

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

**Support for the Realization of Zero-Carbon Society to**  
**Achieve Thailand 4.0**

**Report**

March 2021

Nippon Koei Co., Ltd.  
Osaka City

**FY2020**  
**City-to-City Collaboration Programme for Zero-Carbon Society**  
**Support for the Realization of Zero Carbon Society to Achieve**  
**Thailand 4.0**  
**Report**

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## **ATTACHMENT**

### **1. Presentation materials for the meetings with EEC**

- 1.1. Presentation material for the 1<sup>st</sup> meeting
- 1.2. Presentation material for the 2<sup>nd</sup> meeting
- 1.3. Presentation material for the 3<sup>rd</sup> meeting

### **2. JCM City-to-City collaboration seminar held by MOE**

- 2.1. Introduction of the Project
- 2.2. Presentation material for a panel discussion by Nippon Koei

### **3. Presentation materials for the workshop**

- 3.1. Presentation material by EEC
- 3.2. Presentation material by Osaka City
- 3.3. Presentation material by Hakuhodo Inc
- 3.4. Presentation material by JBIC

### **4. Introduction of overview of JCM**

## **ABBREVIATIONS**

BOI	The Board of Investment, Thailand
COP	Conference of Parties
COP	Coefficient of Performance
DEDE	Department of Alternative Energy Development and Efficiency
DEPA	Digital Economy Promotion Agency
DEQP	Department of Environmental Quality Promotion
EEC	Eastern Economic Corridor
EV	Electrical Vehicle
FY	Fiscal Year
GDP	Gross National Product
GHG	Green House Gas
HVAC	Heating, Ventilation, and Air Conditioning
IPLV	Integrated Part Load Value
JCH	Johnson Control Hitachi, Thailand
JCHT	Johnson Control Hitachi, Thailand
JCM	Joint Crediting Mechanism
LNG	Liquid Natural Gas
LPG	Liquid Petroleum Gas
MRV	Measurement, Report and Verification
OG	Osaka Gas
POME	Palm Oil Mill Effluent
SDGs	Sustainable Development Goals
SOFC	Solid Oxide Fuel Cell
TGO	Thailand Greenhouse gas Organization
UNFCCC	United Nations Framework Convention on Climate Change
VRF	Variable refrigerant flow

## **CHAPTER 1 BACKGROUND**

### **1.1 BACKGROUND**

#### Significance of city-to-city collaborations

All countries have participated in United Nations Framework Convention on Climate Change (hereinafter called “UNFCCC”) of the 21<sup>st</sup> Conference of the Parties (hereinafter called “COP21”) that held in the suburbs of Paris in France in December 2015, and adopted the Paris Agreement which is fair and effective for climate change mitigation after 2020. The agreement states that efforts should be made to keep the global temperature rise below 2 degree Celsius compared to before the industrial revolution, and even below 1.5 degree Celsius. Then, COP24 in Katowice, Poland in December 2018, a rulebook, which states the specific obligations of each country from 2020, was adopted. In addition, the activities of the Paris Agreement has been gradually implemented, such as the submission of the Nationally Determined Contributions (hereinafter called “NDC”) by the end of 2020, and the rules such as the market mechanism left behind at COP26 in November 2021 will be concluded in earnest. In this way, the Paris Agreement, which is the driving force of a zero-carbon society, will be in the stage of full-scale implementation.

At the COP21, it was recognized that the actions of non state bodies including cities welcomed the efforts of all non-government players (urban and other local governments) and its scale up. Urban areas are the places of activity that support socio-economic development, and live citizen. About half of the world's population lives in urban areas, which account for 2% of the world's total land area, and that proportion is expected to increase to 70% by 2050. And, it is estimated that more than 70% of the Carbon Dioxide (hereinafter called “CO<sub>2</sub>”) emissions are in the world emitted from cities as of 2006, and cities play a major role in climate avoiding change risks. Continuous implementation of climate change countermeasures in urban areas is key factor for total Greenhouse Gas (hereinafter called “GHG”) emission reduction and achieving the goals of the Paris Agreement.

To realize a zero-carbon society as a whole, especially in Asia where economic growth is remarkable, it is necessary to accelerate the movement toward the construction of a sustainable decarbonized society and a low-carbon society as a passing point. There is a growing movement to support urban efforts internationally toward decarbonization and low carbonization of cities, which are places of activity that support economic development.

#### City-to-city collaboration with EEC

The Kingdom of Thailand has rapidly developed and become middle-income countries by utilizing natural resources and is attracting foreign-owned enterprises. Then, the government has a sense of crisis on growth slowdown by transition to high-income countries. Aiming for the country's future socio-economic prosperity, the government has set a national strategy of “Thailand 4.0” since 2015, promoting economic growth over 20 years, and entering a high-income country by 2036. To lead the Thailand 4.0, three provinces (Chonburi, Chachoengsao,

and Rayong) were selected as focal area of Eastern Economic Corridor (hereinafter called “EEC”)<sup>1</sup>.

In the EEC region, there are many Japanese factories located that have become important production bases in Southeast Asia since the 1980s. Coastal area of the EEC is remarkably developed as an industrial zone, with regional Gross National Product (hereinafter called “GDP”) exceeding 15% of Thailand. And, there are many companies involved in the Japanese automobile industry, and many Joint Crediting Mechanism (hereinafter called “JCM”) projects have been implemented in this region. It is expected that the number of JCM projects will be developed in the future. In fact, it is confirmed that many companies are eager to join a JCM scheme.

#### Strategy of Osaka City government on city-to-city collaboration

Osaka City Government (hereinafter called “Osaka City”) has implemented city-to-city cooperation with Ho Chi Minh city, Vietnam and Quezon city, Philippines, and has achieved steady results. And Osaka City has involved private entities and supported overseas business expansion etc., by utilizing the “Team OSAKA Network<sup>2</sup>”, a public-private partnership platform.

Osaka City has paid attention to the possibility of forming a JCM model project<sup>3</sup> in the EEC area, where industrial parks have been accumulating since a few years ago. This time, the Osaka City has been consulted from Osaka Gas Co., Ltd. (Osaka Gas) etc. to support business development in this region.

#### Significance of the city-to-city collaboration under COVID-19

The impact of the coronavirus disease (hereinafter called “COVID-19”), which has become an international issue since the latter half of last year, has had a major impact on this city-to-city collaboration project. In particular, all the meetings, discussions, and studies were implemented online due to cancellation of field survey. Combat with COVID-19 are still being carried out at the national and citizen levels, and are also being promoted in cities. It is expected that collaboration between Japan and overseas local governments is expected to produce new results in the future. With an eye on after-corona, it is believed that it is of considerable significance to promote the city-to-city collaboration in the COVID-19 pandemic.

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<sup>1</sup> The EEC is a national strategy for the implementation of Thailand 4.0 in the Kingdom of Thailand, which has been established as a governmental organization and targets three (3) provinces in eastern Bangkok. For this reason, EEC assume a city to create city-to-city collaboration with Osaka City.

<sup>2</sup> It is a public-private partnership platform centered on companies in Osaka City, and more than 140 companies are members.

<sup>3</sup> JCM model project is a project that is subsidized by Japanese government in accordance with introducing high efficiency products, renewable energy system etc. in the partner countries.



## **1.2 OBJECTIVE**

City-to-City Collaboration Programme for Zero-Carbon Society “Support for the Realization of Zero Carbon Society to Achieve Thailand 4.0” (hereinafter called "the Project") is a study on the realization of a low carbon and zero carbon society in the collaboration between EEC and Osaka City, with the following objectives:

- (1) Deepening the cooperation between the two cities, and
- (2) Formulating a JCM model project that contributes to low and zero carbon society in the Kingdom of Thailand.

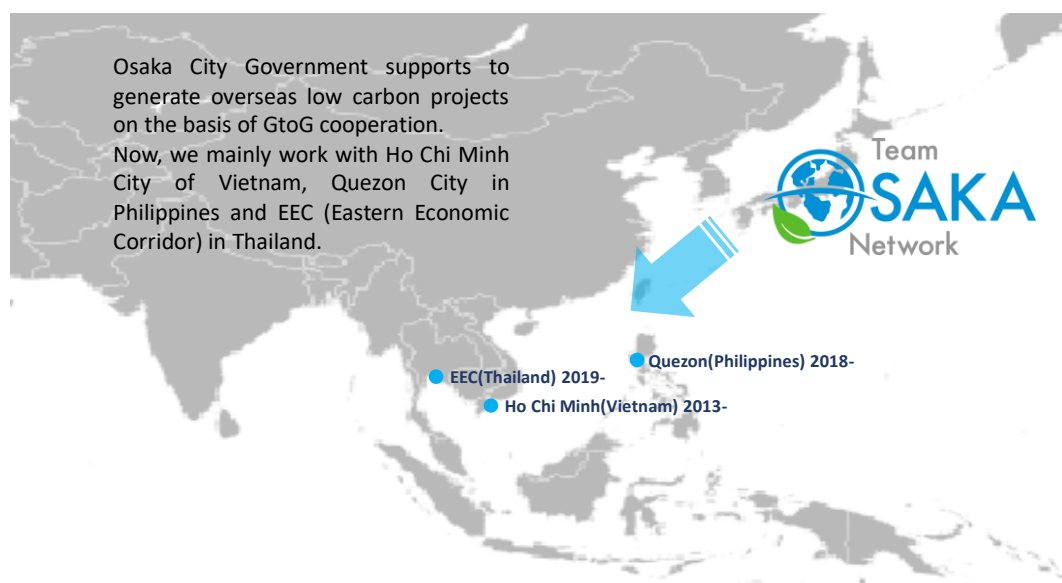
## CHAPTER 2 OVERVIEW OF THE PARTICIPATING CITIES

### 2.1 OSAKA CITY

#### 2.1.1 International Cooperation by Osaka City

Osaka City has been promoting activities with Ho Chi Minh city in Vietnam and Quezon city in the Philippines through the city-to-city collaboration project. In particular, Environmental Bureau of Osaka City, which is the main department in charge of the Project, considers environmental issues not only in Osaka City but also as a matter of concern to the international community and aims to solve environmental issues in developing countries targeted by the JCM. Osaka City has been implementing various actions that support in cities and Japanese companies in packages that include low-carbon technologies.

Also, Osaka City has various urban aspects as one of the major cities in Japan. In terms of environment, it has a history of improving public health of citizens and overcoming pollution issues. It can provide useful insights and contributions to the challenges facing the Bangkok Metropolitan Government and the EEC region. Osaka City expects that supports overseas cities facing environmental problems and create opportunities for private companies to expand their business through cooperation between the cities and the accompanying international cooperation.



Sorce : Osaka City

**Figure 2.1 International cooperation by Osaka City**

Following table shows contribution of Osaka City to EEC.

**Table 2.1 Contribution of Osaka City**

Osaka's contribution	Outlines
Introduction of Japanese companies that contribute to smart city development (Seven Smarts, etc.) in EEC region	Smart city development is counted as one of the important activities in the EEC's goal of Thailand 4.0. And, the development is required to improve the quality by including some elements out of the seven smarts. In this regard, the Project made full use of Osaka City's network with Japanese companies to carry out business matching and company introductions that will contribute to future EEC development.
Enlightenment of JCM system and development of energy saving equipment	In cooperation with the EEC, the Osaka City and Japanese entities provide support for collecting information on factories, public facilities and buildings in the area, provide JCM incentives to local companies at seminars related to the collaboration, and promote project formulation by introducing the JCM incentives.
Introduction of Osaka City companies through Team OSAKA network	JCM model project formulation contributes to realize by introducing the optimal technologies possessed by Japanese companies, including those participating in the Team OSAKA network, for various needs related to various facilities in factories and buildings in the EEC region.
Sharing knowledge and achievements related to energy saving / renewable energy equipment introduction	Osaka City contributes to share technical and financial effects of introducing energy-saving / renewable energy equipment with JCM scheme by sharing the experience of introducing energy-saving / renewable energy equipment at public facilities.
Introduction of public-private partnership projects	To share the knowledge of Osaka City's climate change-related activities and to educate the necessity and importance of countermeasures, Osaka City constructs a base for disseminating JCM model project formulation. In addition, by sharing knowledge of the city-to-city collaboration with other cities in the past, Osaka City also strive to build efficient cooperation.

Source : Nippon Koei

### 2.1.2 Team Osaka Network

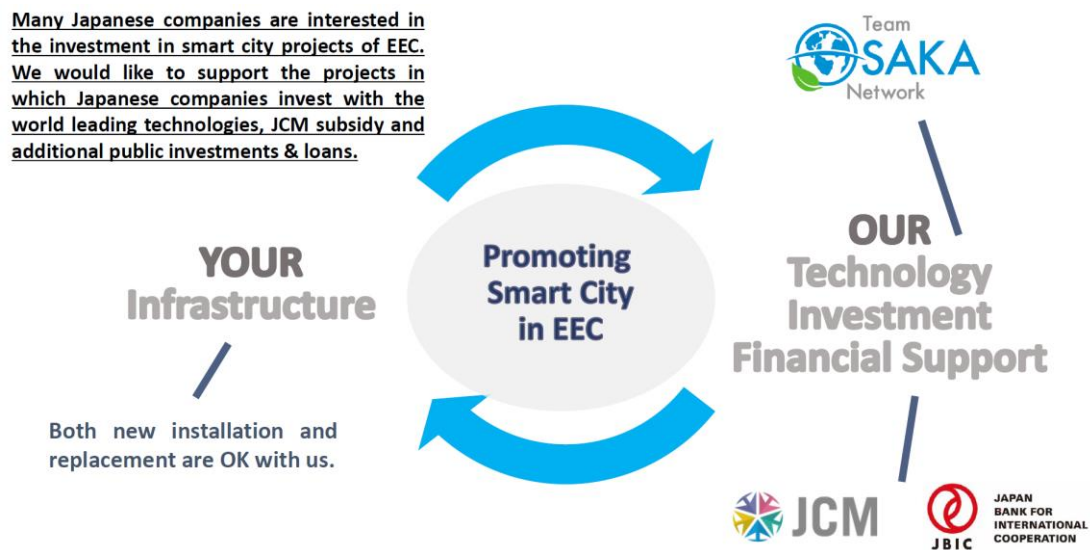
Osaka City is building a public-private partnership platform (Team OSAKA network) to create and support projects for network participating companies while matching domestic and international support needs.



In June 2016, Osaka City launched the "Team OSAKA Network", a platform for more effective cooperation between industry, academia and government, in order to support the realization of a decarbonized society with cities in Asia, etc. Currently, 149 companies are registered, mainly those that own it. The secretariat of this platform is the Environment Bureau, Osaka City.

Team OSAKA Network aims to encourage companies to expand overseas, revitalize the Osaka / Kansai economy, and play a role in Japan in the field of the international environment, so it also meets the purpose of the city-to-city collaboration.

In this year, as a cooperation for the smart city development envisioned by the EEC region, the following support structure was established by initiative of the Osaka City.



出典：大阪市資料より

**Figure 2.2 Supporting structure of Teams Osaka Network on Smart city development**

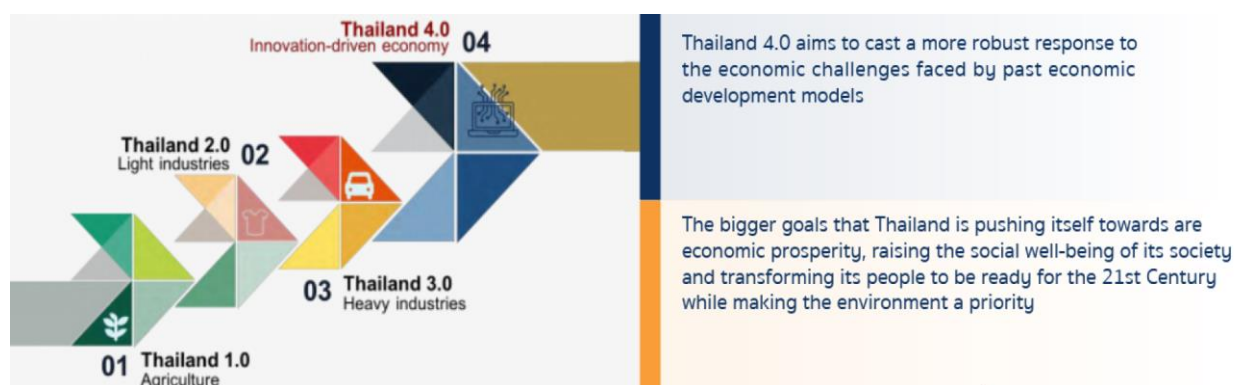
The EEC Secretariat does not directly lead the development of smart cities in the EEC region, and is promoting support for the development of the region, in other words, the realization of Thailand 4.0, through the development of smart cities to encourage various investments and the advancement of companies.

Taking the position of the EEC secretariat into consideration, the Project has conducted to introduce Japanese companies that can contribute to smart city development in terms of various aspects.

## 2.2 EASTERN ECONOMIC CORRIDOR (EEC)

### 2.2.1 Outline of the EEC

The Kingdom of Thailand has formulated a national strategy “Thailand 4.0” in 2016 with the aim of increasing incomes by upgrading the industrial structure of Thailand. This strategy is a policy vision that can be said to be the fourth industrial revolution in Thailand. Based on the previous transition, Thailand 4.0 was developed for aiming at upgrading and adding value to the industry.



Source : EEC presentation material

**Figure 2.3 Transition of Thailand economic development model**

Thailand 3.0 focused on attracting domestic and foreign companies and developing industrial parks by focusing on the export of conventional heavy industries and industrial products. On the other hand, Thailand 4.0 states that it will shift to innovation-led economic growth and aim to become a digital nation in 20 years from 2016. Its main pillars are the development of the digital economy and the fostering of a new generation of industries.

EEC is the leading organization and belongs to the central government of the Kingdom of Thailand in order to realize Thailand 4.0 with comprehensively develops various infrastructures. And the EEC has a concept to promote investment in specific industries such as next-generation vehicles, high-tech industries, medical, aviation, robots, etc<sup>4</sup>.

As shown in the figure below, EEC consists of three (3) provinces, Chachoengsao, Chonburi and Rayong, located on the eastern side of the capital city of Bangkok. The EEC has also begun infrastructure development to support industrial development in terms of social infrastructure.

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<sup>4</sup> EEC is a national strategy for implementing Thailand 4.0 in the Kingdom of Thailand, but it has been organized as a government agency and covers three prefectures in the eastern part of Bangkok. However, it is treated as "equivalent to a city" in the Project.

The main projects which EEC is in charge of are the expansion of existing airports (Tapao Airport) and existing ports (Laem Chabang Port), construction of a high-speed railway etc.

EEC is at the core region of Thailand's national strategy by 2035. Therefore, as shown in the figure below, large-scale projects are also linked to this strategy. It seems that JCM project formation is inferior to the above in scale, is however not only good opportunity to disseminate Japan's sophisticated technologies and products, but also contributes to the creation of an innovation-driven society that realizes Thailand 4.0.



Source : EEC presentation material

**Figure 2.4 EEC area**

### **2.2.2 Potential industry in EEC**

In Thailand, the Board of Investment of Thailand (hereinafter called “BOI”)<sup>5</sup> has been established to increase investment in Thailand. When investing in the EEC region, it is taken to grant additional benefits (EEC packages) in addition to the BOI investment benefits. There are three (3) target areas where the EEC package is awarded: (i) EEC special zone, (ii) 21 designated industrial parks in the EEC, and (iii) other industrial parks in the EEC. Thus, the EEC is a promising area for those doing business in Thailand.

As a focusing sector for the EEC, Thailand 4.0 has specified the following ten target industries that the government encourages.

<sup>5</sup> The Board of Investment (Thailand) is the Thai government agency that is responsible for encouraging investment in Thailand, with the aim of facilitating domestic/foreign investors.



### [Target Industries]

1) Next-generation automotive, 2) Intelligent electronics, Advanced agriculture and biotechnology, 4) Food for the future, 5) High-value and medical tourism, 6) Automation and robotics, 7) Aviation and logistics, 8) Medical and comprehensive healthcare, 9) Biofuel and biochemical and 10) Digital

#1 to #5 are regarded as promising industries (First S-Curve industries) expected to be implemented as a first phase, and #6 to #10 are listed as new S-Curve industries expected to be promoted in the next phase. It aims to enhance the industry-upgrading and value-added targets.

It has been announced that "national defense industry" and "education and human resource development" will be added to the above 10 industries, and detailed plans for both industries are currently being formulated.



Source : EEC presentation material

**Figure 2.5 12 target industries in EEC**

### 2.2.3 JCM Potential in EEC region

Based on the current situation and the development concept of the EEC region, it is expected that various activities and projects that contribute to decarbonization will be implemented. Collaboration with JCM scheme, which is expected to reduce GHG emissions, is expected to be a promising support in the EEC region.

Goal	Contribution of Zero-carbon development in EEC region
Strategy 1	<b><u>Utilization of city-to-city collaboration</u></b> To contribute to the Thailand 4.0, it seems that there is limitation by private companies. To this point, the Project aims to contribute to the EEC through public-private partnership mainly in Osaka City.
Strategy 2	<b><u>Utilization of JCM model project</u></b> In economic development of EEC, it is expected that factories and companies will increase capital investment. In particular, the reduction of initial investment is attractive to local entities, it is an opportunity to introduce energy saving and renewable energy equipment. So JCM application brings new opportunity to local entities.
Strategy 3	<b><u>Collaboration with Japanese entities</u></b> It seems to be difficult to solve issues/needs of Thai private entity. Therefore, the cooperation with Japanese companies will be activated mainly in Osaka City. And this collaboration contributes to EEC's development.

Source : Nippon Koei

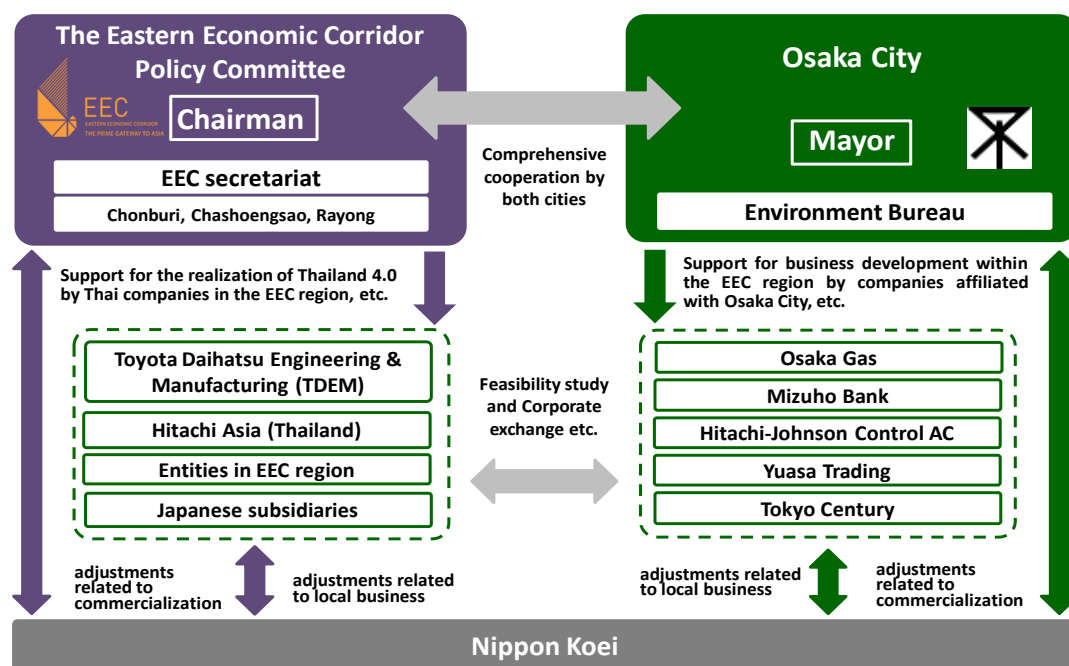
**Figure 2.6 Support strategy through city-to-city collaboration**

Based on the above, the Project aims to contribute to the EEC by formulating JCM model projects through two cities' collaboration.



## 2.3 IMPLEMENTATION STRUCTURE

Implementation structure for the city-to-city collaboration in this year is as shown in the figure below. Osaka City and Japanese companies had conducted from Japanese side and EEC Secretariat and Japanese local company had actioned from Thai side each other. And all players had close cooperation and had periodical online meetings.



Source : Nippon Koei

**Figure 2.7 Implementation structure**

Details of the Japanese project members are presented below.

### (1) Nippon Koei

Nippon Koei Co., Ltd. (hereinafter called “Nippon Koei”) took an initiative of discussions, coordination, and support between the two cities, and was in charge of supporting the formulation of JCM model projects in the EEC region.

Nippon Koei has sales offices in Southeast Asian countries and has a track record of the city-to-city collaboration cooperation project in Indonesia, Vietnam, and Myanmar. In the collaboration, Nippon Koei has made various efforts to form a JCM model project and provide support to the EEC Secretariat and relating organizations, utilizing timely information from other city-to-city collaboration other than the EEC region.

Regarding the effective project management, the city-to-city collaborations to EEC region were carried out efficiently by referring to the efforts in other collaborations shown in the figure below in a timely manner.



Source : Nippon Koei

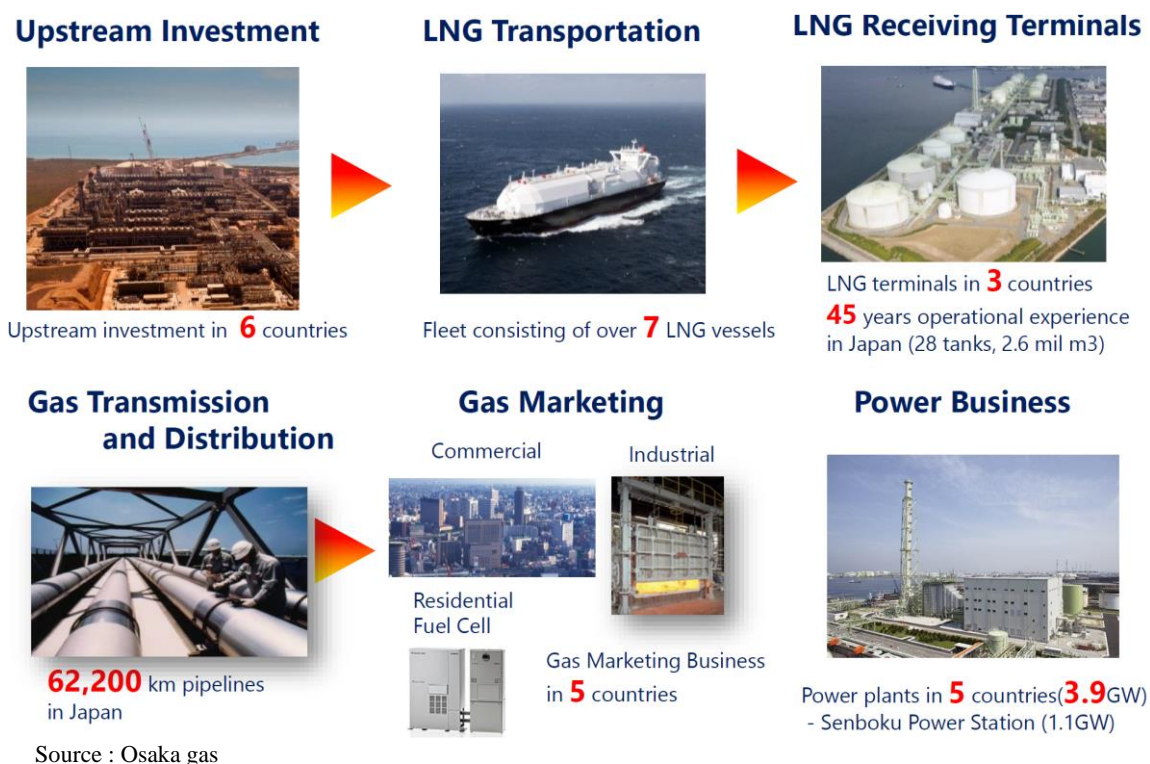
**Figure 2.8 JCM city-to-city collaboration experience by Nippon Koei**

In addition, taking account of the influence of COVID-19, Nippon Koei Bangkok office was utilized to carry out surveys as appropriate in this year.

## (2) Osaka gas

As a total natural gas supplier in the Kansai area, Osaka Gas Co., Ltd. (hereinafter called “Osaka Gas”) is responsible for everything from gas mining to transportation, refining to retailing as a supplier, and gas-fired power generation, with a wide range of activities (See the figure below).

Osaka Gas has already entered the Thai market and established a local subsidiary company, and is promoting business development for biogas refining technology that contributes to the development of the "biofuel and biochemistry" field is positioned as a target industry in Thailand 4.0.

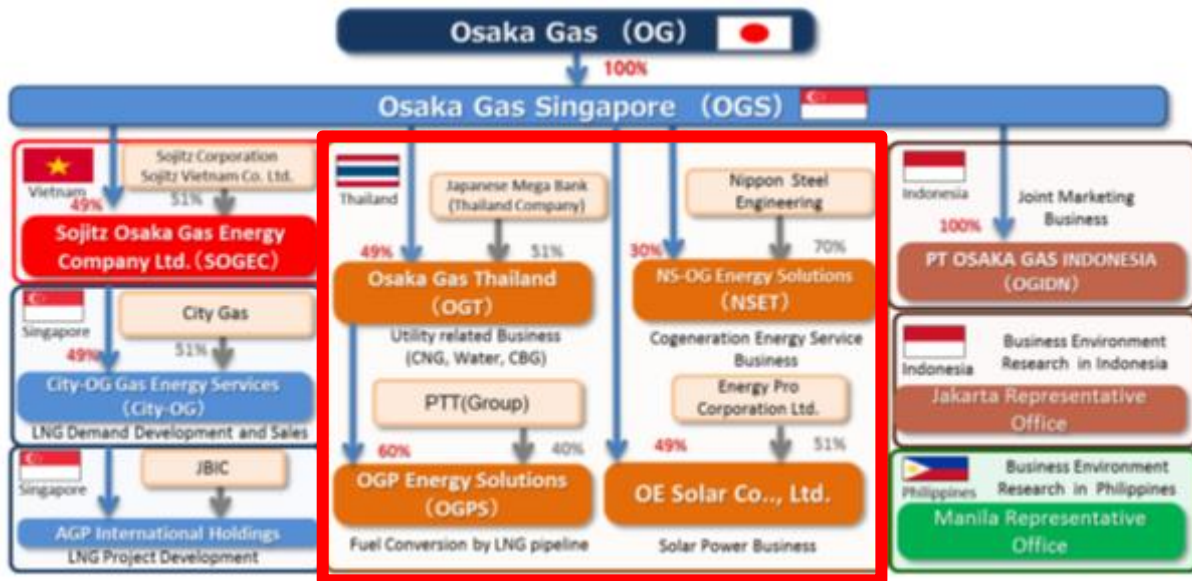


**Figure 2.9 Business field by Osaka gas**

Leveraging its know-how in the gas supply and gas-related businesses over many years, the Osaka Gas is expanding its gas business in the Kingdom of Thailand. An overview of Osaka Gas and its subsidiary in Thailand (Osaka Gas Thailand) is provided below.

**Table 2.2 Outlines of Osaka Gas**

<b>Company name</b>	Osaka Gas Co., Ltd.
<b>Services</b>	<u>Domestic energy and gas:</u> Manufacture, supply and sale of city gas, sale of gas equipment, gas piping work, sale of LNG, sale of LPG, sale of industrial gas <u>Domestic energy and electricity:</u> Generation and sales of electricity <u>Overseas energy:</u> Development and investment in natural gas and oil, energy supply, leasing of LNG transport tankers <u>Life &amp; Business Solutions:</u> Real estate development and leasing, information processing services, sales of fine materials and carbon materials
<b>Establish</b>	April 10, 1897
<b>Staff</b>	5,392 (non-consolidated), 20,224 (consolidated)
<b>Capital</b>	132 billion 166 million JPY



Source : Osaka gas

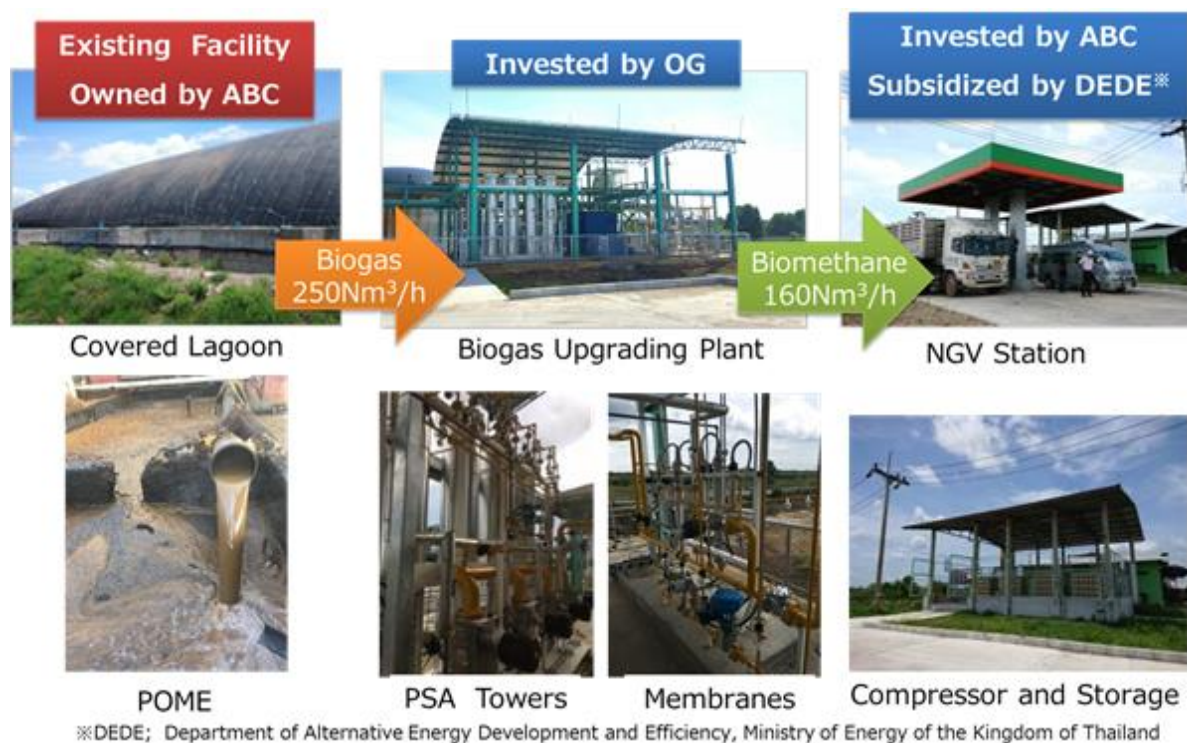
**Figure 2.10 Osaka gas's business structure in south east asian**

**Table 2.3 Outlines of Osaka Gas Thailand**

<b>Company name</b>	Osaka Gas (Thailand) Co., Ltd.
<b>Services</b>	Utility (energy) related business for industrial customers etc.
<b>Location</b>	10F, Wave Place Building, 55 Wireless Road, Lumpini, Pathumwan, Bangkok 10330 Thailand
<b>Establish</b>	October, 2013

Osaka Gas's local subsidiary (Osaka Gas Thailand) is currently compressing and refining biogas obtained from waste liquid (Palm Oil Mill Effluent : hereinafter called “POME”) discharged from a local palm oil manufacturing plant in Nakhon Sita Marat Province, which is the fuel for natural gas vehicles. Following figure shows the Process of biogas refining plant in Thailand by the Osaka Gas Thailand.





Source : Osaka gas

**Figure 2.11 Process of biogas refining plant in Thailand**

### (3) Toyota Daihatsu Engineering and Manufacturing CO., Ltd. (TDEM)

Toyota Daihatsu Engineering and Manufacturing Co., Ltd. (hereinafter called “TDEM”) is a Thai subsidiary of Toyota Motor Corporation and is responsible for overseeing the operations of the company in the Thai region. The outline of TDEM is as follows.

**Table 2.4 Outlines of TDEM**

<b>Company name</b>	TOYOTA DAIHATSU ENGINEERING & MANUFACTURING CO., LTD. (TDEM)
<b>Services</b>	The Small Car Products and Business Planning Department in emerging countries will carry out planning operations related to products and businesses in general, such as the lineup of Toyota brand vehicles in emerging countries and the planning of overall strategies.
<b>Location</b>	99 Moo 5, Ban-Ragad, Bang-Bo, Samutprakarn 10560

Source : TDEM website

TDEM, a local subsidiary of Toyota Motor Corporation in Thailand, which controls the Thai region, is proceeding with various business such as popularizing EV vehicles and procuring zero-emission fuel in the EEC region.

Toyota Motor Corporation has been implemented the "Toyota Environmental Challenge 2050" since 2015 when the Paris Agreement was signed. Specifically, Toyota aims to reduce the negative factors of vehicles



Source : Toyota website

**Figure 2.12 Toyota Environmental Challenge 2050**

to zero and bring positive effects to society in response to global environmental problems such as climate change, water shortages, resource depletion, and biodiversity deterioration. Toyota is promoting initiatives such as the CO<sub>2</sub> Zero Challenge. This year, TDEM had considered the JCM model project in the activities for the spread of Electric Vehicles (hereinafter called "EV") in Pattaya City in the EEC region, and proceeded with preparations for the JCM application for the next year.

### (3) Johnson Control Hitachi Air Conditioning

Johnson Controls-Hitachi Air Conditioning Co., Ltd. (hereinafter called "JCH") is a joint venture between Johnson Controls, a major U.S. air conditioning manufacturer, and the air conditioning division of Hitachi Appliances, which was established on October 1, 2015. Utilizing the advantages of both companies, JCH has sells HVAC<sup>6</sup> products with a global network.

JCH has begun to take an interest in the JCM scheme since last year through the city-to-city collaboration between Osaka City and Ho Chi Minh City. Through this collaboration, JCH has developed two JCM model projects on air conditioning system.

This year, in the city-to-city collaboration in the EEC region, Johnson Controls-Hitachi Air Conditioning (Thailand) Co., Ltd. (hereinafter called "JCHT"), has conducted feasibility study partly for promotion of the high-efficiency air-conditioning equipment with JCM scheme.

An overview of JCH and JCHT is shown below.

<sup>6</sup> Heating, Ventilation and Air Conditioning

**Table 2.5 Outlines of JCH**

<b>Name</b>	Johnson Controls-Hitachi Air Conditioning Co., Ltd. (JCH)
<b>Service</b>	Manufacture and sales of multi-air conditioning systems (VRF) for buildings, package air conditioners for stores, and chiller units that produce cold and hot water for building air conditioning and industrial cooling of factories.
<b>Establish</b>	October 1, 2015
<b>Staff</b>	Approx. 15,000 (as of Oct. 2018)

**Table 2.6 Outlines of JCHT**

<b>Name</b>	Johnson Controls-Hitachi Air Conditioning (Thailand) Co., Ltd.
<b>Service</b>	Sales of multi-air conditioning systems for buildings and chiller units that produce cold and hot water for building air conditioning and industrial cooling of factories.
<b>Location</b>	719 KPN Tower, 8th Floor, Rama Road, Bangkok, Huaykhwang, Bangkok

#### (4) Hitachi Asia (Thailand) Co., Ltd.

Hitachi Asia (Thailand) Co., Ltd. (hereinafter called “Hitachi Asia”) provides sales and services of equipment mainly related to environment and energy saving to local subsidiaries and factories in Thailand within the Hitachi Group. In addition, the products handled include products of Mitsubishi Power, Ltd. (formerly MHPS), an affiliated company of the company. In particular, the Hitachi Asia is also supporting sales activities on "MEGAMIE" which consists of solid oxide fuel cell (hereinafter called “SOFC”) and micro gas turbine (hereinafter called “MGT”).

MEGAMIE is a highly efficient power generation facility that does not burn fuel and converts it directly into electricity with a fuel cell. Therefore, the micro gas turbine can also be charged to effectively utilize the fuel,



Source : Mitsubishi Power website

**Figure 2.13 Image of MEGAMIE**

or steam and hot water can be recovered from the exhaust gas of the micro gas turbine.

Since MEGAMIE has high power generation efficiency, it is possible to reduce the fuel consumption required for power generation compared to conventional power generation equipment. In addition, compared to other cogeneration facilities, it has a high electric heating ratio (high electricity ratio) and is ideal for buildings and factories that use more electricity than heat, and is expected to spread to the EEC region in the future.

#### (5) Mizuho Bank, Ltd.

Mizuho Bank, Ltd. (hereinafter called “Mizuho Bank”), one of the major banks in Japan, concluded a memorandum on attracting corporate investment with the EEC in March 2018,

and has been providing information and support to companies considering investment. Mizuho Bank launched the EEC-OSS (EEC-One Stop Service) in October 2019, which would enable various applications to Thai government agencies to be handled online, in connection with business development in the EEC region and other areas. In this way, Mizuho Bank is pioneering measures for Japanese companies to enter the EEC and is expected to contribute to cooperation between cities.

Due to the influence of COVID-19, Mizuho Bank had played not coordination in Thailand but was in charge of desk review of Thai market, trends of Japanese company in Thailand etc.

#### **(6) Tokyo Century Corporation**

Tokyo Century Corporation (hereinafter called “Tokyo Century”) has been developed leasing businesses for financial and service companies in Japan and overseas. In the JCM scheme, Tokyo Century have a track record of implementing JCM model projects as a representative of international consortium in the JCM partner countries, such as Philippines, Indonesia, and Thailand in the past few years.

In this city-to-city collaboration, Tokyo Century has mainly supported and coordinated with Saha Group, which is a Thai conglomerate that has responded over the past years for enhancement of JCM model project application in their own industrial park.



## 2.4 IMPLEMENTATION SCHEDULE

This city-to-city collaboration has started since October 2019. Before commencing the collaboration, there is no special relationship established between the EEC and Osaka City.

This year, in cooperation with EEC secretariat and Osaka City, the Project has focused on various activities which EEC is interested in and induction to a zero-carbon society. Implementation schedule of this Project is as shown in the figure below.

#	Study items	Year 2020					Year 2021		
		Before Sep	Sep	Oct	Nov	Dec	Jan	Feb	Mar
City-to-city collaboration									
1	Meeting between Osaka and EEC, Online		▽	▽	▽	▽	▽	▽	
2	Support through CtC collaboration, if any		→						
3	Discussion on activities in the next fiscal year					→			
Study on energy saving sector [ EV, A/C, Water etc.]									
4	Consideration of existing conditions etc.		→						
5	Calculation of GHG emission reduction etc.				→				
6	Consideration of JCM application (Intn'l consortium etc.)				→				
7	Discussion on JCM model project application etc.					→			
8	Identification of JCM candidate in next fiscal year					→			
Study on renewable energy sector [ Biogas, SOFC, PV etc.]									
9	Selection of JCM model project		→						
10	Consideration of existing conditions etc.		→						
11	Calculation of GHG emission reduction etc.				→				
12	Consideration of JCM application (Intn'l consortium etc.)				→				
13	Discussion on JCM model project application etc.					→			
14	Identification of JCM candidate in next fiscal year					→			
Miscellaneous									
15	Discussion/preparation on EEC meeting	▽	▽			▽			▽
16	Online workshop between EEC and Osaka City							▽	
Reporting to MOEJ etc.									
17	Meetings	→							
18	Domestic meeting in Osaka/Tokyo etc.	▽	▽	▽	▽	▽	▽	▽	
19	Interim/Final report to MOEJ					▽		▽	
20	Submission of final report								▽

Source : Nippon Koei

**Figure 2.14 Implementation schedule**

## CHAPTER 3 CITY-TO-CITY COLLABORATION

### 3.1 OBJECTIVE

This year is the second year of the city-to-city collaboration between EEC and Osaka City<sup>7</sup>. The Project had focused on discussions and exchange opinions of the smart city development which EEC Secretariat is interested in.

### 3.2 IMPLEMENTATION POLICY

In the Project, the experience and knowledge of Osaka City were shared to EEC Secretariat in order to utilize for EEC's growth toward realization of Thailand 4.0. It is necessary to provide support from various angles to the EEC region, which boasts one of the best economic developments in Southeast Asia, without slowing the growth of the EEC. Therefore, it was decided to conduct the following actions through the Project even during the inconvenient period of COVID-19.

**Table 3.1 Actions of the city-to-city collaboration in this year**

<b>Action 1 : Active use of local consultants and networks</b>	Due to the influence of COVID-19, it was very difficult to forecast overall business situation in Thailand. Therefore, in the Project, with the cooperation and network of Nippon Koei and related companies, flexible implementation structure was built. Specifically, through the Nippon Koei Bangkok office, etc., smooth communications were made with EEC personnel and communication with local corporations. Then, in the cancellation of field survey, if necessary, deep conversation and communication were made for mature understanding each other.
<b>Action 2 : Exit strategy of JCM model project</b>	In this year, the Project supported feasibility study on two JCM model projects, such as OG system and xEVmobolity projects. However, it is difficult to say that the JCM scheme is always optimal for some business ideas. To solve this issue, the project considered other than JCM scheme as an exit strategy for the business. Specifically, the Project considered support of Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development (hereinafter called "JOIN") as a funding source for industrial parks. As other exit strategy, the Project also considered participating in JICA Small and Medium Enterprises (hereinafter called "SME") scheme.
<b>Action 3 : Holding of online workshop including business matching</b>	In the Kingdom of Thailand and the EEC region, there are many Japanese companies entering the market, and it is not so difficult to touch on investment and commercialization compared to other cities in Southeast Asian countries. Taking advantage of the EEC region, the project held an online workshop for EEC secretariat and organizations concerned. Specifically, the invitees were mainly EEC-related persons involved in city-to-city collaboration projects. At the workshop, the project shared information on JCM scheme and provide information of excellent technologies and products owned by Japanese companies.

Source : Nippon Koei

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<sup>7</sup> The EEC is a national strategy for implementing Thailand 4.0 in the Kingdom of Thailand, but it has been organized as a government agency and covers three prefectures in the eastern part of Bangkok. However, it is treated as "equivalent to a city" in this city-to-city collaboration.

### 3.3 REUSULTS OF THE COLLABORATION

#### 3.3.1 Outlines

This year, despite being affected by COVID-19, it is evaluated that the city-to-city collaboration has implemented successfully with dedicated response between EEC secretariat and Osaka City.

Similar to last year, EEC Secretariat and Osaka City has discussed deeply. The Project has supported JCM model projects in parallel with the discussion of two cities. Actually some private companies has faced influence of COVID-19, they could not enough progress on JCM model project preparation. However, two projects which are prepared by Osaka Gas and TDEM had remarkable progress on their JCM model project and will step up next stage in the next fiscal year.

Following table below summarizes the main activities of this year's activities in this city-to-city collaboration, including online workshop, reporting to the Ministry of the Environment Japan (hereinafter called "MOEJ") etc.

**Table 3.2 Major activities in this collaboration**

Date	Activities	Outlines
September 18, 2020	Kickoff meeting with MOEJ	This year's kick-off meeting was held face-to-face at the MOEJ, Osaka City, and Nippon Koei and explained the major activities of this year.
From November 2020	Meetings on smart city development with EECsecretariat	At the request of the EEC, the meetings have been held among city-to-city collaboration members to discuss on support of smart city development promotion by EEC Secretariat since November 2020.
December 14, 2020	Interim report to MOEJ	This year's kick-off meeting was held face-to-face at the MOEJ, Osaka City, and Nippon Koei and explained interim report of the city-to-city collaboration. In particular countermeasure of COVID-19 was discussed.
February 15, 2021	Online workshop on smart city evelopment in EEC region	As the main content of the city-to-city collaboration in the next fiscal year, the online workshop was held hosted by Osaka City and participated Japanese entities who has experience and knowledge and can contribute to smart city development in Thailand.
March 1, 2021	Final report to MOEJ	A final report meeting was held with the MOEJ, Osaka City and Nippon Koei. After report of this year's results and further plan in the next fiscal year, MOEJ gave some comments on the Project.

Source : Nippon Koei

### **3.3.2 Kickoff meeting with MOEJ**

A kick-off meeting was held with the MOEJ, as a report on various activities related to the Project this year. The main contents of the discussion are shown below.

Date : September 18, 2020

Venue : Meeting room of MOEJ

Attendance : MOEJ, Osaka City and Nippon Koei

Minutes : At the kick-off meeting, Osaka City and Nippon Koei explained the background that proposed as a city-to-city collaboration with Osaka City based on the results of last year's activities. In addition, the two private companies (Osaka Gas and TDEM) in charge of JCM feasibility study explained how they would develop their business through the collaboration. In response to the explanation, MOEJ made a comment on expectations for further collaboration with EEC.

### **3.3.3 Discussions with EEC Secretariat on Smart City Development**

#### **(1) Smart city development in Thailand**

In the Kingdom of Thailand, smart city development has been in the limelight with the Prime Minister's Ordinance No. 267/2560 regarding the establishment of the National Smart City Committee in October 2017. According to the Prime Minister's Cabinet Office Ordinance, a national smart city committee chaired by the Prime Minister has been established. In the digital field, the Digital Economy Promotion Agency (hereinafter called "DEPA") has been launched and is building enhancement system for the implementation of smart city development.

The National Smart City Commission has regular consultations and aims to make 100 cities smarter by year 2022. The target areas of the smart city plan include the three cities of southern Thailand / Phuket, northern / Chiang Mai, northeastern / Khon Kaen, Bangkok, and the three (3) prefectures under the EEC.

The figure below shows the smart city development under construction and planned in the EEC region announced by the EEC Secretariat.

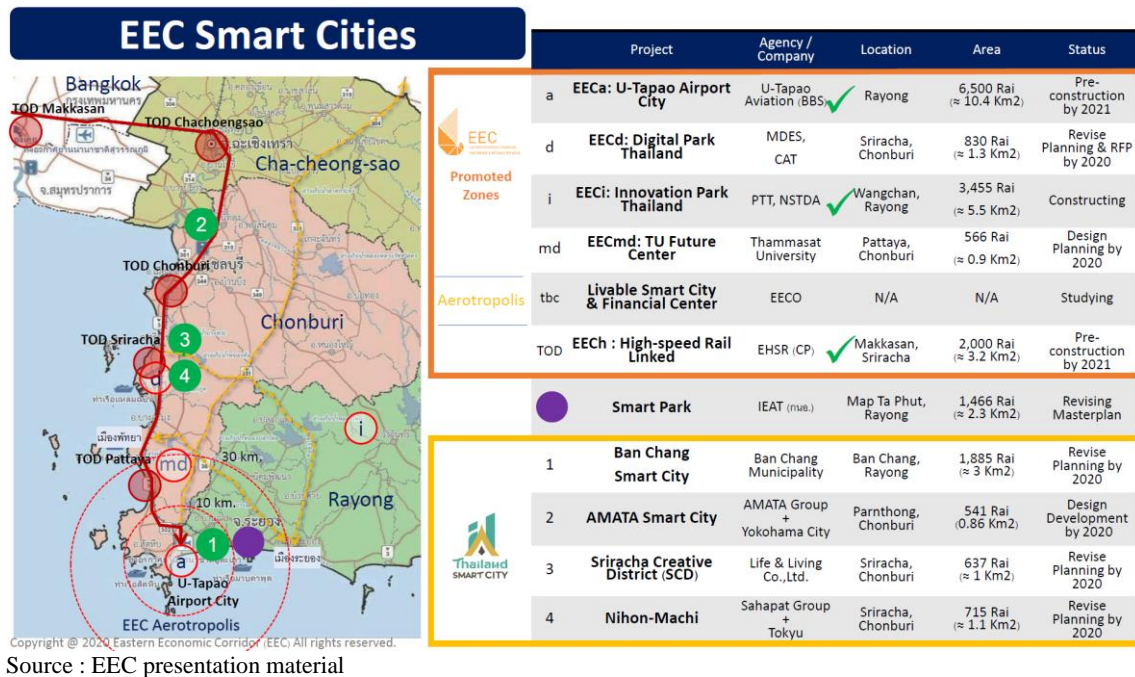


Figure 3.1 Current situation of smart city development in EEC

## (2) Current situation of smart city development in EEC

As smart city development in the EEC region, five (5) factors are focused that contribute to improving the living environment, such as (i) Safety & Security, (ii) Healthcare, (iii) Culture & Environment, (iv) Education, and (v) Infrastructure.

Also, incentive systems such as tax benefits (corporate tax exemption and tax reduction, etc.) for smart city developers are prepared for the investor and/or developers.



Source : EEC presentation material

Figure 3.2 Priority industry in EEC

In addition, smart city development in the EEC is required to meet some of the following seven (7) smart factors.



Figure 3.3 Seven smarts

Finally, there is a flow of the smart city development, including tax incentives etc. See below.

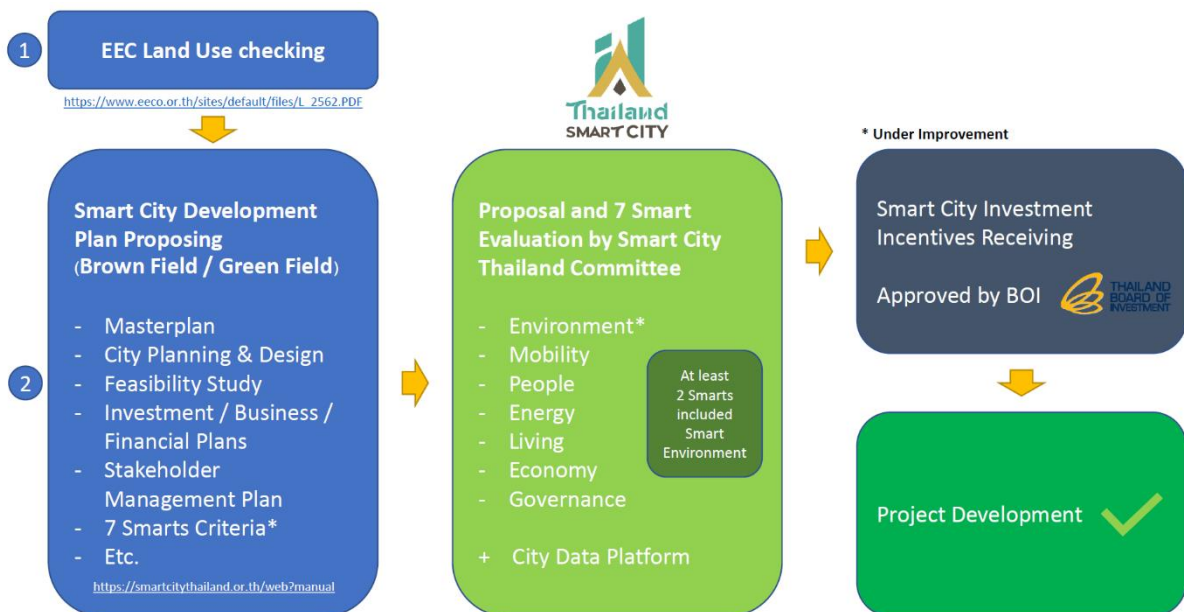


Figure 3.4 Flow of the smart city development

## **(2) Discussions with Japanese companies on Smart City Development in EEC region**

Many Japanese companies are expected to participate and invest in the development of smart cities in the EEC region. Therefore, members of the Project, especially Osaka City and Nippon Koei, had several meetings with Japanese companies, such as manufacturer, supplier, bank, trading company etc.

Some of the companies were participated in an online workshop with the EEC Secretariat in February 2021.

### **3.3.4 Online workshop with EEC on Smart City Development**

As a steppingstone for the city-to-city collaboration in the next fiscal year, the online workshop on smart city development was held which has been announced to be of higher interest than the EEC Secretariat. The purpose of this workshop was to receive an explanation of the current status and policies of smart city development by the EEC, and then to provide a knowledge and experience on the smart city development by Japanese companies. The outline of the workshop is as follows.

Date	: February 15, 2021, from 15:00 to 17:00, JST
Tool	: Zoom meeting
Participants	: EEC, Deputy General Director etc. DEPA MOEJ Osaka City Itochu Corporation, Sumitomo Corporation, Hakuodo, JBIC Nippon Koei
Minutes	: Smart city development is one of the hot issues in EEC region. To this point, a presentation was given by a Japanese company with a track record and knowledge. After the various discussion, it was decided that this discussion would be continued in the next fiscal year onward.





Photo 1, Osaka City



Photo 2, Osaka City



Photo 3, Osaka City



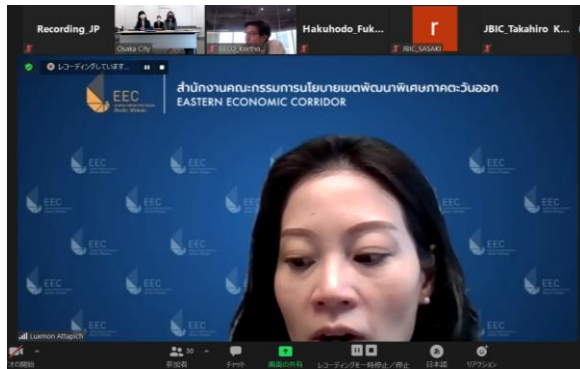
Photo 4, Osaka City

Program and photos of the online workshop are presented below.

**Table 3.3 Program of the online workshop between EEC and Osaka City**

Time	Agenda	Duration	Speaker
15:00 - 15:03	Opening remarks	3 min	EEC
15:03 - 15:06	Opening remarks	3 min	Osaka City
15:06 - 15:09	Opening remarks	3 min	MOEJ
15:10 - 15:20	Future plans and advantages of collaboration	10 min	Osaka City
15:20 - 15:30	Important keys for EEC's smart city development	10 min	EEC
15:30 - 15:50	Company Introduction & reference of smart city activity	20 min	Itochu Corp.
15:50 - 16:10	Company Introduction & reference of smart city activity	20 min	Sumitomo Corp.
16:10 - 16:30	Company Introduction & reference of smart city activity	20 min	HAKUHODO
16:30 - 16:50	JBIC activities in Smart City	20 min	JBIC
16:50 - 16:53	Closing remarks	3 min	Osaka City





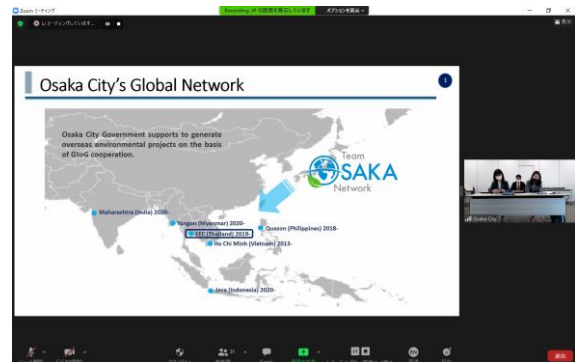
Dr. Luxmon Attapic, EEC



Ms. Ihara, Osaka City



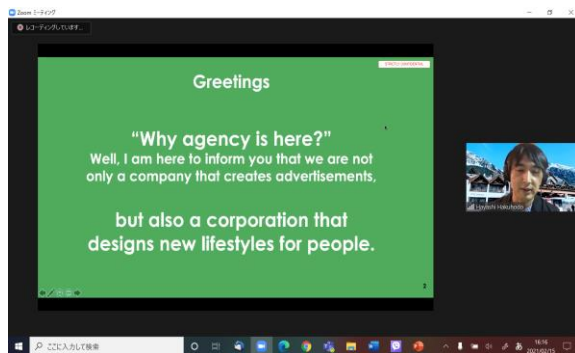
Ms. Inoue, MOEJ



Presentation of Osaka City



Presentation of EECsecretariat



Presentation of Hakuhoodo

### 3.3.5 Final meeting with MOEJ

As a final report of this city-to-city collaboration project, the meeting was held with the MOEJ, Osaka City and Nippon Koei on March 1, 2021. The main contents of the discussion are shown below.

Date : March 1, 2021, from 10:00 to 11:00, JST



Tool : Webex meeting

Participants : MOEJ

Osaka City

Nippon Koei

Minutes : As a final report, Nippon Koei explained the summary of the results of the city-to-city collaboration between EEC and Osaka City in this year under influence of the COVID-19. Based on this year's activities, it was explained that the Project would support smart city development in EEC region with Japanese companies, in terms of utilization of 5G, ICT technology etc. In addition, it was reported that at least two projects would apply to JCM model projects in the next fiscal year.

**令和2年度脱炭素社会実現のための都市間連携事業  
タイランド4.0実現に向けた脱炭素社会形成支援業務**

**環境省 最終報告会資料  
2021年 3月 1日**

**【資料目次】**

1. 事業の概要
2. 事業の全体像
3. 事業の実施体制
4. 事業の全体スケジュール
5. 新型コロナウイルスを踏まえた活動
6. 都市間連携に係る進捗状況及び今後の計画
7. JCM案件形成調査に係る進捗状況及び今後の計画

**NIPPON KOEI**

Meeting material 1

**6. 都市間連携に係る進捗状況及び今後の計画 (1/2)**  
タイランド4.0実現に向けた脱炭素社会形成支援業務

仕様書項目: 4-5. 共通事項 (2) オンライン協議に係る進捗状況及びスケジュールは、以下の通り。

**(1) スマートシティに係るオンライン会議の開催**

- ▶ 日時: 2021年 2月15日 (月) 午後
- ▶ オンラインにて、環境省、大阪市、EEC、DEPA等の参加者に加え、本邦企業として伊藤忠商事、住友商事、博研室、国際協力銀行によるスマートシティに資する各種サービスや実績につき発表があった。

**【概要】**

- ▶ EECからの要望も高いスマートシティ開発に係る本邦企業の実績や知見、想定し得るサービスにつき説明を行った。
- ▶ EEC側からは引き続きの協議や本邦企業への積極的な参加への期待がコメントとして寄せられた。
- ▶ 次年度以降、他のメニューと共に、EEC関係者へスマートシティに係る支援を実施する予定。

**▶ プログラム:**

Time	Agenda	Duration	Speaker
13:00 - 13:05	Opening remarks	5 mins	EEC
13:05 - 13:10	Opening remarks	5 mins	Osaka City
13:10 - 13:15	Opening remarks	5 mins	DEPA
13:15 - 13:20	Presentations and exchange of collaboration	5 mins	Osaka City
13:20 - 13:25	Presentations by EEC's smart city development	5 mins	EEC
13:25 - 13:30	Company introduction & reference of smart city activity	5 mins	Sumitomo Corp.
13:30 - 13:35	Company introduction & reference of smart city activity	5 mins	Sumitomo Corp.
13:35 - 13:40	Company introduction & reference of smart city activity	5 mins	Sumitomo Corp.
13:40 - 13:45	EEC activities in Smart City	5 mins	EEC
13:45 - 13:50	Closing remarks	5 mins	Osaka City

**NIPPON KOEI**

Meeting material 2

### **3.4 MENUES TO BE CONSIDERED BY CITY-TO-CITY COLLABORATION**

#### **3.4.1 Current situation of Plastic Waste in the EEC region**

Toward the realization of the marine pollution, "Osaka Blue Ocean Vision" aims to eliminate new pollution caused by marine plastic waste shared at the G20 Osaka Summit in June 2019 by 2050. The Government of Japan has announced that it will support the capacity building and infrastructure development related to waste management in developing countries.

Osaka City, which played an active role as the host city for holding the summit, has adopted the idea of SDGs and newly formulated the Osaka Blue Ocean Vision.

Implementation plan of the Osaka's vision is suitable for an environmentally advanced city and widely disseminated the idea of the vision to all stakeholders such as citizens. At the same time, it shows measures and processes for strengthening cooperation, and promotes efforts to control the outflow of plastic waste to the ocean, such as cleaning activities for rivers, coasts, roads, parks, etc. and the Osaka Eco Bag Campaign.

Taking the current situation of the EEC into consideration, OsakaCity has been considering a next menu to EEC Secretariat since this year. And, it is expected that this topic will be treated as a new cooperation item through the city-to-city collaboration from the next year.

## CHAPTER 4 JCM PROJECT FORMULATION STUDY

### 4.1 CONSIDERATION OF BIOGAS REFINING TECHNOLOGY & LNG CONVERSION BUSINESS

#### 4.1.1 Study Outlines

##### 1) OG system

Osaka Gas aims to contribute to the spread and expansion of biofuels set forth by the EEC by disseminating and deploying new biogas refining technology (OG system) in the EEC region. Continuing from last year, the Project considered the commercialization and JCM application of the OG system in this area.

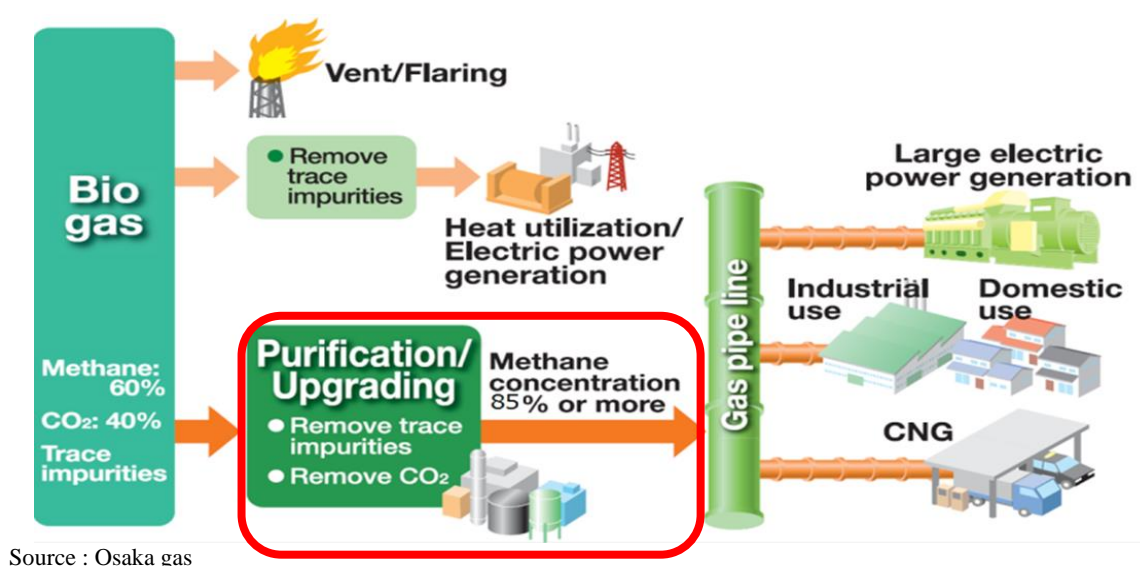


Figure 4.1 Outline of the OG system

This time, with the cooperation of Osaka Gas Thailand, it is examined whether the biogas refining technology can be commercialized and established as JCM model project in the EEC region or not. One of the major industries in Thailand and other Southeast Asian countries is biomass-related business. In particular, Thailand has a greater track record of introducing biogas production facilities than other Southeast Asian countries and has abundant raw materials.

Therefore, effective utilization of biomass and biogas is expected as an activity contributing to low carbon and zero carbon in the EEC. In the use of biogas, CO<sub>2</sub> and impurities are contained in addition to methane gas, and they must be removed in order to use city gas. It is however not done at present.

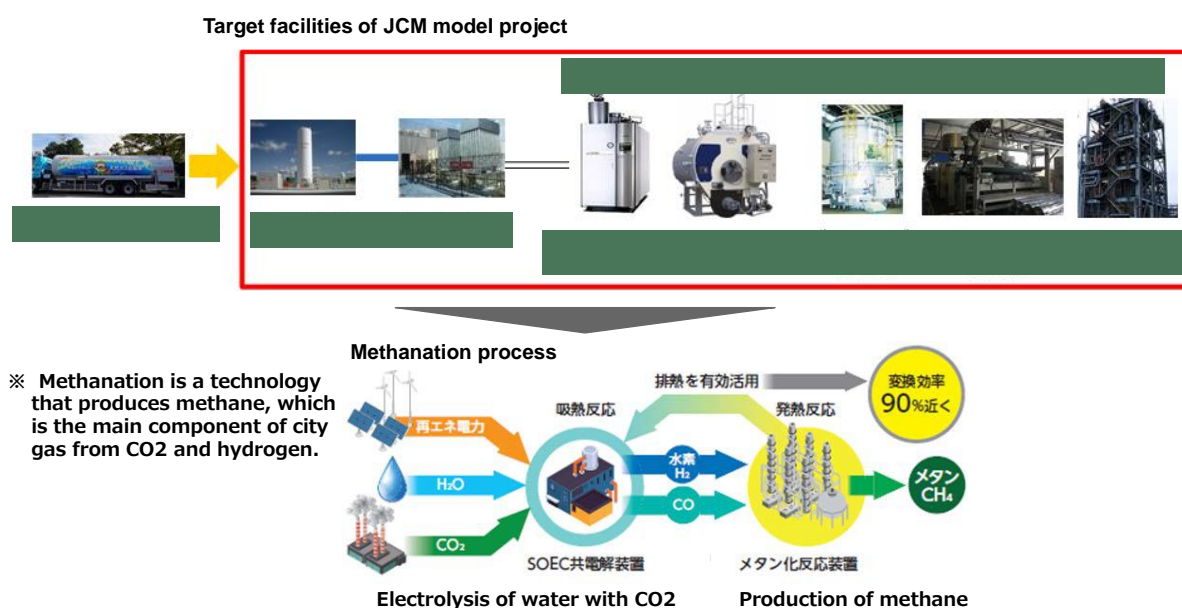
Osaka Gas has developed "Biogas Refining System" to remove impurities from biogas and increase methane concentration, and is introducing it to biomass factories in Thailand and other

countries. Osaka Gas's proprietary biogas refining technology (OG system) has been pilot-tested in Thailand from FY2017 to FY2018, and commercialization has been completed.

In addition, feasibility of OG system has been confirmed through the JCM scheme. In the future, in order to expand the scope of application of this technology, it is planned to clarify effective utilization methods other than fuel applications for natural gas vehicles and related laws and regulations, and consider commercialization, in Thailand and other countries.

## 2) LNG conversion business

Osaka Gas plans to implement urban gasification of factories that use coal and LPG, etc. in anticipation of its contribution to future decarbonization in Thailand and to promote fuel conversion through the spread of natural gas (LNG) in the short term. After that, Osaka gas aims to realize further decarbonization by utilizing the existing gas infrastructure, produce (Methanation<sup>8</sup>) highly efficient and promote carbon-neutral gas from renewable energy.



Source : Osaka gas website information “Contribution to decarbonization of city gas”  
[https://www.osakagas.co.jp/company/press/pr2021/\\_icsFiles/afieldfile/2021/01/25/210125\\_2\\_1.pdf](https://www.osakagas.co.jp/company/press/pr2021/_icsFiles/afieldfile/2021/01/25/210125_2_1.pdf)

**Figure 4.2 Outline of the LNG conversion project**

Metanation technology is considered to be a decarbonization technology that utilizes existing gas infrastructure equipment and is expected to become widespread after 2030. Co-benefit effect of the metahnation is stated below.

<sup>8</sup> Methanation is the conversion of carbon monoxide and carbon dioxide (CO<sub>x</sub>) to methane (CH<sub>4</sub>) through hydrogenation.

### **Technology that contributes to decarbonization**

Osaka gas is challenging to innovate metanation-related technologies in order to take on low-carbonization and decarbonization of the raw gas materials. In case that methane produced by this technology can be used as the main component of city gas system, construction and O&M costs will be saved by utilization of existing infrastructure.

### **Utilization of existing infrastructure**

In recent years, hydrogen technology is expected to spread in the future, it is however necessary to consider some lead time. requires infrastructure development (installation of hydrogen stations, etc.) for social implementation, and a certain amount of lead time is required for surface development. On the other hand, the metanation technology can be converted to base infrastructure by utilizing the existing one. However, minimum equipment changes such as nozzles are required.

### **Domestic business development of methanation technology**

Osaka gas aims to put into practical use the technology "Metanation" that generates city gas system from carbon dioxide and hydrogen by 2030 and plan to expand it domestically and internationally. This technology contributes to decarbonization (zero carbon in 2050), which is of great international interest.

## **4.1.2 Study Results**

### **1) OG system**

To promote the implementation of the OG system, Osaka Gas Thailand has confirmed the potential of biogas in Thailand. In particular, the potential amount of biogas in the EEC is said to be 133.0 [million m<sup>3</sup>/year], and commercialization involving JCM is expected. The amounts of biogas in Chachoengsao, Chonburi and Rayong are 66.4 [million m<sup>3</sup>/year], 31.8 [million m<sup>3</sup>/year] and 34.8 [million m<sup>3</sup>/year] respectively.

In case that installation of the OG system is not sufficient to meet the capital investment, the benefits of introducing a biogas refining plant would be diminished. From this point, it is examined the biogas-related facilities that are highly likely to introduce this system, and confirmed the following results.

As shown in the table below, automotive ethanol purification plants distributed in the Kingdom of Thailand have high biogas production per plant. It is said that the plants can be promising candidates of OG system.

**Table 4.1 Outlines of type of biogas plant in Thailand**

Type of biogas plant	No. of plant	Gas production [Mil. m3/year]	Average gas production per plant [Mil. m3/year/unit]
Starch	56	364.5	6.5
Ethanol	19	243.8	12.8
Live stock	1,250	217.6	0.2
Palm oil	72	177.3	2.5
Others	80	126.6	1.6
Total	1,477	1,130.0	0.8

Source : DEDE

Based on the above, this year, the following candidate factory in the EEC were selected. Since it was not easy to approach private companies in Thailand by Osaka Gas Thailand so far, the Project plans to actively consider commercialization with the support of the EEC Secretariat.

**Table 4.2 Factory information in EEC which expects to apply OG system**

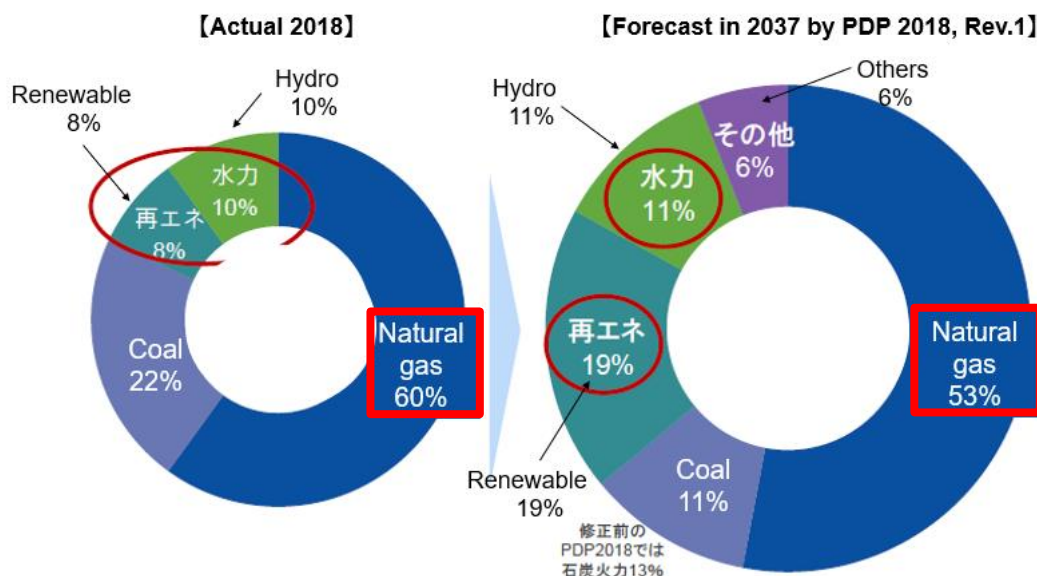
#	Name	Type	Location	Digester volume [m3]	Registered Capital [THB]
1	Candidate factory A	Fruit	Chonburi	225,000	237,000,000
2	Candidate factory B	Slaughterhouse	Chonburi	200,100	100,000,000
3	Candidate factory C	Ethanol	Chachoengsao	54,000	942,000,000
4	Candidate factory D	Cassava starch	Chachoengsao	50,000	750,000,000
5	Candidate factory E	Ethanol	Rayong	30,000	975,000,000
6	Candidate factory F	Rubber	Chonburi	20,400	394,788,000
7	Candidate factory G	Food	Rayong	19,500	9,291,530,318

Source : Osaka gas presentation material

## 2) LNG Conversion business to existing infrastructure

Power Development Plan (hereinafter called “PDP”) was released in April 2019 by the Kingdom of Thailand and covers year from 2019 to 2037.





Source : Mizuho bank

**Figure 4.3 Perspectives of power development plan in Thailand**

As shown in the above figure, it was planned to maintain coal-fired power in PDP2015, but the ratio has been reduced in PDP2018. On the other hand, natural gas-fired power was planned to be significantly reduced in dependence due to the prospect of a decrease in domestic gas. However, at PDP 2018, the majority will continue to maintain gas-fired power by utilizing LNG. For this reason, it is expected that the Kingdom of Thailand will continue to depend on natural gas.

The Government of Thailand has spent a lot of budget to the city gas infrastructure, it is expected to utilize it and convert to decarbonization. It is also expected that metanation technology is good candidate for next generation energy in the urban area in the Kingdom of Thailand.

#### 4.1.3 JCM Application Plan

##### 1) OG system

Discussions have been ongoing with several companies/factories on the business development of the OG system promoted by Osaka Gas Thailand including the EEC region.

It is expected to pursue refining quality of biogas and providing a stable fuel (compressed biogas: CBG) because the quality of the biogas derived from agricultural wastes distributed in Thailand. Osaka Gas's new biogas refining technology (OG system) has advantages over similar technologies related to biogas purification in the points shown in the table below.



**Table 4.3 Technical superiority of OG system**

Type	Pressure fluctuation absorption Competitor A	Membrane Competitor B	High pressure water absorption Competitor C	OG system
Feature	CO <sub>2</sub> is absorbed and removed by the adsorbent. Suitable for small to medium systems	Separation based on the difference in the transmission speed of the polymer membrane between CH <sub>4</sub> and CO <sub>2</sub> . Suitable for small systems	High pressure water absorbs CO <sub>2</sub> and removes it. Suitable for large-scale systems	Combination of PSA and membrane. Concentration to high purity and high CH <sub>4</sub> recovery rate
Actual performance	50 prj in worldwide	10 prj in Europe	More than 50 prj in worldwide	Under preparation
Rate of CH <sub>4</sub> collection	93%	99%	98%	99%
Price [JPY/Nm <sup>3</sup> ]	11.9	21.4	9.7	9.0

Source : Osaka gas presentation material

Due to the COVID-19, there is small progress on the business discussion of the OG system. Therefore, it will be re-started when the impact of COVID-19 diminishes.

## 2) LNG conversion business

LNG conversion business can apply to existing city gas system by replacement of some attachments, such as nozzles, etc. However, since the fuel type will change on the demand side, it is necessary to confirm whether the change of gas quality can be tolerated or not.

Currently, Osaka Gas is discussing with some clients in EEC region on LNG conversion business with JCM model project application.

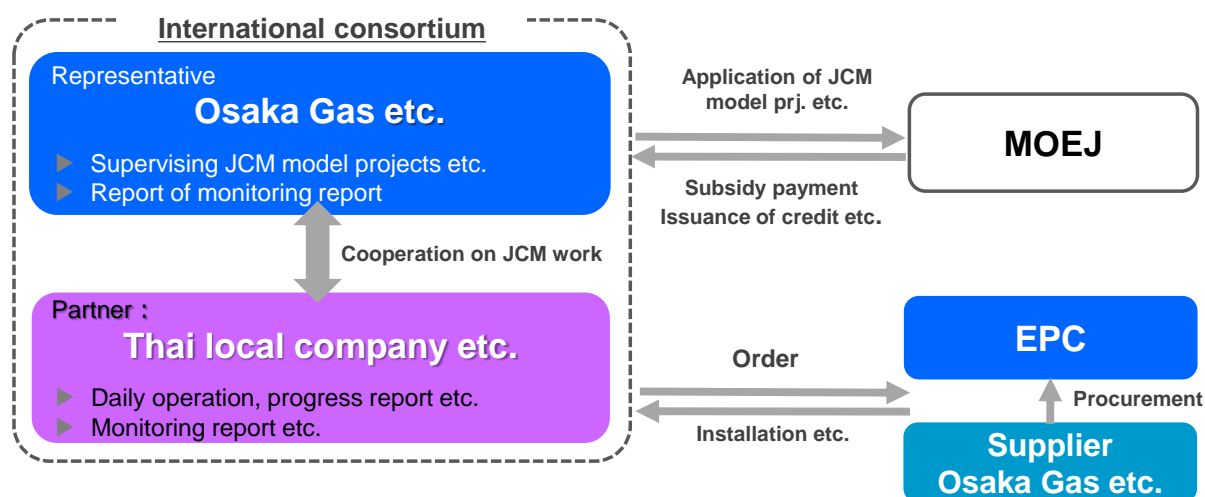
**Table 4.4 Candidate sites of the LNG conversion business**

	fuel			LNG		facility	CO2 reduc t/年	Owner	IC	Subsidy	Sector
	種別	MMBTU/年	効率	MMBTU/年	効率				MTHB	MTHB	
	LPG		-		同左	炉					
	LPG		-		同左	炉 改造					
	石炭					ボイラ					
	LPG		-		-	ボイラ 焼却炉					
	LPG		-		同左	熱媒ボイラ 改造					
	LPG				同左	ボイラ					

Source : Osaka gas presentation material

#### 4.1.4 International Consortium

International consortium of the OG system and LNG conversion business is presented below. In this case, representative of the consortium will be in charge of the player who has enough knowledge of application technology, such as Osaka Gas etc (See below).



Source : Nippon Koei

**Figure 4.4 Perspectives of power development plan in Thailand**

#### **4.1.5 MRV Plan**

In case that fuel provision in the OG system is realized, it is expected to contribute to the realization of a low-carbon/decarbonized society in the EEC region. Quantitative measurement of biogas purification is not a problem as it can be handled within the scope of the system. Therefore, it is considered that the point is to build a system that surely realizes measurement, report and verification (hereinafter called “MRV”) by the owner of the facility. In this regard, Osaka Gas and the project will promote appropriate implementation by explaining appropriate MRV implementation measures.

In addition, it is evaluated that MRV is easy to implement if the existing gas utilization can be quantitatively measured for the LNG conversion project to the existing infrastructure. In the future, Osaka Gas plans to elaborate the details in consultation with the local business operator who plans to apply JCM model project.

#### **4.1.6 Issues on JCM Application**

The OG system is an effective technology that promotes low carbon and decarbonization in the Kingdom of Thailand or the EEC region. In the country, there are many cases such as refining ethanol vehicle fuel which biogas is generated at the production stage and using biogas using agricultural waste. Therefore, it seems that target market of the OG system is expected to be large. From the next fiscal year, Osaka Gas and the project are considering effective JCM model project formation by actively conducting market research and explaining technological advantages.

## 4.2 EV PROJECT IN PATTAYA CITY

### 4.2.1 Study Outline

TDEM aims for zero carbon in the EEC region and concluded Minutes of Understanding (hereinafter called “MOU”) regarding the trial introduction of electric vehicle (hereinafter called “EV”) in the city of Pattaya in the EEC region to achieve the Toyota Environmental Challenge 2050 of Toyota Motor Corporation.

Specifically, as part of the smart city plan in Pattaya City, an EV will be introduced in the city's public transportation system (shared taxi: Songthaew). Then, regarding the purchase of EV, this city-to-city collaboration project examined the application of the JCM model project and conducted various surveys.

### 4.2.2 Project Evaluation

The vehicle to be introduced in Pattaya City is assumed to be an EV. The purchase of the vehicle will be a business operator that operates in the city with a license for public transportation. It is assumed that vehicle owner is a company or an individual. To apply to the JCM model project, it is important to specify the scope of the JCM project and to build an efficient international consortium assuming MRV support. It has been agreed that the charging station that supplies electricity to the EV will be installed by the city of Pattaya or the Kingdom of Thailand.

The above descriptions are stated in the MOU of the signing ceremony with the city of Pattaya, which was signed in December 23, 2020.



Source : Bangkok Post, December 23, 2020  
<https://www.bangkokpost.com/thailand/pr/2040035/pattaya-city-together-with-toyota-and-osaka-gas-lays-the-foundation-for-decarbonized-sustainable-city>

**Figure 4.5 Photo of MOU Signing Ceremony in Pattaya City**

### 4.2.3 International Consortium

The key point in creating an international consortium in this project is the handling of EV owners. In Thailand, vehicle owners belonging to public transportation are not necessarily companies. Taking the above point in to consideration, the international consortium will be created. Image of the consortium is shown below.

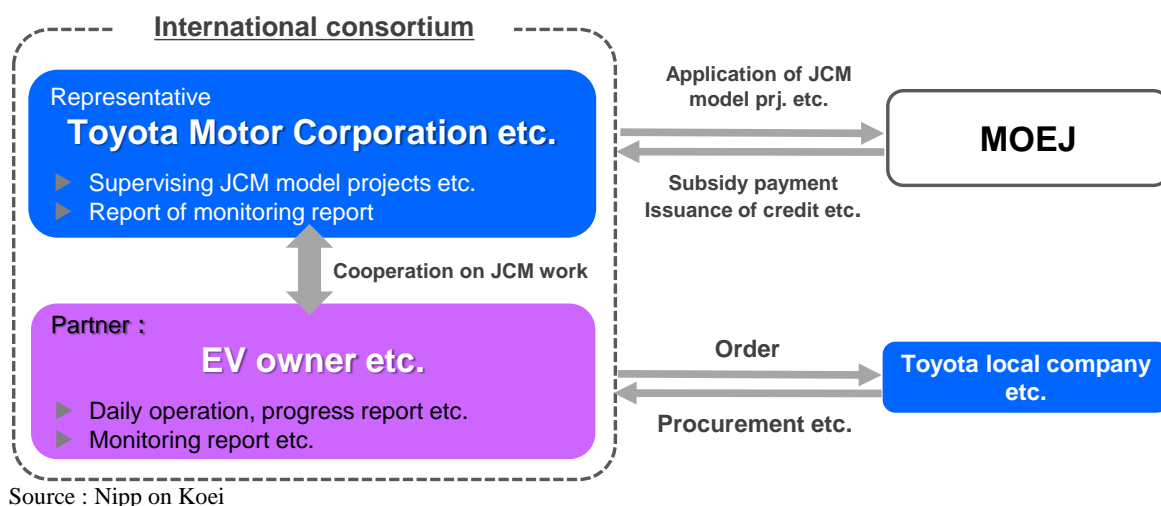


Figure 4.6 International consortium of EV project

### 4.2.4 Calculation of GHG Emission Reduction

As of February 2021, JCM methodology for EV system is not developed yet. Therefore, it is desired to develop a methodology suitable for the project in the future. Currently, pickup trucks are the mainstream of public transportation (Songthaew) in Pattaya City, and most of them use diesel oil as fuel.

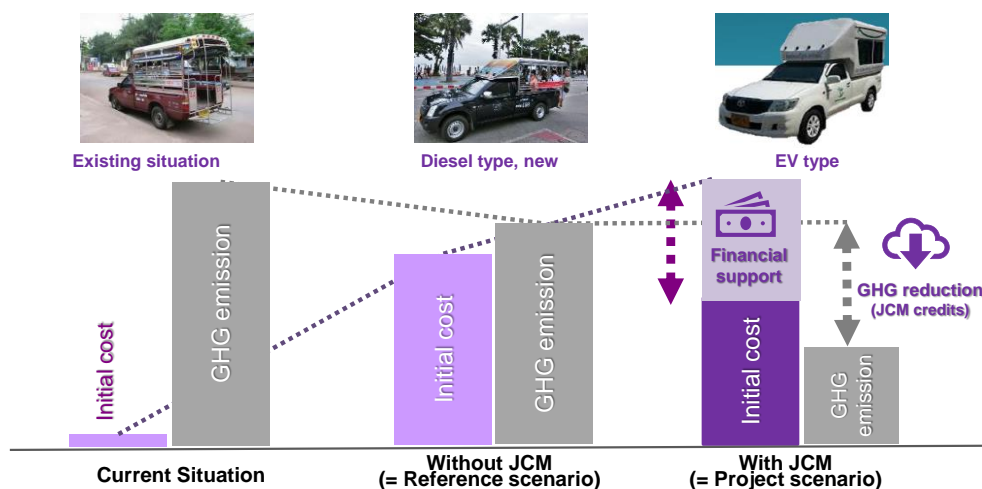
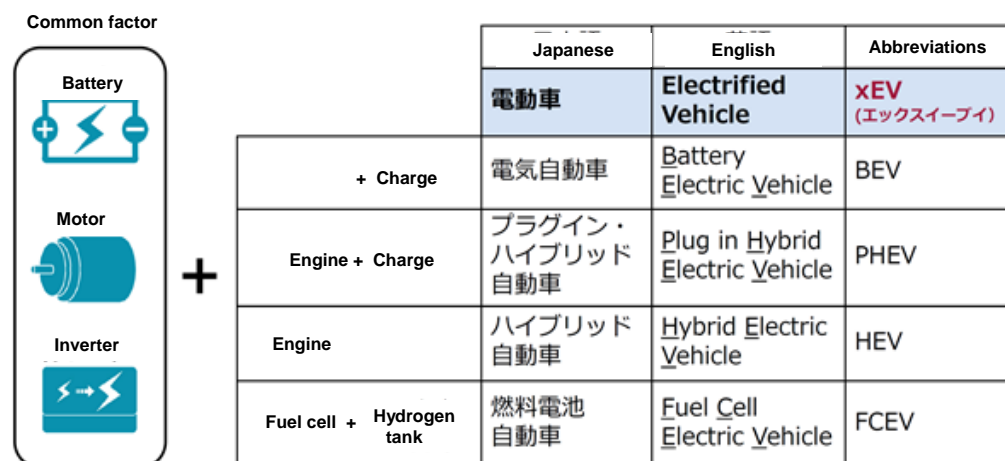


Figure 4.7 Image of JCM project on EV project

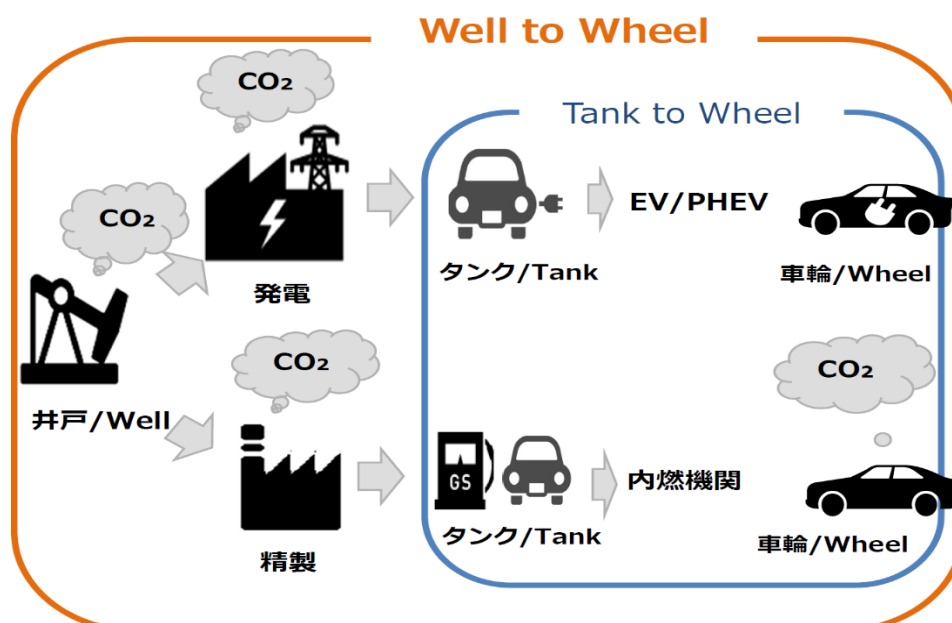
In recent years, many alternatives to gasoline and diesel-fueled vehicles, such as EVs and hybrid vehicles, have been developed and become widespread. Some vehicles run entirely on electricity, while others run in combination with other power sources. These vehicles are collectively called xEV and are expected as a GHG emission reduction tool for zero carbon in the Paris Agreement and 2050.



Source : Agency for Natural Resources and Energy

Figure 4.8 Outlines of xEV

In addition, the points to be considered when applying EV to JCM scheme are the ideas of Well to Wheel and/or Tank to Wheel. Well to Wheel expresses a series of environmental loads from fuel mining, procurement to driving of automobiles. On the other hand, Tank to Wheel is the load from the fuel tank of the car to the wheels. These relationships are shown in the figure below.



Source : Agency for Natural Resources and Energy

Figure 4.9 Image of Well/Tank to Wheel

Based on the above, the following is shown with reference to the methodology of the EV project examined by other JCM feasibility study.

#### Reference emissions

$$RE_p = \sum_i (SFC_i \times NCV_{RF,i} \times EF_{RF,i} \times DD_{i,p} \times N_{RF,i,p})$$

- $RE_y$  : Total reference emissions in year y [tCO<sub>2</sub>/year]  
 $SFC_i$  : Specific fuel consumption of reference vehicle category i [l/km]  
 $NCV_{RF,i}$  : Net calorific value of fossil fuel consumed by reference vehicle category i [(MJ/l)  
 $EF_{RF,i}$  : Emission factor of fossil fuel consumed by reference vehicle category i [tCO<sub>2</sub>/MJ]  
 $DD_{i,y}$  : Annual average distance travelled by project vehicle category i in the year p [km/y]  
 $N_{RF,i,y}$  : Number of reference vehicles in category i in year p

#### Project emissions

$$PE_p = \sum_i (SEC_{PJ,i,p} \times EFe_{lect,p} / (1 - TDL_p) \times DD_{i,p} \times N_{PJ,i,p})$$

- $PE_p$  : Total project emissions in year p [tCO<sub>2</sub>/y]  
 $SEC_{PJ,i,p}$  : Specific electricity consumption by project vehicle category i per km in year p in urban conditions [kWh/km]  
 $EFe_{lect,p}$  : CO<sub>2</sub> emission factor of electricity consumed by project vehicle category i in year p [tCO<sub>2</sub>/kWh]  
 $TDL_p$  : Average technical transmission and distribution losses for providing electricity in the year  
 $DD_{i,p}$  : Annual average distance travelled by the project vehicle category i in the year p [km/year]  
 $N_{PJ,i,p}$  : Number of operational project vehicles in category i in year p

#### **4.2.5 Issues on JCM Model Project Application**

Until now, the JCM methodology for EVs has not been developed in the JCM scheme, and it is necessary to consider how to set the reference scenario based on the concept of Well to Wheel and/or Tank to Wheel. In addition, it will be necessary to consider the characteristics of each project, such as whether the MRV method will be on the vehicle side or the EV charger side.

In this project in Pattaya City, related companies are already considering this point, so it is expected to apply JCM model project in the next fiscal year.



## 4.3 CONSIDERATION OF AIR CONDITIONING EQUIPMENT

### 4.3.1 Study Outlines

JCH has experience on JCM model project mainly in Ho Chi Minh City, Vietnam since 2018, through the city-to-city collaboration between Ho Chi Minh City and Osaka City. From last year, JCH has implemented JCM model project formulation on air-conditioning system in the collaboration with the JCHT.

### 4.3.2 Product Specifications

JCH's high-efficiency multi air conditioner for buildings (Variable refrigerant flow: VRF) maintains the industry's top class performance, and it is possible to flexibly respond to the scale of support by combining units according to customer needs.

In addition, it is a space-saving type, low noise type, equipped with a defrosting function, etc., and is promising to be adopted as a JCM model project as a high-efficiency air-conditioning equipment.

Category	Packaged Air-Conditioner		Chiller system		
Type	PAC	VRF	Air screw chiller	Water screw chiller	Turbo chiller
Outlook					
Capacity	10~20HP	8~96HP	50~400RT	50RT~530RT	300~1000RT
Usage	Factory Shopping mall	Commercial building	Factory Commercial building	Factory Commercial building	Factory Commercial building
Methodology	VN_AM006	VN_AM006	N/A	VN_PM026, under inspection	TH_AM003 (Inverter) TH_AM005 (Non-inverter)

Source : JCH material

**Figure 4.10 Line up of JCM products**

In addition, the general selling points and characteristic of JCH's air conditioning equipment are summarized in the table below.



The above table shows that JCH can continue to be a promising customer. Therefore, the project plan to continue to spread and form the JCM model project application with the cooperation of the JCH in the next fiscal year.

#### **4.3.4 Project Evaluation**

Due to the influence of COVID-19 this fiscal year, the project has not been able to identify the candidates that are expected to lead to JCM model project in the next year. However, the JCH, which has a track record of JCM model projects, is expected to continue to play a leading role in this field (A/C system) and the spread of JCM model project.

Until now, JCH has been implementing the JCM model project in Vietnam as the representative of the consortium. With this experience, it is expected that JCH can also formulate it in the Kingdom of Thailand. In particular, the industrial parks in the EEC region, where Japanese companies are concentrated, are considered to be promising in the following points.

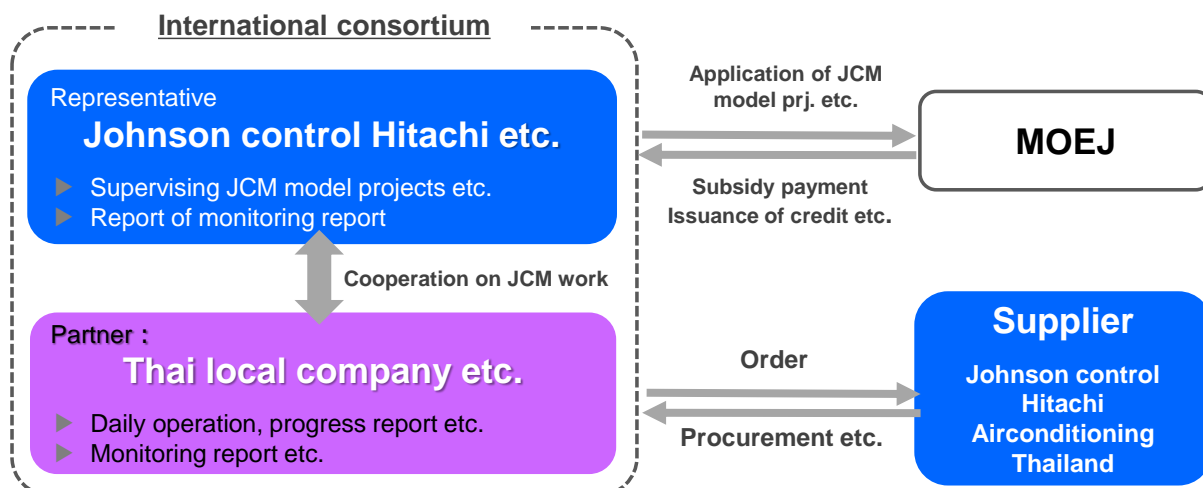
- i) The air-conditioning equipment handled by JCH is a general-purpose equipment in the Kingdom of Thailand, and it is expected that by granting the JCM model project incentive, it will be relatively easy to expand to new customers as well as conventional customers.
- ii) It is easy to implement as one JCM model project by bundling multiple projects even with a small number of installations or small-scale commercial transactions. Has a track record in Vietnam. JCH has track record in Vietnam for similar business model.
- iii) Electricity tariffs in Thailand have risen by less than 20% since 2016, and the reduction of OPEX (operation cost) is urgent for factory owners. Therefore, there is an urgent need to introduce high-efficiency equipment for saving OPEX, and it is expected that installation of high efficiency air-conditioning equipment will increase in the future.

Based on the above, the following points were considered when JCH identifies /formulates JCM model project in EEC region (See below).

#### **4.3.5 International Consortium**

Based on the results of the JCM model project implemented by JCH, the international consortium system plan for implementation in Thailand is shown below. According to previous JCH's project, JCH has become a representative of the consortium and is applying for multiple JCM model projects at the same time.

Although the burden on the representative business operator in one project will increase, it however is expected that the fact that it can include small-scale businesses that were previously difficult to be covered by one JCM application. In addition, it is a tailwind that conditions of minimum budget more than 50 million JPY was dismissed.



Source : Nippon Koei

**Figure 4.11 International consortium of JCH project**

#### 4.3.6 Calculation of GHG Emission Reduction

JCM scheme has already developed several methodologies of the air conditioning equipment (refrigerators, etc.). GHG emission reductions can be calculated for JCM model projects for which approved methodologies can be used, based on the following methodologies.

For reference, the following are the reference emissions and project emissions for calculating GHG emission reductions by the approved methodology (AM\_TH005: Energy Saving by Introduction of High Efficiency Non-Inverter Type Centrifugal Chiller, Version 02.0) in Thailand.

In addition, JCH is envisioning the use of JCM for the sale of building multi-air conditioners (hereinafter called "VRF"). In the future, the GHG emission reduction will be calculated separately by comparing the coefficient of performance (hereinafter called "COP") of the reference chiller and the project chiller.

In the existing methodology, the COP of the reference chiller is set to a constant value according to the cooling capacity of the project chiller under standard rated conditions.

On the other hand, by using VRF, the operating load is not actually constant, but varies depending on the operating load factor of the air conditioner and the outside air temperature.

In chillers for air-conditioning system, operation at 100% load is small, and most of the time it is operating at from 50% to 75% load. In order to calculate the energy saving effect with a

value closer to the actual condition, it is necessary to consider the actual air conditioning operation load.

Based on this point, it is desirable to calculate energy savings for VRF machines in consideration of partial load operation. Generally, a standard term coefficient of performance (Integrated Part Load Value, hereinafter called “IPLV”) is used. IPLV is calculated by the following formula.

$$\text{IPLV} = \alpha A + \beta B + \gamma C + D\delta$$

A : COP of 100% load, B : COP of 75% load, C : COP of 50% load, D : COP of 25% load  
 $\alpha$  : 100% load,  $\beta$  : 75% load%,  $\gamma$  : 50% load%,  $\delta$  : 25% load of operation hours, same as weights

In case of a JCM application is made for a specific VRF machine, the calculation of GHG emission reductions by IPLV will be considered after the next fiscal year.

Based on the idea of IPLV, the reference emissions and project emissions are considered to be calculated as follows.

#### Reference emissions

$$\text{RE}_p = \sum_i \{ \text{EC}_{\text{PJ},i,p} \times (\text{IPLV}_{\text{PJ},tc,i} \div \text{IPLV}_{\text{RE},i}) \times \text{EF}_{\text{elec}} \}$$

$\text{RE}_p$  : Reference emissions during the period  $p$  [tCO<sub>2</sub>/p]

$\text{EC}_{\text{PJ},i,p}$  : Power consumption of project chiller  $I$  during the period  $p$  [MWh/p]

$\text{IPLV}_{\text{PJ},tc,i}$  : IPLV of project chiller  $i$  calculated under the standardizing temperature conditions [-]

$\text{IPLV}_{\text{RE},i}$  : IPLV of reference chiller  $I$  under the standardizing temperature conditions [-]

$\text{EF}_{\text{elec}}$  : CO<sub>2</sub> emission factor for consumed electricity [tCO<sub>2</sub>/MWh]

#### Project emissions

$$\text{PE}_p = \sum_i (\text{EC}_{\text{PJ},i,p} \times \text{EF}_{\text{elec}})$$

$\text{PE}_p$  : Project emissions during the period  $p$  [tCO<sub>2</sub>/p]

$\text{EC}_{\text{PJ},i,p}$  : Power consumption of project chiller  $I$  during the period  $p$  [MWh/p]

$\text{EF}_{\text{elec}}$  : CO<sub>2</sub> emission factor for consumed electricity [tCO<sub>2</sub>/MWh]

#### **4.3.7 Issues on JCM Model Project Application**

JCHT has already accumulated know-how on JCM model project in support of JCH. For this reason, it is recognized that there are no significant issues related to JCM model applications.

On the other hand, in the air conditioning equipment business, the size of each project is slightly small, so there is concern about the burden of bundling multiple projects and applying as a JCM model project.

In this fiscal year, the JCM candidate project has not yet been identified due to limited time and COVID-19, but in the next fiscal year, it is expected that the JCM model project will be formulated through the results and business meeting and JCH's network.

#### **4.4 CONSIDERATION OF JCM MODEL PROJECTS IN THE NEXT FISCAL YEAR**

In this fiscal year, due to the influence of COVID-19, the original activities of the JCM model project formulation survey could not be sufficiently conducted. In addition, it was not possible to conduct a JCM potential survey in the next fiscal year without field survey and face-to-face interviews with local businesses.

Based on the above, some potentials are identified through the surveys/approaches in this year. Then, as much as possible, the Project will consider the formulation of the following JCM model projects from the next fiscal year.

- 1) Technology relating to smart city, such as environment monitoring sensor, ICT etc.
- 2) Zero/Low carbon transportation technology
- 3) Water /Solid waste technology
- 4) Bio-prastic relating technology
- 5) Miscellaneous technology relating to zero/low carbon technology contributing to EEC



## **CHAPTER 5      ISSUES AND COUNTERMEASURES ON COVID-19**

Since January 2020, the infection of the COVID-19 has spread all over the world. The number of infected people in the Kingdom of Thailand has increased sharply since December 2020.

As of the end of February 2021, the total number of infected people reached about 25,000, and the situation is not yet settled.

Under the influence of COVID-19, the Project has faced many restrictions on various activities. However, some activities have made progress with ingenuity and flexible response.

### **5.1      ISSUES AND COUNTERMEASURES ON CITY-TO-CITY COLLABORATION**

#### **5.1.1      Issues**

Since the start of the city-to-city collaboration project last fiscal year, the EEC Secretariat has been receiving request and/or proposal from Osaka City and has taken some actions properly in a short period. It is presumed that this situation was attributed to the fact that the person in charge in both cities visited each city every few months. Due to the influence of COVID-19, it was not possible to realize field survey. The issues listed in the table below however were envisioned.

**Table 5.1      Issues identified through city-to-city collaboration**

#	Issues	Details
1	Difficult to take actions with common understanding.	It is not easy to work toward a common goal so that there is no difference in consciousness. In addition, when faced with an unforeseen situation or situation, it is necessary to confirm the direction and adjust the schedule as appropriate.
2	Difficult to properly grasp the needs and intentions of partner cities.	In the case of online meeting, it is assumed that grasping the reaction of the other participants is limited, and it is not possible to properly grasp the request and intention of the other participants.

Source : Nippon Koei

#### **5.1.2      Countermeasures**

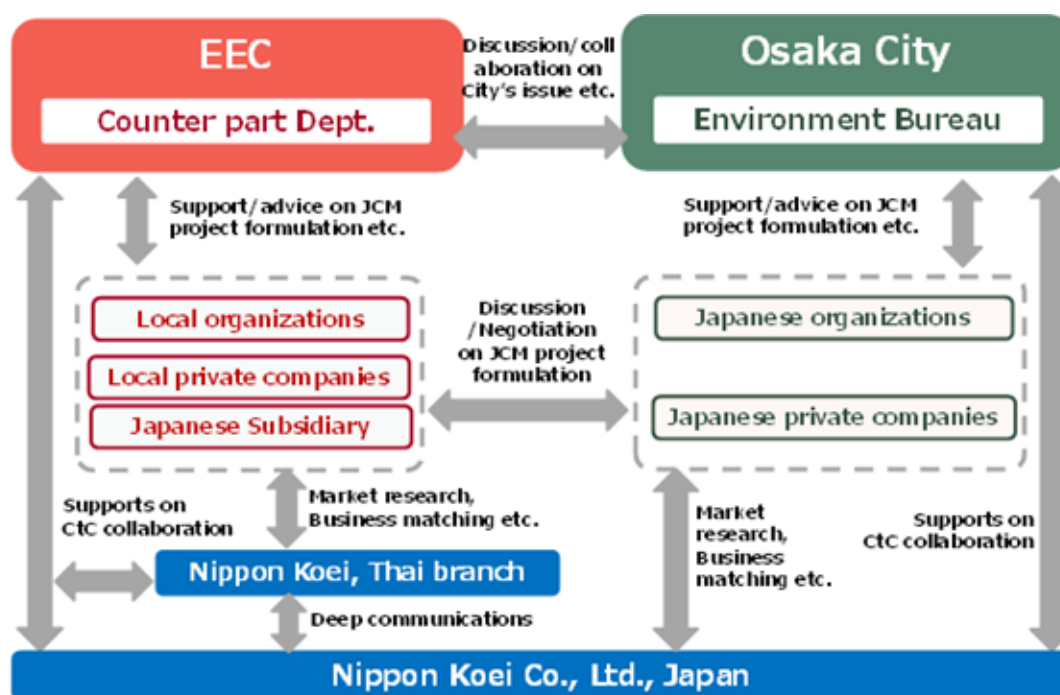
It is a fact that the issues identified in the previous section have been problems such as hindering the progress of work in the past city-to-city collaboration projects. On the other hand, it is evaluated that EEC Secretariat and Osaka City have come close to each other and responded efficiently to COVID-19, which has become an international issue. The response to the issues is summarized below.

**Table 5.2 Countermeasures to Issues identified**

#	Issue	Countermeasures
1	Difficult to take actions with common understanding.	<p>While maintaining the goals of the city-to-city collaboration project, the work process and approach were reviewed in consideration of the following three points.</p> <ol style="list-style-type: none"> <li>1) Review plans and approaches in line with the actual situation of the counterpart cities/companies</li> <li>2) Rethinking short- to medium-term goals</li> <li>3) Confirmation of factors available</li> </ol> <p>In addition, the project held online meetings that took advantage of the characteristics and strengths of the Japanese local government (Osaka City).</p>
2	Difficult to properly grasp the needs and intentions of partner cities.	<p>As cooperation based on the requests and intentions of the EEC Secretariat, which is interested in COVID-19 measures, the followings were examined and implemented as support for green recovery and the implementation of a zero-carbon society.</p> <ol style="list-style-type: none"> <li>1) Status check of counterpart cities and private companies under COVID-19/after COVID-19</li> <li>2) Confirmation of demand for Green Recovery and Zero Carbon technology after-COVID-19</li> <li>3) Review of activities that can be handled through City-to-City collaboration project</li> </ol> <p>At the time of discussions, while respecting the initial plan, Osaka City and Japanese side had considered support for the EEC by utilizing the network of people involved in the city-co-city collaboration as necessary. In addition, follow-up to each consultation was appropriately carried out (see the figure below).</p>

Source : Nippon Koei

The points listed in the above table are also important points in the city-to-city collaboration project from the next fiscal year, so the Project will continue to carry out activities with the aboves in mind.



Source : Nippon Koei

**Figure 5.1 Follow-up structure by Nippon Koei**

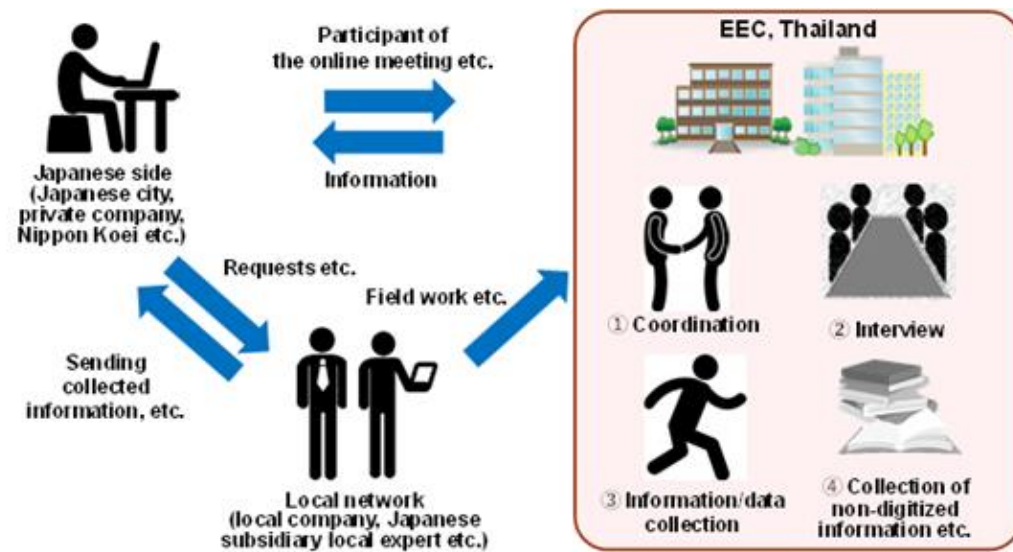
## 5.2 ISSUES AND COUNTERMEASURES ON JCM MODEL PROJECT FORMULATION

It can be said that the results of the JCM model project formation activities this year differed greatly depending on whether the following points were met or not.

- 1) Activities for candidate projects are already underway
- 2) Japanese companies can take the lead to some extent on project formulation stage
- 3) There are expatriates and local staff in the Kingdom of Thailand

Taking some remainings of COVID-19 influence into consideration, it thinks that the points are how to build and respond to the situations 1) to 3) above.

Based on the lessons learned this year, the Project and relating entity plan to build a system like the one shown below among the members in order to deal with the aboves.



Source : Nippon Koei

**Figure 5.2 Collaboration with local stakeholders**

## CHAPTER 6 FUTURE ACTIONS

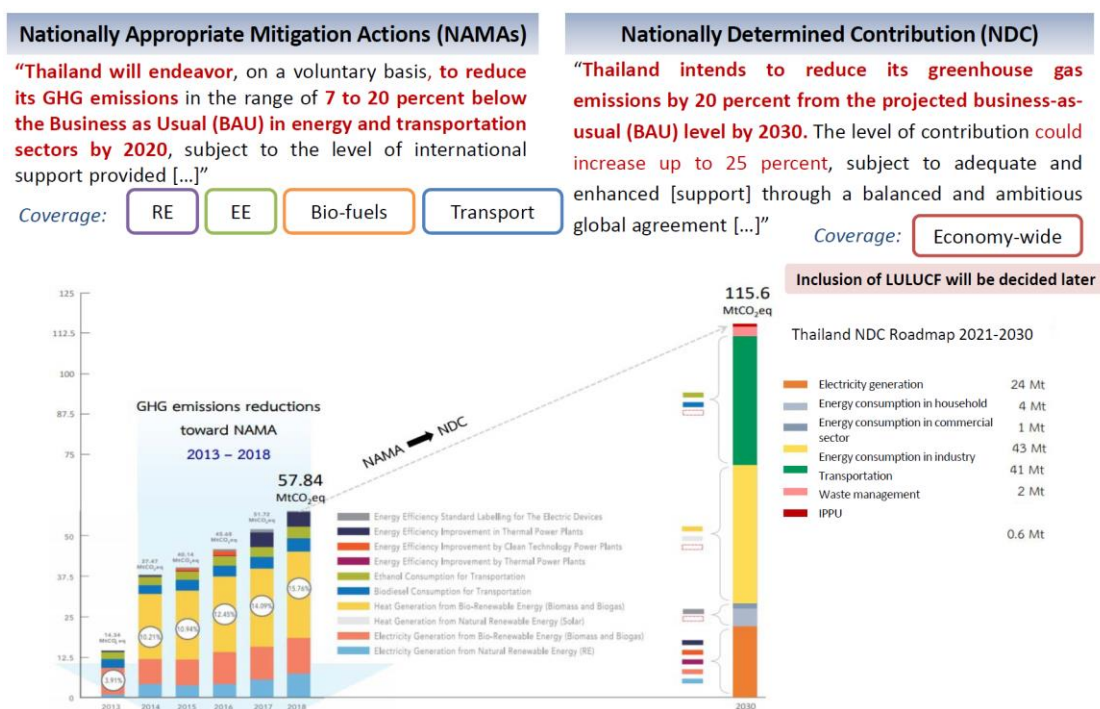
Due to COVID-19, there are unforeseen events happened in this year's activities on city-to-city collaboration. The EEC region, which leads the industry in Thailand, has various plans and activities planned in the future. And it expects that such situation is expected to be a new business opportunity for Japanese companies.

Based on the results of this year, some points will be summarized for promotion in the city-to-city collaboration between EEC and Osaka City from the next year.

### 6.1 TRANSITION TO A CARBON-FREE SOCIETY IN THE EEC

The Kingdom of Thailand is also promoting various climate change activities in response to the Paris Agreement. In particular, the government is ready to submit the country's direction for a future decarbonized society, such as Long Term Strategy (hereinafter called "LTS"). Although the LTS associated with the Paris Agreement has not yet been prepared, the NDC, which is the short-midterm term mitigation plan, is being updated in a timely manner.

According to the government organization (Thailand Greenhouse Gas Management Organization, hereinafter called "TGO"), the Thailand has stated that it will actively introduce decarbonization technology in light of its economic spread.



Source : Updates on Thailand NDCs and JCM Status” , Dr. Paweena Panichayapichet (TGO), Seminar on the Joint Crediting Mechanism/IGES, 16 February 2021

**Figure 6.1 Transition toward the realization of decarbonization in Thailand**

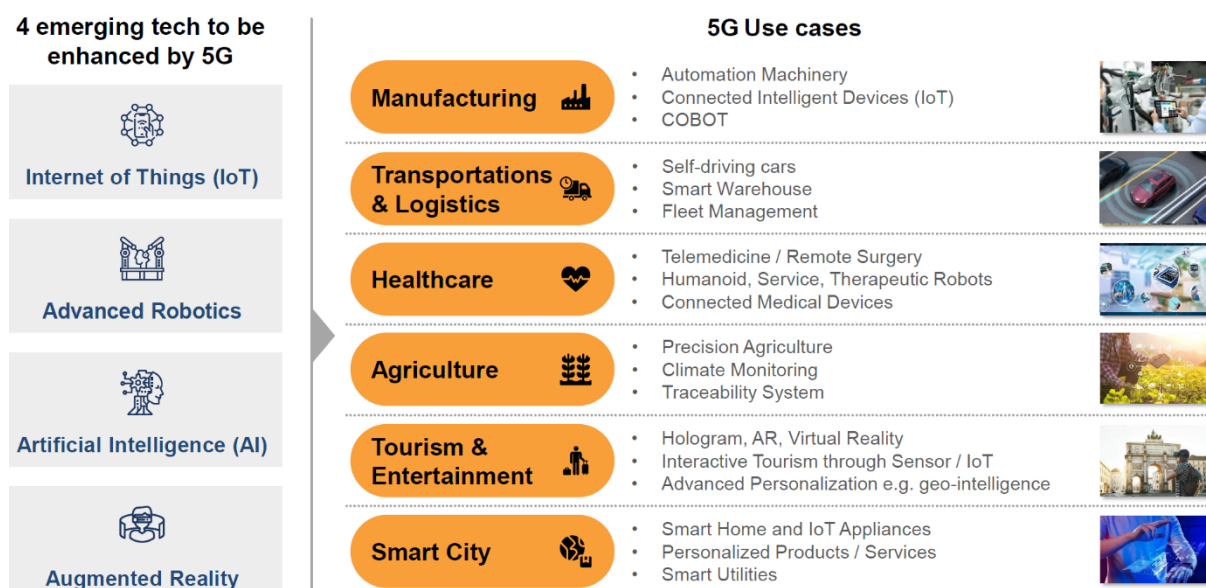
EEC is already required to consider green (environmental conservation, environmental consideration, etc.), and the scope is not limited to energy and smart city development, but also extends to waste and water.



Source : EEC presentation material

**Figure 6.2 EEC green plan**

In addition, in order to realize a smart society, EEC is actively introducing 5G and developing new social infrastructure accordingly. The following is an image of the introduction of 5G in the EEC region, which was explained by the EEC Secretariat this year.



Source : EEC presentation material

**Figure 6.3 Image of 5G promotion in EEC region**

## **6.2 FUTURE ACTIONS**

### **6.2.1 City-to-city collaboration**

Despite the impact of COVID-19, the active cooperation between the EEC Secretariat and Osaka City can be summarized as a result of new discoveries and developments in this year's city-to-city collaboration.

In particular, although it is recognized that discussions involving field survey will continue to be necessary on a regular basis, the Project will select and concentrate activities and discussions during field surveys by conducting preparatory stages and exchanging opinions among related parties at online meetings. Therefore, based on the lessons learned from this year, the Nippon Koei and Osaka City would like to scrutinize the system and response methods for the next year.

It is planned that the menu of the city-to-city collaboration is mainly focused on the smart city development and other relating topics, such as IoT, communication tool, natural gas etc.

In addition, as a contribution to the EEC green plan, Osaka City is currently initiating "Osaka Blue Ocean Vision<sup>9</sup>" which promotes bio-plastic etc. In the next fiscal year, the above topics will be scrutinized and selected as menu of the city-to-city collaboration.

### **6.2.2 JCM model project formulation**

Many private companies were affected by COVID-19, and the project to be planned forced to cancel or postpone. Some companies that cooperated in the Project were also affected by the same and there were some projects/studies where the application for the JCM model project in the next fiscal year was postponed or canceled.

Under these circumstances, it is confirmed that some projects/studies are preparing to apply for the JCM model project in the next fiscal year by continuing cooperation with local stakeholders. To these projects, Nippon Koei will continue to support so that they can play a role in decarbonization in the EEC region.

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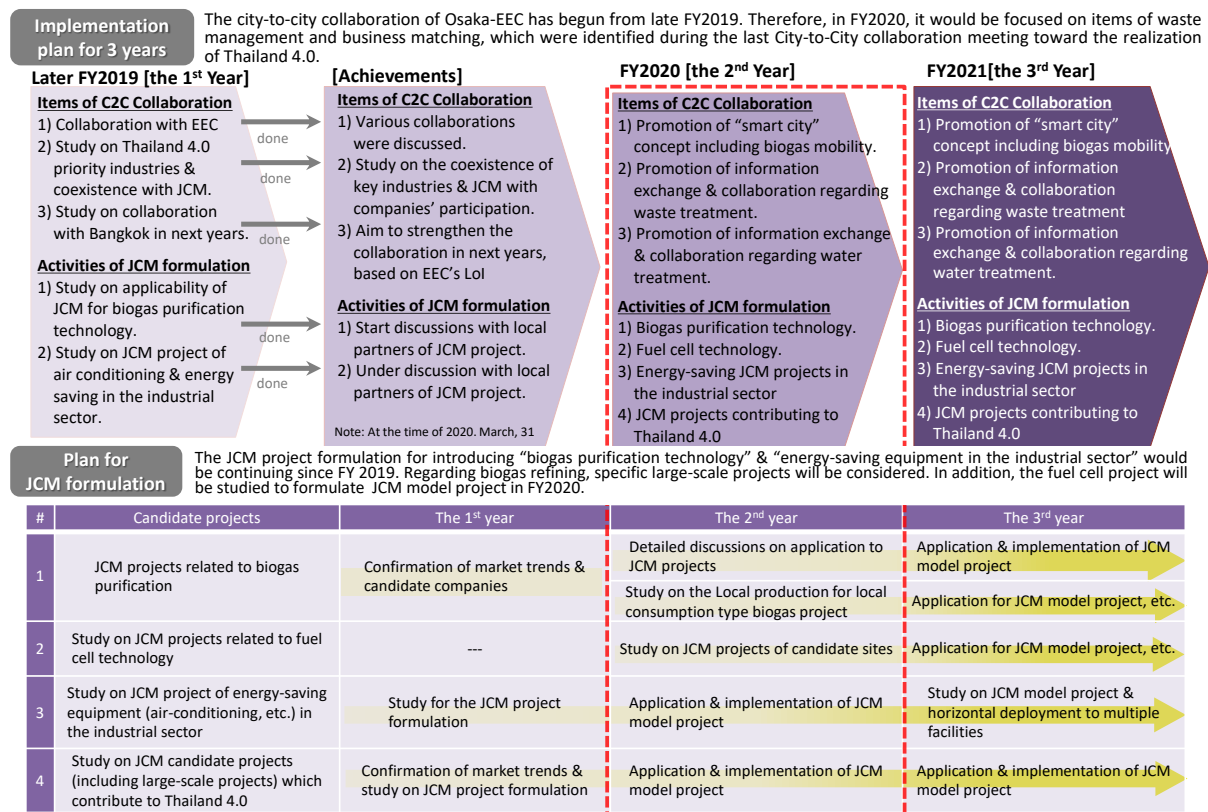
<sup>9</sup> Osaka Blue Ocean Vision aims for zero new pollution from marine plastic waste by 2050.



### 6.3 THREE YEAR'S PLAN

At the beginning of this year, various activities were started assuming the three-year plan shown in the figure below. However, it was difficult to carry out many planned activities, due to COVID-19.

To conclude this report, the activities for this year is reviewed and summarized the direction for the next year.



Source : Nippon Koei

**Figure 6.4 Three year's plan of this city-to-city collaboration, as of April 2020**

It can be said that the collaboration between the EEC Secretariat and Osaka City since last year has been smooth and flexible, despite the influence of COVID-19. Then, in the situation where it was not possible to implement field survey, the EEC Secretariat he collaboration were able to deepen discussions on smart city development and prepare a flow to connect to the next fiscal year.

Since smart city development is not a project scheme that can be participated and achieved in a short period, Osaka City and Nippon Koei would like to deepen cooperation so as to promote low-carbonization/decarbonization from a medium- to long-term perspective and from multiple perspectives.

In addition, regarding the formulation of JCM model projects, which is another pillar, the projects that Osaka Gas and TDEM have considered participating in, are expected to be technologies and business models that are expected to spread in JCM countries including the EEC region in the future. Accordingly, Osaka City and Nippon Koei would like to take advantage of characteristic and its network.