FY2019 Project for Ministry of the Environment Japan

FY2019 City-to-City Collaboration Programme for Low-carbon Society

City-to-City Collaboration between Semarang City and Toyama City for the Promotion of Clean-Energy based on Low-Carbon Society Scenario

Report

March 2020

Nippon Koei Co., Ltd. Toyama City

FY2019 City-to-City Collaboration Programme for Low-carbon Society

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Report

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Abbreviations

Abbreviation	Description			
BAPPEDA	Badan Perencanaan Pembangunan Daerah (Regional Development			
	Planning Agency)			
CASBEE	Comprehensive Assessment System for Built Environment Efficiency			
CNG	Compressed Natural Gas			
CO	Carbon monoxide			
COP	Coefficient of Performance			
CO2	Carbon dioxide			
DDF	Dual Diesel Fuel			
DLH	Dinas Lingkungang Hidup (Department of Environment)			
EPC	Engineering, Procurement, Construction			
GB	Green Building			
IFC	International Finance Corporation			
JCM	Joint Crediting Mechanism			
MRU	Mobile Refueling Unit			
MRV	Monitoring, Reporting and Verification			
NDC	Nationally Determined Contribution			
ODA	Official Development Assistance			
PLN	National Energy Company			
PV	Photovoltaics			
RAN-GRK	National Action Plan for Reducing Greenhouse Gas Emissions			
RAD-GRK	Regional Action Plan for Reducing Greenhouse Gas Emissions			
RUEN	Grand National Energy Plan			
SDGs	Sustainable Development Goals			
SE4ALL	Sustainable Energy for All			
SGP	Selamat Global Partners			
WGBC	World Green Building Council			

CHAPTER 1 BACKGROUND AND OBJECTIVE

1.1 BACKGROUND OF THE STUDY

In December 2015, all countries participated in United Nations Framework Convention on Climate Change 21st Conference of the Parties (COP21) which was held in Paris, France. In the COP21, Paris Agreement was adopted as a legal framework of fair and practical countermeasure to climate change after 2020. Paris Agreement aims at keeping global warming below 2 degrees Celsius above pre-industrial level, and it requires efforts to keep it below 1.5 degrees Celsius by promoting activities for decarbonization. In addition, it was decided that activities by non-state actors (including cities) and efforts by all non-governmental entities (cities and other local governments etc.) are acknowledged and encouraged to be scaled out in COP21. Cities are the places to support social and economic growth since a lot of people live there. Although the total of urban areas is only 2% of all land in the world, approximately half of world population lives in urban areas and the percentage is predicted to increase to 70% by 2050. Also, it is estimated that more than 70% of global CO2 emissions are emitted from cities as of 2006. Hence, cities have important roles for mitigation of climate change. Thus, implementation of countermeasures to climate change and greenhouse gas (GHG) emission reduction in cities are important for achievement of the goal of Paris Agreement.

In Indonesia, the Government of Indonesia established National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK), and each regional government enacted Regional Action Plan for Reducing Greenhouse Gas Emissions (RAD-GRK) in 2013. In addition, Grand National Energy Plan 2015-2050 (RUEN) formulated in January 2017, particularly considers promoting energy saving and utilization of natural gas in Indonesia as priority countermeasures. Furthermore, Indonesian Government has promised to reduce 29% of GHG emission compared to Business As Usual (BAU) according to their NDC, and in case international assistance such as JCM is introduced, their target is 41% in NDC. Therefore, Indonesia is expecting to implement JCM, which Indonesia and Japan signed, for achievement of the target in NDC.

Semarang City is a provincial capital of Central Java in Indonesia and is located 450 km east from Jakarta. Population of Semarang City is approximately 1.7 million (census 2015), and it is the fifth largest city in the country. There are 9 Industrial Parks in Semarang, and energy demand and fuel consumption in industry sector have been increasing along with the growing manufacturing industry.

On the other hand, Toyama City which is located along the coast of the Japan Sea has many types of industries and has been promoting energy saving actions very well. The following table shows achievements of Toyama City for development of sustainable low carbon society.

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Year	Award	Description		
2008	Environmental	Toyama City's activities for "low-carbon society" and concept of		
	Model City	"compact city" are recognized as good examples for energy		
		saving.		
2011	Environmental	The strategy of "compact city" is recognized as a good solution		
	Future City	for the issues of all local cities.		
2014	UN's SE4ALL	The plan for improvement of energy efficiency was developed to		
		achieve the goal which is proposed by UN's SE4ALL.		
2016	Host city for G7	Development of resilient city has been promoted in Toyama City.		
	Environment	Mr. Mori, Toyama City Mayor, summarized the contents of a		
	Minister's Meeting	parallel session at the Minister's meeting as "the role of cities".		
2018	SDGs Future City	On 15 June 2018, Toyama City was selected for "SDGs Future		
		City" to contend comprehensively with many issues related to		
		economy, society, environment sector. In addition, Toyama City		
		is selected "Municipality SDGs Model Business" as well.		

Table 1-1 Award for Toyama City related to Sustainable Ci	ity
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Source: Prepared by Nippon Koei based on information from Toyama City

In addition to the above achievements, Toyama City is promoting "City cooperation programme by utilizing the Environmental Future City's knowledge". Also, Toyama City and Semarang City were selected as one of "100 Resilient Cities" by the Rockefeller Foundation.

Then, "FY2017 City-to-City Collaboration Programme for Low-Carbon Society between Toyama City and Semarang City" was adopted to realize low carbon society in Semarang City by sharing Toyama City's experiences and knowledge. In this programme, the activities on "Compact City type transportation system" and "Low carbonization resilient City construction" in Semarang were implemented.

Furthermore, Toyama City is actively carrying out City-to-City Collaboration activities. Technical cooperation agreement was established between Toyama City and Semarang City. Mr. Masashi Mori (Toyama City Mayor) and Mr. Hendrar (Semarang City Mayor) signed on the agreement at Toyama International Conference Center in December 2017. On the same day, Toyama City and IGES also signed the technical cooperation agreement aimed towards the realization of sustainable, decarbonized development.



The technical cooperation agreement between Toyama and Semarang for low-carbon society

Major achievements of the City-to-City collaboration are summarized in the following table.

#	Year and Date	Description
1	August 2017	"FY2017 City-to-City Collaboration Programme for Low-Carbon
		Society between Toyama City and Semarang City" was adopted. It
		aimed to develop "compact City type transportation system" and "low
		carbonization resilient City construction" in Semarang City.

 Table 1-2
 History of Toyama and Semarang City-to-City Collaboration

#	Year and Date	Description			
2	December 2017	The technical cooperation agreement between Toyama and Semarang			
		for low-carbon society was established.			
3	March 2018	"City-to-City Collaboration between Toyama City and Semarang City			
		Introduction of Energy Saving Equipment in Industry Sector of			
		Semarang" was selected as FY 2019 City-to-City Collaboration			
		Programme			
4	June 2018	"Introduction of CNG-Diesel Hybrid Equipment to Public Bus in			
		Semarang" was selected as FY2018 JCM model project			
5	October 2019	"City-to-City Collaboration between Semarang City and Toyama City			
		for the Promotion of Clean-Energy based on Low-Carbon Society			
		Scenario" was selected as FY 2018 City-to-City Collaboration			
		Programme			

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

1.2 OBJECTIVE OF THE STUDY

"The City-to-City Collaboration Programme for Low-Carbon Society" (hereinafter called "the Study") aims to implement investigations for developing a low carbon society in foreign cities by Japanese cities who have valuable knowledge and experiences. Japanese cities also collaborate with Japanese research institutes, private companies, and universities in order to conduct the surveys in an effective and efficient manner.

In this project, study to formulate JCM model projects and support on policies of Semarang City was carried out for promotion of clean energy based on "Low-carbon Society Scenario Semarang 2030" developed by Semarang City in 2018 under City-to-City Collaboration with Toyama City.

1.3 IMPREMENTATION STRUCTURE

The Regional Autonomy Unit and The Regional Development Planning Agency (BAPPEDA) of Semarang City were the main counterpart of the Study. Furthermore, State-own Companies, Industrial Parks and the Chamber of Commerce and Industry (KADIN) in Semarang City were involved in the Study as well. Toyama City introduced private companies, Nihon Air-conditioning Hokuriku Co., Ltd. and Hokusan Co., Ltd. based in Toyama which have good environmental technologies to solve environmental issues in Semarang City.

Nippon Koei Co., Ltd. supported all activities of the City-to-City Collaboration, feasibility studies for JCM model project formulation, and consideration of MRV plan.



Source: Prepared by Nippon Koei

Figure 1-1 Implementation Organization

1.4 STUDY SCHEDULE

The Study schedule is as follows.

	plan/	2019			2020	
Study items	Achievement	Oct	Nov	Dec	Jan	Deb
1. Study for JCM model project formulation						
1) Study for JCM model project formulation						
	Plan					
a) Condideration of specification	Achievement					
b) Development of projcet chedule and evaluation	Plan					
of the project	Achievement					
c) Development of financial schedule	Plan					
c) Development of mancial schedule	Achievement					
d) Decision of project schedule	Plan					
a) Decision of project schedule	Achievement					
2) Development of MRV plan						
a) Preparation of drafts of mehodology and PDD	Plan					
a) reparation of analis of menodology and r bb	Achievement					
b) Preparation of monitoring plan	Plan					
b) rreparation of monitoring plan	Achievement					
3) Consideration and agreement of international co	onsortium				-	
 a) Considuration and finalization of implemetation 	Plan					
structure	Achievement					
h)Preparation of draft Agreement	Plan					
b) reparation of draft Agreement	Achievement					
2. City-to-City Collabration activities						
1) Site Study	Plan		A	A	A	A
	Achievement					A
2) Japan Visit	Plan				\triangle	
	Achievement				\triangle	
3. Others	r	1	r	r	r	1
3-1 Monthly report	Plan			\triangle	\triangle	\triangle
	Achievement			\triangle	Δ	\triangle
3-2 Reporting meeting with MOE1	Plan		\triangle			\triangle
	Achievement		Δ			
3-3 Meetings with Toyama City and private	Plan		\triangle	Δ		\triangle
enterprises	Achievement		\triangle	\triangle		
3-4 Site Study	Plan		A	▲		A
	Achievement					
3-5 Seminar and workshop in Semarang	Plan					
	Achievement					
3-6 City-to-City Collaboration seminar	Plan				△1/16,17	
	Achievement				\triangle	
3-7 Final report	Plan					Δ
	Achievement	L				Δ
▲ : Implemented in Indonesia (Plan) △ : Implemeted	in Japan (Plan)	: implem	ented in Indonesia (Ac	hievement) 🛆 : imple	mented in Japan (Ach	evement)
			Plan		Achievement	

Source: Prepared by Nippon Koei

Figure 1-2 Study Schedule in FY2019

1.5 OVERVIEW OF SITE VISITS

In this project, field surveys were carried out 4 times. Overview of the visits is listed in Table 1-3.

Title	Duration of visit	Activities					
1st field survey	26, 27 November, 2019	 <u>Study for JCM model project formulation</u> Meeting and site study with an electronics factory <u>City-to-City Collaboration activities</u> Meeting with Trans Semarang 					
2nd field survey	17-19, December, 2019	Study for JCM model project formulation - Meeting with Industrial park management company - Meeting and site study with management company of power station City-to-City Collaboration activities - Meeting with Pertagas - Meeting with Trans Semarang - Implementation of Kick-off Meeting with Semarang City					
3rd field survey	21-23 January, 2020	 <u>Study for JCM model project formulation</u> Meeting with agricultural machines factory Meeting and site study with garment factory Meeting with boiler manufacturer <u>City-to-City Collaboration activities</u> Meeting with Semarang City Joint meeting with trans Semarang and Pertagas Meeting regarding Green Building Regulation (Singapore) 					
4th	10 February,	City-to-City Collaboration activities					
field survey	2020	- Implementation of Joint Wrap-up Meeting in Bali					

Table 1-3Overview of site visits

Source: Prepared by Nippon Koei



Site study at electronics factory (Nov 2019)

Meeting with garment factory (Jan 2020)

CHAPTER 2 STUDY FOR JCM MODEL PROJECT FORMULATION

City-to-City Collaboration project between Semarang City and Toyama City has been implemented since FY2017. Study for JCM model project formulation of this FY was carried out with targeting factories in industrial parks located in Semarang or surrounding the city with huge consumption of fuels/electricity, which is the same method as previous years' study. Also, as candidate technologies for JCM, photovoltaic (PV) system (renewable energy) and high-efficient equipment (Air-conditioning equipment and boiler etc.) were introduced to factories. In addition, in order to promote utilization of clean energy, installation of high-efficient equipment with fuel exchange (including Dual Diesel Fuel (DDF) technology which is mixed burning technology with natural gas) was also considered as candidate technology and studied this FY.

2.1 JCM MODEL PROJECT FORMULATION IN PRIVATE SECTOR

Study for JCM model project formulation of this FY was carried out with targeting factories in industrial parks located in Semarang or surrounding the city with huge consumption of fuels/electricity, which is the same method with the previous years' study. Project team contacted such factories and checked their interest in JCM model project and low-carbon technologies and collected information such as existing equipment and financial plan. In order to find candidate factory for JCM model project formulation efficiently, first contacts (meeting or telephone meeting) to the factories were carried out by Selamat Global Partners (SGP), which is local partner of this project, and then the project team had meetings with factories who showed high interests in the first meeting with SGP.

Project team had a meeting with the factories listed below (including factories who only SGP had a meeting or telephone meeting with).

No.	Type of factory	Main energy source	Meeting result
1	Steel pipe factory	Coal	No interest in JCM and low-carbon technology as they are already using high-efficient equipment.
2	Steel bar factory	Coal	They showed an interest in installation of low-carbon technology but were not selected as study target because they have no investment plan in equipment in the factory
3	Iron and Steel Smelting	Coal	No interest in installation of low-carbon technology.
4	Agricultural machine factory	(Electricity)	They showed an interest in installation of low-carbon technology but were not selected as study target because they have no investment plan in equipment in the factory

 Table 2-1
 Meeting result with private sector

No.	Type of factory	Main energy source	Meeting result
5	Automotive assembly factory	(Electricity)	No interest in installation of low-carbon technology.
6	Tabaco factory	(Electricity)	No interest in installation of low-carbon technology.
7	Vending machine factory	(Electricity)	No interest in installation of low-carbon technology.
8	Agricultural equipment factory	(Electricity)	No interest in JCM and low-carbon technology as they are already using high-efficient equipment.
9	Fully integrated plastic molding factory	(Electricity)	No interest in installation of low-carbon technology.
10	Glasses flame factory	(Electricity)	No interest in JCM and low-carbon technology as they are already using high-efficient equipment.
11	Electronics factory	(Electricity)	This factory is owned by one of the biggest electronics manufacturers and manufacturing refrigerator in Semarang. At first, they are keen to introduce high-efficient equipment, PV system to the factory and fuel exchange in trucks as JCM model project, thus, project team had some meetings. However, this factory, after all, decided not to invest in equipment due to impact such as closing of another factory.
12	Food processing factory A	(Electricity)	Project team designated as study target because this factory has plans for extension of the factory and replacement of factory. The team studied for installation of roof-top PV system and high-efficient equipment.
13	Wire factory	(Electricity)	No interest in installation of low-carbon technology.
14	Steel roof, Iron wall sheet factory	(Electricity)	They showed an interest in installation of low-carbon technology but were not selected as study target because they have no investment plan in equipment in the factory
15	Garment factory S	Diesel	This factory has an interested in installation of PV system to their new factory being constructed. Project team designated this factory as study target and exchanged information continuously.
16	Management company of industrial park.		Project team confirmed there is no possibility to install low-carbon technologies to facilities owned by the management company, thus requested the company to share information of JCM and low-carbon technologies with tenant factories.

Source: Prepared by Nippon Koei (including information collected by SGP)

2.1.1 Selection of study targets

As a result of meetings with factories listed in Table2-1, Study for JCM model project formulation was implemented in garment factory (No.15) and food processing factory (No.12). Conditions for selection were as follows.

- 1) Factory with plans for construction of new factory, extension of existing factory or replacement of equipment.
- 2) Roof of factory with enough space and enough durability to install more than certain amount of PV panels.
- 3) Factory with understanding on improvement of value of company by implementing JCM model project with installation of low-carbon/zero-carbon technologies.

2.1.2 Installation of PV system in garment factory

Overview of the factory

Garment factory S has two locations in Semarang. Currently a new factory is under construction and after construction, the existing two factories will be closed and integrated into the new factory.

Existing factories are operated by electricity generated by their own diesel engines and the diesel engines are planned to be relocated to the new factory. It is also being considered to cut fuel cost by installing roof-top PV system (self-consumption) into the new factory with utilization of JCM subsidy



Existing diesel engine



Construction site of new factory

Location and specification of the installed equipment

New factory is under construction in Bukit Semarang Baru Industrial Park located in west part in Semarang. Total floor area of the factory is 1.5ha and the plant has two stories (186m x 36m). Installation of roof-top PV system to the plant was studied.

As installed PV panel, NU-AF345H of SHARP is assumed. As this product has high salinity tolerance, it is possible to install into the sea-side area of Semarang. Also, previous JCM model projects selected this PV panel as low-carbon technology.



Source: Prepared by Nihon Air-conditioning Hokuriku





Source: Prepared by Nihon Air-conditioning Hokuriku

Figure 2-2 Layout of roof-top PV system in new factory of garment factory S

Trial calculation of CO2emission reduction

Nihon Air-conditioning Hokuriku calculated that 2,430 panels (total capacity 834.35kW) can be installed to the new factory's roof. Also, as a result of trial calculation of average solar irradiation by simple model, Global Solar Atras GTI, annual electricity generation was expected to be 1,165 MWh. Calculation process is shown in Table 2-2.

CO2 emission reduction was calculated in accordance with Indonesian JCM methodology "JCM_ID_AM013_Installation of Solar PV System. ver01.0".

garment factory				
Item	value	Unit	Remarks	
PV output	838.35	kW		
Average solar irradiation	5.330	kWh/m2/d	Global solar atlas GTI Value	
Total system efficiency	0.7982			
Average temperature bias	0.8952			
Annual operation dates	365	days/yr		
Annual PV generation	1,165,424	kWh		
Emission Factor	0.613	tCO2/MWh	GEC, Jawa-Bali, Self consumption	
Annual CO2 emission reduction	714.4	tCO2/yr		
Project year	15.0	year	Legal lifetime for electricity generation equipment (Tentative)	
Project CO2 emission reduction	10,716.1	tCO2		
Subsidy	30	%		
CO2 ER cost effectiveness	2,206	JPY/tCO2		

Table 2-2	Trial calculation of CO2 emission reduction for installation of PV system to
	garment factory

Source: Prepared by Nippon Koei

As shown in the table above, annual emission reduction is 714.4 which is relatively small as JCM model project. On the other hand, it was confirmed that if subsidy rate is 30%, cost effectiveness, 2,206 JPY/tCO2 meets the condition of JCM model project (less than 4,000 JPY/tCO2)

Consideration of international consortium

Assumed implementation structure is shown in Figure2-3. International consortium consists of Nihon Air-conditioning Hokuriku as representative entity and garment factory S as partner entity.

Nihon-Air-conditioning Hokuriku has many experiences of installation and maintenance of airconditioning equipment, sales of PV system and electricity generation business in Hokuriku area. Also, in 2019, the company was in charge of procurement of PV panels (SHARP's OV panels, Approx.30kW) in a project for installation of small-scale roof-top PV system for electricity source of water pump for irrigation in Klungkung Regency, Bali Province. Therefore, it can be said that Nihon Air-conditioning meets the conditions to be a representative entity. In addition, Nihon Air-conditioning Hokuriku attended to meetings with the garment factory, implemented site study to check equipment in an existing factory and almost agreed to apply for JCM model project with the garment factory. Although EPC contractor for this project has not been decided, one of EPC contractors, that has experiences to install PV system in Semarang, will be selected. Installation works can be carried out smoothly with Nihon Air-conditioning Hokuriku's support such as supervising and advising.



Source: Prepared by Nippon Koei

Figure 2-3 Implementation structure of JCM model project (Garment factory)

2.1.3 Installation of PV system and high-efficient equipment to food processing factory

Overview of the factory

95% of total capital of Food processing factory A is owned by Japanese companies and almost all production in the factory is exported to Japan. Since this factory has an interest in installation of PV system and cutting fuel cost, JCM project formulation with PV system was studied. Also, this factory has a plan of extension and replacement and addition of production equipment, possibility of JCM model project formulation could be high.

1) Consideration of installation of roof-top PV system

Location and specification of the installed equipment

It was considered installing PV panels onto roofs of 4 plants of factory A (total 2,700 m2) in an industrial park located in north-west area in Semarang. Setting image is shown in Figure2-4 and layout of PV panels in Figure 2-5.



Source: prepared by Nihon Airconditioning Hokuriku

Figure 2-4 Setting image to food processing factory

Installed PV panels are assumed to be NU-AF345H of SHARP, same as project in garment factory.



Source: prepared by Nihon Air-conditioning Hokuriku



Trial calculation of CO2emission reduction

Nihon Air-conditioning Hokuriku calculated that 594 panels (total capacity 204.93 kW) can be installed to the new factory's roof. Also, as a result of trial calculation of average solar irradiation by simple model, Global Solar Atras GTI, annual electricity generation was expected to be 285MWh. Calculation process is shown in Table 2-3.

CO2 emission reduction was calculated in accordance with Indonesian JCM methodology "JCM_ID_AM013_Installation of Solar PV System. ver01.0".

roou processing factory				
Item	Value	Unit	Remarks	
PV output	204.93	kW		
Average solar irradiation	5.330	kWh/m2/d	Global solar atlas GTI Value	
Total system efficiency	0.7982			
Average temperature bias	0.8952			
Annual operation dates	365	days/yr		
Annual PV generation	284,881	kWh		
Emission Factor	0.613	tCO2/MWh	GEC, Jawa-Bali, Self consumption	
Annual CO2 emission reduction	174.6	tCO2/yr		
Project year	10.0	year	Legal lifetime for food production factory	
Project CO2 emission reduction	1,746.3	tCO2		

Table 2-3 Trial calculation of CO2 emission reduction for installation of PV system to food processing factory

Source: Prepared by Nippon Koei

As shown in the table above, annual emission reduction is 174.6tCO2/yr, which is quite small and cannot meet a condition of JCM model project (more than 1,000 tCO2/yr). Thus, it was considered adding CO2 emission reduction by integrating energy saving from installation of other high-efficient equipment to the factory.

2) Consideration of installation of high-efficient equipment

As mentioned above, since only installation of PV system cannot secure enough CO2 emission reduction, information collection of replacement plan of other equipment is being carried out. Equipment installed with high possibility of meeting the conditions is listed in Table 2-4. Project team is requesting the food processing factory to provide expected specification, operation hour and energy consumption. Soon after collection of information, trial calculation of CO2 emission reduction and selection of target equipment will be implemented.

			T. L
Equipment	Unit	Expected year to install	Use
Gas boiler	1	2021	Heat source of blanching cooling tank
Chiller unit	1	2021	Cooling water used in whole factory
Refrigerator	1	2021	Storage of production
Sharp freezer	1	2021	Food processing
Blanching cooling tank	1	2021	Food processing

 Table 2-4
 List of installed equipment

Source: prepared by Nippon Koei with information provided by food processing factory

Consideration of international consortium

Assumed implementation structure is shown in Figure 2-6. International consortium consists of Nihon Air-conditioning Hokuriku as representative entity and food processing factory as partner entity.

Although EPC contractor for this project has not been decided, one of EPC contractors, who has experiences to install PV system in Semarang, will be selected. Installation works can be carried out smoothly with Nihon Air-conditioning Hokuriku's support such as supervising and advising.





2.2 JCM MODEL PROJECT FORMULATION IN PUBLIC SECTOR

As Green Building (GB) Regulation of Semarang City was developed (see CHAPTER 3) in September 2019, it is expected that not only private sector but also public sector will be promoted to install energy-saving equipment and renewable energy system to buildings. Also, Semarang City has a huge interest in installation of renewable energy system to their own buildings as model project, installation of roof-top PV system to 7 buildings was studied.

Setting image is shown in Figure 2-8 and layout of PV panels are in Figure 2-9.



Source: prepared by Nihon Air-conditioning Hokuriku

Figure 2-7 Setting image to Semarang City's buildings



Source: prepared by Nihon Air-conditioning Hokuriku

Figure 2-8 Layout of roof-top PV system in Semarang City's buildings

Trial calculation of CO2emission reduction

Nihon Air-conditioning Hokuriku calculated that 2,394 panels (total capacity 825.93kW) can be installed to the new factory's roof. Also, as a result of trial calculation of average solar irradiation by simple model, Global Solar Atras GTI, annual electricity generation was expected to be 1,148 MWh. Calculation process is shown in Table 2-5.

CO2 emission reduction was calculated in accordance with Indonesian JCM methodology "JCM_ID_AM013_Installation of Solar PV System. ver01.0".

Semarang City's bundings					
Item	Value	Unit	Remarks		
PV output	825.93	kW			
Average solar irradiation	5.330	kWh/m2/d	ESMAP Global solar atlas		
Total system efficiency	0.7982				
Average temperature bias	0.8952				
Annual operation dates	365	days/yr			
Annual PV generation	1,148,159	kWh			
Emission Factor	0.613	tCO2/MWh	GEC, Jawa-Bali, Self-consumption		
Annual CO2 emission reduction	703.8	tCO2/yr			
Project year	15.0	year	Legal lifetime for electricity generation equipment (tentative)		
Project CO2 emission reduction	10,557.3	tCO2			
Subsidy	30	%			
CO2 ER cost effectiveness	2,240	JPY/tCO2			

Table 2-5 Trial calculation of CO2 emission reduction for installation of PV system to Somarang City's buildings

Source: Prepared by Nippon Koei

As shown in the table above, annual CO2 emission reduction is 703.8 tCO2/yr which is a little bit smaller than condition of JCM model project. In addition, these buildings are not facilities to consume large amount of electricity. Thus, it is necessary to confirm if the generated electricity can be consumed in each building. In addition, as it is expected that public tender is carried out for this proposed project, it is required to arrange schedules of JCM model project and the tender.

Consideration of international consortium

Assumed implementation structure is shown in Figure 2-9. International consortium consists of Nihon Air-conditioning Hokuriku as representative entity and Semarang City as partner entity.

Although EPC contractor for this project has not been decided, one of EPC contractors, who has experiences to install PV system in Semarang, will be selected. Installation works can be carried out smoothly with Nihon Air-conditioning Hokuriku's support such as supervising and advising.



Figure 2-9 Implementation structure of JCM model project (Semarang City)

CHAPTER 3 SUPPORT ON POLICIES RELATED TO ENERGY SAVING AND RENEWABLE ENERGY

3.1 POLICY DEVELOPMENT FOR LOW-CARBON/ZERO-CARBON SOCIETY IN SEMARANG

Semarang City has been developing some policies for low-carbon society. In addition to "Lowcarbon Action Plan" developed in 2018, GB regulation, which regulate energy utilization of buildings, was developed in September 2019. Also, under direction of Central Jawa Provincial Government, SDGs Action Plan is being formulated.

3.1.1 Green Building Regulation of Semarang City

In September 2019, Semarang City developed GB regulation with support by International Financial Corporation (IFC) and Swiss Government. As a result, Semarang City became the third municipality with GE regulation in Indonesia.

Target of GB regulation of Semarang is on new buildings, extended building and buildings which change their use. The regulation set different criteria for sizes of buildings, large, medium and small. Each evaluation category is listed in Table 3-1 and it can be confirmed that criteria regarding energy utilization are regulated for all sizes. Attachment 3 is the whole document of the GB regulation.

Total floor area	Evaluation category	Sub-category
Large	a Energy efficiency	a Building envelope:
(more than	u. Energy enterency	h Air-conditioning system:
5.000m ²)		c Artificial lighting system;
5,000112)		d Transportation system in huildings
		a. Electricity system
	h Water officier ou	e. Electricity system.
	b. water efficiency	a. Flow rate
		b. Measuring devices (sub-meters) at building
		water sources; and
		c. Harvesting rainwater
	c. Management of	a. CO sensors and mechanical ventilation
	indoor air quality.	systems
		b. CO2 sensor
Medium	a. Energy efficiency	a. Building envelope;
(2,500~5,000m2)		b. Air conditioning system; and
		c. Artificial lighting system.
	b. Water efficiency.	a. Flow rate
		b. Measuring devices (sub-meters) at building
		water sources; and
		c. Harvesting rainwater

 Table 3-1
 Evaluation criteria of GB regulation of Semarang

Total floor area	Evaluation category	Sub-category
Small (300~2500m2)	a. Energy efficiency	a. Building envelope;b. Air conditioning system; andc. The use of energy saving lamps.
	b. Water efficiency	a. Flow rate

Source: prepared by Nippon Koei based on GB regulation of Semarang (No. 24/2019)

3.1.2 Activities for SDGs in Semarang

Semarang City is formulating their SDGs Action Plan under direction of Central Jawa Province. Draft of table of contents is shown below. For achievement of the 17 goals, the Action Plan will consist of evaluation of current situation, issues to be solved and how to approach the issues. With consideration of which goals existing plans of the City can contribute to, the Action Plan is being developed.

Chapter 1	Introduction/Background
Chapter 2	Interpretation of the 17 goals in Semarang
Chapter 3	Issues to be solved to achieve the 17 goals
Chapter 4	Measure and solution to achieve the 17 goals
Chapter 5	Conclusion and recommendation

3.2 SUPPORT ON POLICIES UNCER CITY-TO-CITY COLLABORATION

3.2.1 Consideration off support on implementation of GB regulation

Although, Semarang City developed GB regulation, the city government staff does not have enough expertise of GB and, of course, citizens are not familiar with such regulation. In this context, it is necessary to provide support for implementation and dissemination of the GB regulation. Since Toyama City does not have independent GB regulation such as CASBEE Yokohama of Yokohama City, it was considered supporting Semarang City in terms of technologies of private companies based in Toyama City such as Nihon Air-conditioning Hokuriku.

As a result of a meeting with a Singaporean enterprise that is a member of World Green Building Council (WGBC) and knows about the situation of GB in South-east Asia, they mentioned that required elements for dissemination of GB regulation are 1) formulation of model project, and 2) Workshop for capacity building targeting both staff of local government and citizens. Thus, project team proposed installation of PV system to Semarang City's buildings. Staff of Semarang City showed their interest in this idea so feasibility of PV system installation as JCM model project was studied (see. Section2.2)

Although workshop with theme of GB regulation cannot be held in the project, it was confirmed that GB experts from the Singaporean enterprise mentioned above can attend and support when such workshop is held. In addition, by introducing technologies, such as energy-

saving technologies and technologies for efficient water use, of private companies based in Toyama in such workshop, it can be possible to develop projects with utilization of the GB regulation.

3.2.2 Support on development of regulation for SDGs

Toyama City is quite active for achievement of SDGs and was selected as "SDGs Future City" and "Municipality SDGs Model Business" Activities of Toyama City are being carried out in accordance with "Toyama City's SDGs Future City Plan". In the plan, "Toyama City's Vision for 2030" is decided to be "Realization of a sustainable value added to innovative city by applying a compact city strategy". In addition, "3 Values", that is, economic value, social value and environmental value are determined as priority goals for materialization of the vision. Also, the Plan set evaluation criteria and target year to be achieved.

In this City-to-City Collaboration project, Toyama City supported development of SDGs Action Plan of Semarang City by explaining about contents of "Toyama City's SDGs Future City Plan" To do this, English version of brochure "Toyama City's SDGs Future City Plan (Summary)", which was handed out only in Japan, was prepared. Toyama City shared their know-how and experiences to setting goals and develop plans for achievement of the set goals, evaluation criteria and target year. In addition, Toyama City introduced the details of activities for City's SDGs carried out since 2018. By doing this, ideas to develop more practical and effective plan to promote activities to reach at set goals, was given to Semarang City. "Toyama City's SDGs Future City Plan (Summary)" is attached as Attachment 4.

CHAPTER 4 SEMINAR AND PRESENATION

In this project, while study for JCM model project formulation was carried out, support for implementation and development of policies of Semarang City and ongoing JCM project was implemented.

Activities under this project are listed in the table below.

Activities	Date	Overview
Kickoff meeting at	Nov. 7, 2019	Explained to MOE the plan/activity of both city -
MOE		to-city collaboration and JCM formulation in
		FY2019
1 st field survey	Nov. 26 - 27, 2019	 <u>Study for JCM model project formulation</u> Meeting and site study with an electronics factory <u>City-to-City Collaboration activities</u> Meeting with Trans Semarang
Training for	Nov. 27 - 29, 2019	To deepen understanding about City-to-City
realization of low- carbon society through city to city		Collaboration and share know-how of Japanese local governments, Toyama city mainly had
collaboration at		presentation to introduce environment project
Toyama city		and background of city collaboration in abroad.
2 nd field survey	Dec. 17 - 19, 2019	 <u>Study for JCM model project formulation</u> Meeting with Industrial park management company Meeting and site study with management company of power station <u>City-to-City Collaboration activities</u> Meeting with Pertagas Meeting with Trans Semarang Implementation of Kick-off Meeting with
City-to-City Collaboration seminar and Japan visit	Jan.14 - 18, 2020	Two officers from Semarang city was invited to participate in City-to-City Collaboration Seminar in Japan and site visit in Toyama city. At the seminar, Toyama city and Nippon Koei made a presentation for introduction of the achievement of city collaboration and Semarang city also attend the papel discussion
3 rd field survey	Jan.21 - 23, 2020	Study for JCM model project formulation - Meeting with agricultural machines factory - Meeting and site study with garment factory - Meeting with boiler manufacturer <u>City-to-City Collaboration activities</u> - Meeting with Semarang city - Joint meeting with trans Semarang and Pertagas

Table 4-1 Activities under City-to-City collaboration in FY 2019

Activities	Date	Overview
		Meeting regarding Green Building Regulation (Singapore)
Workshop for promotion of city to city collaboration to develop zero emission society at Yokkaichi city	Feb. 3 - Feb.5, 2020	The workshop aimed to find potential of wide spread of cooperation among local governments in Japan and share good experience of city to city collaboration project in abroad. Toyama city made a presentation on the background of the city-to- city cooperation agreement with Bali and Semarang and exchanged opinions with participants.
4 th field survey	Feb. 10 - 12, 2020	Held the joint wrap-up meeting with Bali province and Semarang city and discussed for the collaboration and potential of JCM model project in both cities.
Final report meeting at MOE	Feb. 26, 2020 (Scheduled)	Reported to MOE the achievement of city-to-city collaboration activity and results of JCM formulation.

Source: prepared by Nippon Koei

4.1 KICK-OFF MEETING (DEC 2019, SEMARANG)

Date/Time:	19th December 2019 / 10:30~12:00
Venue:	Meeting room in City Hall of Semarang City
Participants:	18 (including 7 related Toyama City)

Kick-off meeting of this project was held at City Hall of Semarang City on 19 December 2019. From Semarang side, Regional Autonomy Unit, BAPPEDA and Trans Semarang attended to the meeting while Toyama City, Hokusan and Nippon Koei joined. In this meeting, both sides discussed activities of this project.

Support on ongoing JCM project

Regarding issues of JCM project for introduction of CNG buses to Trans Semarang (transfer of ownership and supply of CNG), Toyama City declared that they positively support to solve the issues. The details of these issues are referred in Chapter 5.

Discussion of JCM model project formulation and City-to-City collaboration activities

Japanese side explained that the themes of study for JCM model project formulation are PV system provided by Nihon Air-conditioning Hokuriku and fuel exchange technology provided by Hokusan. On the other hand, Semarang City proposed fuel exchange of water pump and showed interest in installation of PV system to city's buildings as candidate projects in public

sector. For more discussion, Semarang City promised to set a meeting among departments in charge, Nihon Air-conditioning and Hokusan.

In addition, Semarang City requested for support on gasification of sewage sludge and installation of hydro power generation system with cooperation with university in Semarang under City-to-City collaboration with Toyama.



Kick-off meeting

Group photo

4.2 **CITY-TOCITY COLLABORATION SEMINAR AND JAPAN VISIT (JAN 2020,** TOKYO)

"Seminar on City-to-City Collaboration for Zero-Carbon Society" organized by MOE was held at Tokyo on 16th and 17th of January 2020. For participation to the seminar, two staff of Semarang City were invited to Japan.

Wing Wiyarso Poespojoedho	Head of Public Relations and Protocols
Muhammad Luthfi Eko Nugroho	Head of Infrastructure and Environment Research and Development Sub-Division, BAPPEDA

Schedule of the Japan visit is shown in table 4-2.

Table 4-2 Japan visit schedule			
Date	Activities		
	- Arrival at Tokyo		
14 Jan (Tue)	- Moving to Toyama		
	- Site study in Toyama		
15 Jan (Wed)	Site study in Toyama		
	- Moving to Tokyo		
16 Jan (Thu)	- Participation to Closed seminar-1 "Exchanging information on zero-		
	carbon project development"		
	- Site visit to Shinagawa Incineration Plant		

Date	Activities			
17 Jan (Fri)	- Participation to Closed seminar-2 "Exchange views on zero-carbon			
	and sustainable urban development"			
	- Participation to Open seminar "Seminar on city-to-city collaboration			
	for zero-carbon society"			
18 Jan (Sat)	- Departure from Haneda			

Source: prepared by Nippon Koei

In the morning of 16th, Closed seminar "Exchanging information on zero-carbon project development" was held. During the closed seminar, each Japanese municipality implementing City-to-City Collaboration Project had a presentation about their activities and achievements. For collaboration between Semarang City and Toyama City, Toyama City presented about activities related to compact city and clean energy which they are promoting and Nippon Koei explained about activities such as support for promotion of SDGs in Semarang. (Presentation material is attached as Attachment 5.)

In the afternoon of the 16th, the two invitees from Semarang participated in site visit to Shinagawa Incineration Plant and listened to processes of waste disposal in the plant.

Also, in the panel discussion of "Exchange views on zero-carbon and sustainable urban development" on the 17th, Mr.Luthfi mentioned about benefits from City-to-City collaboration with Toyama City to date, and supports which Semarang City expects hereafter.



Presentation by Toyama City

Presentation by Nippon Koei



Mr. Luthifi in panel discussion

Group photo

4.3 JOINT WRAP-UP MEETING/WORKSHOP BETWEEN BALI PROVINCE AND SEMARAN CITY (FEB 2020, BALI)

Date/Time	February 10, 2020 (Mon) 15:00~17:00
Venue	DLH office, Bali province
Number of Participant	40 people (including 2 officers from Semarang city)

The Joint wrap-up meeting of Bali province and Semarang city was held in 10th of February 2020 organized by Toyama city and Bali province to share achievement and experiences in City-to-City Collaboration in FY2019 each other. The presentation materials of the meeting/workshop are attached as Attachemet-5.

At the direction of the provincial government, Bali's department in charge of the collaboration was changed from BAPPEDA to Dinas Lingkungang Hidup (DLH) just before the meeting. Therefore, most of participants from Bali province did not have enough information about the collaboration and JCM scheme.

To improve the situation, the background and achievement of JCM model project under the collaboration between Semarang City and Toyama City was explained by Semarang City officer, and participants understood the purpose of the collaboration.

To deepen understanding in JCM scheme between Bali province and Semarang city, time was used for discussion instead of some presentations. Opinions and questions were raised by each organization such as Bali DLH and PLN Bali. One of the achievements of the meeting was the creation of a cooperative relationship between the two Indonesian cities through active exchange of opinions.

#	Program	Speaker
1	Opening remarks	Bali province (DLH)
		Toyama city
2	Introduction of the participants	All attendance
3	Achievement of JCM model project in Bali Province and	Nippon Koei
	Semarang City from Aug.2019 to Feb.2020	
4	Presentation of Low carbon technology	Hokusan/Nippon Koei *
5	Introduction of governor's clean energy regulation and	Bali province*
	other related policy in Bali	
6	Plan and target of introducing of renewal energy under	PLN Bali*
	the clean energy regulation	
7	Introduction of Low carbon scenario 2030, SDGs and	Semarang city
	Green Building regulation in Semarang	
8	Closing remarks	Bali province (DLH)

Table 4-3Agenda of Joint wrap-up meeting/workshop

* To prioritize discussions between Bali province and Semarang city, some presentations were changed to only distribute materials.

Source: Prepared by Nippon Koei

	Table 4-4 Participant organization list of Joint wrap-up meeting/worksnop				
#	Organization	Sub-organization (number of participants)			
1	Bali Province	Assistant of secretary of Bali province and staff (5)			
	ditto	Environmental management of Bali province/DLH (18)			
	ditto	Bureau of General Affairs and Protocol of Bali Province (1)			
	ditto	Bureau of Government and Regional Autonomy of Bali Province (1)			
	ditto	Public Works and Housing of Bali Province (1)			
	ditto	Manpower - Energy and Mineral Resources of Bali Province (1)			
2	PLN Bali	(4)			
3	PERTAMINA	(2)			
	Gas, Jakarta				
4	Semarang City	BAPPEDA (1), Department of Regional Autonomy of Semarang city (1)			
5	Toyama City	Toyama officers (2) and related company staff (2)			
6	Nippon Koei	(2)			
a					

Table 4-4 Participant organization list of Joint wrap-up	meeting/workshop
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Source: Nippon Koei



Joint wrap-up meeting/workshop at DLH office, Bali province

CHAPTER 5 SUPPORT ON ONGOING JCM MODEL PROJECT

5.1 **PROJECT OVERVIEWS**

In June 2018, "Introduction of CNG-Diesel Hybrid Equipment to Public Bus in Semarang", which Hokusan works as representative, was selected as one of FY2018 JCM model Projects.

Based on a cooperation agreement between Semarang City and Toyama City, this JCM model project is being carried out by international consortium structured by a company in Toyama City, Hokusan as a representative entity and public transportation company of Semarang City, Trans Semarang as partner entity This project aims to reduce GHG emissions through fuel switch from diesel to CNG. In the project, 72 out of total 141 diesel bases owned by Trans Semarang, including 25 large buses and 47 medium buses, are retrofitted from diesel engine to hybrid engine with CNG system available. In January 2019, the project buses were introduced to Trans Semarang and commercial operation and MRV started in July and August, respectively.

This JCM model project is the first JCM project of transportation sector in Indonesia. DDF matches with national policy of Indonesia and is a technology expected to be scaled out. For these reasons, the supports below for smooth implementation of the JCM project were conducted in this City-to-City project.

- 1. Support on ownership transfer in the international consortium
- 2. Support on stable CNG supply

5.2 BACKGROUND OF OWNERSHIP TRANSFER ISSUE AND COORESPONDING OF OWNERSHIP TRANSFER

5.2.1 Background

Trans Semarang is managed by Department of Transportation of Semarang City and one of public bodies. Although Trans Semarang directly paid for cost of retrofitting of 47 medium buses mentioned and has ownership of them, Hokusan paid for 25 large buses and delivered them to Trans Semarang. As a result, Hokusan has the ownership of the 25 large buses as asset.

Generally, when transferring ownership in Indonesia, it is necessary to transfer via the Central Government. That is, 2 processes are required, one is from asset provider (Hokusan) to the Central Government and the other is from the Central Government to local government (Trans Semarang).

In this case, it was agreed that asset registration is carried out after technical evaluation and asset evaluation by Ministry of Transportation. However, concrete processes were not shown and, as a result, ownership transfer has not been carried out as of February 2020. Although it is not problematic for implementation of JCM model project since the asset is kept inside international consortium, corresponding to the ownership transfer was considered so that Trans Semarang, who manage and operate the buses, could receive the ownership within the implementation period of the JCM model project.

5.2.2 Corresponding

When this City-to-City Collaboration project launched in October 2019, even staff of Trans Semarang did not understand the 2 processes for transfer. Thus, explanation by means of document such as Figure 5-1 was carried out. In parallel, project team prepared draft of ownership transfer agreement between Hokusan and Ministry of Transportation and it was sent to the Ministry of Transportation. Furthermore, as Trans Semarang needed documents such as asset holding certificate for periodic inspection, they sent request letter to the Minister of Transportation via Semarang City Mayor to accelerate process by the Ministry.

Hand over from Hokusan to Kementerian Perhubungan	Hokusan	F	Kementerian	Trans Se	marang	
	Ownership –		;		25 Granted	Ownership Purchased
	Hokusan	F	Kementerian Perhubungan			
	Sign		Sign			
	Agreen	nent documen	nt			
Hand over from			Kementerian		Trans Se	marang
Kementerian		•	rnubungan			Ownership
Perhubungan to			Ownership —		25 Granted	Purchased
Trans Semarang						
			Kementerian		Trans Se	marang
		r	Sign		Sign	
			Agr	eement docur	nent	
Completion of the					Trans Se	marang
handover					Ownership	Ownership
					25 Granted	Purchased

Procedure of ownership transfer from Hokusan to Trans Semarang

Source: prepared by Nippon Koei

Figure 5-1 Process of ownership transfer

5.3 BACKGROUND OF CNG SUPPLY ISSUE AND CORRESPONDING

5.3.1 Background

CNG supply to Trans Semarang is operated by PT. Pertagas Niaga (Pertamina) who is a subsidiary company of national oil and gas corporation, PT. Pertamina. Before the JCM model project starts, Trans Semarang and Pertagas concluded an CNG supply agreement including monthly supplied amount and CNG cost rate.

As illustrated in lower row of Figure 5-2, gas is delivered to the CNG supply point, the carpark of Department of Transportation of Semarang City, by tank truck. Mobile Refueling Unit (MRU) was set in the supply point and produces CNG. Although CNG stations have already constructed in Semarang City, pipeline has not connected due to demand balance. After

pipeline connection has been done, it becomes possible to supply CNG from CNG stations. Toyama City has been supporting for acceleration of construction works under City-to-City collaboration.



Source: PT.Pertagas Niaga

Figure 5-2 Proposed measures of CNG supply by Pertagas

This JCM model project started MRV at the end of August 2019 after technical evaluation by Ministry of Transportation and CNG supply by MRU became stable.

Monthly MRV data was sent from Trans Semarang to Hokusan but because monthly report was not carried out from November, site check was implemented. Trans Semarang explained two main causes to suspend CNG supply of Pertagas;

- 1) Cooldown time became necessary as compressor of MRU is loaded by a decrease in gas pressure of tank truck when continuous filling
- 2) Additional cost by that CNG filling work became long unexpectedly

5.3.2 Corresponding

Regarding Technical issue 1), as Hokusan predicts that the cause is not enough abdominal pressure time, Pertagas increased number of MRU. Also, to solve economic issue of item 2), it was requested Semarang City Mayor to send improvement request letter to Minister of Energy and Mineral Resources.

Furthermore, as a result of discussion with Pertagas in City-to-City Collaboration, Pertagas proposed resign current agreement with Trans Semarang and conclude renewed agreement including revision of gas price, which means expense of additional MRUs is added to gas price. Although economic effect of fuel exchange on Trans Semarang will decline, it is better than

continuing to use diesel until pipeline connection in terms of finance. Thus, Trans Semarang almost agrees on renewing the agreement.

As of February 2020, discussion of agreement renewing is being carried out. Soon after this process has been done, CNG supply and MRV will re-start.

CHAPTER 6 ACHIEVEMENTS AND DIRECITION

6.1 ACHIEVEMENTS

For clean energy promotion based on Low-carbon Society Scenario of Semarang City, in this project, Toyama City's experiences and know-how of SDGs promotion were transferred to Semarang City and implementation direction of GB regulation of Semarang City was considered. In addition, as study for JCM model project formulation, installation of PV system to garment factory, food processing factory and Semarang City's buildings were studied.

6.2 APPLICATION FOR JCM MODEL PROJECT IN FY2020

In consideration of study result, 3 projects below are planned to apply for JCM model project. Regarding No.2, as CO2 emission reduction by only PV system is not enough, trial calculation of installation of other high-efficient equipment is being carried out. In regard with No.3, discussion of budget and tender schedule is being implemented with Semarang City on the basis of consideration of trial calculation.

	1 0		. . <i>.</i>
Representative / Partner	Project name (tentative)	Installed technologies	Expected CO2 emission reduction
1.Nihon Air- conditioning Hokuriku / Garment factory	Introduction of PV system to garment factory	PV system:840kW	Approx.710 tCO2/year
2.Nihon Air- conditioning Hokuriku / Food processing factory	Introduction of PV system and high- efficient equipment to food processing factory	PV system :200kW High-efficient equipment: under consideration	Approx.180 tCO2/year
3. Nihon Air- conditioning Hokuriku / Semarang City	Introduction of PV system to Semarang City's buildings	PV system:825kW	Approx.700 tCO2/year

 Table 6-1
 Candidate projects to be applied for JCM model project

Source: prepared by Nippon Koei

6.3 PRESENT ISSUES AND PROPOSAL ABOUT PUBLIC TENDER

The project for installation of rooftop PV system at Semarang city hall is one of candidates of JCM model project in FY2020, however it is necessary to coordinate schedule among JCM application and public tender as a critical point. If the public tender is required for implementing the project, the tender schedule should be confirmed and considered to suit JCM application. It is difficult to adopt the project to introduce advanced technology with high price before the tender, on the other hand, it is difficult to reduce JCM subsidy in advance from total project cost because the subsidy will be paid after completion of the payment.

To be adopted JCM model project through public tender in Indonesia, the public tender period and open tender need to be done between unofficial contract and official contract in JCM application process as shown in Figure 5-1.

It is impossible to coordinate both schedule by private company itself, so that proper explanation of benefit of JCM to partner organization under the City-to-City Collaboration.

On the other hand, the scale of public project is relatively larger than private sector project. Considering such contribution of GHG emissions reduction by public project, it is recommended to be flexible application procedure and selection process of JCM, not avoid public project.



public tender

6.4 POTENTIAL OF JCM MODEL PROJECT IN SEMARANG

Connection of gas pipeline is scheduled in 2020 and GB regulation was developed in 2019 in Semarang. Considering this context, it is expected that "replacement of equipment with fuel change" and "introduction of energy-saving equipment and renewable energy system to buildings" would be promoted with initiative of the municipality. Therefore, potential of JCM model project will increase in the 2 areas in near future.

6.4.1 Proposal of target of JCM model project (Fuel exchange)

Connection of gas pipeline to Semarang City is scheduled in 2020. Plan of connection is shown in Figure 6-2.



Source: PT.Pertagas Niaga

Figure 6-2 Gas pipeline connection plan

Currently, pipeline from south to city center (Blue line) has been constructed and the pipeline will be extended to west and east hereafter. Pipeline from city center to east will be connected in 2020 (gas supply starts in 2021) and city center to west in 2022 (gas supply starts in 2022). Then, gas supply at gas stations (Square 1,2,3) will become available. Pertagas explained that they are planning to have supply capacity twice the anticipated gas demand in and surrounding Semarang, which means that stable gas supply can be secured in case of fuel exchange of equipment in factories and buildings. Document of pipeline connection plan and gas supply plan is attached as Attachment 7.

Once stable gas supply has been secured, it is considered that the JCM potential of fuel exchange project become much higher. Thus, hotels, shopping malls factories in private sector and infrastructures managed and operated by Semarang City or public companies can be candidate target of study. Regarding infrastructure facility, Semarang City already has an interest in fuel exchange in irrigation pump stations. Study for JCM model project and support for project development will be continuously carried out including consideration of scaling out DDF technology of Hokusan.

6.4.2 Proposal of target of JCM model project (Green building)

It is easily expected that demand of energy-saving equipment and renewable energy system for buildings in Semarang since GB regulation was developed last year. Although this GB regulation set evaluation criteria of efficient use of energy for all 3 categories of building size, larger buildings (categorized as "Large") has to meet more criteria (Table 3-3). To date, project team has been reckoning installation of energy-saving and renewable energy to factories as main industry of Semarang. However, in consideration of electricity consumption, it can be said that large commercial buildings such as hotels and shopping malls have huge potentials as JCM target.

On the other hand, in Semarang, even concept of GB has not been disseminated and citizens does not have enough knowledge such as which technology can lead to green building. Thus,

it can be proposed to hold workshops regarding GB so as to promote understandings of the GB regulation. In addition, by add technology introduction by companies in Toyama to the workshops, it becomes possible to implement study for JCM model project formulation with advantage of the regulation.

6.5 PLAN FOR CITY TO CITY COLLABORATION IN FY2020

Based on Low-Carbon Society Scenario in Semarang City, Toyama City advised for improvement of environmental policy and supported on the promotion of SDGs under the City-to-City Collaboration between Semarang City and Toyama City in FY2019. In addition, the measures for spread of Green Building Regulation in Semarang City was considered as well.

Semarang City government is willing to promote practical action toward low/zero carbon society with JCM scheme which suits to existing regulations of Semarang City.

On the other hand, since Semarang City government had been able to experience project formulation to implementation independently using JCM scheme, it seemed that it has enough knowledge and administrative skills to continue the activity widespread.

For issues under discussion for on-going JCM project, Hokusan as a representative company will support Trans Semarang both ownership transfer of CNG buses and stabilization of CNG supply continually.

For three solar PV projects which promoted in this fiscal year, Nihon Air-conditioning Hokuriku which is a candidate representative company of international consortium, plans to continue discuss preparation of JCM application with each partner organization.

In addition, through Joint wrap-up meeting in February 2020, Semarang City government (BAPPEDA) and Bali provincial government (DLH) had good communication and exchanged opinion about City-to-City Collaboration and JCM formulation.

Therefore, it is planned to support continuously on environmental regulation/policy of Semarang City and promote JCM model project in both public and private sector in the next fiscal year under the City-to-City Collaboration. As an additional activity of Toyama City, it also includes provides opportunity of discussion for support Bali province which has not experiences of JCM.