates a bread manufacturing and sales business in Chile. They were interested in participating in the bundling solar power generation project next year and considered installing rooftop solar power generation with a capacity of approximately 1 MW for self- consumption.
Company M	Warehouse		Solar power	The company provides warehousing services in Chile. They have already installed rooftop solar power generation in their warehouses and interested in participating in the bundling solar project next year for expanding it in the future. The company owns one warehouse in Renca and is considering installing rooftop solar power generation with a maximum power generation capacity of 3,000 kWh. Also, the company plans to introduce solar power generation in areas other than Renca.

Table 2-8 Potential	nrojects identified	during the	survey in Chile
Table 2-0 Totential	projects identified	uur mg the	survey in Chile

## CHAPTER 3. SUPPORT FOR INSTITUTIONAL DEVELOPMENT

## 3.1 SHARING EXPERIENCES OF SDGS AND ZERO CARBON CITY DECLARATION

The project aims to promote SDGs and decarbonization efforts by sharing information and knowledge related to SDGs and Zero Carbon City declaration of Toyama City with Renca Municipality, Santiago City.

In June 2018, Toyama City was selected by the Japanese Cabinet Office as both a "SDGs Future City" and a "Local Government SDGs Model Project." "SDGs Future Cities" are local governments that propose excellent approaches to achieve SDGs among Japanese municipalities. In the first year of 2018, 29 local governments, including Toyama City, were



selected. In addition, the "municipal SDGs model project" refers to a project that is making particularly leading SDGs efforts, and 10 projects were selected in the first year of FY2018, including the project of Toyama City.

For this reason, Toyama City, which is actively engaged in SDGs among Japanese municipalities, can provide information and innovations on actual initiatives from SDGs planning through city-to-city collaboration. Therefore, sharing activities of Toyama City is considered to be very useful for Renca Municipality, which is also considering the promotion of SDGs.

For Toyama City, SDG actions are a good example not only for Toyama City, but also for overseas cities, and that they are positioned as one of the initiatives for international cooperation is in line with SDGs's goals. Therefore, the promotion of SDGs has significant merits for both cities.

Toyama City declared Zero Carbon City as the fifth city in Toyama Prefecture in March 2021, in response to the growing momentum toward carbon neutrality by 2050 in Japan. In order to achieve the goal of carbon neutrality, Toyama City has established the "Toyama Regional Circular and Ecological Sphere Model Formation Platform" with local energy companies, universities, financial institutions and local government since 2019. Through this platform, they have been discussing measures to be taken by the public and private sectors. In March 2021, "Toyama City Energy Vision" was published, which sets out policies and reduction targets for achieving carbon neutrality. In November 2022, Toyama city developed Toyama City Vision for Smart City Promotion and started planning of EV sharing system for decarbonization. These Toyama City's efforts through the public-private partnership can be helpful for Renca Municipality, which has interest in decarbonisation and announced its participation in the Race to Zero campaign at COP26.

Based on the knowledge sharing on decarbonization and SDGs in Phase 1, planning of a contribution plan to support Renca in achieving Race to Zero was started in phase 2 this fiscal year. Toyama City and Renca have been discussing the contribution plan through online meetings and during the trip to Chile, and both cities will continue to discuss the plan in the next fiscal year.

## 3.1.1 **Progress of Race to Zero activities of Renca Municipality**

Renca Municipality was the first Municipality of Chile to join Race to Zero campaign in October 2021. Renca Municipality is actively working to address climate change, and through this campaign, aims to be a model in urban, social and economic transformation, including a sustainable mark that incorporates different climate change adaptation and mitigation initiatives.

Renca has so far reported its mitigation and adaptation activities annually since 2021 on the "DCP-ICLEI" which is Race to Zero and Race to Resilience platforms, with respective evaluation results: in 2021, the overall score was B, the thematic scores were A- for adaptation and D for mitigation. In 2022, the overall score was A-, adaptation was A, and mitigation was B, higher than the previous year. In 2023, the overall score was A-, adaptation was A, and mitigation was A-. The overall score was similar to the previous year, but both adaptation and mitigation reached A-level scores, indicating that Renca's Race to Zero and Race to Resilience campaign efforts in mitigation and adaptation were highly valued.

## 3.1.2 Collaboration with neighboring municipalities of Ranca

Renca Municipality plans to continue to cooperate with neighboring municipalities in the Race to Zero initiative. Specifically, it is considering to formulate JCM Model Project in neighboring municipalities areas around Renca. One local company was considering to install a solar power generation system in the areas, and the discussion will be continued to formulate JCM project.

## 3.1.3 Collaboration with Switzerland

Under Article 6 of the Paris Agreement, Chile is cooperating with Switzerland's Climate Protection and Carbon Offset Foundation (KliK) in GHG reduction activities. The KliK Foundation was established in 2012 by the Swiss Petroleum Institute, and is funded by taxes on transportation fuel, with the aim of offsetting the CO2 emissions of domestic importers of vehicle fuel, and is looking for partners for offset programs around the world. With Chile, KliK is considering cooperating with the field of E-Mobility, BESS, biogas, energy saving in industry, CO2 reduction in cement factories, energy saving in buildings, green cooling, engine generator replacement, etc.

## 3.1.4 Collaboration with United Kingdom of Great Britain and Northern Ireland

Renca Municipality has developed a climate change action plan with the United Kingdom of Great Britain and Northern Ireland (UK). It is continued to monitor the progress of action plan formulation and considered specific details of cooperation in the Race to Zero contribution plan.

## 3.1.5 Collaboration with United States of America

Renca Municipality is implementing city-to-city collaboration activity called the "City Forward Program" with the city of Evanston, Illinois, United States of America (USA). The City Forward Program is a joint partnership between the US Department of State, ICLEI-Local Governments for Sustainability, Resilient Cities Catalyst, and the Institute of the Americas, through the implementation of projects that solve key urban sustainability issues, helping cities in Latin America and the Caribbean to build sustainable and resilient societies.

Also, Dalberg Catalyst is developing activities using Artificial Intelligence (AI) to address the issue of urban heat phenomena in Chile.

### **3.1.6** Japan's approach

Japan has support schemes for Chile such as the "SME and SDGs Business Support Program" and the "International volunteer program" by the Japan International Cooperation Agency (JICA). As for the content of cooperation with Renca Municipality, it was considered deepening interaction between Renca Municipality and Toyama City and promoting the sharing of knowledge related to decarbonization through the JICA volunteer program, which attracted the interest of Renca Municipality.

### 3.1.7 Draft contribution plan to achieve Race to Zero of Renca

Renca Municipality has set a goal of reducing GHG emissions by 30% by 2030 under Race to Zero. A draft contribution plan for achieving the Race to Zero in Renca was created as below, which started in the second phase. During the field trip in February, Renca Municipality showed a new interest in park management and environmental education, and it was planned to share the knowledge from Toyama City in the future.

Institutional development	<promotion decarbonization="" domino="" of="" sdgs="" through<br="">decarbonization/SDGs activities to neighboring municipalities&gt; <ul> <li>Decarbonization activities: Sharing knowledge related to energy policy</li> <li>SDGs activities: Dissemination of TSUMUGI@</li> <li><sharing and="" environmental<br="" knowledge="" management="" park="" related="" to="">education&gt;</sharing></li> <li>Interaction through visits to both cities</li> </ul></promotion>
	interaction unough visits to both entes

Table 3-1 Race to Zero contribution plan (draft)

JCM project development	<fy2024 jcm="" project=""> <ul> <li>Application and implementation of rooftop solar power generation installation project to facilities in Renca</li> <li>Activities after 2025&gt;</li> </ul></fy2024>
	<ul> <li>Waste treatment technology introduction project</li> <li>Biogas project</li> <li>Electric boiler introduction project</li> </ul>

## **3.2** CONSIDERATION OF SPECIFIC ACTIONS RELATEDTO THE SDGS

### 3.2.1 Examination of activities based on the results of the SDGs assessment by "TSUMUGI@" in Phase 1

## (1) Discussion of activities in Phase 2

In Phase I (FY2021 and FY2022), Renca Municipality assessed and visualized their various initiatives in line with SDGs by using online tool called "TSUMUGI@", an SDGs assessment and visualization tool for local governments developed by Nippon Koei. The results confirmed that, although Renca Municipality has not formulated, implemented, or monitored any SDG-specific strategies, it has comprehensively developed and implemented its initiatives toward the realization of a sustainable society. In particular, it was confirmed that the Renca Municipality was actively working on Goal 10 (inequality), Goal 7 (energy), Goal 2 (hunger), and Goal 16 (peace). On the other hand, it was revealed that more practical efforts were expected for Goal 15 (terrestrial ecosystems), Goal 8 (economic growth), and Goal 5 (gender). Toyama City also conducted a "TSUMUGI@" diagnostic of its initiatives, and both parties shared the results of the diagnostic each other and concluded that specific activities and countermeasures would be discussed and considered based on the results in the next phase.

### (2) Initiatives that promote the participation of diverse stakeholders

The results of the TSUMUGI@ assessment confirmed that Renca Municipality had a relatively low rating on questions related to collaboration with regional financial institutions, local businesses, and startups. Furthermore, the Renca Municipality showed a high level of interest in promoting communication and collaboration with a variety of stakeholders. Therefore, a specific activity proposal to be considered in Phase 2 is to strengthen the system of collaboration with diverse stakeholders.

For Toyama City, as shown in Table 3-6, various initiatives to raise awareness at each stage: knowledge sharing, understanding, and making action, have been carried out. It also builds and operates platforms for strengthening collaboration with various stakeholders. In addition, Toyama City has been considering establishing a registration and certification system for local enterprises in collaboration with financial institutions and other nearby cities, and aiming to promote the SDGs in Toyama City by involving various stakeholders such as citizens, industry, academia, government and finance, and strengthening the collaboration system.

	For Citizens	For Businesses		
SDGs	Creation of "SDGs Start Book," a booklet	Video "Action for the Future! Toyama		
dissemination	to promote understanding of the SDGs	City SDGs [Corporate Activities]" is now		
and information	Video "Action for the Future! Toyama	available.		
provision	City SDGs [Citizen's Life]" is now			
[Knowledge	available.			
sharing]				
SDG	Organization of event called "SDG Week"	and other related events		
dissemination	-			
and information				
provision				
[Understanding]				
Promotion of	SDGs Supporter Registration System: A	registration system for individuals, citizen		
activities of	groups, corporations, educational institut	tions, etc., who are working together to		
each	promote the SDGs. Special website has b	een established to widely disseminate the		
organization	efforts and activities of registered supported	ers.		
related to the	SDGs Supporter Support Program: I	Provision of subsidies to support SDGs		
SDGs [Making	supporters for events that lead to the dis	ssemination of the SDGs, the creation of		
Action].	dissemination and awareness-raising tools	, and other initiatives.		
SDGs dominoes	SDGs promotion communicator syst	tem: Through training courses, SDGs		
in the city	promotion communicators are trained who	can proactively spread the SDGs and put		
	them into practice. Those who complete the	e training receive a certificate, with the aim		
	of making the SDGs a domino effect amor	ng individuals in the city.		
Building	Sketch Lab was established as a base for p	romoting "future co-creation" with various		
Platforms	stakeholders. It is a facility where peop	ble from various positions in businesses,		
	academia, government, and the private sector can interact and co-create. It hosts			
	various events and provides co-working space.			
Cooperation	-	Studying the establishment of a		
with Financial		registration/certification system for		
Institutions		companies, etc. in collaboration with		
		regional financial institutions and other		
		SDG future cities in the prefecture		

Table 3-2 Major	<b>Activities Related to</b>	<b>Public-Private</b>	Partnerships in	n Toyama City

### (3) Proposals for the next fiscal year

In the next year, various experiences and knowledge regarding the initiatives that promote the participation of various stakeholders in Toyama City as shown in Table 3-6 will be shared with Renca Municipality to examine the direction it should take, and develop a plan for specific actions, taking into consideration of advice from Toyama City.

## 3.3 IMPLEMENTATION OF THE DECARBONIZATION AND SDGS DOMINOES

The decarbonization domino and SDGs domino means that local communities will take the initiative in creating a sustainable society, and that these efforts will spread to every region of the country.

In Japan, the goal is for the leading decarbonization regions to become the base of the decarbonization domino by actively working toward decarbonization, which will then spread to the surrounding regions to achieve the goal for Japan in the future.

The Decarbonization Leading Regions have been called for a total of four times, and 74 proposals from 95 municipalities in 36 prefectures across Japan have been selected from the first through the fourth rounds. In addition, the Decarbonization Leading Areas are unique in that they allow multiple local governments to work together, as well as private companies, universities, and other organizations to work in partnership with local governments.

Although the fifth round of applications has not yet been determined, we plan to solicit and select at least 100 decarbonized regions twice a year, with the aim of selecting at least 100 decarbonized regions by 2025 to achieve carbon neutrality in 2050.



Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://policies.env.go.jp/policy/roadmap/assets/preceding-region/4th-DSC-kekka.pdf



## 3.3.1 Initiatives for decarbonization domino effect in Japan

## (1) Launch of "National Movement to Create a New and Prosperous Life Leading to Decarbonization"

In Japan, a new national movement (Deco-Katsu) was launched in October 2022 to change people's behaviours and create a swell or movement of lifestyle change to realize a new affluent lifestyle that leads to decarbonization.

Based on the image shown in Figure 3 2, this national movement proposes a new lifestyle that will be richer, more comfortable, and healthier for people in about 10 years from now, and that

will simultaneously achieve the 2030 greenhouse gas reduction target. The plan also divides all areas of daily life (food, clothing, shelter, employment, transportation, and shopping) into seven major areas, identifies mechanisms to structurally resolve issues and bottlenecks from the people's perspective, encourages cooperation and collaboration among businesses, local governments, organizations, and provides the necessary support and policy development in cooperation with ministries and agencies to the maximum extent possible. Specific actions are shown in Table 3 1.



Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://ondankataisaku.env.go.jp/decokatsu/en/

### Figure 3-2 Image of the new national movement (Decokatsu)

Classification		Action				
Start here	Shelter	<b>Electricity is also energy saving</b> Insulated house (Live in an insulated, energy-saving home that keeps your electricity bill down)				
	Shelter	The fun of being particular about Eco goods				
		(LED · Choose energy-saving home appliances, etc.)				
	Food	<b>Heart of gratitude</b> No leftover food(eating up food、Use up of ingredients)				
	Job	<b>Connected office</b> Telework(Connect anywhere and it becomes your workplace)				
$CO_2$ will drop	Shelter	High efficiency water heater, Choose equipment that saves water				
by itself	Transfer	Choose an environmentally friendly next-generation car				
	Shelter	Incorporate renewable energy such as solar power generation				
Practice	Clothing	Cool biz • Warm Biz, Working on sustainable fashion				
together	Shelter	Reduce garbage as much as possible, properly separate it as resources, and reuse it.				
	Food	Actively choose local, seasonal ingredients				
	Transfer	Travel by public transportation, bicycle, or foot as much as possible				
	Buy	Buy what you like, only in the amount you need, such as by selling on a scale				
	Live	Receive parcel delivery at once				

#### Table 3-3 Details of Decokatsu

Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://www.meti.go.jp/shingikai/energy\_environment/gx\_product/pdf/003\_06\_00.pdf

In order to ensure the effective implementation and integrated development of the new national movement, a public-private partnership council consisting of the national government, local governments, private companies and organizations, and consumers was established at the same time as the new national movement.

The following actions will be discussed among the participants in the public-private partnership council and are planned for implementation.

- Collaboration to effectively appeal to consumers by proposing new, affluent lifestyle packages that combine digital applications, products, and services, and lead to creating opportunities and venues
- Sharing of knowledge, experiences, and lessons learned from the initiatives of each entity and horizontal deployment of best practices (e.g. Green Life Point projects)
- Proposals and requests for government policies (e.g. specific uses and ideas for the Ministry of the Environment's dissemination and awareness-raising budget)

## (2) Realization of GX through a growth-oriented carbon pricing concept

" Carbon pricing" is a policy technique introduced to put a price on CO<sub>2</sub> (carbon) emissions by companies and others, thereby changing the behaviours of emitters.

In contrast, the "Growth-Oriented Carbon Pricing Concept" is to establish a mechanism to provide incentives for the government to establish a comprehensive strategy and accelerate GX investment to realize over 150 trillion yen of public-private GX investment over the next 10 years.

Considering the situation in which it finds itself, Japan intends to realize GX through a "growthoriented carbon pricing concept" that effectively combines "carbon pricing" and "investment promotion measures" through GX Economic Transition Bonds in an optimal manner.

Specific initiatives for the growth-oriented carbon pricing business are described below.

- Advance investment support through "GX Economic Transition Bonds" (tentative name) (20 trillion yen over the next 10 years)
- Incentives to invest in GX through carbon pricing (introduction of fossil fuel levy system, introduction of paid auctions for power generators, etc.)
- Utilization of new financial instruments (e.g. strengthening public-private financial support such as debt guarantees by the GX mechanism, fostering international understanding of transitions, etc.)



Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://www.meti.go.jp/shingikai/sankoshin/sangyo\_gijutsu/chikyu\_kankyo/ondanka\_follow\_up/pdf/2023\_001\_05\_00.pdf

### Figure 3-3 Image of Growth-Oriented Carbon Pricing Concept

## (3) Creation of Decarbonization Promotion Project Bonds

In order to enable local governments to systematically implement decarbonization initiatives, a new local fiscal measure, the "Decarbonization Promotion Project Bonds," was established in FY2023.

The "Decarbonization Promotion Project Bonds" program was established in FY2023 as a local fiscal measure to enable local governments to systematically implement decarbonization initiatives, based on the "Basic Policy for Realizing GX" approved by the Cabinet in February 2023, which stipulates that local governments, including public corporations, should take the lead in implementing priority measures that form the foundation for decarbonization.

Relevant projects are local independent projects for decarbonization of public facilities, etc. (renewable energy, ZEB conversion of public facilities, energy conservation, etc.) to be implemented based on the local government action plan, and the project cost is approximately 100 billion yen.

## **3.3.2** Sharing of information on initiatives in Decarbonization Leading Areas

Among the leading decarbonization regions in Japan, we have organized the regions that are carrying out advanced activities related to the JCM equipment subsidy project in Renka District (biogas technology, CCU technology, hydrogen technology).

### (1) Shikaoi Town, Kato County, Hokkaido

### 1) Area Overview

Shikaoi Town, Kato County, Hokkaido, is located in the northwestern part of the Tokachi Plain, with an area of 404.70 km<sup>2</sup> and a population of 5,266 (as of January 2023). Agriculture is the town's main industry, accounting for the largest share of production by industry, with dairy cattle accounting for 2/3 of the total.

In FY 2019, the greenhouse gas emission in Shikaoi Town was approximately  $62,000 \text{ t-CO}_2$ , with agriculture, forestry, and fisheries, business, households, and freight vehicles each accounting for about 20% of the total emissions. In addition, emissions from the use of electricity and gasoline, diesel, and kerosene account for about 30% and 50% of the total, respectively. The region is characterized by its heavy use of fossil fuels due to the heavy heating load in this snowy and cold region and its dependence on automobiles due to the scattered settlements and the lack of adequate public transportation systems.



Source: Created by Nippon Koei using a map of global Japan from the website of the Geospatial Information Authority of Japan, Ministry of Land, Infrastructure, Transport and Tourism.

#### Figure 3-4 Location of Shikaoi Town, Kato County, Hokkaido

### 2) Main initiatives (biogas $\rightarrow$ hydrogen utilization)

In the Shikaoi Town, Kato County, Hokkaido, the Shikaoi Hydrogen Farm, a joint venture between Air Water Hokkaido and Kajima Corporation, is the first company in Japan to convert livestock manure into hydrogen, which is then used as energy.

The annual milk production of the town of ShiKaoi is over 100,000 tons, one of the highest in the region. Based on that the odor of manure and compost and its management has been a problem, Shikaoi Town established two biogas plants in the town to improve the surrounding environment and increase agricultural productivity and is promoting the development of a town based on the recycling of local resources.

The biogas plant is a facility that converts livestock manure and raw garbage from households into resources through methane fermentation. Shikaoi Town has been using biogas to generate electricity, which is then sold through a feed-in tariff (FIT) system and is now converting this energy into hydrogen for effective use within the town.



Source: AIR WATER Inc. HP (accessed on 15 Feb 2024) https://www.awi.co.jp/ja/special/special-24043321519152832932.html Figure 3-5 Biogas plant feedstock tank

When hydrogen is produced from methane gas,  $CO_2$  is also produced along with the hydrogen, but grass, which is used to feed livestock, is carbon neutral because it fixes  $CO_2$  from the atmosphere through photosynthesis during its growth stage.

The hydrogen produced is pressurized at a hydrogen station, filled and sold as fuel for fuel cell vehicles. Hydrogen is also filled and used as fuel for fuel cell forklifts in the same farm, and hydrogen is stored and transported in high-pressure containers to be sold as hydrogen gas for fuel cell and industrial use.

In the town of Shikaoi, 10 fuel cell vehicles have been introduced as official vehicles for the town office, and another 9 vehicles have been introduced by private companies such as JA and financial institutions, for a total of 19 vehicles that run on hydrogen produced at Shikaoi Hydrogen Farms.



Source: AIR WATER Inc. HP (accessed on 15 Feb 2024) https://www.awi.co.jp/ja/special/special-24043321519152832932.html

Figure 3-6 Fuel Cell Vehicles Introduced in Shikaoi Town

## (2) Yokohama City, Kanagawa Prefecture

## 1) Area Overview

Yokohama City, Kanagawa Prefecture, is the largest basic municipality in Japan, located in the eastern part of Kanagawa, with an area of 437.71 km<sup>2</sup> and a population of 3,766,999 (as of February 1, 2023). The city has a role as a port city that has driven active trade, commerce, shipping, and shipbuilding. In addition, a world-class industrial zone stretches from the northern part of Tokyo Bay to the eastern part of the city and is home to a diverse range of manufacturing industries, including electronics, machinery, and automobiles.

Greenhouse gas emissions from the city area in FY 2019 were 17.72 million t- $CO_2$ , a decrease for the sixth consecutive year after peaking in FY 2013. Factors contributing to the decrease include a decrease in energy consumption due to energy conservation efforts and an improvement in the emission factor for electricity. In addition, emissions from the consumer sector (household and business) are larger than the national rate.



Source: Created by Nippon Koei using a map of global Japan from the website of the Geospatial Information Authority of Japan, Ministry of Land, Infrastructure, Transport and Tourism.

### Figure 3-7 Location of Yokohama City, Kanagawa Prefecture

### 2) Main initiatives (CCU demonstration test)

Yokohama City, Tokyo Gas, Mitsubishi Heavy Industries, Ltd., and the Mitsubishi Heavy Industries Group are jointly preparing for a demonstration test to establish a CCU, which will separate and recover CO<sub>2</sub> contained in the exhaust gas from the Tsurumi Plant of the Yokohama City Department of Resources and Recycling and then use it as a resource.

In 2023, with the completion of the trial operation of all equipment, a demonstration test was started to transport  $CO_2$  separated and recovered from the exhaust gas of the Tsurumi Plant to the Tokyo Gas Yokohama Techno Station to be used for methanation (a technology to

synthesize methane from  $CO_2$  and hydrogen). This is the first CCU verification experiment in Japan involving regional collaboration in which  $CO_2$  separated and recovered from the exhaust gas of a waste incineration plant is transported to different demand locations and used for methanation.



Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://www.mhi.com/jp/news/23072802.html

Figure 3-8 Image of CCU demonstration test

In Japan, thermal energy generated from waste incineration is classified as "environmentally friendly energy" with no  $CO_2$  emissions because it does not use fossil fuels such as coal, oil, or city gas. Electricity generated from this thermal energy by steam turbines is likewise classified as "environmentally friendly energy" that does not emit  $CO_2$ . In addition to the existing utilization of heat and electricity generated by the waste incineration plant within the city limits, Yokohama City is working on a CCU project to separate, recover, and utilize  $CO_2$  from the waste gas of the waste incineration plant in a public-private partnership, aiming to create a virtuous cycle between the environment and economy centered on the waste incineration plant. Furthermore, in the JCM concept and the calculation of carbon footprint in Chile,  $CO_2$  is generated from the incineration of waste in accordance with the type of waste.



Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://www.city.yokohama.lg.jp/city-info/koho-kocho/press/shigen/2021/0224\_CCUjissyousiken.files/20220224\_ kisyahappyou.pdf

#### Figure 3-9 Image of a decarbonized society centered on waste incineration plants

### (3) Sapporo City, Hokkaido

#### 1) Area Overview

Located in the southwestern part of the Ishikari Plain, Sapporo, Hokkaido, is a large city with an area of 1,121.26 km<sup>2</sup> and a population of 1,971,225 (as of January 1, 2023). The industrial structure of Sapporo, in terms of both the number of establishments and the number of employees, is dominated by tertiary industries such as wholesale and retail trade and food and lodging services, with a lower percentage of secondary industries such as manufacturing than the rest of Japan.

Sapporo's greenhouse gas emissions in FY2016 were approximately 11.93 million t-CO<sub>2</sub>. The city's three sectors (household, business, and transportation) accounted for about 90% of the city's CO<sub>2</sub> emissions. The background is the high heating energy consumption of households in snowy and cold regions, an industrial structure centered on tertiary industries, and high dependence on automobiles in daily life.



Source: Created by Nippon Koei using a map of global Japan from the website of the Geospatial Information Authority of Japan, Ministry of Land, Infrastructure, Transport and Tourism.

#### Figure 3-10 Location of Sapporo City, Hokkaido

#### 2) Main initiatives (Green hydrogen technology, hydrogen mobility technology)

To strengthen its efforts to utilize renewable energies such as solar power, which is considered to have high potential in Hokkaido, the City of Sapporo is working with electric and gas companies to establish a new company to produce and sell hydrogen. The new company will produce and sell "green hydrogen" by utilizing renewable energy sources such as solar and wind power. Green hydrogen, which emits no  $CO_2$  during the manufacturing process, is attracting attention in Japan and abroad as a next generation decarbonization energy source with a wide range of related industries. Sapporo City aims to take advantage of Hokkaido's location as a suitable location for renewable energy to become one of the leading manufacturing and sales bases in Japan.



Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://www.hokkaido-np.co.jp/article/958381/

#### Figure 3-11 Image of new company to produce and sell green hydrogen in Sapporo City

In addition, the City of Sapporo is working to establish a hydrogen supply chain by building hydrogen stations that can be used for FC buses and trucks to realize a hydrogen society.

In the future, the company is considering the introduction of vehicles that use hydrogen fuel and AI technology as a new form of public transportation without rails or overhead wires, replacing the streetcars that run through the center of the city. After conducting demonstration tests starting in the summer of 2024, the city aims to have these vehicles in operation by 2030, in anticipation of the extension of the Hokkaido Shinkansen to Sapporo, to increase convenience for citizens and to promote tourism.



Source: Compiled by Nippon Koei based on the following website (accessed on 15 Feb 2024) https://www.city.sapporo.jp/kankyo/energy/documents/gaiyouban.pdf

## Figure 3-12 Image of the construction of a hydrogen supply chain in Sapporo City

# 3.3.3 Consideration of decarbonization domino activities through horizontal expansion of JCM Model Project

As a decarbonization domino activity, it was considered promoting decarbonization through the horizontal expansion of the JCM Model Project that has been adopted. During the field trip to Chile in February, several potential JCM projects were founded in areas around Renca, and the discussion will be continued to JCM formulation. Also, as a first attempt during the trip, the decarbonization/SDGs dominoes seminar was held for neighboring municipalities in Renca and was able to gain interest in the JCM Model Project from the municipalities. In addition, some of the participating municipalities said that one of the issues is that there is no place to share information. Municipalities are also looking forward to holding similar seminars, so it was considered to continue to hold the seminars to spread awareness of the JCM project.

## 3.3.4 Consideration of SDGs Domino by utilizing "TSUMUGI@"

## (1) Study of the possibility of expanding "TSUMUGI@" to other municipalities

Renca Municipality has shown great interest in TSUMUGI@ as its effectiveness of the diagnostic process and the possibility of utilizing the results. In addition, "TSUMUGI@" can be used as a communication tool; Renca Municipality will be able to take the lead in expanding it to other municipalities, creating opportunities for dialogue with other municipalities on sustainability, and strengthening collaboration.

For example, by utilizing the Municipality for Sustainability, which Mayor of Renca Municipality serves as the leader, Renca Municipality can introduce "TSUMUGI@" to neighbouring local governments. By letting them utilize "TSUMUGI@" for assessment of their initiatives, this could contribute to the creation of a catalyst for the SDGs Dominoes.

This year, at the Intercity Collaboration Seminar for Chilean local governments held on February 1, 2024 (see Section 4.3 for details), TSUMUGI@ was introduced to local governments to discussed the usage of SDGs diagnostic tools. Renca Municipality officials also shared their experiences and benefits of using TSUMUGI@, which provided an opportunity for other municipalities to increase their interest in the tool. A total of six municipalities (Lampa, Huechuraba, Maipu, Cerrillos, Pudahuel, and Quilicura) participated in the meeting. Several municipalities showed great interest in the TSUMUGI@ diagnosis, and it was decided to continue discussions for implementation next year.

Furthermore, during discussions with the representatives of the UN Global Compact in Chile, it was agreed that Renca Municipality would introduce "TSUMUGI@" to a working group that included local governments in northern Chile with particular interest in sustainability.

### (2) Localization of "TSUMUGI@".

The 17 goals and 169 targets of the SDGs set forth in the Agenda for Sustainable Development adopted by the United Nations in 2015 are targets presented from a global perspective. On the other hand, concrete actions at the local level are important to accelerate efforts toward achieving the SDGs. Therefore, it is necessary to "localize" each goal and target and incorporate them into goals and action plans at the local government level.

Questions in TSUMUGI@ were set by localizing the SDGs based on the Cabinet Office's " SDGs Local Indicator List (August 2019 version)5" and the area of responsibilities for local governments, and case studies of local governments. The results of the demonstration conducted in FY2022 in the Renca Municipality confirmed the adaptability of TSUMUGI@ in Chile, where the economic structure and social development conditions are not significantly different from those of Japanese local governments, while it pointed out that some of the

<sup>&</sup>lt;sup>5</sup> Currently, the August 2022 revised edition is being published.

questions were not applicable to Chilean municipalities. (The system was designed to remove such questions from the diagnosis by marking them as not applicable.)

In response to the high interest of the Renca Municipality and neighbouring municipalities, it was agreed to make the tool more accurate and fit in Chile by consulting with the Renca Municipality and the Chilean representatives of the UN Global Compact, and reviewing and modifying the questions in the tool by experts who are familiar with the field of sustainability.

	Table 3-4 Discussion details with Global compact
item	Summary
Date and	Wednesday, January 31, 2024, 9:00-10:00 AM (Chile time)
Time	
participant	Global Compact: Margarita Ducci (Executive director), Eduardo Perez (Chief adherent)
	Toyama City: Kajikawa, Hashimoto
	La Febrica: Carolina Torres, Cristina Contreras
	Nippon Koei: Saito, Yasuda, and local consultants (Sherpas)
Details of	$\checkmark$ There are many municipalities in Chile that are active in SDG initiatives.
Discussions	$\checkmark$ Currently, discussions are underway with the cities of Antofagasta, Valparaiso, and
	Concepcion. The city of Antofagasta is particularly active in SDG initiatives and is
	conducting training for municipal officials, so TSUMUGI@ is expected to be a good
	tool for them.
	✓ It would be desirable for La Febrica to participate and introduce "TSUMUGI@" to
	other interested municipalities, including their experiences.
	$\checkmark$ It was agreed that the localization of the questions would be reviewed in Spanish
	conduced by Global Compact.

## Table 2.4 Discussion details with Clabel compact

### (3) Proposals for the next fiscal year

Based on the above, the following initiatives are to be planned in the next year for SDGs Domino by utilizing "TSUMUGI@"; (1) to update "TSUMUGI@" to a tool for local governments in Chile through localization of SDGs, (2) to diagnose initiatives using "TSUMUGI@" by neighbouring municipalities and/or other municipalities with hight interest in, and (3) to share the results of TSUMUGI@ with Renca Municipality and implementing municipalities, and discuss the future initiatives for SDGs in collaboration with them.

## CHAPTER 4. RESULTS OF SEMINARS AND MEETINGS

This chapter summarizes the results/plans of the various workshops and seminars. Through these meetings, the needs and issues of Renca Municipality were identified and discussed specific support by Toyama City from the perspective of Toyama City SDGs Future City. At the same time, it considered the possibility of JCM projects for existing projects and facilities with high potential for renewable energy and advanced technology, etc.

### 4.1 MEETING WITH MINISTRY OF THE ENVIRONMENT, JAPAN

#### 4.1.1 Kick-off meeting with Ministry of the Environment, Japan (11 July 2023)

The kick-off meeting for FY2023 Toyama-Renca city-to-city collaboration project was held online. The summary and results of the kick-off meeting are shown in the table below.

Kick-off meeting with MoEJ		
Online		
11 July 2023, 14:00-15:00		
Kick-off meeting for city-to-city collaboration project between Toyama City		
and Renca Municipality		
Explain the project outline to MoEJ and exchange opinions regarding the		
project implementation strategy.		
1.Overview of the project		
2.Comments and questions on the outline of the project plan and		
implementation strategy		
MoEJ (2 people)		
Toyama City (2 people)		
Nippon Koei (5 people)		
MoEJ expressed high praise for the 2.0MW solar power project adopted last year,		
and expressed hope that JCM will be promoted in Chile in the future.		

Table 4-1	<b>Summary</b>	of the	kick-off	meeting	with MoEJ	
	•/					

Source: Nippon Koei

## 4.1.2 Interim meeting with MoEJ (7 November 2023)

The interim meeting with MoEJ was held online. The summary of the interim meeting is shown in the table below.

Item	Final meeting with MoEJ		
Implementation	Online		
method			
Date and time	7 November 2023, 10:00-10:30		
Overview	Interim meeting of the city-to-city collaboration project between Toyama		
	City and Renca Municipality		
Objective	Report to MoEJ on the progress of the project.		
Agenda	1. Overview of the project		
	2.Report on the progress of the project		

Table 4-2 Overview of interim meeting with MoEJ

	3.Comments and questions		
Participants	MoEJ Toyama City Nippon Koei		

Source: Nippon Koei

## 4.1.3 Final meeting with MoEJ (22 February 2024)

The final meeting with MoEJ was conducted to report the results of city-to-city collaboration project between Toyama City and Renca Municipality in FY2023 and the proposed activities for next fiscal year. The summary of the final meeting is shown in the table below.

Table 4-5 Over view of final meeting with MoE5			
Item	Final meeting with MoEJ		
Implementation	Online		
method			
Date and time	22 February 2024, 10:00-11:00		
Overview	Final meeting of the city-to-city collaboration project between Toyama		
	City and Renca Municipality		
Objective	Report to MoEJ on the results of this year's project and plans for next		
	year.		
Agenda	1.Report on the results of the project and explanation of the plans for next		
	year		
	2.Comments and questions		
Participants	MoEJ		
	Toyama City		
	Nippon Koei		

Table 4-3	Overview	of final	meeting	with Mol	E.I
		vi imai	meening		

Source: Nippon Koei

## 4.2 JCM INTRODUCTORY SEMINAR FOR ZERO CARBON CITY (26 OCTOBER 2023)

The "JCM Introductory Seminar for Zero Carbon City" workshop was held at Hybrid on October 26, 2023. For the purpose of forming a JCM project in Renca, JCM projects, and the Renca JCM project adopted last year, "Energy Supply Project by 2.0MW Rooftop Solar Power System to Industrial Plastic Plant in Renca, Santiago Metropolitan Region" was introduced for participating companies in Renca. In addition, Ryoshin Co., Ltd., a Toyama City company, introduced waste-related technology. The draft agenda for the workshop is shown in the table below. The presentation materials are referenced in the attached materials.

Title	JCM Introductory Seminar for Zero Carbon City		
Implementation	Hybrid		
method			
Date and time	26 October 2023, 21:00-23:00		
Overview	For the purpose of forming JCM projects in Renca, JCM schemes and case studies were introduced to participating companies in Renca. In addition, Ryohshin, a company based in Toyama City, introduced waste-related technology.		
Agenda	<ol> <li>Opening Remarks: La Fabrica</li> <li>City-to-City Collaboration Project: Renca Municipality</li> <li>JCM Model Project: Nippon Koei</li> <li>Tehmco Project: Tehmco</li> <li>Waste-related technology: Ryohshin</li> <li>Q&amp;A</li> <li>Closing Remarks</li> <li>Gaffee headle</li> </ol>		
Participants	Toyama City and companies in Toyama City Renca Municipality (including mayor), companies and NGOs in Renca Nippon Koei, local staff Interpreters		

#### Table 4-4 Outline of the online workshop

Source: Nippon Koei

## 4.3 DECARBONIZATION/SDGS DOMINO SEMINAR FOR CHILEAN MUNICIPALITIES (1 FEBRUARY 2024)

With the aim of decarbonization/SDGs domino, "Decarbonization/SDGs domino seminar for Chilean municipalities" was held on February 1, 2024 for Chilean municipalities in Renca. There was a wide range of participating municipalities, including Lampa, Huechuraba, Maipu, Cerrillos, Pudahuel, and Quilicura, and the seminar introduces and promotes activities related to decarbonization and SDGs Domino. The agenda and contents of the seminar are shown in the table below.

Subject	Decarbonization/SDGs Domino Seminar for Chilean municipalities			
Date and time	February 1, 2024, 15:30-16:15 (Chile time)			
Meeting place	Hall in La Fabrica			
Attendees	Chilean municipalities Diego Torrealba (Lampa), Camilo O (Lampa), Q'ala Beacker (Huechurab Irrarázaval (Huechuraba), Matías C (Maipu), Sergio Soto (Maipu), Nést (Cerrillos), Hugo Melo (Cerrillos), S Cifuentes (Pudahuel), Erica Noram (Pudahuel), Paulina Rojas (Quilicur			
	Renca Municipality	Pamela Torres (Chief of Environment Department DIMAO Renca)		
	La Fabrica	Cristina Contreras		
	Toyama City	Keiko Kajikawa, Kana Hashimoto		
	Sherpas	Gonzalo Díaz, Felipe Gálvez Engels		
	Nippon Koei	Tetsuya Saito, Mari Yasuda		
1. 15:30-15:45	Introduction of activities of Renca Municipality (Ms. Torres, Renca Municipality)			
Ms. Torres from t	Ms. Torres from the Environment Department of Renca Municipality introduced the decarbonization			

Table 4-5 Overview of Decarbonization/SDGs Domino Seminar

efforts of Renca to date. Renca started their activities globally in 2017 and explained their background including participation in Race to Zero in 2021. Furthermore, in the Race to Zero, Race to Resilience platform called "CDP-ICLEI", Renca Municipality's mitigation and adaptation activities were highly evaluated, and they will continue to promote mitigation and adaptation efforts in the future.

2. 15:45-16:00 Introduction of TSUMUGI@ and JCM project (Saito, Nippon Koei) Mr. Saito of Nippon Koei introduced City-to-City Collaboration Project, TSUMUGI@, and JCM projects. TSUMUGI@ was introduced to municipalities and encouraged its use as an SDGs diagnostic tool. Also, JCM Model Project of the solar power project in Renca adopted last year was introduced and explained that they are proceeding with project formation activities in areas other than Renca, and Nippon Koei's support in the JCM project formation.

#### 3. 16:00-16:15 Q&A, opinion exchange

Participating municipalities actively exchanged opinions regarding City-to-City Collaboration Project, JCM project, and TSUMUGI@. There was questions and answers regarding this project, and issues were shared by each municipality. Cerrillos has the issue of the urban heat phenomenon and was interested in this project. Additionally, some expressed dissatisfaction with the fact that since municipalities basically operate independently, there is no place to share knowledge like this seminar. It was hoped that sharing opportunities like this seminar would be held in the future. Also, during the opinion exchange, there were many questions related to TSUMUGI@, and was a high level of interest in using TSUMUGI@, as there is no established SDGs diagnostic tool in municipalities.





## 4.4 CITY-TO-CITY COLLABORATION SEMINAR TO REALIZE A DECARBONIZED SOCIETY (26 TO 27 FEBRUARY 2024)

The "City-to-City Collaboration Seminar to Realize a Decarbonized Society" is scheduled to be held for two days from February 26th to 27th, 2024. In this seminar, participants will deepen their understanding of climate change countermeasures in cities, which have been accelerating in recent years, and discuss problem-solving with diverse stakeholders. This seminar consists of an open seminar commemorating the 10th anniversary of the city-to-city collaboration project, a mutual learning session between participants focused on climate change countermeasures in cities, and a field visit to learn about climate change countermeasures in Japanese cities.

## CHAPTER 5. FUTURE PLAN

## 5.1 OVERVIEW OF PHASE 2

In Phase 2, the purposes are to concretely advance Renca's contribution to the Race to Zero, advance concrete initiatives regarding SDGs, promote decarbonization and the SDGs domino, and form and realize projects that contribute to decarbonization.

The three-year concept for Phase 2 is reproduced below.



Source: Nippon Koei

Figure 5-1 Concept of phase 2

Below, main policies for next year's activities based on this year's project implementation policy were organized.

# 5.2 POLICIES FOR CITY-TO-CITY COLLABORATION PROJECT IN THE COMING YEAR

### 5.2.1 Institutional development approach

1) This year, regarding the plans and progress of the Race to Zero, the progress was made in organizing what kind of contribution Toyama City and Japan can make, especially considering the status of support from other countries. In particular, while it has been officially announced that cooperation between the United States and Switzerland will be promoted this year, it has also been revealed that the specific details of the cooperation will continue to be considered. As mentioned above, this fiscal year, the contents regarding Japan's contributions were organized, so adjustments will be made and the plan will be finalize next fiscal year when more information on other countries' plans is added.

2) In promoting specific initiatives for the SDGs, in addition to Renca's efforts that were visualized using TSUMUGI@ last year, the initiatives for the SDGs through public-private collaboration were discussed. During discussions regarding this year's field trip, it was discovered that Toyama City's PPP initiatives would be of interest to Renca. In particular, it was considered taking advantage of this year's invitation to Japan to introduce their PPP initiatives. Unfortunately, the invitation to Japan did not materialize this year, so for next year, firstly the examples of PPP initiatives will be introduced online, and then the opportunity to invite participants to actually observe and deepen their understanding will be planned.

3) With regard to decarbonization and SDGs Domino, it was able to establish specific action policies through interviews with Global Compact Chile and the holding of the Decarbonization and SDGs Domino Seminar this year. In particular, the TSUMUGI@ initiative has generated strong hope among neighboring municipalities around Renca, and plans are being made to implement concrete activities from next year.

## 5.2.2 JCM Model Project formation approach

1) In line with its participation in the Race to Zero, Renca needs to take visible actions towards decarbonization and report on them. This fiscal year, the 2.0MW solar power generation of JCM Model Project was completed, and an annual reduction of approximately 1,200 tons of CO2 has begun. More and more use of JCM Model Project will be expected as concrete projects.

2) The solar installation scheme mentioned above by ESCO was adopted as JCM Model Project in 2022, and construction was completed this year. The success of this project was introduced in this year's JCM introduction seminar (October 2023), completion ceremony (February 2024), and decarbonization/SDGs domino seminar (February 2024). Also, it has been widely publicized through SNS from Renca and Renca's Mayor, and has greatly contributed to the increase in the number of companies expressing interest.

Although the solar power generation project in Renca was once rejected, it was discovered through a field survey that it could contribute to Renca's own decarbonization goals. It was planned to continue to apply for this project, as it will directly contribute to the SDGs goal of "delivering clean energy to everyone". Since the small scale of the project was pointed out as a reason for its rejection, bundling the application with other projects will be considered.

3) Additionally, in this year's survey, companies that use natural gas for heat have expressed interest in introducing electric boilers for decarbonization. It is considered to propose the use of biogas in terms of the current status of its introduction in Japan and as a project for electric boiler suppliers in the Chilean market.

4) Also, this year, at the JCM introduction seminar, new companies in Toyama city introduced waste treatment technology. As a result of introducing related technology to companies within and outside Renca, several companies have expressed interest in converting waste into alternative fuels, and will consider forming projects next year.

5) Due to its convenient location, Renca is home to many companies that involve transportation, such as warehousing, beverages, and food manufacturing. When decarbonizing the

transportation sector, electrification, hydrogenation, biogasification, etc. can be considered as options, but they have advantages and disadvantages, and there are no large electric/hydrogen trucks in the Chilean domestic market. It seems like it will take a little more time. While it may be difficult to develop concrete projects during Phase 2, each company is rapidly progressing with decarbonization efforts, so it is continued to update information.

## 5.3 CONSIDERATION AFTER PHASE 2

Cooperation between Toyama City and Renca Municipality is progressing smoothly, and although it was not possible for people to travel from Chile to Japan this year, progress in mutual travel will allow concrete progress in the Race to Zero initiative. In order to continue fruitful collaboration in Phase 2 and beyond, an exit strategy for this City-to-City Collaboration Project will be considered from next year.