FY2017 Project for Ministry of the Environment Japan

FY2017
City-to-City Collaboration Programme for Low-Carbon Society

Project to Realize Low Carbonization in Phnom Penh Capital City, through Introduction of Saving Energy Technologies and Renewable Energies (Kitakyushu- Phnom Penh Capital City Cooperation Project)

Report

February 2017

NTT Data Institute of Management Consulting, Inc.

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Chapter 1: Background and Objectives of the Project

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1.1 Overview of Phnom Penh City

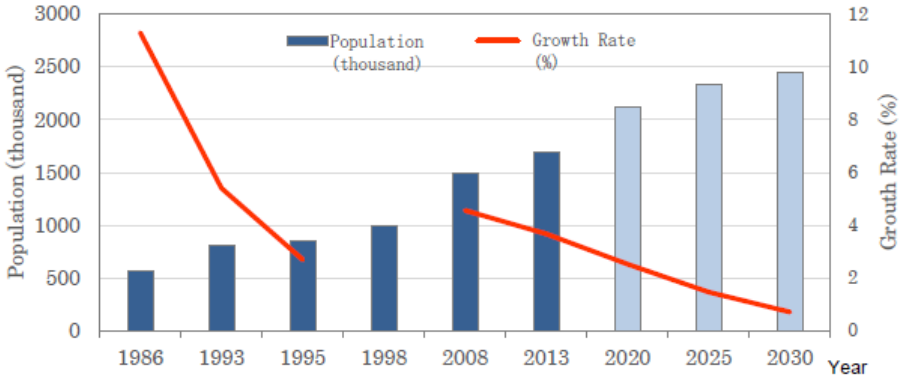
(1) General

Phnom Penh city is Cambodia's administrative, cultural and economic center and Cambodia's most important metropolis where remains the beautiful cityscape of the French colonial period which was told as "Paris of the Orient". There are a royal palace, and the Kingdom of Cambodia lives. The name of Phnom Penh means Khmer and "Penh's Hill". Mrs. Penh was a religious woman, found a Buddha image that had flowed through the river, was named "Phnom Penh" because it made a shrine in a nearby hill and worshiped the Buddha statue gently, it became the name of the town. The hill is named Wat Phnom, and the statue of Mrs. Penh and the pagoda are standing.

(2) Population of Phnom Penh City

The area of Phnom Penh city is 678.46 km², the population is 2,234,566 people, and the population density is 3,293.6 people/km2. It is about four times as large as the population in 1986 about 30 years ago when the civil war did not end. Figure 1.1-1 shows the population of the division and distinction of the Phnom Penh city.

Figure 1.1-1 Population change



(3) Administrative Organization of Phnom Penh City

Administrative organization chart of Phnom Penh city is shown in Figure 1.1-2 shows.

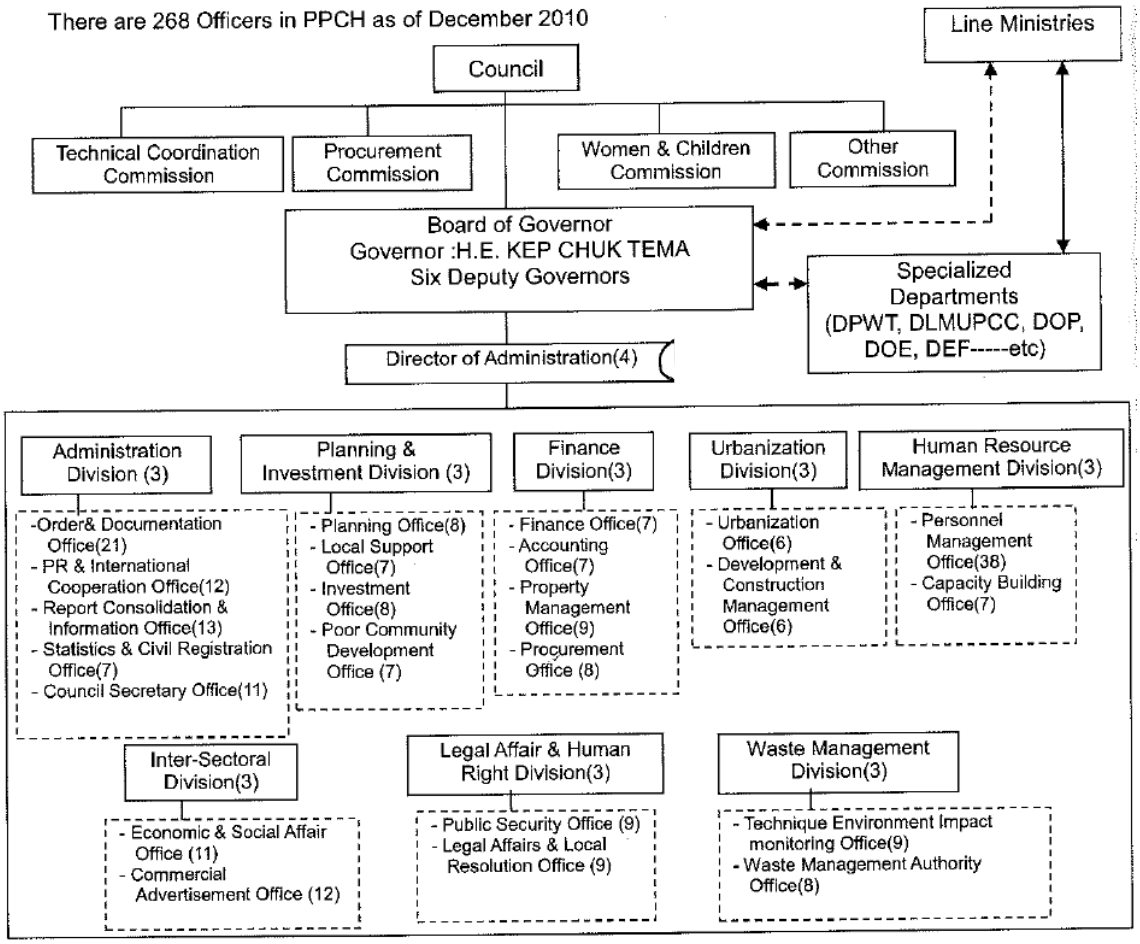


Figure 1.1-2 Administrative Organization of Phnom Penh City

(Source: Material given by Phnom Penh)

(4) Climate of Phnom Penh City

Phnom Penh city belongs to tropical monsoon climate, and is divided into rainy season and dry season. The rainy season is around May and October, humid southwestern monsoon blows from the Indian Ocean and the Gulf of Thailand, with rainfall being the most common in September and October. The dry season is around November to March, and rainfall is extremely low in January and February. The temperature rises in April just before entering the rainy season. Refer to Figure 1.1-3.

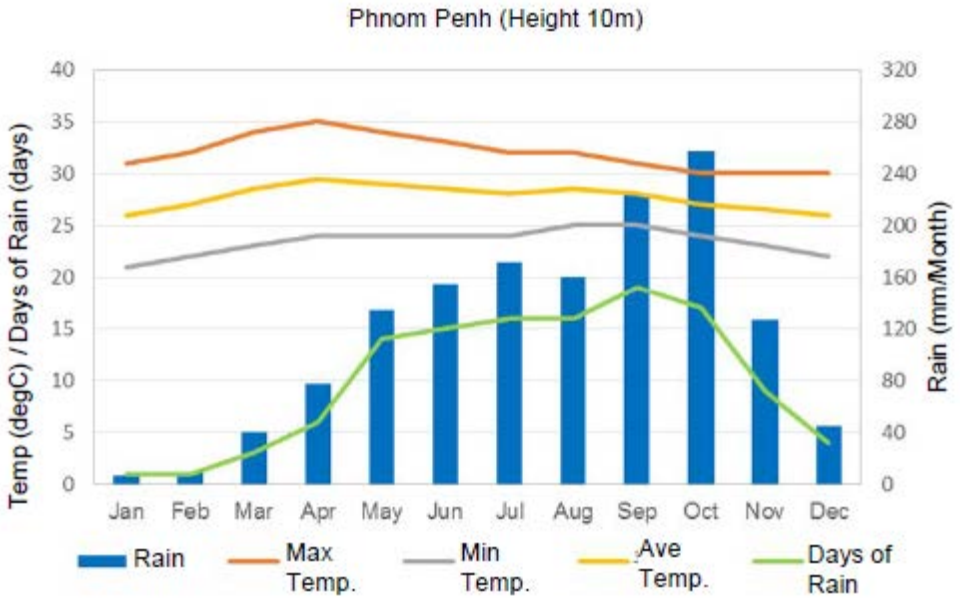


Figure 1.1-3 Climate of Phnom Penh City

(5) Economic Growth in Cambodia and its Accompanying Impact

Cambodia, despite the impact of the Lehman shock, has seen remarkable economic growth since the beginning of the 2000s, and GDP per capita has reached US $ 1,016 in 2013. See Figure 1.1-4.

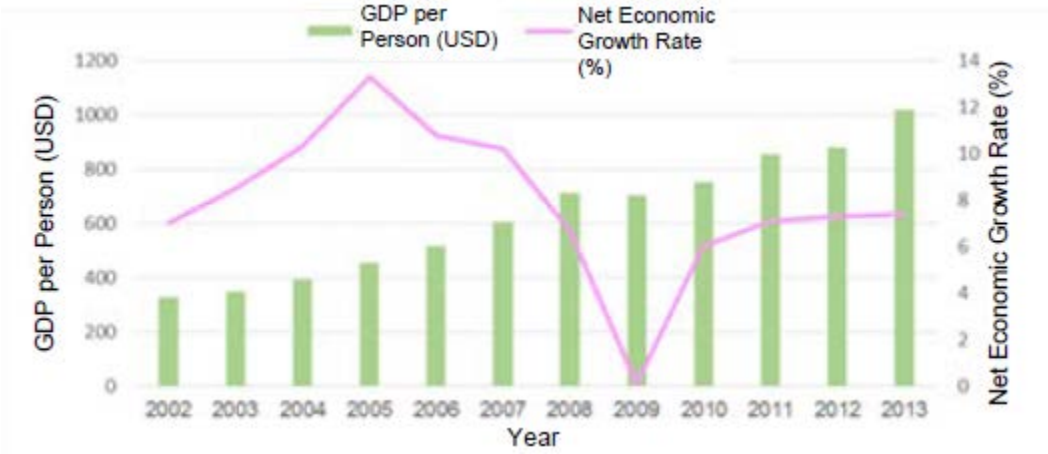


Figure 1.1-4 GDP per person in Cambodia

As a background of such remarkable economic development, it is said that there is a proactive economic opening policy, and special economic zones are set up and investment incentives for overseas enterprises are taken. In addition to these policies, along with the impact of the movement of China+1, etc., there are more than 40 Japanese companies entering Phnom Penh Special Economic

Zone.

On the other hand, steady economic development creates several challenges specific to emerging countries. For example, the current situation is that Phnom Penh also faces the problem common to emerging countries such as population concentration in the capital city Phnom Penh, increasing waste and tightness of disposal sites, and wastewater discharged as untreated. Also, looking at infrastructure, power supply infrastructure is inadequate and the frequency is decreasing, but there is also a problem of many power outages. In addition, despite the prospect of future mining of oil and gas resources to become a resource-rich country, currently, fossil fuels such as petroleum are dependent on imports, and among the Southeast Asian countries, the issue that the electricity fee is relatively high As well.

(6) Challenges Faced

Below is a summary of the challenges facing Cambodia in the energy field.

[General]

・With regard to the electricity of Cambodia, blackouts caused by supply shortage have occurred frequently. To cope with this, a large number of hydropower stations are built by Chinese capital, and there are still multiple plans to continue. In addition, increasing power demand is mitigated by purchasing electricity from Vietnam.

・On the other hand, with regard to hydroelectric power built by Chinese capital, the power generation unit price presented by the business operator is high and the electricity bill is high, which is a big problem for reducing the price in the present situation

[Resolving power failure]

・In Phnom Penh city, frequent blackouts as in the past have ceased, but the extent of the improvement depends on the area in the city. In Phnom Penh Special Economic Zone, the frequency of blackouts was once a month, the situation was improved up to a blackout of about 10 minutes per one time, but depending on the manufacturing process, short-term power outage may be hindered. With a power outage of about 10 minutes, private power generators maintained in the Phnom Penh Special Economic Zone are not in operation, and tenant companies strongly hope to completely eliminate blackouts.

・Also, Japanese companies operating in areas other than the Special Economic Zone in Phnom Penh still have frequent blackouts at the moment.

[Voltage instability]

・In addition to blackouts, voltage often becomes unstable, and there are cases in which factory operation may interfere with operation of equipment. There are places where stabilizers are introduced because Japanese manufacturing companies have an influence on manufacturing equipment.

[High electricity price]

・Many enterprises entering Phnom Penh city have a serious problem that the electricity price is high in addition to voltage instability. Efforts are currently being made to lower the unit price of electricity as a policy, but the unit price of electricity is still higher than the surrounding countries, and it is becoming an obstacle to development of national land including industrialization.

[Renewable energy use]

・The Ministry of Industry and Energy intends to strongly promote the use of renewable energy including sunlight in the future, but at present, the use of renewable energy is not progressing.

1.2 Climate Change Related Laws of Cambodia

In 2004, the Cambodian government established a quadrilateral strategy that is the basis of the national development plan and formulated a five-year National Strategic Development Plan (NSDP) as a medium-term development plan under the same strategy.

・In the Second National Strategic Development Plan (2009-2013) announced in 2010, measures to combat climate change are positioned as national priorities and the need for capacity development and strategy building is stated (Source: JCM large scale project formation feasibility research project for achieving low carbon society in Asia in fiscal year 2013, (one company) Overseas Environmental Cooperation Center).

・The Cambodian government is working on climate change countermeasures based on this national plan. In 1993 established the Climate Change Office in the Ministry of the Environment (promoted to the Climate Change Department in 2006), ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and formulated the Cambodian Adaptive Action Plan in 2006.

・In 2009 the National Climate Change Committee (NCCC) crossing ministries, chaired by the prime minister, was set up and in 2013 the Cambodia Climate Change Strategic Plan 2014-2023 was formulated. In order to realize sustainable growth, the National Strategic Development Plan (NSDP) formulated as a five-year plan beginning in 2006 (1st: 2006-2010, 2nd: 2009-2013, 3rd: 2014 -2018), the following policies are shown in the environmental field

(1) National Adaptation Programme of Action to Climate Change, Aug-2006

・The National Adaptive Action Plan (NAPA) is a strategy for identifying and responding to mid- and long-term adaptation needs of each country.

・Least developed countries including Cambodia (LDCs, Least Developed Country)developed a plan for imminent needs for adapting to climate change with the support of the Global Environment Facility (GEF), which manages the Least Developed Country Fund (LDCF)

・Cambodia's adaptive action plan to adapt to climate change mainly consist of 1) introduction / background, 2) framework of adaptation planning, 3) confirmation of major adaptation needs, 4) selection criteria for preferentially implemented actions, and 5) the top priority action list.

(2) Cambodia Climate Change Strategic Plan 2014-2023, Nov-2013

・The Strategic Plan (CCCSP) will be the first comprehensive national policy document to address the climate change challenges facing Cambodia.

・CCCSP shows key strategic objectives and direction for development that responded smartly to climate change over the next 10 years from 2014 to 2023.

・Specifically, CCCSP describes 1) impact prediction by climate change, 2) vision / target / strategic goal, 3) stage-specific action plan, 4) funding, 5) monitoring and evaluation. Also, according to strategic objectives, action plans by ministries and agencies are indicated.

・It is said that this will ensure a strategic coupling with the existing policy and create a synergistic effect to mitigate GHG emissions and develop low-carbon type.

(3) Cambodia Climate Change Action Plan 2015-2018 by each ministry

・Change Action Plan for each ministries and agencies 2015-2018 are prepared based on the Cambodia Climate Change Strategic Plan 2014 - 2023 in the preceding paragraph, an action plan covering 2015 to 2018 is formulated for each ministries and agencies.

・Of these action plans for each ministries and agencies, projects that seemed to be related to the four areas covered by the action plans were shaded field by field. Figure 1.2-1 shows the result of this arrangement as a whole.

Figure1.2-1 Action plans for each ministries and agencies

Name	Area	Project
Ministry of Agriculture	Waste, energy	・Carry stock of carbon in the range of the networking of afforestation site, growth, production, biomass etc experiences and rubber tree afforestation currently underway in the five AEZ
	Energy	・Promoting integrated approach of input used for efficient energy and rubber / rubber wood products
	Waste, environmental preservation	・Strengthened waste management from domestic animals and reduction of greenhouse gas emissions
Ministry of Industry and Handicrafts	Energy	・Establishment of guidelines on efficiency of resources and energy in industrial and handicraft sectors
		・Training of national experts on resource and energy efficiency, human resources on industries
		・Assessment at the site of industry and SMEs
		・Practice of efforts on optimum energy use for industries and SMEs
		・Potential investigation of renewable energy summaries in the industrial sector
		・Creation of outline on technologies of utilization of renewable energy in the industrial sector
		・Promotion of on-site renewable energy production in industrial sectors and industrial parks
	Environmental preservation	・Establishment of Green Industry Policy and Green Industry Award Program
		・Formulation of national optimal reduction action plan in at least 3 areas
		・Improvement of mapping system for industries supporting the development of flexible low-carbon industry
Land Management・Urban Planning・Construction Ministry	Environmental preservation	・Development of green infrastructure, development of green building guidelines for existing and current urban master plan
		・Validation of budget for climate change: 20% (energy efficiency)
Ministry of Tourism	Waste	・Implementation of Pilot project for solid waste management and improvement of sanitation in ecotourism
Ministry of Tourism	Environmental preservation	・Promotion of "one traveler, one tree" campaign through maintenance of tourism park
Ministry of Water Resources and Meteorology	Environmental preservation	・Maintenance of meteorological observation, the tide level observation station (4 ministries)
		・Promotion of gender issues in water management, climate change impact and its adaptation
Ministry of Public Health	Environmental preservation	・Formulation of guidelines for waterborne infectious diseases, preventive measures (Excerpt of related parts)
		・Practice of public awareness raising awareness raising activities (Same as above)

1.3 Energy Related Laws of Cambodia

The outline of Cambodia's energy policy, power policy, laws and ordinances is shown below. (Source: Cambodia Phnom Penh Metropolitan Area Transmission Distribution Network Expansion Improvement Project Phase 2 Preparatory Survey, Final Report, December 2016, JICA, NewJeck, Chugoku Electric Power Co., Ltd.)

(1) Energy policy

・In the energy policy of Cambodian government, the following goal is set in 'Energy Sector Development Policy' formulated in 1994.

①Supply energy nationwide at an appropriate rate.

②Establishment of electricity charges to promote investment and economic development and stable and reliable power supply.

③To achieve energy supply commensurate with economic development and promote the development of social and environmentally friendly energy resources

④Promote efficient specification of energy and minimize environmental impact.

・In the National Strategic Development Plan In 2014 (National Strategic Development Plan 2014), the key measures for the energy sector are listed below as priority measures.

①Expansion of supply capacity (especially renewable energy) by further low cost and high technology and extension of transmission and distribution substation equipment

②Further promotion of private investment and compatibility of environmental social consideration and economic efficiency in development project

③Execution of electricity policy to achieve electrification target

④Support for Rural Electrification Fund

⑤Reduction of electricity charges during off-peak hours, making electric power consumption more efficient by utilizing it for production and irrigation

⑥Promotion of exploration and commercialization of petro and gas

⑦Strengthen organization of electric power-related organizations, improve management capacity and improve planning / management skills through

training human resources

⑧Continuation of regional cooperation

(2) Electricity Policy

・In the Third Quadrilateral Strategy of the Cambodian government, "Electric power development" is positioned as a priority area included in "development of infrastructure" which is one of the four pillars.

・Based on this strategy, the National Strategic Development Plan 2014 - 2018 (National Strategic Development Plan 2014 - 2018) states the following in the power sector.

①Ensure supply capability

②Expansion of supply area

③Cheap electricity charge

④Enhancement and development of capacity with power related organizations

⑤Improve public standard of living by electricity

・In addition, as targets for power conversion, (1) the village electrification rate including battery lighting by 2020 is set to 100%, and (2) household electrification rate by supply from the electric power system is set to 70% by 2030.

・It should be noted that the village electrification ratio is 79.1% as of 2013 (Electric Authority of Cambodia, Cambodia), household electrification rate as of March 2013 is 48% (urban 94%, rural 36%) .

(3) Electricity Law

・Figure 1.3-1 shows the Electricity law and relevant laws and ordinances. The Electricity Law of the Kingdom of Cambodia was promulgated on February 2, 2001 for the purpose of the following.

・Principles on the operation of the electric power business and the activities of business operators providing electricity service

・Creation of favorable conditions for investment in power facilities and business activities

・Principles on Regulation of Electricity Business in Cambodia

・Protection of consumer rights receiving reliable enough power supply service at reasonable price

・Promotion of private ownership of equipment that provides power supply

service

・Establishment of competition in the power sector

・In order to regulate electricity supply service, establish EAC by giving rights and obligations to it, apply penalties to suppliers and consumers concerning power generation and power supply facilities as necessary

Figure 1.3-1 the Electricity law and relevant laws and ordinances

No.	Name of Standard Documents	Promulgated by	Date Promulgated
1	Electricity Law of the Kingdom of Cambodia	The King	February 2, 2001
2	Sub-Decree on the Rate of the Maximum License Fees applicable to Electric Power Service Providers in the Kingdom of Cambodia	Royal Government	December 27, 2001
3	Procedures for Issuing, Revising, Suspending, Revoking, or Denying Licenses	Electricity Authority of Cambodia	September 14, 2001
	Revision 1		December 12, 2002
	Revision 2		March 16, 2004
4	Regulations on General Conditions of supply of Electricity in the Kingdom of Cambodia	Electricity Authority of Cambodia	January 17, 2003
	Revision 1		December 17, 2004
5	Regulatory Treatment of Extension of Transmission and Distribution Grid in the Kingdom of Cambodia	Electricity Authority of Cambodia	October 28, 2003
6	Regulations on Overall Performance Standards for Electricity Suppliers in the Kingdom of Cambodia	Electricity Authority of Cambodia	April 2, 2004
7	Procedure for Filing Complaint to EAC and for Resolution of Complaint by EAC	Electricity Authority of Cambodia	April 2, 2004
8	General Requirements of Electric Power Technical Standards of the Kingdom of Cambodia	Ministry of Industry, Mines and Energy	July 16, 2004
	First Amendment		August 9, 2007
9	Sub-Decree on Creation of Rural Electricity Fund of the Kingdom of Cambodia	The King	December 4, 2004
10	Sub-Decree on Principles for Determining the Reasonable Cost in Electricity Business	Royal Government	April 8, 2005
11	Prokas on Principles and Conditions for issuing Special Purpose Transmission License in the Kingdom of Cambodia	Ministry of Industry, Mines and Energy	July 21, 2006
12	Specific Requirements of Electric Power Technical Standards of the Kingdom of Cambodia	Ministry of Industry, Mines and Energy	July 17, 2007
13	Regulations on General Principles for Regulating Electricity Tariffs in the Kingdom of Cambodia	Electricity Authority of Cambodia	October 26, 2007
14	Procedures for Data Monitoring, Application, Review and Determination of Electricity Tariff	Electricity Authority of Cambodia	October 26, 2007
15	Grid Code	Electricity Authority of Cambodia	May 22, 2009

(4) Electric technical standards

・The National Power Standards Standards Committee (GREPTS: General Requirements of Electric Power Technical Standards of the Kingdom of Cambodia) is based on the draft GREPTS plan which was formulated by JICA working with the Ministry of Industry and Energy (MIME) and Minesand Energy (MME: Ministry of Mines and Energy) as counterparter, and took effect as a ministerial ordinance on August 16, 2004.

・GREPTS consists of Chapter 1 "General clause (14 articles)" and Chapter 2 "Basic matters required for power equipment (51 articles)" in total of 65 articles. Chapter 1 stipulates the definition of terms, the purpose and scope of

technical standards, the type of voltage / frequency, prevention of electric shock, fire, etc., prevention of supply trouble, environmental conservation etc. Figure 1.3-2 shows the composition of Chapter 2.

Figure1.3-2 List of basic matters required for GREPTS electric power equipment

Composition of Chapter 2 (Articles 15 to 65)	
Part 1	General requirements common to all power facilities (Article 15 ~ Article 20)
Part 2	General requirements to Thermal power generation facilities (Article 21 ~ Article 25)
Part 3	General requirements to Hydro power generation facilities (Article 29 ~ Article 28)
Part 4	General requirements to other power generation facilities (Article 15 ~ Article 30)
Part 5	General requirements common to Transmission and distribution facilities (Article 31 ~ Article 39)
Part 6	General requirements to High voltage transmission line (Article 40 ~ Article 48)
Part 7	General requirements to Midium and Low voltage transmission line (Article 49 ~ Article 56)
Part 8	General requirements to Indoor wiring (Article 57 ~ Article 65)

- GREPTS is a "performance specified " type standard, not a " Specification specified" type in which detailed numerical values are specified. In developed countries including Europe and the United States, the foundation of the electric business system is established, and, since the "Voluntary safety" of the electric utility company is the basic concept, " performance specified " of electric power standards are attained.
- However, in Cambodia, as the organization structure of the electric power business itself is weak and its capacity itself is not high, It was the current situation of MIME and EAC (Electric Authority of Cambodia) that operate electric power standards was not fully operational only with GREPTS.
- Therefore, from 2004 to 2007 with JICA's support, the detailed technical regulations on electric power technology for thermal power generation / transmission / transformation / distribution (SREPTS: Electric Power Technical Standards of the Kingdom of Cambodia), together with the improvement of the technical review capacity for EAC, was legislated on 17th July 2007. After that, from 2008 to 2009 SREPTS on hydroelectric power generation was created with the support of JICA and it was legislated in 2010.

1.4 Cooperative Relationship between Phnom Penh City and City of Kitakyushu

The relationship between City of Kitakyushu and Phnom Penh city is old, and dates back to 1993. At that time, in Cambodia, since 1991 when the long-term civil war had ended, urban infrastructure that was devastatedly damaged, especially "access to safe water" is cited as one of the most important issues for reconstruction of the country. City of Kitakyushu has been involved in a project aiming at human resource development in the water supply field under the request of the Ministry of Health, Labor and Welfare and JICA. By doing this, great results called "Phnom Penh's Miraculous " have been realized: the non-revenue water rate (leakage + theft), which was around 70% in 1993, was reduced to 8% of City of Kitakyushu level, and drinkable tap water was realized immediately after the end of the civil war.

Against this backdrop, in July 2015 Prime Minister Hun Sen visited City of Kitakyushu and proposed mutual exchange by sister city partnership with Phnom Penh. Meanwhile, the mayor of Kitakyushu said that he would like to actively participate in the environment and citizen exchange, not just in the water field.

At the end of January 2016, when mayor of Kitakyushu visited Cambodia and talked about a sister city tie-up, Prime Minister Hun Sen and Governor of Phnom Penh also requested cooperation from the city of Kitakyushu towards solving the problems of Phnom Penh city including waste, transportation, sewage / drainage measures

Based on cooperation and consultation so far, on March 29, 2016, a sister city agreement between City of Kitakyushu and Phnom Penh City was signed. Figure 1.4-1 shows the state of the sister city agreement concluding ceremony.

Figure1.4-1 Sister city agreement concluded ceremony 29 of March, 2016

As part of the project based on this sister city alliance, in October 2015 we conducted a basic survey to grasp the current situation and issues in Phnom Penh city in order to improve the urban environmental infrastructure, which is strongly requested from the locality. In addition, when environmental staff members of Phnom Penh city were invited to the "JCM inter-city collaboration workshop" sponsored by the Ministry of the Environment in January 2016, they were also invited to City of Kitakyushu to visit the environmental-related facilities and opinions were exchanged. Furthermore, in February 2016, as a follow-up to the workshop above, the visit to Phnom Penh Municipal Government Organizations etc. was conducted and a cooperative relationship on exchange in the future environmental field was established. Especially, cooperation and support from SAO SOPHEAP Cabinet Secretary (JCM Cambodia Joint Committee Chair) of the Ministry of the Environment of Cambodia was requested and his consent for full cooperation and support was received. This research project is based on the relationship between City of Kitakyushu and Phnom Penh city.

This research project is continued project of the “FY2016 Feasibility Study of Joint Crediting Mechanism Project by City to City Collaboration (Project to realize low carbonization in Phnom Penh Capital City, through introduction of saving energy technologies and renewable energies (Kitakyushu- Phnom Penh Capital City Cooperation Project)).” Under the cooperation of City of Kitakyushu, which has know-how to form a low-carbon society, and Phnom Penh city in Cambodia, which is in a partnership relationship to realize a low-carbon society, activities to acquire JCM credits targeting energy fields with a large room for energy-derived CO2 emission reduction are conducted.

In feasibility study of FY2016, City of Kitakyushu and NTT Data Institute of Management Consulting, Inc. were conducted feasibility survey for the following three activities in saving energy and renewable energy field:

Activity 1: Low-carbon Business by Energy-Saving Facilities for Large Hospital

Activity 2: Low-carbon Business by Energy-Saving Facilities for Shopping Mall, etc.

Activity 3: Introduction of Waste Heat Recovery Power Generation System for Cement Plant

We would like to highlight the activity 2, “Low-carbon Business by Energy-Saving Facilities for Shopping Mall, etc.” As results of the cooperation

with AEONMALL and AEONMALL Cambodia, “Introduction of 1MW Solar Power System and High Efficiency Centrifugal Chiller in Large Shopping Mall” was approved as FY2016 JCM subsidy project. Figure 1.4-2 shows outline of the project.

Figure1.4-2 Introduction of 1MW Solar Power System and High Efficiency Centrifugal Chiller in Large Shopping Mall

In addition, in FY2016, City of Kitakyushu and Nikken Sekkei Civil Engineering supported to develop the “Action Plan for the Climate Change Strategy in Phnom Penh Capital City.” Figure 1.4-3 shows the outline of it.

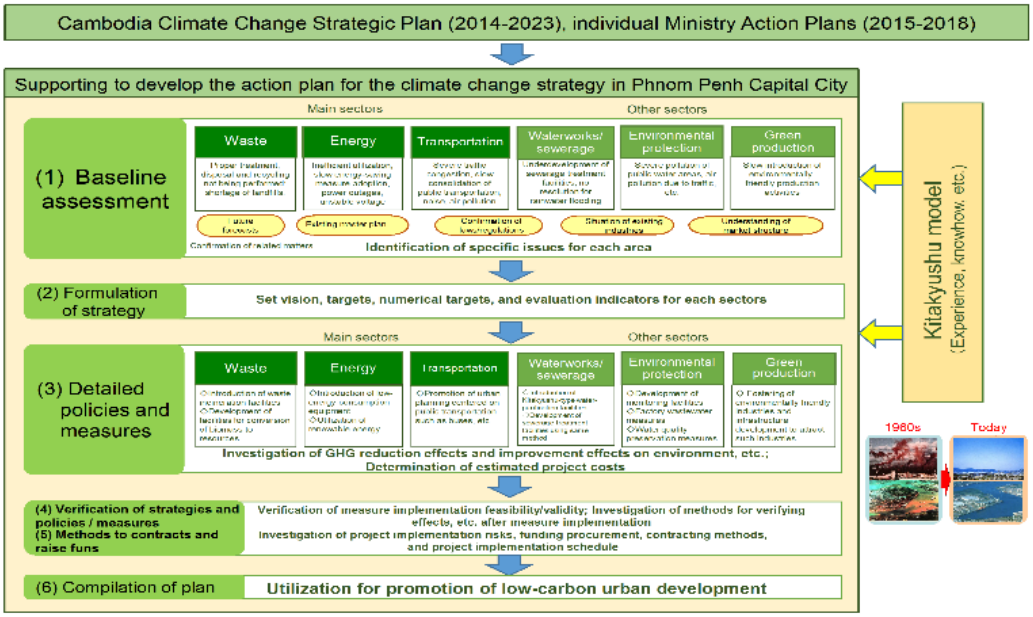


Figure1.4-3 Action Plan for the Climate Change Strategy in Phnom Penh Capital City

Chapter 2: Purpose and Implementation Structure of Project Formation Potential Study

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2.1 Project Outline

All countries participate in the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 21) held in Paris, France in December, 2017, and the Paris Agreement, a legal framework for equitable and effective climate change after 2020, was adopted.

In the Paris agreement, the temperature rise of the earth is kept sufficiently lower than 2 ° C compared to before the industrial revolution, furthermore, it was stated that pursuing efforts to keep it below 1.5 ° C, promotion of efforts towards decarbonization is required. At COP 21 decided to recognize the actions of non-state actors including cities and decided to welcome the efforts of all non-governmental organizations (such as the city and other local governments) and was decided to invite the scale up.

Also in the "Declaration of Marrakesh Action for Climate and Sustainable Development" adopted at COP 22nd held in Morocco / Marrakech in November 2015, the climate is warming at an unprecedented rate, so urgent It was emphasized that there is an obligation to respond and it was recognized that global actions including not only the government but local governments, as well as economic transformation, are active opportunities for further prosperity and sustainable development.

Cities are the site of activities to support the development of socioeconomic, many people live. About 50% of the world's population live in cities with less than 2% of the total area of the world, the proportion is expected to increase to 70% by 2050. As of 2006, it is estimated that more than 70% of the world's CO2 emissions are emitted from cities, the role of cities to mitigate climate change is significant, steady implementation of climate change countermeasures in peripheral urban areas , Reduction of greenhouse gas emissions is important to achieve the goal of the Paris Convention.

Meanwhile, Cambodia is getting on the wave of economic growth, and it is in the stage of full-fledged development. Although GDP per capita has also risen sharply, it is well below 3,000 USD, which is an indication

for consumer spending becoming active in emerging countries, and, although there are some exceptions, it has not reached the point, as a whole, where consumption is not necessarily becoming active. In these countries, as economic development often involves destruction of the environment including pollution, there is a need for "leap frog type development" that will develop the economy without experiencing environmental destruction. Efforts to reduce carbon emissions by this survey project can be a concrete countermeasure.

As Cambodia has not been considering enough energy conservation measures or introduction of renewable energy so far, although the switching of energy-intensive-type equipment to highly efficient energy-saving equipment, solar power generation system and solar hot water introduction etc. have already lost its advanced nature in Japan, it has advanced nature in Cambodia. At the moment, Cambodia's needs for sophisticated energy management etc. are not high, but there is a high need for low-cost energy-saving equipment, etc., which is useful for reducing relatively high electricity cost.

Although it is pointed out that Cambodia is likely to become an energy power country such as oil and gas in the future, as it currently relies on import for most of fossil fuels, the introduction of cogeneration using natural gas, etc., for example, is not easy at present.

Based on the above points, in this survey project, based on the collaboration with Kitakyushu City, which has the know-how of forming a low-carbon society, with Cambodia and Phnom Penh, a partnership to realize a low-carbon society, activities for acquiring JCM credits for energy fields with a large margin for reducing emissions of energy-derived CO 2 will be carried out. Through conducting the survey activities, we also aim to develop capacity for a low-carbon society in Phnom Penh.

2.2 Target Field and Applied Technology

(1) Target Field

Based on the results of the survey in FY2016, the following two activities were taken as main activities.

① Customized proposal for large enterprises which have needs for energy cost reduction

In large-scale enterprises with financial capabilities, they invest to items which have reasonable necessity. However, energy saving and renewable energy are not promoted so much. We assume that the reason is these facilities are not meet their investment criteria, or they do not recognized the suitable facilities. Therefore, we propose the customized proposals including making company criteria and internal adjustment etc. Specifically, we will propose to cement plants of the possibility of introducing waste heat recovery power generation facilities with study of project implementation system and introduction technology, investigation of project profitability, examination of CO2 reduction amount and cost effectiveness etc. and aim for significant reduction of CO2. Figure 2.2-1 shows the image of cement plants.

Figure2.2-1 Image of Cement Plants

② Proposal of ESCO type business model packaged with financial services

Start-up companies and small and medium-sized companies are interested in reducing energy costs. However, there are some cases where they abandon the introduction of energy-saving facilities and re-energy facilities in terms of financial capability. Therefore, by integrating energy-saving facilities and renewable energy facilities with financial services, we will construct an ESCO-type business model that can ideally be introduced at start-up companies and small and medium-sized enterprises that will become users of such facilities without initial cost. Specifically, we aim to establish a business model of ESCO type service by packaging equipment such as photovoltaic power generation system and financial services. Examination of project implementation system and fund composition scheme, investigation of project profitability, examination of CO2 reduction amount and cost effectiveness etc. are studied. Figure 2.2-1 shows the image of ESCO-type business model.

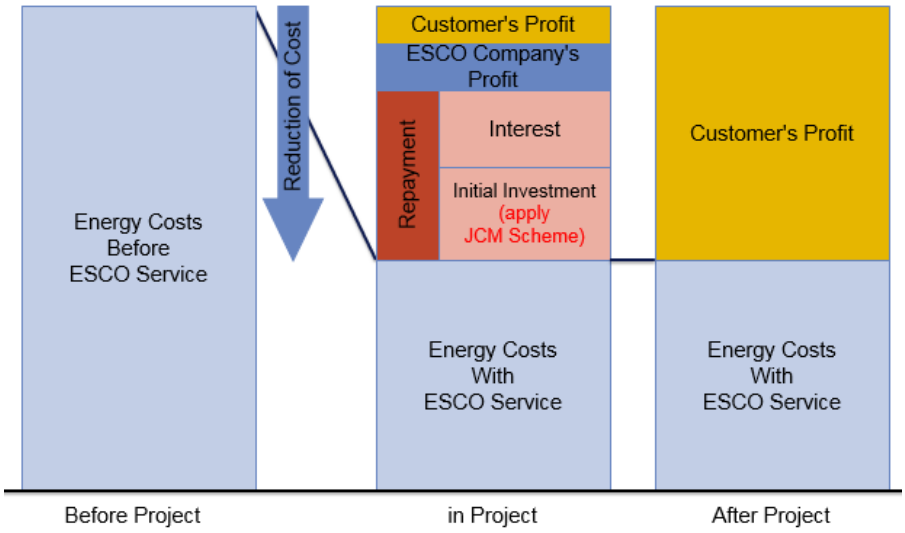


Figure2.2-2 Image of ESCO-type Business Model

(2) Applied Technology

The technology to be applied in this survey project was selected from the results of the survey in FY2016. Techniques selected as introduction candidates are as shown in the table below.

Figure2.2-3 Target facilities and Technology applied

Category	Target facility	Technology applied
Activity 1	Cement Plants	Waste heat recovery power generation system
Activity 2	User of ESCO-type Business Model	Solar power system

2.3 Implementation Organization

The survey implementation organization of this project is shown below.

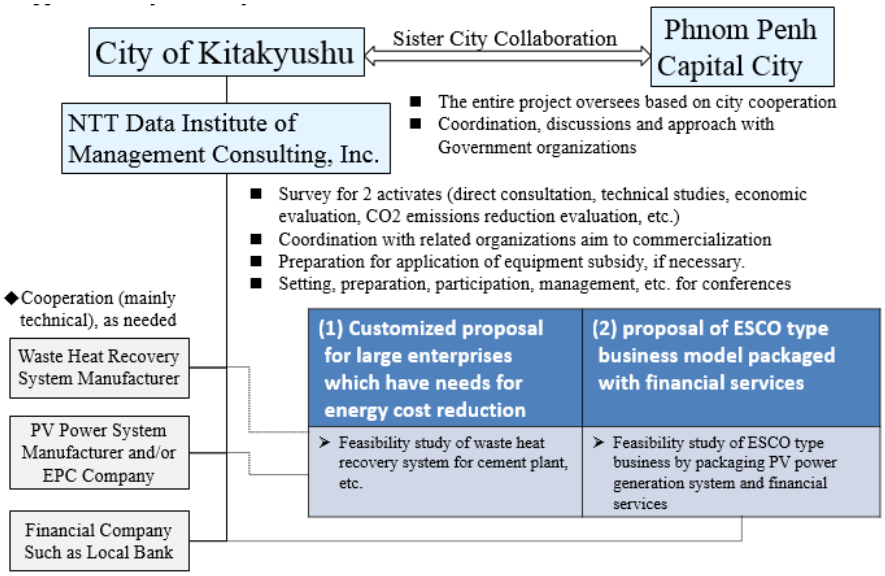


Figure2.3-1 Implementation Organization

In this survey project, we will conduct a feasibility study of JCM equipment financing projects under the inter-city collaboration between Phnom Penh City in Cambodia, which has a partnership to realize a low-carbon society, and Kitakyushu City, which holds know-how to form a low-carbon society.

Kitakyushu City and Phnom Penh City have conducted overall supervision based on intercity collaboration, and encouragement for coordination, collaboration and introduction with administrative organizations such as related departments in Phnom Penh city and Administrative agencies such as relevant ministries and agencies in Cambodia.

NTT Data Institute of Management Consulting, Inc. will conduct direct consultation with the survey subjects for each activity, technical examination, economic consideration examination, assessment of CO 2 emission reduction, etc., and proposals and hearings etc. to the survey subjects. If necessary, the company will also conduct consultation of detailed examination of technology with some of various manufacturers, and support for JCM equipment financing project application, etc.

2.4 Survey Plan and Schedule

(1) Survey Plan

The survey in this project was conducted in the following 4 steps

Figure2.4-1 Survey Step

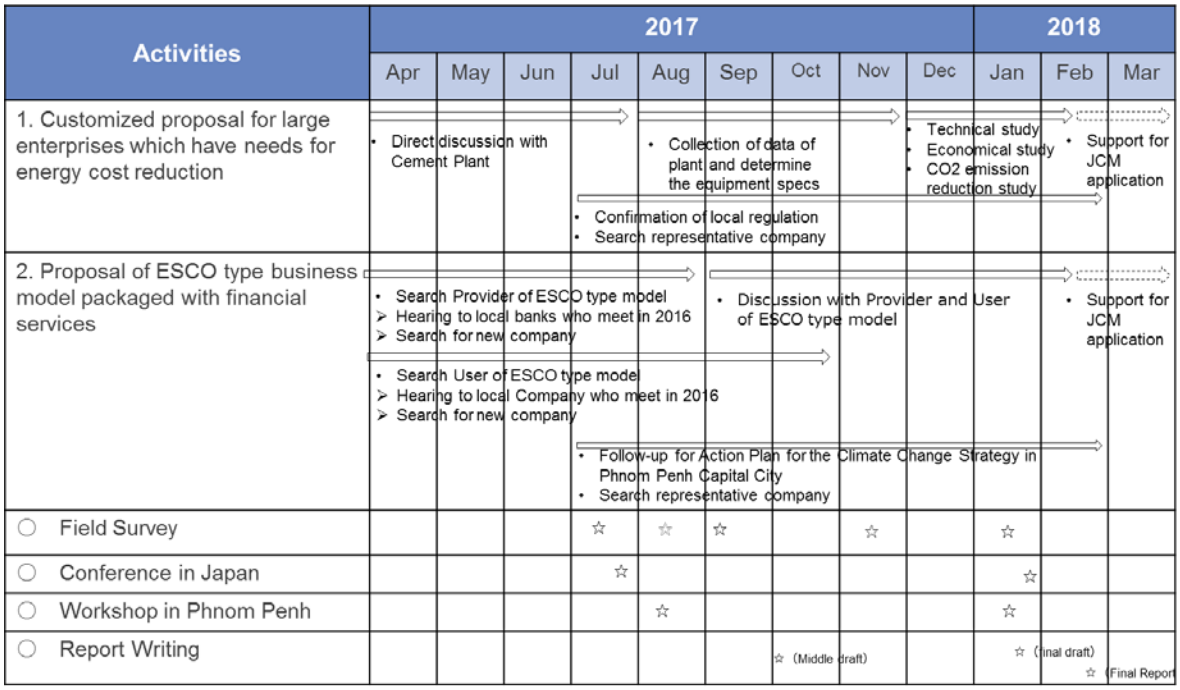
1) We searched candidates companies, enterprises or organization, by introduction of Water Supply Authority utilizing sister city relationship between City of Kitakyushu and Phnom Penh Capital City, introduction of candidates from the companies who related in FY2016, and direct appointments by independent survey. etc. We focused on candidates who may have high possibility of CO2 emission reduction.

2) The current diagnosis was conducted to extract the tasks and needs faced by each target facility through direct hearing by utilizing the visits etc. during the field survey.
3) In considering countermeasures, based on the hearing results of 2), energy conservation measures, introduction of energy conservation facilities, economic consideration, and CO 2 emission reduction effect, etc., which are considered to be feasible, were examined. Partly, a practical study was conducted through the cooperation from experts on photovoltaic panel construction,
4) In the proposal and discussion, the results of the examination with the staff in charge of each facility were shared, and further hearing of opinions and issues, and how to proceed in the future were examined.

(2) Schedule

The implementation schedule of this survey project is as shown in Figure 2.4-2.

Figure2.4-2 Survey Schedule



Chapter 3 Results of Project Formation Potential Study

Chapter 3 Table of Contents

3.1 Summary of Field Survey

In this section, we will organize the visit schedule of the first to forth field surveys, and summarize the main agenda and activity contents. For detailed discussion etc. at each visiting destination, each activities are summarized as Section 3.2 (Activity 1: Customized proposal for large enterprises which have needs for energy cost reduction) and Section 3.3 (Activity 2: Proposal of ESCO type business model packaged with financial services)).

3. 1. 1 The First Field Survey

(1) Schedule

The first field survey was conducted from Monday, 3-Jul to Thursday, 6-Jul in 2017. The meeting schedule and the place of visits are as shown in Figure 3.1.1-1.

Figure 3.1.1-1 1st field survey schedule

Time	7/3(Mon)	7/4(Tue)	7/5(Wed)	7/6(Thu)	Time
09:00		Phnom Penh Adminiatration			09:00
10:00	Chip Mong Insee Cement Phnom Penh Office		Embassy of Japan	NEXUS	10:00
11:00					11:00
12:00					12:00
13:00					13:00
14:00	Ministry of the Environment		Phnom Penh Adminiatration		14:00
15:00			AEON MALL Cambodia 2nd		15:00
16:00	Sunrise Japan Hospital				16:00
17:00					17:00
18:00					18:00
19:00					19:00

(2) Visiting Participants from Japan

・City of Kitakyushu, Kitakyushu Asian Center for Low Carbon Society

・NTT Data Institute of Management Consulting, Inc.

(3) Main Agenda, Activities

・As the first on-site survey, we visited Phnom Penh Capital City, Ministry of the Environment, Cambodia and Embassy of Japan in Cambodia and explained the outline, background, purpose of this research project, etc.

・We had a meeting with Phnom Penh capital city that also served as kickoff. We also made adjustments for coming ceremony of "City of Kitakyushu - Phnom Penh Capital City Celebration Ceremony" held in August. This is a ceremony is for handed out to the Phnom Penh city side of "Phnom Penh city Climate Change Strategic Action Plan" that City of Kitakyushu formulated and supported in FY2017. Figure 3.1.1-2 shows a meeting with Phnom Penh capital city, Figure 3.1.1-3 shows the ceremony with Kitakyushu City - Phnom Penh capital city.

Figure 3.1.1-2 Phnom Penh Capital City (Kick-off Seminar)

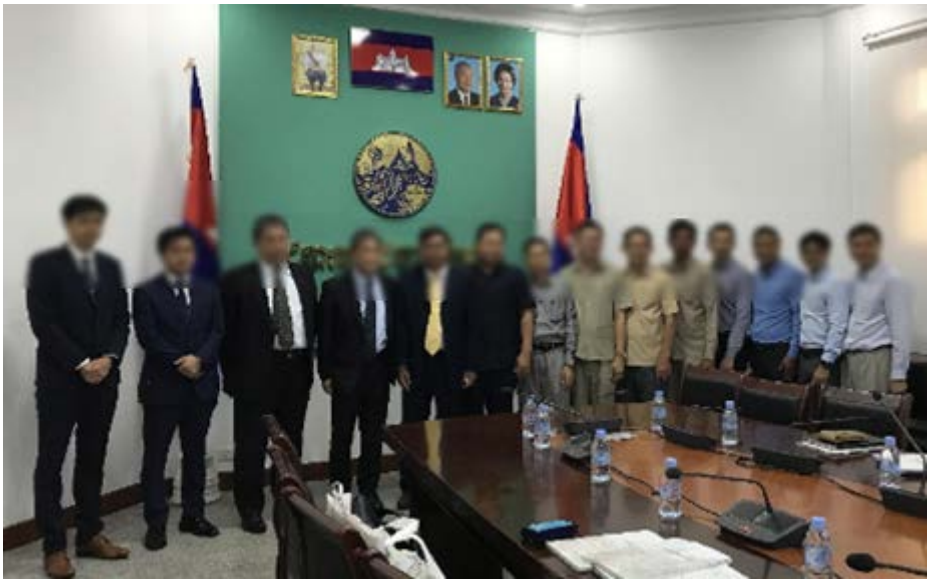


Figure 3.1.1-3 Ceremony between City of Kitakyushu and Phnom Penh Capital City

・We visited Chip Mong Insee Cement, which is the target of the cement factory of Activity 1 and conducted detailed discussion towards JCM financing programme. Originally, we planned to propose to JCM financing programme in 2018, but, as a result of the discussion, they requested us to consider to apply the 2nd call for JCM financing programme in 2017. Detail contents of discussion is explained in section 3.2.

Figure3.1.1-4 Meeting with Chip Mong Insee Cement

・We visited Sunrise Japan Hospital which is a candidate for ESCO business model user of Activity 2 and told them that we are considering construction of "ESCO type business model" to introduce equipment without initial investment burden. They were interested in this scheme and they positively consider cooperative relations with us. Detail contents of discussion is explained in section 3.3.

Figure3.1.1-5 Sunrise Japan Hospital

3. 1. 2 The Second Field Survey

(1) Schedule

Based on discussions with Chip Mong Insee Cement in the first field survey, in order to conduct a detailed studies for the 2nd call for JCM financing programme in 2017, the 2nd field survey (Fri) on September 1, 2017 was carried out.

(2) Visiting Participants from Japan

・GLOBAL ENGINEERING CO., LTD.,
・Shanghai Conch Kawasaki Engineering Co., Ltd.
・NTT Data Institute of Management Consulting, Inc.

(3) Main agenda, activities

・We visited Chip Mong Insee Cement, which is the target of the cement plant of activity 1, and conducted detailed discussion for the 2nd call for JCM financing programme in 2017. We determined implementation organization and studied the introduction technology in detail.

Details are described in Section 3.2.

3. 1. 3 The Third Field Survey

(1) Schedule

From the Monday, 20th November, 2017 to Wednesday, 22th November, 2016, the third field survey was conducted.

The meeting schedule and the place of visits are as shown in Figure 3.1.3-1.

Figure3.1.3-1 the 3rd field survey schedule

Time	11/20(Mon)	11/21(Tue)	11/22(Wed)	Time
08:00				08:00
09:00	Sunrise Japan Hospital	Water Supply Authority		09:00
10:00		Site Visit of Water Treatment Plants (Chroy Changva or Niroth)		10:00
11:00			Embassy of Japan	11:00
12:00				12:00
13:00				13:00
14:00				14:00
15:00	Phnom Penh Administration Waste Treatment			15:00
16:00		SHINRYO Cambodia		16:00
17:00				17:00
18:00				18:00
19:00				19:00

(2) Visiting Participants from Japan

・City of Kitakyushu, Kitakyushu Asian Center for Low Carbon Society

・NTT Data Institute of Management Consulting, Inc. (*)

(3) Main agenda, activities

On November 20, 2017, we held a seminar with Phnom Penh, and discussed and followed up on "Phnom Penh Municipal Climate Change

Strategic Action Plan" that Kitakyushu City formulated and supported last year. We discussed pilot project in the waste field with the Waste Management Bureau in Phnom Penh Capital City.

The state of the seminar is shown in Figure 3.1.3-2.

Figure3.1.3-2 Meeting with the Phnom Penh Capital City

・We visited Water Supply Authority which can be a candidate for users of the ESCO business model of Activity 2 and told them that we are considering construction of "ESCO type business model" to introduce equipment without initial investment burden. We also conducted site visit of two water treatment plants which have possibility of introducing solar panels. Details are described in Section 3.3. Two water purification plants are shown in Figure 3.1.3-3 and 3.1.3-4.

Figure3.1.3-3 Chroy Changvar Water Treatment Plant

Figure3.1.3-4 Niroth Water Treatment Plant

3. 1. 4 The Fourth Field Survey

(1) Schedule

The fourth field survey was conducted from Thursday, February 8 to Saturday, February 10 in 2018. The meeting schedule and the place of visits are as shown in Figure 3.1.4-1.

Figure3.1.4-1 the 4th field survey schedule

Time	2/8(Thu)	2/9(Fri)	2/10(Sat)	Time
08:00				08:00
09:00	Water Supply Authority		Phnom Penh－City of Kitakyushu Workshop	09:00
10:00				10:00
11:00				11:00
12:00				12:00
13:00				13:00
14:00				14:00
15:00	Cambodia Hotel Association	Starts Hotel Cambodia		15:00
16:00				16:00
17:00	Sunrise Japan Hospital			17:00
18:00				18:00
19:00				19:00

(2) Visiting participants from Japan

・City of Kitakyushu, Kitakyushu Asian Center for Low Carbon Society

・NTT Data Institute of Management Consulting, Inc.

(3) Main agenda, activities

・We visited Water Supply Authority which can be a candidate for users of the ESCO business model of Activity 2. Based on the received

layout drawings of the water treatment plants, we reported the result of feasibility study of introducing the solar panel. Details are described in Section 3.3.

・We visited the Cambodia Hotel Association as an excavation of new candidate for users of ESCO business model of Activity 2 and asked for cooperation on project formulation. They introduced STARTS Hotel to us, then we visited the hotel, and explained the outline of JCM scheme, applicable technology, ESCO type business model etc..

・As a follow-up to the Phnom Penh City Climate Change Strategy Action Plan, we participated in citizen enlightenment workshop in city of Phnom Penh and city of Kitakyushu in water field and environment field. Figure 3.1.4-2 shows photo of the workshop.

Figure3.1.4-2 Phnom Penh – City of Kitakyusu Workshop

3.2 Activity 1: Customized Proposal for Large Enterprises Which Have Needs for Energy Cost Reduction

3.2.1 Overview of Survey

(1) Outline of survey contents

In order to avoid shelving introduction of energy saving equipment and renewable energy equipment due to the reasons such as not knowing the suitable technology or not meeting company's investment criteria, we propose energy saving equipment and renewable energy equipment which are well-considered the situation of company.

As a detail activity, we discussed with Cement Company, whose head office is in Phnom Penh and their cement plant is located in limestone production areas, to study the possibility of introducing waste heat recovery power generation systems for cement plant.

In Cambodia, along with economic development, the construction rush continues in various places in Phnom Penh city, and the demand for cement is increasing. As a result, cement factories are being developed in Phnom Penh city and its surrounding areas, and it is increasing even now. As importance is placed on cement production with emphasis on speed, many cement factories do not have a mechanism for recovering waste heat at present. Therefore, in this survey, we investigate the possibility of introduction of waste heat recovery power generation system at cement factories which have a large effect of reducing CO2 emission (examination of project implementation and fund composition scheme, investigation of project profitability, CO2 reduction amount and examination of cost effectiveness etc). The activity items and activity contents are summarized in Figure 3.2.1-1.

Figure 3.2.1-1 Activity items and contents of activities

	Activity item	Content of activity
①	Direct discussion with local cement company	We contact the candidate cement company, explain the JCM system again and confirm the intention to participate in the JCM business.
②	Based on actual operation data of plant, basic technical study is conducted to decide requirements and specification	Based on actual operation data such as waste heat temperature of the local cement plant, we study technical requirements and determine the equipment specification.
③	Conduct technical study based on required specifications	Based on the specification studied in ② above, consider detail study of introduction techniques with Vendor.
④	Economic evaluation for equipment introduction	Based on the estimate and performance obtained from the vendor, make an economic evaluation such as investment payback period.
⑤	Examine the calculation method and monitoring method of CO2 reduction effect.	Calculate CO2 emission reduction based on performance obtained from vendor and existing similar MRV methodology.
⑥	Extraction and encouragement of representative companies	To establish JCM organization, we will extract Japanese companies that will become representative company of international consortiums and encourage them to work.
⑦	Decision making for implementation of JCM project	Explain the JCM scheme and study results, and support them to make decisions for JCM project implementation.
⑧	Confirmation of local regulation etc.	Confirm the existence of a local regulations which may affects project implementation.

(2) Outline of survey target site

・Based on the results of the last year's survey, we conducted further study with Chip Mong Insee Cement. Although the head office is located in Phnom Penh, the cement plant itself is located in the province of Kampot, where is limestone production area and it is located in a district about 125 km away from Phnom Penh. The survey target site is shown in Figure 3.2.1-2

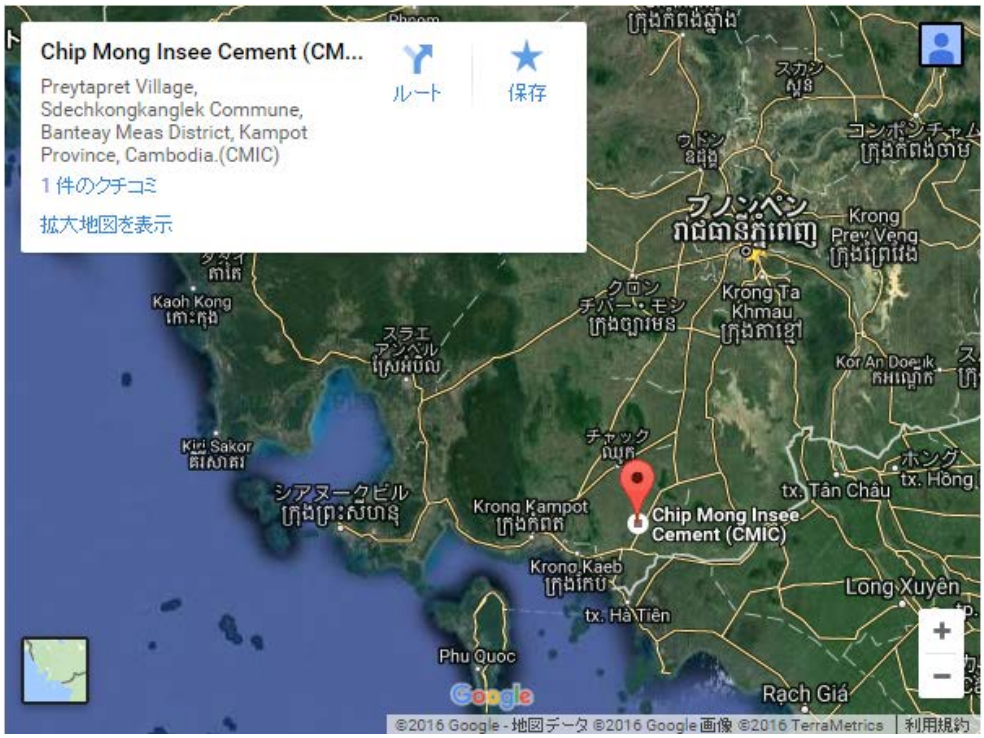


Figure 3.2.1-2 Cement factory site of Chip Mong Insee Cement

(Source：Google Map)

・Chip Mong Insee Cement is a joint venture between Cambodia's leading construction company Chip Mong Group (CMG) and Thailand's leading cement company Siam City Cement (SCCC). It is a company founded in 2015 with 40% ownership by Siam City Cement (SCCC) which has cement technology and with 60% ownership by Chip Mong Group (CMG) which has local sales channels etc. Figure 3.2.1-3 shows the joint venture's ownership ratio and the logos of both companies.

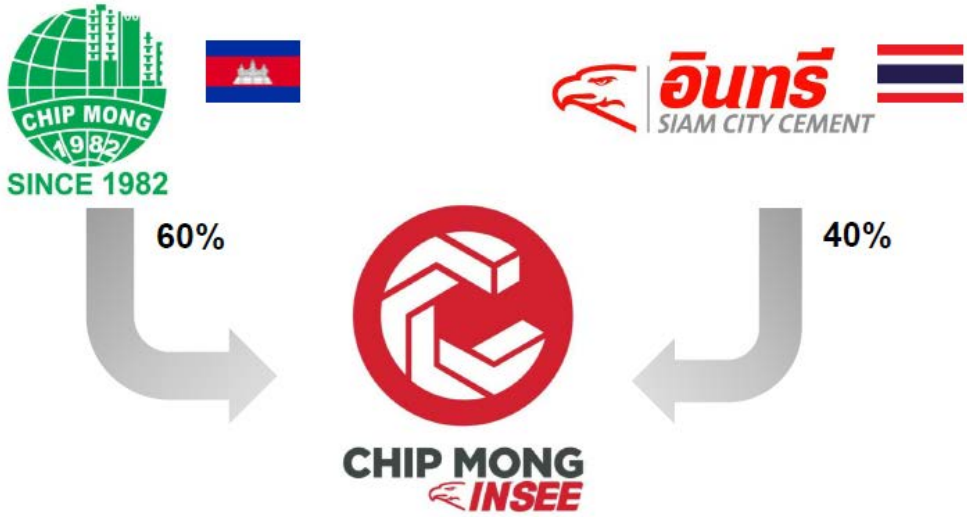


Figure 3.2.1-3 Ownership of Chip Mong Insee Cement
(Source: Prepared from presentation materials of Chip Mong Insee Cement)

・As a result of discussion with Chip Mong Insee Cement in the first and second field survey, it was decided to apply the 2nd call for JCM financing programme in 2017. It was originally planned to submit a proposal for the JCM financing programme in FY2018 but based on the request from CMIC to introduce the waste heat recovery system at an early stage because the plant construction of the main facilities were progressing smoothly. In the following sections, we summarize technical study, economic evaluation, CO2 reduction effect etc of waste heat recovery power generation system at cement plant of Chip Mong Inse Cement.

3.2.2 Technical Study Based on Required Specification

・Collect waste heat from cement factory owned by Chip Mong Insee Cement and generate electricity. Since all the electricity generated by the system will be consumed in the cement plant, they do not sell electricity to power grid.

・Figure 3.2.2-1 shows the schematic layout of the cement factory.

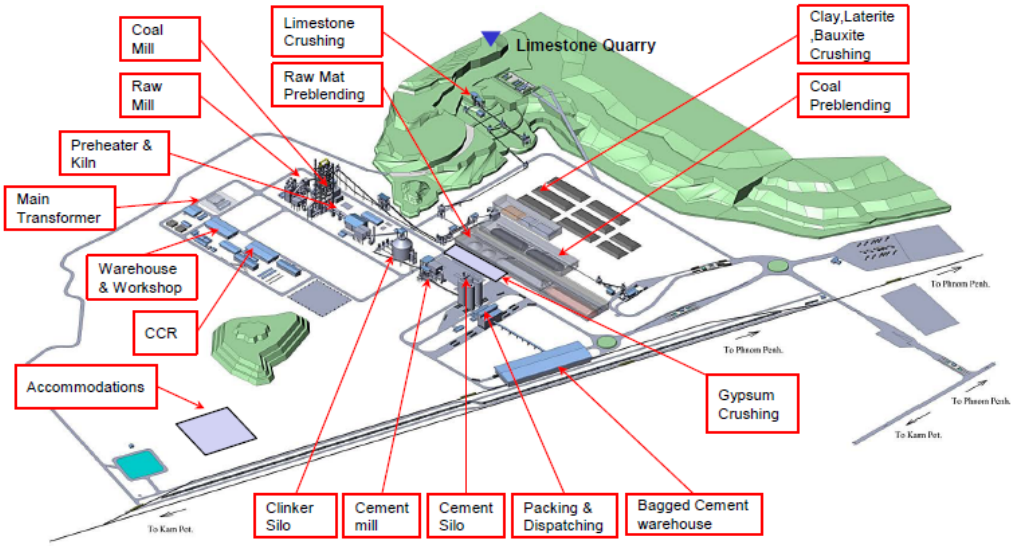


Figure 3.2.2-1 General layout of cement factory

(Source: From the presentation materials of Chip Mong Insee Cement)

(1) Outline of Technology and Facilities

・In the cement factory, a waste heat recovery boiler was installed at two locations, one is at Pre-Heater (PH) that pre-heating raw material and the other is at Air Quenching Cooling (AQC) that quickly cooling the high temperature clinker. Electricity is generated using steam obtained from both boilers. Figure 3.2.2-2 shows the scale of boilers and steam turbine generators, which are main facilities to be introduced.

Figure 3.2.2-2 Outline of Facilities

Introduction facility	Outline	Scale etc.
Pre-Heater (PH)boiler	Horizontal forced circulation boiler	Steam: 22.9t/h (@ 0.9MPaA, 296.0℃)
Air Quenching Cooling (AQC) Boiler	Vertical natural circulation boiler	Steam: 35.0t/h (@ 0.8MPaA, 347.3℃)
Steam Turbine Generator	3000rpm, 50Hz	Generation Capacity: 8,000kW

(2) Advantages of Technology and Facilities

・Steam Rankine Cycle (SRC) has been widely used as a waste heat recovery power generation system to cement plants. In recent years, a case where a binary cycle (BC) is also used in a cement plants as a new system is beginning to emerge. Binary Cycle is a system that performs heat exchange of two steps, waste heat recovery is performed in the first stage, and power generation is performed in the second stage.

・Currently, the Organic Rankine Cycle (ORC) and the Kalina Cycle (KC) are often used as the Binary Cycle, and the medium used in the two stages is also different. As shown in Figure 3.2.2-3, comparing with the Steam Rankine Cycle, generally, the Binary Cycle has the problem that facilities become complicated and the initial investment becomes larger correspondingly.

・In the Organic Rankine Cycle, heat oil is used for the first stage heat exchange and silicon oil, iso-pentane, etc. is often used for the second stage power generation. The applicable temperature range of the heat oil used for the first stage heat exchange is about 160 degree-C to 270 degree-C, the temperature range recovered from the cement plant is about 280 degree-C to 400 degree-C, and it is not necessarily an appropriate temperature range.

・Also, in the Kalina Cycle, water is used for the first stage heat exchange and ammonia is used for the second stage power generation. However, ammonia in the second stage is separated into high-concentration ammonia and low-concentration ammonia, and high-concentration ammonia is used for power generation. In the case of the Kalina Cycle, the first stage heat exchange medium is water, which is suitable for the waste heat temperature range of the cement factory. On the other hands, handling of ammonia is difficult, and the efficiency of the entire system is assumed to be less than or equal to the Steam Rankine Cycle, and the Steam Rankine Cycle has superiority in terms of plant complexity and performances.

・In view of the above, this project considered introducing Steam Rankine Cycle which has high applicability to waste heat from cement plants and has a proven experiances worldwide.

Figure 3.2.2-3 Comparison of Steam Rankine Cycle and Binary Cycle

Equipment	Steam Turbine Cycle	Binary Cycle	
		Organic Rankine Cycle	Kalina Cycle
Primary Heat Exchanger	Required	Required	Required
Heat Exchange Medium (Primary)	Water	Heat Oil	Water
Secondary Heat Exchanger	Not Required	Required	Required
Heat Exchange Medium (Secondary)	N/A	silicon oil, iso-pentane, etc	ammonia
Separator	Not Required	Not Required	Required
Turbine and Generator	Required	Required	Required
Cooler (water cooled or Air cooled)	Either water or air	Only air	Either water or air

(3) System diagram of introduction facilities

・As shown in Figure 3.2.2-2, introduction of pre-heater (PH) boiler, AQC boiler, steam turbine generator was considered. Figure 3.2.2-4 shows the system diagram of the introduction facilities. Facilities surrounded by a red frame is a device that has been considered for subsidized items of JCM financing programme.

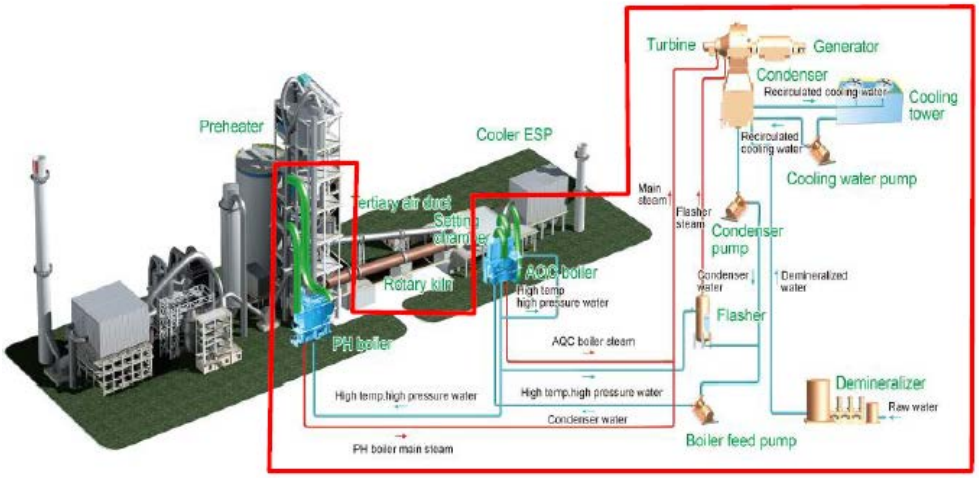


Figure 3.2.2-4 System diagram of introduction Facilities

(4) Study of Annual Power Generation

・Based on the data obtained from Shanghai Conch Kawasaki Engineering Co., Ltd., the manufacturer of the waste heat recovery system, and data such as the assumed operation hours from Chip Mong Insee Cement, the annual power generation amount was studied. As shown in Figure 3.2.2-5, approx. 32,442,120 kwh of electricity generation is assumed annually.

Figure 3.2.2-5 Estimated annual power generation

Operation Basic Data	Figure	Remarks	Unit
1) Gross Power Output	6,170	—	kW
2) Auxiliary Power Consumption (Self used)	470	—	kW
3) Net Power Output	5,700	1) - 2)	kW
4) Annual Operation	7,440	（310day*24hours/day）hours	hours
a) Operation Rate of Kiln	85		%
b) Operation Rate of Generator	90		%
Net Power Generation per Year	32,433,120	= 3) Net Power Output × 4) Annual Operation × a) Operation Rate of Kiln × b) Operation Rate of Generator =5700kW×7440hour×85%×90%	kWh/Year

3.2.3 Economic Consideration for Installation Facilities

・The initial investment cost is prepared by Chip Mong Insee Cement.

・Electricity generated by the waste heat recovery power generation system is all self-consumed in plant. Therefore, it is possible to reduce the monthly electricity bill according to the annual power generation amount

・We studied the initial investment cost, the annual electricity cost reduction, and payback period.

(1) Approximate initial investment cost

・An quotation was prepared at Shanghai Conch Kawasaki Engineering Co., Ltd., a manufacturer of waste heat recovery equipment. The initial investment amount is approx. 1.41 billion yen. An approximate quotation is shown in Figure 3.2.3-1.

Figure 3.2.3-1 Initial Cost of waste heat recovery equipment

Item	CNY	JPY
Engineering	2,200,000	37,422,000
Offshore Equipment Supply	46,800,000	796,068,000
Supervisory Service	2,500,000	42,525,000
Construction and Local Service	31,640,000	538,196,400
Total	83,140,000	1,414,211,400

・Regarding the exchange rate, it is calculated at 1 CNY = 17.01 JPY, the value at the submitted time of JCM application.

・In addition to above, labor cost and travel expenses of representative company, and non- subsidized equipment, an initial investment cost is about 1.54 billion yen.

(2) Approximate annual electricity cost reduction

・Estimated annual power generation amount studied in section

3.2.2 was about 32, 442, 120 kWh / year. Since this power generation amount is smaller than the power consumption amount used in the cement plant, the whole amount of generated power can be reduce the purchasing of electricity from power grid, then purchasing electricity cost is reduced.

・Since the electricity price per kWh contracted by Chip Mong Insee Cement is 0.124 (USD / kWh), the electricity cost that can be reduced by waste heat recovery power generation will be approximately 440 million yen / year.

・Calculated by the following formula:

Approximate annual electricity cost reduction (yen / year) = estimated annual electricity generation (kWh / year) x electricity price per kWh (USD / kWh) x exchange rate (JPY / USD)

(32,442,120kWh/year x 0.124 USD/kWh x 109.42 JPY/USD = 440,177,280 USD/year)

・For the exchange rate, we used 1 USD = 109.42 JPY, which is the value at the submitted time of JCM application.

(3) Study for Operation and Maintenance Cost

・Approximately 1,000,000 USD / year (= 109.420,000 yen / year) as expenses related to the operation of waste heat recovery equipment is considered. It was the result of similar projects as shown Figure 3.2.3-2.

Figure 3.2.3-2 approximate operation expenses of waste heat recovery unit

Item	USD	JPY
Employee and other Cost	200,000	21,884,000
Raw Water Cost	120,000	13,130,400
Chemical Cost	120,000	13,130,400
Equipment Repair and Maintenance	400,000	43,768,000
Plant Insurance	160,000	17,507,200
Total	1,000,000	109,420,000

・The estimation is based on experiences of similar facilities.

・For the exchange rate, we used 1 USD = 109.42 JPY, which is the value at the submitted time of JCM application.

(4) Study for payback period

・Payback periods calculated the following formula are as follows:

(Total Initial Cost – Subsidy amount) / (Annual cost reduction by power generation – Annual expenses for operation)

- Without subsidy: 4.7 years
- With 50% subsidy: 2.5 years
- With 40% subsidy: 2.9 years
- With 30% subsidy: 3.4 years

・Since one of criteria of project selection for JCM project is that payback period with subsidy is longer than approx. 3 years. Therefore, considering this criteria, with 40% of subsidy can be promising for selection JCM project.

3.2.4 Study on Calculation Method of CO2 Reduction Effect and Monitoring Method

・By collecting discarded and unused waste heat and generate electricity, it is able to reduce the purchase of electricity from the power grid. As results, the amount of CO2 emission can be reduced since power grid emits a certain amount of CO2 per kWh.

・Since the power generation by waste heat recovery system is approximately 25% of the power consumption of the cement plant, all amount of power generation is used in the plant and not to be sold to power grid.

・The estimated annual power generation amount of the waste heat recovery power generation system was estimated in 3.2.2 and it was about 32, 442, 120 kWh / year.

・As for the grid emission factor of Cambodia, since the grid emission factors for JCM application are set by counties and by divisions, we should use this parameters. Figure 3.2.4-1 shows the grid emission factor set for 2nd calling for JCM financing programme..

・Since the introduced technology to the plant is not categorized in "When replacing in-house generation," Table 3 is to be applied. Since the location of the cement plant is in Kanpot, No.2 Kampot –Shhnouk grid: o.645 tCO2 / MWh is to be applied.

Figure 3.2.4-1 Grid Emission Factors by JCM Application

[Note] This list is used to application of JCM Financing Program and does not predict JC's decision.

FY2017 JCM Financing Program: List for CO2 emission factor (tCO2/MWh)

No.	Contory	Energy Efficiency			Renewable Energy		
		All	Other than left	When replacing in-house generation	All	Other than left	When replacing in-house generation
11	Cambodia	–	See table 3	0.8	–	0.353	0.533

Table 3 Cambodia

No.	Grid	Energy Efficiency
1	National Grid	0.384
2	Kampot-Sihnouk Grid	0.643
3	Kampong Cham Grid	0.724

Source: GEC「FY2017 JCM Financing Program: List for CO2 emission factor (tCO2/MWh)」

· Therefore, annual CO2 emission reduction is approx. 20,860 tCO2 / year.

(32, 442, 120 kWh / year / 1000 x 0.643 (ton - CO 2 / MWh) = 20, 860 (ton - CO 2 / year))

· According to the regulations of the useful life of Japan, the project institution is nine years. Therefore, CO2 emission reduction in project periods is approx. 187,740 tCO2.

· The cost effectiveness (subsidy amount v.s. CO2 emission reduction) is calculated as 3,039 yen / tCO2, when assuming subsidy of 40% as mentioned in Section 3.2.3.

(3,039 yen / ton CO2 = subsidy amount ÷ (Annual CO2 reduction amount × statutory useful life))

· This value meets the criteria of the cost effectiveness of 4,000 yen / tCO2 or less, which is another criteria of selection of JCM applications.

3.2.5 Consideration for Implementation of JCM

・As results of our survey for extraction of representative companies and encouragement, Global Engineering were decided to become representative company of this project.

・Figure 3.2.5-1 shows the project implementation organization of JCM equipment financing projects.

・Representative Company is Global Engineering and Partner Company at local is Chip Mong Insee Cement who introduce Waste Heat Recovery System to the plant. The two companies are member of International Consortium.

・Shanghai Conch Kawasaki Engineering Co., Ltd., who is joint venture between Japanese KAWASAKI Heavy Industry and Chinese comany is in charge of manufacturing, shipping and installing of waste heat recovery system.

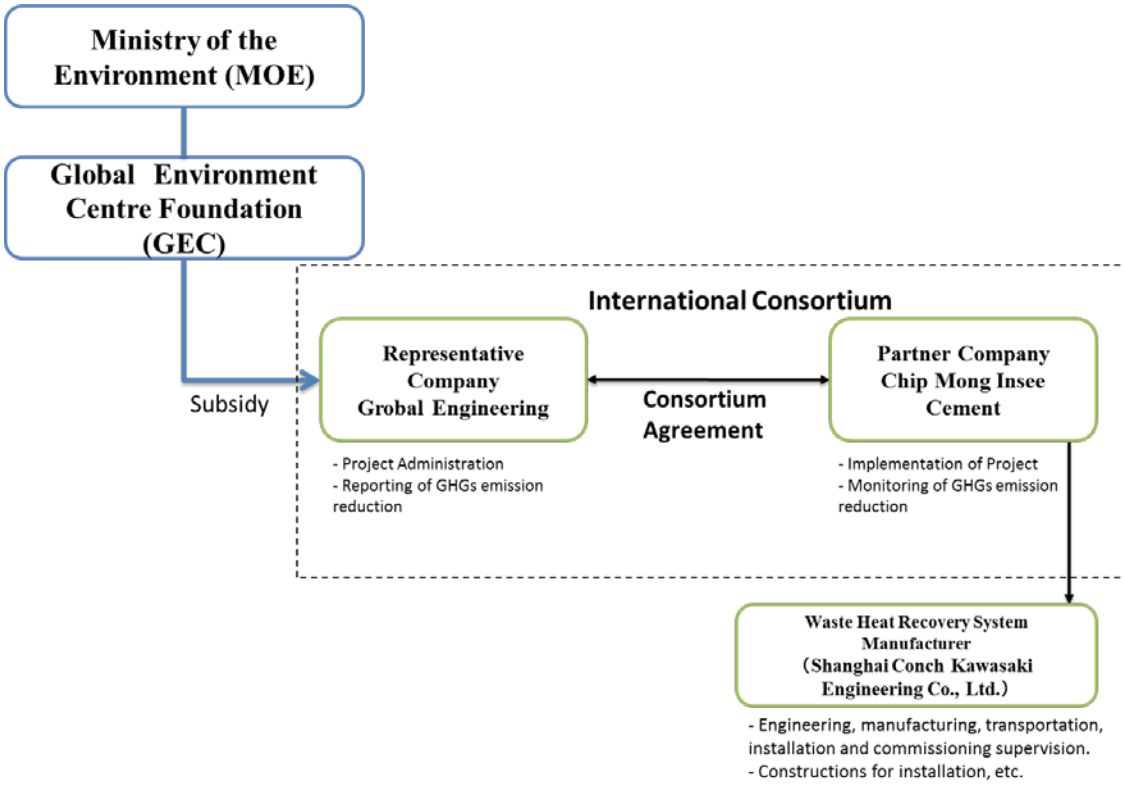


Figure 3.2.5-1 Implementation Organization for JCM

・Figure 3.2.5-2 shows the operation and maintenance organization of introduction facilities and equipment.

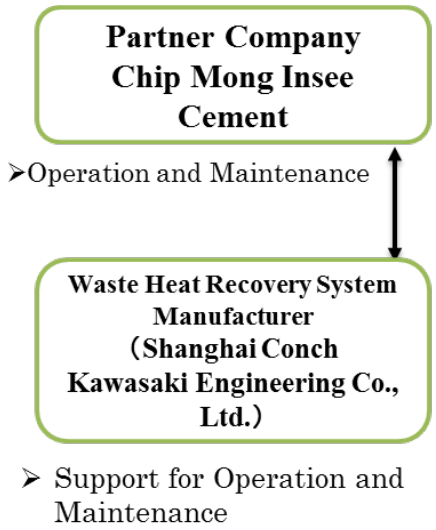


Figure 3.2.5-2 Organization for operation and maintenance

・Figure 3.2.5-3 shows the MRV implementation organization.

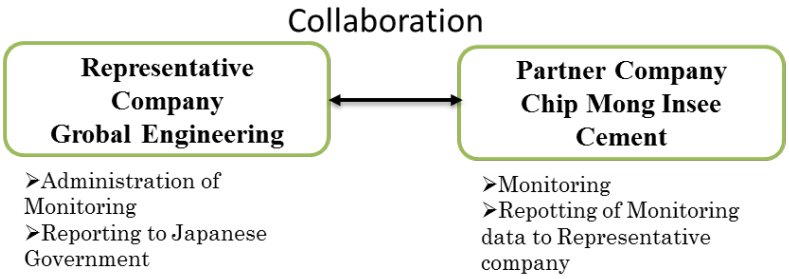


Figure 3.2.5-3 Organization for MRV impementation

3.2.6 Situation after submission to JCM Application

・Based on the detailed studies in this project, we were able to submit the application to 2nd calling for second JCM financial programme in fiscal 2017, which was earlier than our initial expectation. However, after the bidding by Chip Mong Insee Cement for waste heat recovery system, our proposed Shanghai Conch Kawasaki Engineering Co., Ltd. is not selected but other Chinese EPC contractor were awarded, unfortunately. We heard that it is based on the judgement of Chip Mong Group who is parent company of Chip Mong Insee Cement.

Eventually, we decided to withdraw our proposal to the JCM application.

3.3 Activity 2: Proposal of ESCO Type Business Model Packaged with Financial Services

3.2.1 Overview of Survey

(1) Outline of survey contents

We aim to establish ESCO type business model service by packaging equipment such as photovoltaic power generation system and financial services so that user can be install the equipment without initial cost.

For example, packaging photovoltaic power generation system and financial services, install the panels on the rooftop. Then, the use can be generated power to be purchased cheaper than the original electricity price from reduce the grid. After a certain period, ownership of PV panels is transferred to user. We aim to establish kind of ESCO type business model. When the ESCO type business model is established, start-up companies and small and medium-sized enterprises, who concerning their financial strength, can get the PV panels after a certain periods of using their rooftop space.

In order to realize such services, cooperation with organizations that own facilities and lease, (however, the lease fee depends on electricity generation amount) is necessary. Discover candidate providers of ESCO type business mode and build the business model.

In addition, as a user of the ESCO type business model, we found potential customers who have needs and made proposals to facilities such as hospitals and water supply companies.

Figure 3.3.1-1 shows the image of the ESCO business model.

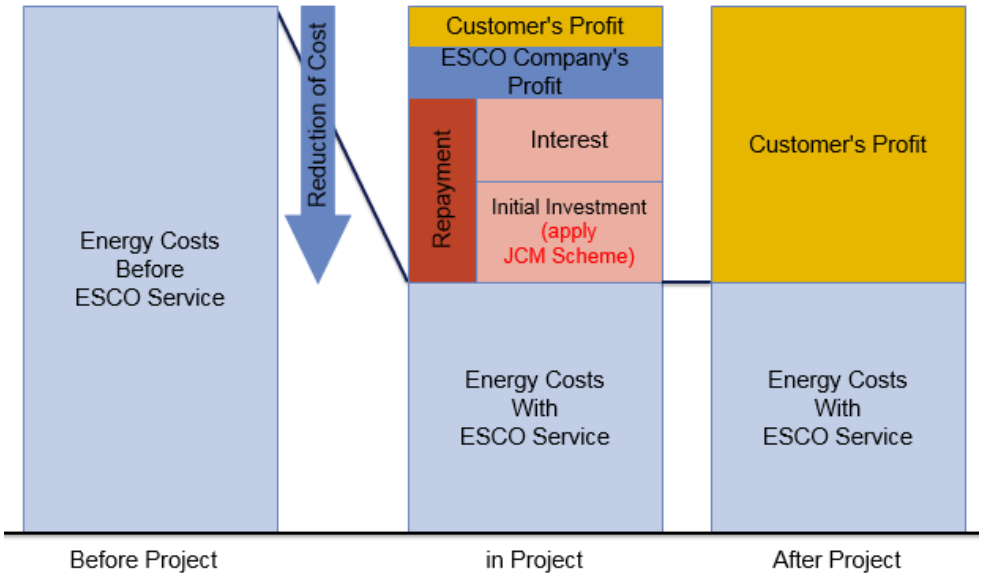


Figure 3.2.5-3 Image of ESCO Type Business Model

In this survey, we search for the provider of the ESCO business model and consider the structure making. In addition, we investigate the users of the ESCO business model, and study the possibility of introducing the photovoltaic power generation system (technical study, investigation of business profitability, study for CO2 reduction and cost effectiveness, etc.). The activity items and contents of activities of activity 2 are summarized in Figure 3.3.1-2.

Figure3.3.1-2 Activities Items and Contends of Activities

	Activity item	Content of activity
①	Direct discussion with local financial bank etc. for providing ESCO type business model	We verify the possibility of business model realization through direct discussion with local financial banks etc. that can be candidates for providers of ESCO type service.
②	Search for new financial institution etc. for providing ESCO type business model	We search for new financial institutions, leasing companies, funds, etc. that can be candidates for providers of ESCO type services, and verify the possibility of realizing the business model.
③	Search for new local companies etc. as user of ESCO type business model	As a user of ESCO type business model, we search for candidates of local companies etc.
④	Direct discussion with local companies etc. as user of ESCO type business model	As a user of ESCO type business model, we discuss directly with the local companies excavated in above ③ and the local hospitals already networked, and consider introducing energy-saving / renewable energy equipment.
⑤	Consideration for JCM project formation	Consult with provider candidate and user candidates and consider for establishment of ESCO type business model
⑥	Extraction and encouragement of representative companies	To establish JCM organization, we will extract Japanese companies that will become representative company of international consortiums and encourage them to work.
⑦	Follow up for the Phnom Penh City Climate Change Strategy Action Plan	Submit “Phnom Penh City Climate Change Strategy Action Plan,” which is prepared last year, to Phnom Penh and follow up it.

(2) Study for Provider of ESCO Type Business Model

・We discussed with “ACLEDA Bank” and “SATHAPANA Bank” who are local financial institution and we surveyed and visited last

year, whether they can collaborate as the provider of ESCO type business model. However, it is difficult that they become provider of ESCO type business model due to the reasons such as high business risk for no experienced or unprofessional equipment and lease business, and they needs down payment or collateral considering high credit risk for user of equipment.

・On the other hands, as a new contacted financial institution, we discussed with "MGM Sustainable Energy Fund" in this year. They are considering to collaborate for ESCO type business model in South East Asia. The fund is investing in energy saving business and renewable energy business in Latin America regions. They also have a few experiences of JCM financing programme with NTT Data Institute of Management Consulting, Inc. in Costa Rica, Mexico and Chile. Currently, they are studying the launch of the second fund, and considering investing 10% of the investment in Southeast Asia.

・The summary of each financial institutions are summarized in below.

① ACLEDA Bank

Location of Head Office：#61, Preah Monivong Blvd., Sangkat Srah Chork, Khan Daun Penh Phnom Penh, Kingdom of Cambodia

Web site : www.acledabank.com.kh

Summary : Established in 1993 and it is the largest commercial bank in Cambodia. Mitsui Sumitomo Bank Corporation owns 18.25% of the bank's shares. They started business in Laos in 2008, then in 2013 they expanded their business in Myanmar in microfinance business field.

② SATHAPANA Bank

Location of Head Offic : #83, Preah Norodom Boulevard, Sangkat Phsar Thmey 3, Khan Daun Penh, Phnom Penh Capital, Cambodia

Web site : https://www.sathapana.com.kh/

Summary : It is Japanese commercial bank, which has 163

branches in Cambodia, and the second largest bank in Cambodia in terms of number of branches, and the fifth largest in Cambodia in terms of capital size. Maruhan Japan Bank, the first Japanese Cambodian Commercial Bank opened in March 2008 as a subsidiary of Maruhan Co., Ltd., and Satapanana Corporation, a major microfinance institution (small-lot finance) in Cambodia established in 1995 as a predecessor of local NGOs. Maruhan Japan Bank merged Satapanana Corporation in April 2016 and the bank is formed. Figure 3.3.1-3 shows the headquarters picture of Satapana Bank.

Figure 3.3.1-3 SATHAPANA BANK

③ MGM Sustainable Energy Fund

Web site : http://www.mgminnovagroup.com/capital/#msef1

Summary : Established in 2010 by Marco G. Monroy, an environmental and energy entrepreneur, and they are investment funds (about 50 million dollars) only for investing various energy saving businesses and renewable energy businesses in Latin America. Their main investment targets are commercial facilities, hotels, small and medium factories, etc. Major investors of capital of MGM are international development institutions such as the European Investment Bank (IDB) and the German Development Authority (DEG). JICA is also investor of MGM capital (as support for Energy-saving and Renewable Energy Business in Latin America). As mentioned in above, the launch of the second fund is

under preparation, and 10% of the investment can be investing in Southeast Asia.

(3) Study for User of ESCO Type Business Model

Following last year's survey, we contacted Sunrise Japan Hospital to considering collaboration as a user of ESCO type business model

In addition, under the cooperation between the city of Kitakyushu and the city of Phnom Penh city, "Phnom Penh Water Supply Authority" is introduced. They has large energy consumption is two local water treatment plants so that we studied introduction of solar panels.

Furthermore, as a possible candidate, we are discussing with the hotel association, and we are asking for cooperation in collaboration and project possibility survey from next fiscal year.

The summary of Sunrise Japan Hospital and Phnom Penh Water Supply Authority which conducted detailed examination are shown in below.

① Sunrise Japan Hospital

Location : Phum2, Sangkat Chroy Changvar, Khan Chroy Changvar, Phnom Penh

Facility owner: JGC Corporation, Industrial Innovation Organization, Kitahara Medical Strategies International Co., Ltd.

Hospitalization: September 2016

Website : http://www.sunrise-hs.com/index.php/jp

Summary :

・Projects that have the same purpose as the growth strategy of the Japanese government's "hospital export".

・Two operating rooms, the latest MRI, CT.

・It is operated by about 20 Japanese medical staff and about 100 Cambodian staff trained in Japan.

・They offer high quality medical services of Japan standards such as emergency medical care, general medicine, general surgery, gastrointestinal internal medicine, cardiovascular internal medicine, neurosurgery, intracerebral intravascular treatment, neurological internal medicine,

rehabilitation, remote medical examination networked with Japan and health check etc. .

Figure3.3.1-5 Sunrise Japan Hospital

② Phnom Penh Water Supply Authority

Loaiton : 45, Street 106, Sangkat Srah Chork, Khan Daun Penh, Phnom Penh, Cambodia

Website : http://www.ppwsa.com.kh/

Summary : In 1993, with the inauguration of the Kingdom of Cambodia, they began working on infrastructure development for water supply while receiving assistance from overseas country. In 1997, as the public corporation independence, the current Phnom Penh Water Supply Authority (PPWSA) was established.

City of Kitakyushu Water Supply and Drink Bureau has been providing technical assistance to Phnom Penh Water Supply Authority since 1999 and has participated in JICA 's Water Supply Project Human Resources Development Project started in 2003 and has been providing support so far. At present, the water penetration rate of Phnom Penh, which was 25% in 1993, exceeds 90%, and "water non-revenue rate" which could not collect water fee for water leakage and stealing also increased from 70% in the 1990s to 6%, it drastically declined. The success is called "the miracle of Phnom Penh". Figure 3.3.1-6 shows the meeting with Phnom Penh Water Supply Authority.

Figure 3.3.1-6 Meeting with Water Supply Authority

3.3.2 Technical Study Based on Required Specification

① Sunrise Japan Hospital

・Continuing from the last fiscal year, we are considering the introduction of solar power generation equipment and asking for cooperation as a user of ESCO type business model.

・As Sunrise Japan Hospital was just opened in September 2016, equipment such as air conditioning and lighting already installed at the time of construction, it is difficult, by introducing energy saving equipment, to make the hospital as a case. Therefore, we will focus on introducing solar power generation system and examine it

【Consideration of solar power generation system】

・ Along with experts in solar panel construction, we actually inspected candidate spaces for the installation site and examined the panel scale.

・Since a part of the rooftop space was secured as a relaxing space for patients, and. Although it cannot be installed on the entire surface. However, if lightweight panels and lightweight construction are deployed, there is a possibility of introduction at the top of the roof of the shade. Also we studied introducing a solar panel as a roof of the vehicle in the parking space.

・Figure 3.3.2-7, 3.3.2-8, 3.3.2-9 show the solar panel installation candidate spaces.

Figure 3.3.2-7 Roof of building (Rest space)

Figure 3.3.2-8 Roof of building (roof of sun shade)

Figure 3.3.2-9 Parking Space

【Study of lightweight solar module】

・As mentioned above, considering the strength of the roof, it is necessary to consider the introduction of lightweight panels.

・As a lightweight panel, following study was proceed with the consideration with the product of Next Energy & Resources Co., Ltd.'s NER 660 M 275 A (4) -LS as a candidate. This product achieves about half the weight (10.5 kg) of general solar cell module. Catalog values of product specifications are shown in Figure 3.3.2-10.

Figure 3.3.2-10 Product specifications of lightweight panel made by Next Energy & Resources Co., Ltd.

Type	NER660M275A(4)-LS
Nominal maximum output (Pmax)	275 W
Nominal maximum output operating current (Imp)	8.88 A
Nominal maximum output operating voltage (Vmp)	31.0 V
Nominal short circuit current (Isc)	9.46 A
Nominal release voltage (Voc)	38.4 V
Module conversion efficiency	16.9 %
Nominal mass	10.5 kg
Nominal size	W983 mm x H1639 mm x D 35 mm
Cell type	Single crystal

(Source: Next Energy & Resources Co., Ltd. NER660M275A(4)LS catalog)

【Study on lightweight installation method】

・As mentioned above, due to the problem of the strength of the roof, it is also necessary to consider the introduction of a lightweight construction method.

・ As lightweight construction, we will consider the ultra light installation method of Kawaguchi Steel Industry as a candidate. This installation method can be installed on a fragile roof such as a folded plate, a slate, a livestock corrugated board, etc. without reinforcement work. For reference, the installation image of folded plate and slate roof is shown in Figure 3.3.2-11, Figure 3.3.2-12.

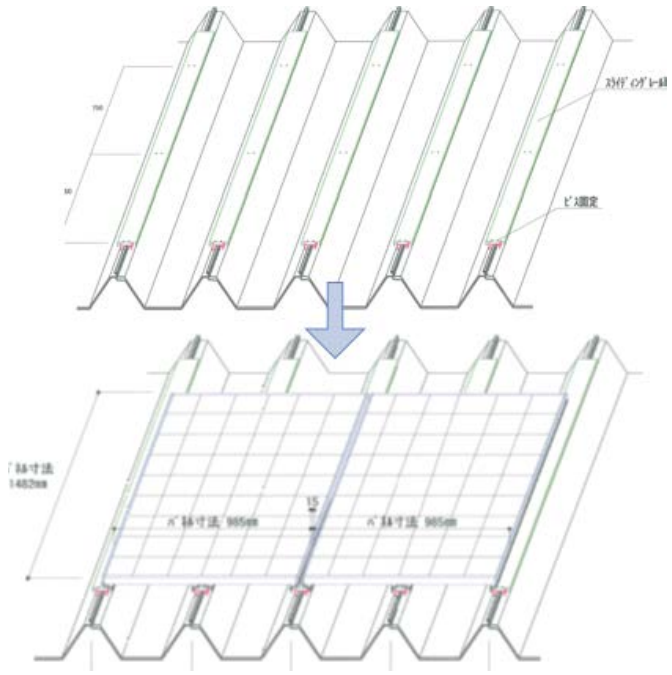


Exhibit 3.3.2-11 Ultra light installation method (folded-plate roof)

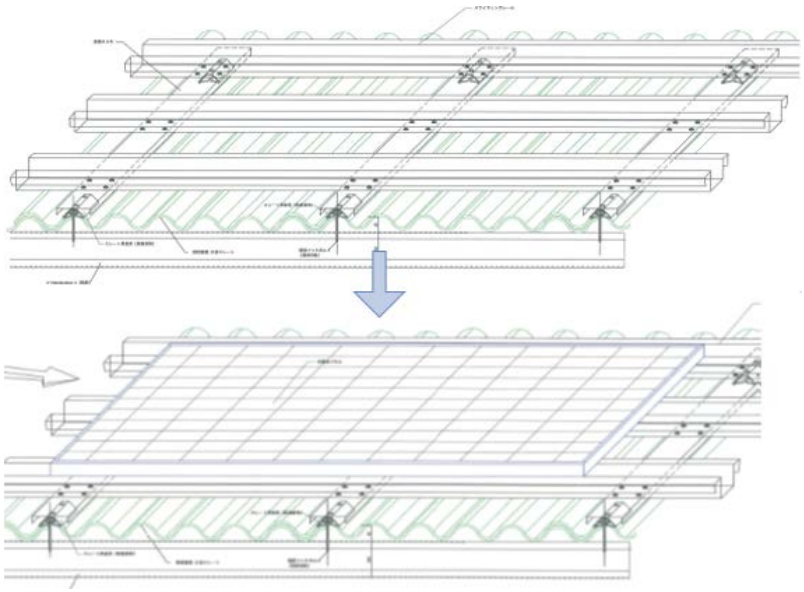


Figure 3.3.2-12 Ultra light installation method (slate roof)
(Source: Prepared from Kawaguchi Steel Industrial Mounting Procedure Diagram)

【Investigation of solar power panel capacity】

・We examined allocation of solar panels from field survey and drawings.

The examination results are shown in Figure 3.3.2-13.

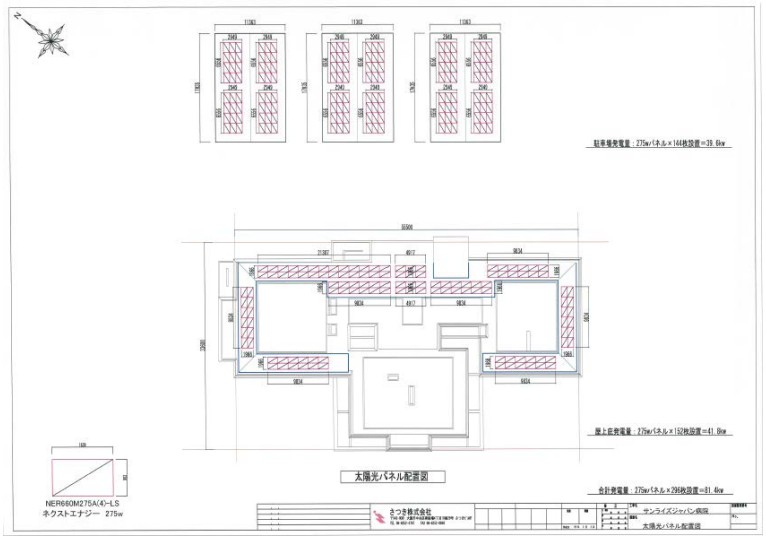


Figure 3.3.2-13 Assignment of solar panels (Sunrise Japan Hospital)

・As a result of examination, we found that 81.4 kW solar power generation system can be introduced. The number solar panels of the parking space and rooftop space are as follows.

- Parking Lot：275W x 144 Panels = 39.6 kW （Figure 3.2.2-11 top）
- Roof Space：275W x 152Panels = 41.8 kW （Figure 3.2.2-11 bottom）

【Annual Estimated Effective Total Generated Power Generation】

・For the introduction of photovoltaic power generation system, a certain method for the annual estimated effective total power generation has already been established.

・Public Interest Foundation Corporation Global Environment Centre Foundation publishes a worksheet for calculating the annual estimated effective total power generation of the solar power generation system and the CO2 reduction effect when applying for JCM financing projects, based on this calculation methods, annual estimated total effective power generation was calculated for this project. The calculation results are shown in Figure 3.3.2-14.

・As a result of trial calculation, the estimated total effective power generation per year was about 110,000 (kWh / year).

Figure 3.3.2-14 Estimation of total effective power generation

Project name	Sunrise Japan Hospital Phnom Penh											
Implementation site	adre	Phum2, Sangkat Chrouy Changvar, Khan, Chroy Changvar, Phnom Penh, 12303 カンボジア										
	N	11° 34'52.0"N	E	104° 55'44.7"E								
System solar battery capacity =	81.4	(kW)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average daily solar radiation per day (value at implementation site: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Daily average effective sunlight per day (Correction value at azimuth, installation angle: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Temperature correction factor (when there is no loss = 1.0)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Loss factor by shadow (1.0 if not)	1	1	1	1	1	1	1	1	1	1	1	1
Power conditioner conversion efficiency (rated load power efficiency)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Other loss (when nothing: 1.0) (module dirt, transmission loss, aged deterioration etc.)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Estimated generated electric energy per day (kWh / day)	298.6	297.2	322.4	290.5	330.8	327.2	332.8	325.4	284.3	265.3	254.9	276.7
Average daily power consumption on the working day of factory etc. (kWh / day)	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Average surplus electricity amount on the working day of factory etc. (kWh / day)	0	0	0	0	0	0	0	0	0	0	0	0
Number of days during which the amount of power generation is the total amount of surplus power on non-working days												
Actual effective days	31	28	31	30	31	30	31	31	30	31	30	31
)Monthly estimate surplus electric energy (kWh / month)	0	0	0	0	0	0	0	0	0	0	0	0
Estimated monthly active generation Electric energy (kWh / month)	9256.2	8322.5	9994	8714.5	10253	9815.3	10317	10086	8530	8224.6	7648.2	8576.1
Estimated effective total generated electricity per year	109738	kWh/Year										

(Source: Created from application form for Public Interest Foundation Corporation Global Environment Centre Foundation)

※ This result is an assumed value for grasping the scale of the business, and detailed study including solar panel manufacturers and construction companies etc. is necessary for promoting implementation.

※ For some figures, the assumed figures are used (Orange shaded area in Figure 3.3.2-14). In order to raise the accuracy of the examination results, further detailed examination such as installation angle, temperature correction, various losses due to aged deterioration, etc. is required, but, in this research project, as a rough estimate to grasp the scale of the project, the result is used.

② Phnom Penh Water Supply Authority

・We consider introducing solar power generation system into the two water treatment plants of Phnom Penh Water Supply Authority.

【Location of candidate water treatment plant】

・Consider introducing solar panels to Chroy Changvar water treatment plant and Niroth water treatment plant out of the three water purification plants managed by Phnom Penh Water Supply Authority. Regarding the Phum Prek water treatment plant located in central Phnom Penh, solar panels made by Kyocera have already been introduced in Japanese ODA, so this time we targeted the remaining two water treatment plants. Figure 3.3.2-15 shows the location of Chroy Changvar water treatment plant and Niroth water treatment plant.

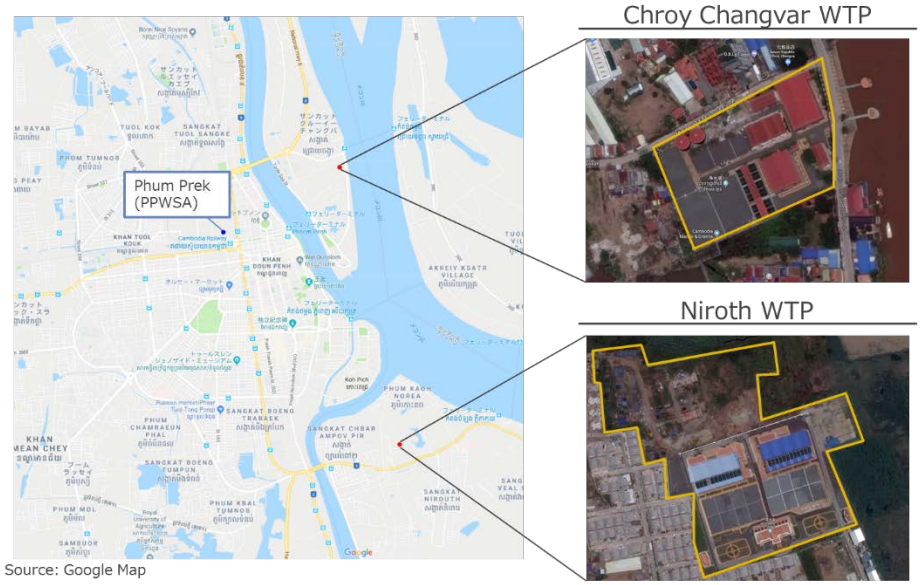


Figure 3.3.2-15 Location of Chroy ChangvarWTP and Niroth WTP

【Study of solar power generation system】

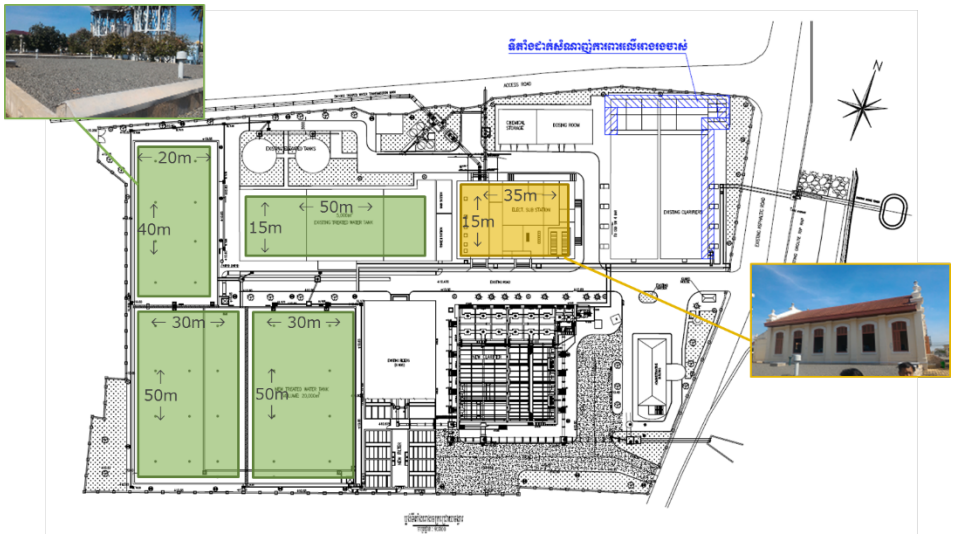
・At the third field survey, we visited both water treatment plants and examined candidate spaces for places where solar panels could be installed.

・ Aerial photographs of the Chroy Changvar water treatment plant

located in the eastern area of Phnom Penh and the candidate areas for panel installation are shown in Figure 3.3.2-16 and 3.3.2-17, respectively.

＜Chroy Changvar water treatment plant＞

Firgure 3.3.2-16　Aerial photographs of the Chroy Changvar WTP



Fgure3.3.2-17 Candidate areas for panel installation of Chroy Changvar WTP

・For the green shaded area shown in Figure 3.3.2-17, it is the area corresponding to the top of the underground water tank, which is suitable for placing conventional solar panels on the ground. In Figure 3.3.2-18, place a picture of the relevant area.

・ Considering the protrusions on the chimney and maintenance space etc. in this area, we assumed that solar panels can be installed in about 60% of the area.

Figure 3.3.2-18 Candidate area①top of the underground water tank

・For the yellow shaded area shown in Figure 3.3.2-17, it is the area where the roof of the building. This is also an area where conventional solar panels can be installed. Figure 3.3.2-19 shows the picture of the area.

・ In this area, we assumed that solar panels could be installed in an area of about 25% of the area.

Figure 3.3.2-19　Candidate area②Rooftop of Building

＜Nirothwater treatment plant＞

・Aerial photographs of the Niroth water treatment plant located in the southeastern area of Phnom Penh and candidate areas for panel installation are shown in Figure 3.3.2-20 and 3.3.2-21, respectively.

Firgure 3.3.2-20 Aerial photographs of the Niroth WTP

Figure3.3.2-21 Candidate areas for panel installation of Niroth WTP

For the green shaded area shown in Figure 3.3.2-21, it is the area

corresponding to the top of the underground water tank, which is suitable for placing conventional solar panels on the ground. In Figure 3.3.2-22, place a picture of the relevant area.

· Considering the protrusions on the chimney and maintenance space etc. in this area, we assumed that solar panels can be installed in about 60% of the area.

Figure 3.3.2-22 Candidate area①top of the underground water tank

・For the yellow shaded area shown in Figure 3.3.2-21, there are material storage space, and conventional solar panels can be installed. Figure 3.3.2-23 and 3.3.2-24 show pictures of the corresponding areas.

· Since this area is material storage space, we tried assumed that solar panels can be installed in an area of about 25% of the area.

Figure3.3.2-23 Candidate area②material storage space 1

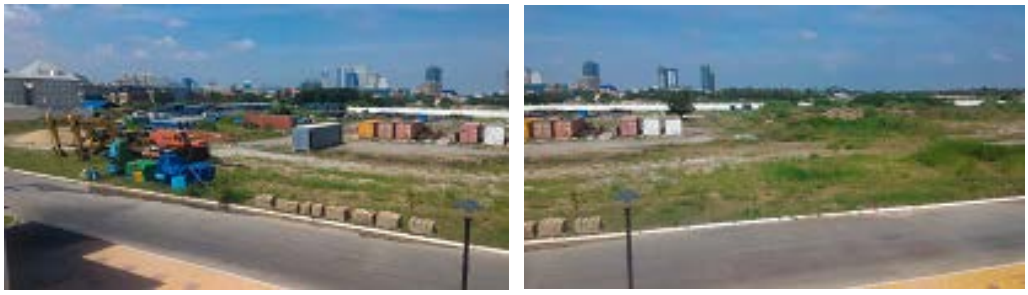


Figure3.3.2-24 Candidate area②material storage space 2

【Study for capacity of solar panels】

・Calculate the installable panel capacity by referring to the catalog value of the product of a certain manufacturer. In the catalog value, the area per module is 1.26 (m 2), and the maximum output per panel is 240 (Wp). We calculated the number of panels and the solar panel capacity from the installable space mentioned above. Figure 3.3.2-25 shows the estimation result of approximate solar panel capacity of each water treatment plant.

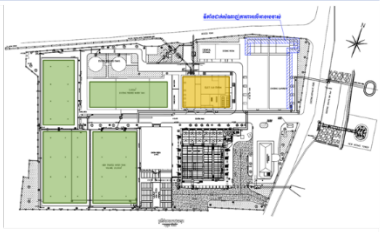
Site	Chroy Changvar WTP	Niroth WTP
Map		
Available Space	**2,900m²** (= [Area A] 2,700 m² + [Area B] 200m²)	**9,900m²** (= [Area A] 5,100 m² + [Area B] 4,800m²)
Expected Number of Panels	**2,300pcs** (≒ 2,900 / 1.26)	**7,850pcs** (≒ 9,900 / 1.26)
Expected Capacity of PV Module	**552kW** (≒ 2,300 x 240 /1000)	**1,884kW** (≒ 7,850 x 240 /1000)

Figure 3.3.2-25 Estimated solar panel capacity of each WTP

Estimated solar panel capacities are as follows:

- Chroy Changvar WTP : 552kW
- Niroth WTP : 1,884kW

【Annual Estimated Effective Total Generated Power Generation】

・For the introduction of photovoltaic power generation system, a certain method for the annual estimated effective total power generation has already been established.

・Public Interest Foundation Corporation Global Environment Centre Foundation publishes a worksheet for calculating the annual estimated effective total power generation of the solar power generation system and the CO2 reduction effect when applying for JCM financing projects, based on this calculation methods, annual estimated total effective power generation was calculated for this project. The calculation results for Chroy Changvar water treatment plant is shown in Figure 3.3.2-26 and for Niroth water treatment plant is shown in Figure 3.3.2-27.

・As a result of rough calculation, the estimated effective total generated electricity of the year is as follows:

- Chroy Changvar WTP : Approx. 744,000 (kWh/year)
- Niroth WTP : Approx. 2,539,000 (kWh/year)

Figure 3.3.2-26 Chroy Changvar WTP: Estimation of power generation

Project name	Phnom Penh Water Supply Authority : Chroy Changwar WTP											
System solar battery capacity =	552	(kW)										
	1 月	2 月	3 月	4 月	5 月	6 月	7 月	8 月	9 月	10 月	11 月	12 月
Average daily solar radiation per day (value at implementation site: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Daily average effective sunlight per day (Correction value at azimuth, installation angle: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Temperature correction factor (when there is no loss = 1.0)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Loss factor by shadow (1.0 if not)	1	1	1	1	1	1	1	1	1	1	1	1
Power conditioner conversion efficiency (rated load power efficiency)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Other loss (when nothing: 1.0) (module dirt, transmission loss, aged deterioration etc.)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Estimated generated electric energy per day (kWh / day)	2,025	2,016	2,186	1,970	2,243	2,219	2,257	2,206	1,928	1,799	1,729	1,876
Average daily power consumption on the working day of factory etc. (kWh / day)	39079	39079	39079	39079	39079	39079	39079	39079	39079	39079	39079	39079
Average surplus electricity amount on the working day of factory etc. (kWh / day)	0	0	0	0	0	0	0	0	0	0	0	0
Number of days during which the amount of power generation is the total amount of surplus power on non-working days												
Actual effective days	31	28	31	30	31	30	31	31	30	31	30	31
)Monthly estimate surplus electric energy (kWh / month)	0	0	0	0	0	0	0	0	0	0	0	0
Estimated monthly active generation Electric energy (kWh / month)	62,679	56,438	67,772	59,096	69,531	66,561	69,961	68,398	57,845	55,773	51,865	58,158
Estimated effective total generated electricity per year	744,166		kWh/年									

(Source: Created from application form for Public Interest Foundation Corporation Global Environment Centre Foundation)

Figure 3.3.2-27 Niroth WTP: Estimation of power generation

Project name	Phnom Penh Water Supply Authority : Niroth WTP											
System solar battery capacity =	552	(kW)										
	1 月	2 月	3 月	4 月	5 月	6 月	7 月	8 月	9 月	10 月	11 月	12 月
Average daily solar radiation per day (value at implementation site: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Daily average effective sunlight per day (Correction value at azimuth, installation angle: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Temperature correction factor (when there is no loss = 1.0)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Loss factor by shadow (1.0 if not)	1	1	1	1	1	1	1	1	1	1	1	1
Power conditioner conversion efficiency (rated load power efficiency)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Other loss (when nothing: 1.0) (module dirt, transmission loss, aged deterioration etc.)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Estimated generated electric energy per day (kWh / day)	6911	6879	7462	6723	7655	7572	7703	7530	6581	6141	5901	6403
Average daily power consumption on the working day of factory etc. (kWh / day)	62313	62313	62313	62313	62313	62313	62313	62313	62313	62313	62313	62313
Average surplus electricity amount on the working day of factory etc. (kWh / day)	0	0	0	0	0	0	0	0	0	0	0	0
Number of days during which the amount of power generation is the total amount of surplus power on non-working days												
Actual effective days	31	28	31	30	31	30	31	31	30	31	30	31
)Monthly estimate surplus electric energy (kWh / month)	0	0	0	0	0	0	0	0	0	0	0	0
Estimated monthly active generation Electric energy (kWh / month)	214235	192625	231310	201696	237313	227174	238780	233444	197427	190357	177017	198494
Estimated effective total generated electricity per year	2,539,872	kWh/年										

(Source: Created from application form for Public Interest Foundation Corporation Global Environment Centre Foundation)

※ This result is an assumed value for grasping the scale of the business, and detailed study including solar panel manufacturers and construction companies etc. is necessary for promoting implementation.

※ For some figures, the assumed figures are used (Orange shaded area in Figure 3.3.2-14). In order to raise the accuracy of the examination results, further detailed examination such as installation angle, temperature correction, various losses due to aged deterioration, etc. is required, but, in this research project, as a rough estimate to grasp the scale of the project, the result is used.

3.3.3 Economic Consideration for Installation Facilities

① Sunrise Japan Hospital

・We examine the economic efficiency related to the introduction of photovoltaic power generation system.

【Approximate initial investment amount】

・We asked solar panel construction experts accompanying on-site survey to calculate the initial investment per solar panel capacity. An approximate estimate is shown in Figure 3.3.3-1.

Figure 3.3.3-1 Estimate of the initial investment per solar panel capacity

Material expenses		Construction cost	
name	Price/kW	name	Price/kW
panel	¥99,000	Racks installation (together with panels)	¥68,000
Power Conditioner	¥13,000	Electrical construction	¥45,000
Cubicle	¥16,000	Electrical incidental	¥13,000
Connection box	¥4,000	Monitoring device installation	¥1,500
Currency collection box	¥4,000	Safety measure	¥8,000
Cable	¥1,500	Overhead expenses	¥6,200
Monitoring device	¥4,000		
total	**¥141,500**	**total**	**¥141,700**
Equipment cost + material expenses		**¥283,200**	**/kW**

・As estimated in Section 3.3.2, the solar cell capacity is 81.4 kW. Therefore, the approximate initial investment amount is approximately 23 million yen (200 thousand USD).

(81.4 kW x 283,200 yen / kW = 23,052,480 yen ≈ 200,000 USD)

(Calculated as ※ 1 USD = 115 yen)

※This calculation is an assumed value for grasping the scale of the project, and detailed study including solar panel manufacturers, construction companies, etc. is necessary for promoting implementation.

【Approximate annual electricity cost reduction amount】

・Estimated annual power generation amount estimated in 3.3.2 was about 110,000 kWh / year. Since this power generation amount is smaller than the power consumption amount used by the hospital, the whole amount of the generated power is used as self power consumption, which leads to reduction of electric energy purchased from grid electric power.

・Since the electricity charge per kWh contracted by Sunrise Japan Hospital is approximately 0.19 (USD / kWh), the electricity cost that can be reduced by solar power generation will be approximately 20,000 (USD / year) per year.

・Estimated by the following formula.

Estimated annual electricity reduction (USD / year) = estimated annual electricity generation (kWh / year) x electricity charge per kWh (USD / kWh)

(110,000 kWh / year x 0.19 USD / kWh = 20,900 USD / year)

※This calculation is an assumed value for grasping the scale of the project, and detailed study including solar panel manufacturers, construction companies, etc. is necessary for promoting implementation.

【Hearings to the hospital】

・In addition to the results of the last fiscal year's study, we explained the mechanism of the ESCO type business model and asked for cooperation as a user of it. Since the scale of introduction is 81.4 kW, which is not a large scale. Hence, we are considering if it is possible to reduce the unit price per capacity by procuring simultaneously with large projects of other candidate companies etc.

・Because it was just opened in September 2016, they do not think of a high initial investment from self-funds at the present time. Therefore, they are interested in this ESCO type business model, which can introduce equipment without burden of initial investment.

② Phnom Penh Water Supply Authority

・We conduct economics evaluation of introducing solar power generation system to the two water purification plants of Phnom Penh Water Supply Authority.

【Approximate initial investment amount】

・Although the cost of initial investment varies depending on solar panel manufacturers and construction companies, in order to grasp the approximate initial investment amount, multiply the unit price per wattage by the solar panel capacity (wattage) to be introduced estimated the initial investment amount. Assuming the unit price per wattage as 2,000 (USD / kW), rough calculation was done.

・As described in section 3.3.2, The approximate solar panel capacities were as follows:

- Chroy Changvar WTP: 552kW
- NirothWTP: 1,884kW

・Therefore, the approximate initial investment costs are as follows:

- Chroy Changvar WTP : 1,104,000 USD
  （552 kW x 2,000 USD/kW = 1,104,000USD）
- Niroth WTP : 3,768,000 USD
  （1,884 kW x 2,000 USD/kW = 3,768,000 USD）

※This estimation is for grasping the scale of the project, and detailed study including solar panel manufacturers and construction companies etc. is necessary for promoting commercialization.

【Approximate annual electricity cost reduction】

・As shown in section 3.3.2, the approximate annual power generation of each water treatment plant was as follows:

- Chroy Changvar WTP : Approx. 744,000 (kWh/year)
- Niroth WTP : Approx. 2,539,000 (kWh/year)

・Since this amount of power generation is less than the amount of power consumption used by the water treatment plant, all generated power is used as self-consumption, which leads to a reduction in the amount of electricity purchased from the grid power.

・The electricity cost that can be reduced by photovoltaic power generation was estimated by the following formula:

Approximate annual electricity cost reduction (USD / year) = estimated annual electricity generation (kWh / year) x electricity price per kWh (USD / kWh)

・Since the electricity price per kWh contracted by Phnom Penh Water Supply Authority is approximately 0.167 (USD / kWh), the

electricity cost that can be reduced by solar power generation is as follows:

- Chroy Changvar WTP: Approx.124,000 (USD/year)
  (744,000 kWh/year x 0.167 USD/kWh = 124,248 USD/year)
- Niroth WTP: Approx.424,000 (USD/year)
  (2,539,000 kWh/year x 0.167 USD/kWh = 424,013 USD/year)

※This estimation is for grasping the scale of the project, and detailed study including solar panel manufacturers and construction companies etc. is necessary for promoting commercialization.

【Hearing to Phnom Penh Water Supply Authority】

・Regarding the results of the above discussion, we discussed the possibility of project formulation with Phnom Penh Water Supply Authority. They advised a few comments comparing with other proposals for solar panel from Taiwan companies and Singapore companies. The introduction space of solar panel and capacity of power generation are almost same with proposal from the other company. We heard that the investment cost of other company's proposal was cheaper than our proposal, but it is probably using inexpensive panels made in foreign countries. We consider that by utilizing JCM financing programme, and by reducing the unit cost per capacity by procuring simultaneously with large projects of other candidate companies etc. as ESCO type business model.

・They are very interested in this ESCO type business model which can be introduced without burden of initial investment

【Rough Study of ESCO type business model】

・As described in above, since the second fund of MGM Sustainable Energy Fund, which can be invest in southeast Asia, is under preparation, we conducted the payback period assuming ESCO type business model in a simplified manner.。

・Regarding the ratio of subsidy, the upper limit of subsidies is determined for each country and for each number of applied technology in JCM financing programme. Since the number of solar power projects adopted in Cambodia is three, the subsidy rate for the next entry is 40% at the maximum. Figure 3.3.3-2 shows the upper limit of subsidy rate and the number of projects adopted in Cambodia.

➢ Subsidy rate varies depending on the number of projects using similar technology in the country.

The number of projects using similar technology in the country	0 (first case)	From 1 to 3	Over 4
Upper Limit of Subsidy Rate	Maximum 50 %	Maximum 40%	Maximum 30%

➢ In Cambodia, upper limits of subsidy are as follows:

Technology	Chiller	LED Street Lighting with Dimming System	Frequency Inverter for Pump	Solar Power Plant
Number of Projects	1	1	1	3
Upper Limit of Subsidy Rate	Max. 40%	Max. 40%	Max. 40%	Max. 40%

Figure3.3.3-2 Upper limit of subsidy rate and the number of projects adopted in Cambodia

＜Chroy Changvar water treatment plant＞

・Simple trial calculation of payback period and internal rate of return (IRR) was carried using a few the precondition shown in Figure 3.3.3-3. Figure 3.3.3-4 shows the results of simplified cash flows, Figure 3.3.3-5 shows the results of estimating the payback period and internal rate of return (IRR).

・The electricity cost that Phnom Penh Water Supply Authority pays to ESCO operators is estimated assuming 0.12 USD per kwh. Since the electricity payment originally paid to grid is 0.167 USD / kWh. Hence, it is set to be cheaper by 47 cents per kWh, and it is a trial calculation which is sufficiently beneficial also as Phnom Penh Water Supply Authority. For pricing in implementation phase, it is necessary to discuss the details such ad lease period, compensation amount, etc. among fund, ESCO companies and Phnom Penh water supply authority.

Figure 3.3.3-3 Precondition of Simulation: Chroy Changvar

Precondition

Item	Remark	Value	Unito
Initial Cost	552 kW x 2,000 USD/kW	1,104,000	USD
Ratio of Subsidy		40	%
Subsidy Amount		441,600	USD
Amount of self-payment of Initial Cost		662,400	USD

	item	Valure	Unit
The other assumption for simulation	Monitoring Period	17	year
	Expected Anuual Power Generation	744	MWh
	O&M Cost: Assumed 1% of Initial Cost	1,104	USD
	Current Electricity Price	0.167	$/kWh
	Electricity Price for ESCO business (Assumptio	0.120	$/kWh

Figure3.3.3-4 Cash flow simulation: Chroy Changvar

			1年目	2年目	3年目	4年目	5年目	年目	17年目
Intial Cost without subsidy	Initial Cost	1,104,000	0	0	0	0	0	0	0
	subtotal (USD)	1,104,000	0	0	0	0	0	0	0
Intial Cost with subsidy	Amount of self-payment of Initial Cost	662,400	0	0	0	0	0	0	0
	subtotal (USD)	662,400	0	0	0	0	0	0	0
	Expected Annual Power	0	744	744	744	744	744	744	744
	Electricity Price ($/kWh)	0	0.120	0.120	0.120	0.120	0.12	0.120	0.120
	Avenue of ESCO business (USD)	0	89,280	89,280	89,280	89,280	89,28	89,280	89,280
	Subtotal (USD)	0	89,280	89,280	89,280	89,280	89,28	89,280	89,280
	O&M Cost (USD)	0	▲ 1,104	▲ 1,104	▲ 1,104	▲ 1,104	▲ 1,1	▲ 1,104	▲ 1,104
	Subtotal(USD)	0	▲ 1,104	▲ 1,104	▲ 1,104	▲ 1,104	▲ 1,1	▲ 1,104	▲ 1,104
Cash flow without subsidy	Avenue - O&M Cost	0	88,176	88,176	88,176	88,176	88,	88,176	88,176
	Subtotal (USD)	▲ 1,104,000	88,176	88,176	88,176	88,176	88,	88,176	88,176
Cash flowt with subsidy	Avenue - O&M Cost	0	88,176	88,176	88,176	88,176	88,1	88,176	88,176
	Subtotal (USD)	▲ 662,400	88,176	88,176	88,176	88,176	88,1	88,176	88,176

Figure3.3.3-5 Payback Period and IRR: Chroy Changvar

Without Subsidy	**Payback Period**	**12.5 year**
	Internal Rate of Return (IRR)	**3.6%**
With Subsidy (40%)	**Payback Period**	**7.5 year**
	Internal Rate of Return (IRR)	**11.1%**

※This estimation is for grasping the scale of the project, and detailed study including ESCO business provider, solar panel manufacturers and construction companies etc. is necessary for promoting commercialization.

・In the simple trial calculation, with subsidy, payback period is 7.5 years, and it can be said that the value meets the criteria of 5 to 8 years or less, which is the criterion for the initial study of the MGM Sustainable Energy Fund.

・ However, since the subsidy rate is a trial calculation with the upper limit of 40%, there are also criteria for cost-effectiveness (subsidy amount ÷ (CO2 emission reduction amount / year × statutory useful life year)), so the subsidy rate may less than 40%. Figure 3.3.3-6 shows the sensitivity analysis results of payback period analyzed by the total project cost (initial investment amount) and subsidy rate parameters.

Figure3.3.3-6 Sensitivity Analysis of payback Period : Chroy Changvar

Payback Period		Initial Cost (USD)			
		800,000	900,000	1,000,000	1,104,000
Ratio of Subsidy (%)	40	5.42	6.11	6.80	7.51
	35	5.88	6.62	7.36	8.14
	30	6.33	7.13	7.93	8.76
	25	6.78	7.64	8.50	9.39
	20	7.23	8.15	9.06	10.02
	15	7.69	8.66	9.63	10.64

＜Niroth water treatment plant＞

・Simple trial calculation of payback period and internal rate of return (IRR) was carried using a few the precondition shown in Figure 3.3.3-7. Figure 3.3.3-8 shows the results of simplified cash flows, Figure 3.3.3-9 shows the results of estimating the payback period and internal rate of return (IRR).

・The electricity cost that Phnom Penh Water Supply Authority pays to ESCO operators is estimated assuming 0.12 USD per kwh. Since the electricity payment originally paid to grid is 0.167 USD / kWh. Hence, it is set to be cheaper by 47 cents per kWh, and it is a trial calculation which is sufficiently beneficial also as Phnom Penh Water Supply Authority. For pricing in implementation phase, it is necessary to discuss the details such ad lease period, compensation amount, etc. among fund, ESCO companies and Phnom Penh water supply authority.

Figure 3.3.3-7 Precondition of Simulation: Nitroth

Precondition

Item	Remark	Value	Unito
Initial Cost	1,884 kW x 2,000 USD/kW	3,768,000	USD
Ratio of Subsidy		40	%
Subsidy Amount		1,507,200	USD
Amount of self-payment of Initial Cost		2,260,800	USD

	item	Valure	Unit
The other assumption for simulation	Monitoring Period	17	year
	Expected Anuual Power Generation	2,539	MWh
	O&M Cost: Assumed 1% of Initial Cost	3,768	USD
	Current Electricity Price	0.167	$/kWh
	Electricity Price for ESCO business (Assumptio	0.120	$/kWh

Figure3.3.3-8 Cash flow simulation: Niroth

			1年目	2年目	3年目	4年目	5年目	年目	17年目
Intial Cost without subsidy	Initial Cost	3,768,000	0	0	0	0	0	0	0
	subtotal (USD)	3,768,000	0	0	0	0	0	0	0
Intial Cost with subsidy	Amount of self-payment of Initial Cost	2,260,800	0	0	0	0	0	0	0
	subtotal (USD)	2,260,800	0	0	0	0	0	0	0
	Expected Annual Power	0	2,539	2,539	2,539	2,539	2,539	2,539	2,539
	Electricity Price ($/kWh)	0	0.120	0.120	0.120	0.120	0.12	0.120	0.120
	Avenue of ESCO business (USD)	0	304,680	304,680	304,680	304,680	304,68	304,680	304,680
	Subtotal (USD)	0	304,680	304,680	304,680	304,680	304,68	304,680	304,680
	O&M Cost (USD)	0	▲ 3,768	▲ 3,768	▲ 3,768	▲ 3,768	▲ 3,7	▲ 3,768	▲ 3,768
	Subtotal(USD)	0	▲ 3,768	▲ 3,768	▲ 3,768	▲ 3,768	▲ 3,7	▲ 3,768	▲ 3,768
Cash flow without subsidy	Avenue - O&M Cost	0	300,912	300,912	300,912	300,912	300,	300,912	300,912
	Subtotal (USD)	▲ 3,768,000	300,912	300,912	300,912	300,912	300,	300,912	300,912
Cash flowt with subsidy	Avenue - O&M Cost	0	300,912	300,912	300,912	300,912	300,	300,912	300,912
	Subtotal (USD)	▲ 2,260,800	300,912	300,912	300,912	300,912	300,9	300,912	300,912

Figure3.3.3-9 Payback Period and IRR: Niroth

Without Subsidy	**Payback Period**	**12.5 year**
	Internal Rate of Return (IRR)	**3.6%**
With Subsidy (40%)	**Payback Period**	**7.5 year**
	Internal Rate of Return (IRR)	**11.1%**

※This estimation is for grasping the scale of the project, and detailed study including ESCO business provider, solar panel manufacturers and construction companies etc. is necessary for promoting commercialization.

・In the simple trial calculation, with subsidy, payback period is 7.5 years, and it can be said that the value meets the criteria of 5 to 8 years or less, which is the criterion for the initial study of the MGM Sustainable Energy Fund.

・ However, since the subsidy rate is a trial calculation with the upper limit of 40%, there are also criteria for cost-effectiveness (subsidy amount ÷ (CO2 emission reduction amount / year × statutory useful life year)), so the subsidy rate may less than 40%. Figure 3.3.3-6 shows the sensitivity analysis results of payback period analyzed by the total project cost (initial investment amount) and subsidy rate parameters.

Figure3.3.3-10 Sensitivity Analysis of payback Period : Niroth

Payback Period		Initial Cost (USD)			
		3,000,000	3,250,000	3,500,000	3,768,000
Ratio of Subsidy (%)	40	5.97	6.47	6.97	7.51
	35	6.46	7.01	7.55	8.14
	30	6.96	7.55	8.13	8.77
	25	7.46	8.09	8.72	9.39
	20	7.96	8.63	9.30	10.02
	15	8.45	9.16	9.88	10.64

3.3.4 Study on Calculation Method of CO2 Reduction Effect and Monitoring Method

① Sunrise Japan Hospital

【Approximate CO2 reduction effect】

・We examine the effect of CO2 reduction and monitoring method related to the introduction of photovoltaic power generation system.

・The approximate annual power generation amount estimated in 3.3.2 was about 110,000 kWh / year. Since this amount of electric power generation is less than the electric power consumption of the hospital, the whole amount of the electric power generated is used as self power consumption, and it is possible to reduce the amount of electric power procured from the conventional electric power system. Through this reduction, CO2 emissions are reduced by reducing the amount of electricity procured from fossil fuels.

・According to the survey results of the Public Interest Foundation Corporation Global Environment Centre Foundation, Cambodia's grid emission coefficient is 0.641 (ton-CO2 / MWh). It is shown in Figure 3.3.4-1. Last year's survey used this value.

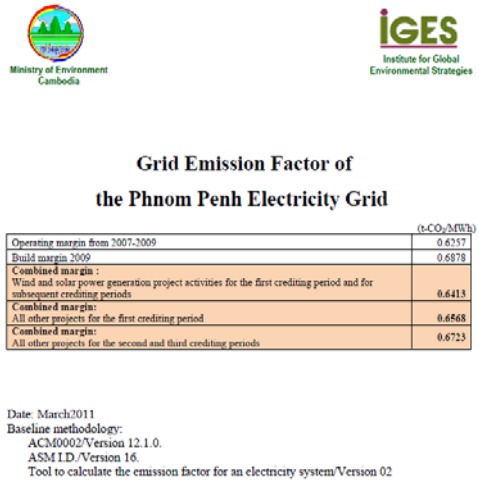


Figure 3.3.4-1 Grid emission factor in Cambodia (Source: GEC)

・However, from the 2nd public calling of JCM financial programme in FY2007, the grid emission factor used for proposals was determined for each country and category. Since this technology is a category of renewable energy, it is not "when replacing in-house generation," 0.353 (tonCO 2 / MWh) is applicable. Figure 3.2.4-1 shows the grid emission factor set for 2nd calling for JCM financing programme..

Figure 3.3.4-2 Grid Emission Factors by JCM Application

[Note] This list is used to application of JCM Financing Program and does not predict JC's decision.

FY2017 JCM Financing Program: List for CO2 emission factor (tCO2/MWh)

No.	Contory	Energy Efficiency			Renewable Energy		
		All	Other than left	When replacing in-house generation	All	Other than left	When replacing in-house generation
11	Cambodia	–	See table 3	0.8	–	0.353	0.533

Table 3 Cambodia

No.	Grid	Energy Efficiency
1	National Grid	0.384
2	Kampot-Sihnouk Grid	0.643
3	Kampong Cham Grid	0.724

Source: GEC「FY2017 JCM Financing Program: List for CO2 emission factor (tCO2/MWh)」

・Therefore, instead of 0.641 (tonCO 2 / MWh), this fiscal year we are revising the estimate using 0.353 (tonCO 2 / MWh) prescribed in the requirements for JCM financing programme.

・Regarding the introduction of photovoltaic power generation systems, a method for calculating a certain CO2 reduction effect has already been established.

・Since the Public Interest Foundation Corporation Global Environment Centre Foundation published a worksheet to calculate the annual estimated effective total power generation of the photovoltaic power generation system and the CO2 reduction effect when applying for JCM equipment financing projects, in this project, based on this calculation method, the CO2 reduction effect by realizing this project was calculated. The result shows in Figure 3.4.4-3.

・As a result of trial calculation, the estimated CO2 reduction effect is 38.8 ton-CO2 / year.

Figure 3.2.4-3 Approximate CO2 reduction effect (Sunrise Japan Hospital)

Estimated effective total generated electricity per year	110,000	kWh/yr

(1)In case of self-power-consumption only

emission factor of self power consumption	0.353	(ton-CO2/MWh)

Reference CO2 emissions Re1	38.83	ton-CO2/yr
1Project CO2 emissions Pj1	0	ton-CO2/yr

CO2 emission reduction amount Q1=(Re1-Pj1)	38.8	ton-CO2/yr

(Source: Created from application form for Public Interest Foundation Corporation Global Environment Centre Foundation)

② Phnom Penh Water Supply Authority

・We study CO2 reduction effect and monitoring method leading to introduction of photovoltaic power generation system.

・As shown in section 3.3.2, the approximate annual power generation of each water treatment plant was as follows:

Chroy Changvar WTP : Approx. 744,000 (kWh/year)

Niroth WTP : Approx. 2,539,000 (kWh/year)

・Since this generated electricity is less than the electricity consumption of the water treatment plant, all generated electric power is used as self-consumption, and it is possible to reduce the amount of electric power procured from the power grid. Through this reduction, CO2 emissions are reduced by reducing the amount of electricity procured from grid which emits fossil fuels.

・As mentioned above, for the grid emission factor, use the grid emission factor prescribed in the application for JCM financing programme in FY2007. Since this technology is a category of renewable energy, it is not "when replacing in-house generation," 0.353 (ton CO 2 / MWh) is applicable. (See Chart 3.3.4-2)

・Since the Public Interest Foundation Corporation Global Environment Centre Foundation published a worksheet to calculate the annual estimated effective total power generation of the photovoltaic power generation system and the CO2 reduction effect when applying for JCM equipment financing projects, in this project, based on this calculation method, the CO2 reduction effect by realizing this project was calculated.

The result for Chroy Changvar WTP shows in Figure 3.4.4-4 and the result for Niroth WTP shows in Figure 3.4.4-5.

・As a result of rhe calculation, the approximate CO2 reduction is as follows:

- Chroy Changvar WTP: approx. 262 (tonCO2/year)
- Niroth WTP: approx. 896 (tonCO2/year)

Figure3.4.4-4 Approximate CO2 reduction effect (Chroy Changvar WTP)

Estimated effective total generated electricity per year	744,000	kWh/yr

(1)In case of self-power-consumption only

emission factor of self power consumption	0.353	(ton-CO2/MWh)

Reference CO2 emissions Re1	262.6	ton-CO2/yr
1Project CO2 emissions Pj1	0	ton-CO2/yr

CO2 emission reduction amount Q1=(Re1-Pj1)	262.6	ton-CO2/yr

(Source: Created from application form for Public Interest Foundation Corporation Global Environment Centre Foundation)

Figure3.4.4-5 Approximate CO2 reduction effect (Niroth WTP)

Estimated effective total generated electricity per year	2,539,000	kWh/yr

(1)In case of self-power-consumption only

emission factor of self power consumption	0.353	(ton-CO2/MWh)

Reference CO2 emissions Re1	896.2	ton-CO2/yr
1Project CO2 emissions Pj1	0	ton-CO2/yr

CO2 emission reduction amount Q1=(Re1-Pj1)	896.2	ton-CO2/yr

(Source: Created from application form for Public Interest Foundation Corporation Global Environment Centre Foundation)

3.2.5 Consideration for Implementation of JCM

As a provider of the ESCO type business model, we assume "MGM Sustainable Energy Fund" introduced in Section 3.3.1.

・The fund is a fund that invested in energy efficiency projects and renewable energy projects in Latin America. Using similar scheme, a few projects are awaded as JCM financing progreamme in Costa Rica, Mexico and Chile working with NTT Data Institute of Management Consulting, Inc.

・Currently preparing for the launch of the second fund, it is considered to investing 10% of the fund's investment in Southeast Asia. It is assumed that it will be possible to provide ESCO type business model in Southeast Asia as soon as the Fund launched.

・Figure 3.3.5-1 and 3.3.5-2 show the assumed organization of JCM financing programme cooperating with MGM Sustainable Energy Fund.

・ For the representative company, (A), MGM Inova Capital Japan Co., Ltd. established in May 2017 is assumed.

・ (B) ESCO type business model provider is supposed to establish a special purpose company by each countries and businesses, by funded by MGM Sustainable Energy Fund.

・ (C) assumes Sunrise Japan Hospital and Phnom Penh Water Supply Authority, which are local company we have conducted detail study.

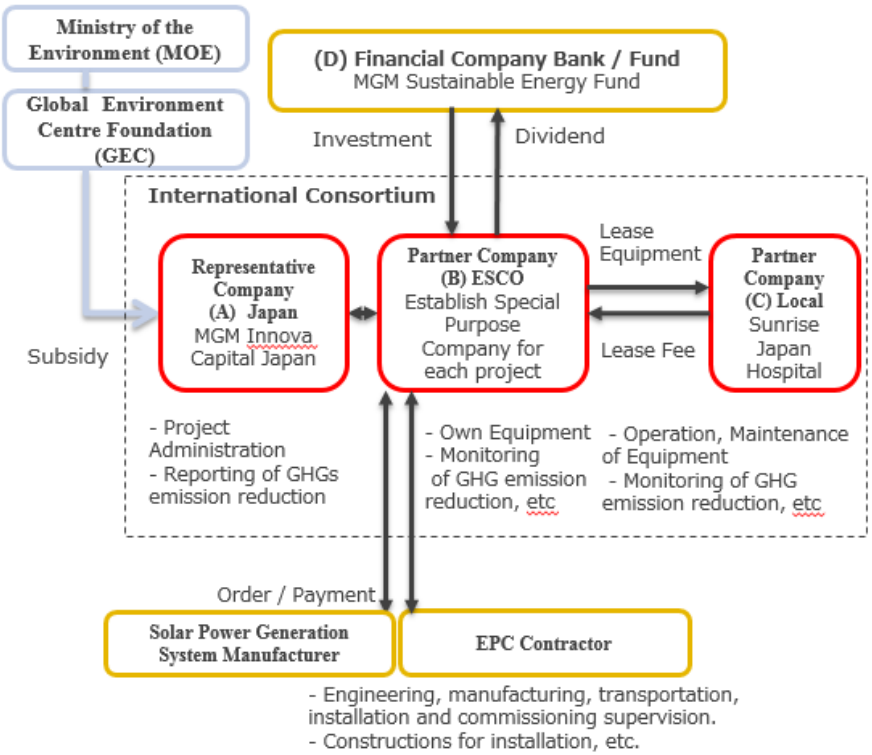


Figure 3.3.5-1 Image of Organization: Sunrise Japan Hospital

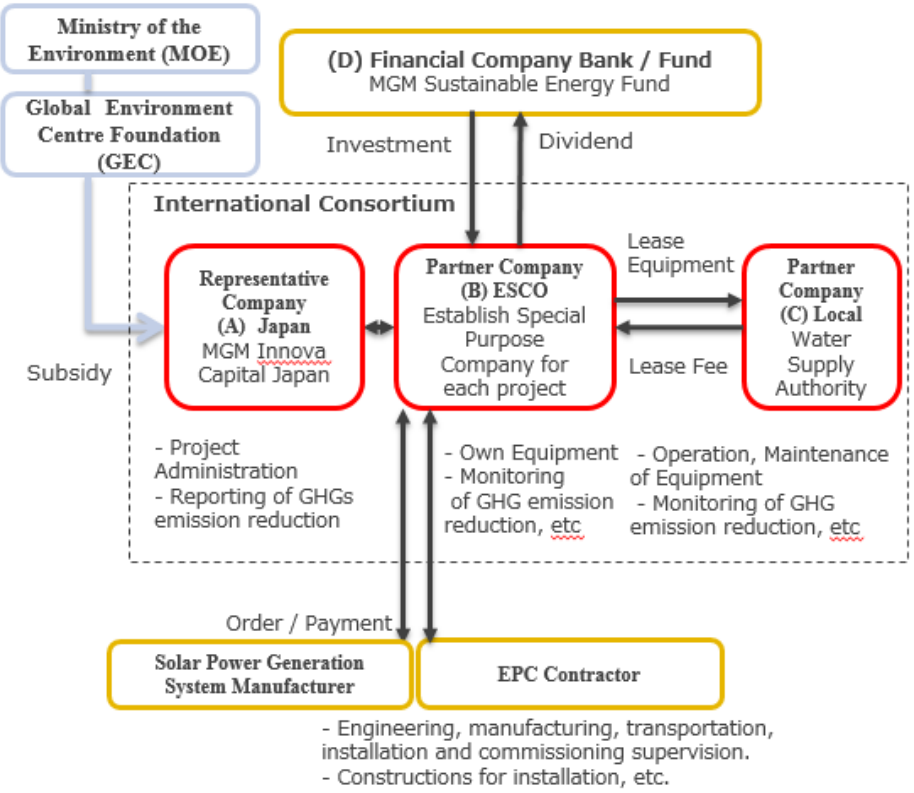


Figure 3.3.5-2 Image of Organization: Water Supply Authority

3.2.6 Issues in Implementation of JCM

・Issues for JCM implementation are summarized below.

- Establish the 2nd fund of MGM Sustainable Energy Fund which can be invest to South East Asia.
- Establish the Special Purpose Company who is provider of ESCO type business model.
- Detailed design and examination with photovoltaic panel manufacturers and construction companies
- Study for lease fee and lease period of ESCO type business model
- Support for decision-making for JCM project implementation

Chapter 4:　Attending Workshop

Chapter 4　Table of Contents

4.1 City-to-City Collaboration Project Workshop

(1) Overview

"City to City Collaboration Project Workshop" was held for domestic municipalities that have entrusted City-to-City Collaboration Programme for Low-Carbon Society in FY2017, and staff and related companies of Asian municipalities. Organized by the Ministry of the Environment, the workshop was held in Kawasaki City and Tokyo a total of twice in a year

(2) Date and time held

In Kawasaki city: 27- July to 28-July, 2017
In Tokyo City: 30-January, 2018

(3) Contents

Each seminar was held in the following program.

① In Kawasaki city

＜Day 1＞

- Session 1: Outline of City-to-City Collaboration Project and its Expected Outputs
- Session 2: The activities and issues for creating the low carbon society
- Session 3: Introduction of the activities for low carbon society by foreign cities
- Site Visit : Life science environment research center
- Site Visit : Ukishima-waste treatment plant, Rycling plant, Solar PV plant
- ＜Day 2＞
- Session 4: Strategy for good outcome by promoting city to city collaboration
- Session 5: Introduction of the activities for low carbon society by foreign cities
- Site Visit : corelex
- Site Visit : petrefinetechnology

② In Tokyo metropolitan area

(Morning section) Private seminar

- Greeting from the organizer
- Project case briefing session
- Overview of fund scheme

(Afternoon section) Open seminar

- Greeting from the organizer
- Introduction of financial support schemes and examples to promote low carbonization in Asian cities
- Examples of actions taken by participating cities of Intercity Collaboration projects
- Panel Discussion
- Closing remarks

(4) Reference materials

Minutes from participating in the seminar on the day and materials used by our company for presentation are attached as reference materials.

（memo 1）

City to City Collaboration Project Workshop in Kawasaki
Minutes of Meeting

27 and 28-Jul, 2017
At Nikko Hotel Kawasaki

Minutes:

＜DAY1_27-Jul, 2017＞

I. 【Session 1: Outline of City-to-City Collaboration Project and its Expected Outputs】

1. Explanation (IGES Kataoka)

The number of visitors to cooperating cities increases year by year, and the expectation for each city action against climate change is increasing. Among the 17 goals of SDGs, it is said that the functions of cities are important as "goal 11. sustainable inter-city collaboration".

This intercity cooperation effort is important for promoting low carbon society, urban toughness and sustainable development, and can also contribute to the achievement of SDGs goal.

2. Overview of City-to-City Collaboration Projects and its Expected Outputs (MOE Mr. Sai)

It is the purpose of this WS to reaffirm the final goal and what to do this year.

① The role of the city on climate change。

- Two points were reconfirmed at COP 21: 1) recognizing activities of non-government actors, 2) cooperation between central government and local governments is important.
- · Also at the Environment Ministers Meeting held in Toyama in 2016, the importance of urban roles was reaffirmed. We unanimously agreed to encourage activities of the city.

② About the scheme of cooperation between cities

Formation among Private enterprises, Cities in Japan (municipalities) and Cities in overseas cities. As a role of cities in Japan, sharing, supporting and guiding the environmental technologies and know-how that each city possesses to overseas cities, supporting plan formulation, establishing environmental standards, creating a foundation for building a low-carbon city, operating them It is to support such as skill up to do.

③ Flow of excavation of project

The flow of excavation of projects is as follows.

Phase 1: Plan formulation (prioritization) → Phase 2: Survey of local needs → Phase 3: Detailed examination, selection of candidate sites, confirmation of legal system → Phase 4: Project realization

We are expecting support and cooperation such as support for project finding from local cities at each phase and provision of information such as local legal system.

④ Main milestones until project implementation

The main milestones are as follows.

Basic study → Technical study → Economic consideration → Preparation of initial investment cost → Adjustment with stakeholders → preparation for JCM financing programme

In particular, procurement of initial investment cost is important for project formulation, and we are expecting to coordinate with representative company and partner companies.

I would like you to discuss directly through activities in intercity collaboration and form projects with more feasibility.

Also, we plan to hold seminars similar to this seminar at the beginning of 2018, so please do a feedback again and check the shortcomings etc. in each group.

⑤ Explanation of JCM

A brief introduction was given about the background of JCM, the signatory countries, financial support schemes, etc.

⑥ Results of last fiscal year

It was introduced as the main achievement that information on tours and workshops in Kitakyushu and intercity collaboration projects at COP 22 was disseminated.

II. 【Session 2: The activities and issues for creating the low carbon society】

1. Low carbonization in Kawasaki city (Kawasaki)

Kawasaki city works in collaboration with Yangon and JCM projects are being implemented. Introduction about low carbon initiatives in Kawasaki city, especially low carbon initiatives at the coastal area where you are visiting.

· Kawasaki Environmental Research Institute Environmental Monitoring

· Ukishima processing center, resource recycling facility, → a case example of collaboration between companies.
· Mega solar, example of reenergization
· Iriyasaki Water Treatment Center Re-Energy Case
· Corex San-Ei PET to PET → a case example of corporate collaboration

○Explanation of the coastal area

Explanation about the use of residents' beach at the Kawasaki coastal area of the past. Although it was originally a natural and rich area, landfill progresses gradually, and many industries have gathered (1960 - 1970). After that, it gets annoyed by pollution problems. Considering the economic growth rate, is not it similar to the city of the former Kawasaki and guests' cities? What situation did Kawasaki once fell into? The living environment of citizens is polluted, industrial waste water to the Tama river, illegal dumping of a large amount of garbage. Air pollution. Introducing photos of the coastal area. Air is cloudy due to air pollution. As the environment improvement (administration + citizen + local company's efforts) from this situation progressed, it is now beautiful, the coastal area · Tama river is a leisure spot. Ayu was also confirmed in the Tama River.

○Three cases of low-carbon initiatives in Kawasaki city

①Kawasaki Eco Town

First certification when the Ministry of the Environment and the Ministry of Economy and Trade began projects about 10 years ago (as in Kitakyushu city)
· Manufacture of ammonia as a plastic raw material at Showa Denko
· Eco cement. Waste used as cement raw material
· Corex Sanei. We use wastewater treated water for making toilet paper.

② Renewable energy equipment (highly efficient power plant using PV, biomass, natural gas)

Hydrogen strategy

We are devising three strategies with the aim of utilizing hydrogen discharged from the petrochemical complex as energy. 1. Supply system, 2. Introduction of utilization technology as energy, 3) To promote society utilizing hydrogen. As a project to realize these, the following three points were introduced.

A) FCV. Kawasaki is also owned by a public vehicle (Toyota's Mirai). In addition, a hydrogen station is installed as a hydrogen supply source.
B) (A) As an effort towards supply, take out hydrogen from the plastic of Showa Denko (Kawasaki KPR) in the process of ammonia formation.
C) (B) We also have BCP in cooperation with Toshiba. Fuel cell

container. H2 ONE unit. Generate hydrogen from the electricity generated by the solar panel and store it. It is possible to supply electricity for 300 people, hot water supply, and it is possible to operate continuously for one week.

2. Japan Environment Sanitation Center

Tender process and system for the suitable technology installation

① raised the issue of infrastructure export

I would like to spread Japan's excellent environmental technology to Asia, but there are many problems in each country in terms of institution. I am thinking about various support, but when exporting public works, there are parts that Japanese do not understand, I would like to organize and raise problems. In Japan, I have made sophisticated things, but I can not export to Asia as it is. For example, garbage disposal in Asia. Some cities are doing good modernization of garbage disposal flow, others are not so, and as a result there are problems in terms of environmental hygiene.

There, the use of private vitality is increasing. In Japan, municipalities plan themselves, EPC, O & M are also outsourced to the private sector, so it is characterized by high expertise in local government planning. The challenges in doing this approach are the formulation of a business model, the FS to respond to the problem, and the proposal of a scheme.

The Japanese government also supports this FS and hopes that Japanese companies will efficiently enter Asian cities.

About the scheme of BOT. There is not only a chipping fee, but a viewpoint of electricity sales income is necessary. It is difficult to secure profitability alone with a chipping fee.

The case in Bandung city was also explained.

② About the bidding process

Facility Plan formulation → Site selection · Environmental Impact Assessment · Consensus formation with local citizen → PPP FS → bid → contract

There is a method called "voluntary contract after comparative examination of proposal" rather than comprehensive evaluation method bidding.

Bidding in Asia is being conducted, but some do not progress after bidding. Succeeded in Thailand, but not in Jakarta or Bandung. I get a bidding process and go to O & M, but I can see a case of bidding and stopping. There are also cases where the bid itself does not advance, and this can not raise a hand from the viewpoint of risk. For this reason, it is necessary to clarify the risk with FS, but there is a problem that the flow from FS to bidding expires.

In recent Japan, PPP has come in and not only construction but also private sector is in charge of operation. Feasibility Plan, Site selection + EIA (Resident agreement in Japan is troublesome, it takes about 5 years, taking time to look at Japan) Consideration of business scope. In the case of Japan, there are few issues of initial funding. The central ministries have great financial support.

③ Case Study in Asia

In Malaysia, Malaysia tender process by KPI comprehensive evaluation method is made. We maintain bidding quality through screening.

In Indonesia, it is a procedure that evaluates the hardship of the first proposer. It is very important to negotiate how much electricity sale income can be bought, but this process is not transparent, it is unclear because there are multiple procedures and moreover it is difficult to create a business.

The Swiss challenge method is interesting in the Philippines. Is not it the way of giving privilege to those who first performed FS in popularization in Asia.

④ Summary

It is important to create a bidding process together with the site. Capacity building is necessary, and it is necessary to take advantage of the use of the Swiss challenge method.

Improvement of the bidding process is necessary, such as a one - stop system when giving permission, a persistent system on residents' consensus.

3. Supporting the establishment of a low-carbon action plan (JCM / AIM's initiative)

- Support for the establishment of a low-carbon action plan (JCM / AIM initiatives) was introduced.
- We have created a system to simulate and evaluate the environmental impact of projects and support them using this system. It is aimed to quantify the impact, to make it visible, to grasp the current situation, to utilize it for future planning and so on.
- Each city has a potential that is close to 10 times the amount of CO2 reduction of projects studied through collaboration among cities. It is important to advance the scale-up.
- Therefore, I would like you to formulate an action plan for each city and promote activities.

III. 【Session 3: Introduction of the activities for low carbon society by foreign cities】

1. Myanmar Yangon / Mr. Zaw Win Naing （YCDC : Yangon City Development Committee）

Main explanation of cooperation with Kawasaki city is main. Utilizing the scheme of JCM, we will try to improve and normalize the atmosphere and water environment. Particularly by making garbage compost and recycling, educational dissemination in this field, we aim to establish Eco Town.

There was explanation about waste management, solar power generation, water supply and sewage management.

2. Thailand Ms. Mayuree Deeroop （Port Authority of Thailand＝PAT）

Introduction of Thailand's port managed by PAT. We have set up a framework for reducing GHG emissions and sustainable development at ports.

"PAT's environmental master plan and estimation emission baseline." We aim to reduce 10% in the six years from 2013 to 2019.

3. Vietnam Hai Phong Mr. Mai Quang Tho （Hai Phong City）

Introduction of sister city relations with Kitakyushu city, OECD Green City Program, city low carbonization activities from Hai Phong City Foreign Affairs Bureau.

3 items on JCM projects.

· Pilot project introduction of EV bus in Katoba Island
· Waste heat recovery power generation business of industrial waste.
· Takakura compost example Planned amount of 50 tons / day in the future.

As future challenges and challenges by introducing JCM, it is necessary to formulate policies, establish laws and regulations, formulate a management scheme of the city, make Hai Phong city unique based on examples with Kitakyushu city, technical and personnel There was a shortage.

We point out that the problem of enterprises is the lack of such technology and the lack of long-term strategy.

As a proposal to Kitakyushu City, training on PPP, waste management / environmental technology field, creation of new project was presented.

4. Myanmar Ayabwadi Division Mr. Ye Tun （The Government of the Ayeyawaddy Resion）

It is a province in the southern part of Myanmar and has a population of about 300,000. Fukushima city, Fujita, MRI in cooperation with JCM to commercialize. We are examining JCM for solar power generation.

Economically it is in the development stage, there are many policies to set the foundation as the industrial policy of the province. As urgent issues of the country, it is necessary to relax the barriers to the creation of new business, promote the flow of investment, develop human resources education, develop business tutor service (BDS), create innovation, secure accessibility to the market, information utilizing the Web Transmission, access to energy sources and waste disposal. Also, the central government and municipalities have great interest in JCM.

We will promote waste management, including rice husk power generation in rural areas, and micro-grid in local communities in the Aiyadi district.

5. Cambodia Phnom Penh Mr. Keat Reinsey （Phnom Penh Department of Environment）

Introduction on waste management in Phnom Penh. Municipal waste, industrial waste, medical waste is divided into three. Municipal waste is handled by the ward, and Sintury is processing it. The Ministry of the Environment is responsible for industrial waste, and the Red Cross is in charge of medical waste. 1700 tons in one year. 69% are garbage.

Stung Meanchey treatment plant (closed) Dangkor treatment plant

Until 2009-2016, 40 million tons of city garbage are being processed. As a daily dose, 1.1 ton / day medical waste is treated, and 3.6 ton / day industrial waste is treated.

Challenges and challenges: There is a limit to fostering the awareness of residents, 3R measures by the government. Sorting collection is not done at the time of waste collection. As the most important point, the amount of hazardous waste has increased rapidly, and furthermore, it is not separated from general household waste.

At present, there is not enough funded capital investors to build a waste treatment plant with a consistent treatment process. As a result, landfill processing will increase.

6. Q&A

Moderator) About Thai PAT, what is the point of cooperation with Yokohama City?

Thailand) Consulting in energy calculation etc. The database is calculated and updated automatically every day

Japan Ministry of the Environment) About Vietnam. I would like to ask about the priority of this year.

Yangon) We will prepare a master plan for 2040 with local governments.

Hai Phong) We will specialize in waste management to realize a low-carbon society. Also, in terms of transportation, as I recommend in Cappado City, I will also promote clean transportation in Haiphong.

Japan Ministry of the Environment) Since we are promoting capacity building in foreign countries in Japan, we hope that we will push forward even in Hai Phong City and report the output in the next January.

Moderator) JCM expects not only the development of cities but also the development of policy and plan formulation on the environment. It was included in the announcement of each city. So, what kind of projects are given priority and how do you secure funds in the action plan?

Nguyan Trun Viet) Explain about Ho Chi Minh City. Push forward G to G first. Since it takes time in C to C, we will speed up the process with the private sector. Haiphong city is implementing it with Osaka city. We are also promoting City to Company, B to B.

The private intention in the city is Biogas or a small-scale renewable project. In addition, some companies efficiently utilize rainfall. Because water consumption is remarkable in the city and costs are costly, cost reduction is aimed at by efficient use of rainfall. In case

According to the result of rainfall analysis in Ho Chi Minh City concerning air pollution, the city has a very low pollution degree. (On the other hand, there are many cars in Bangkok, so the degree of pollution of rain is large.)

The issue in PV thinks that investment and government policy are the subjects.

Japan 's Ministry of the Environment) Ask questions to local governments in

Japan. In terms of implementation positioned in the action plan, as to how to do with the overseas counterparts, how is the part described in the action plan implemented

Kawasaki City) We are trying to make low carbon action plan in cooperation with Yangon City. Kawasaki City also has a plan as a municipality, but since it is difficult to apply it to the site as it is, it is assessing it by drafting what is applicable to the locale while grasping the needs of the locality. Japanese municipalities have taken the flow of securing budget and implementing based on the plan, but since overseas does not always have such a recognition, how to recognize the meaning of the plan Is a problem. We will carry out such activities according to the action plan. I would like to promote using limited resources not limited to JCM

	
Workshop	Explanation

＜Day 1. 27-Jul Afternoon Site Visit＞

1. Life science environment research center

・Greeting

・History of pollution control in Kawasaki city

・Q&A

Yangon City) What is the use of drainage standard management as a parameter? And how do you manage it?

Director) For aqueous matter, harmful substances are concentration standards. When we inspected with drainage ditch, we gather water and analyze it. And we are seeking regular reports. Regarding living environment items, there are two types of concentration control and total amount control. Kawasaki City faces the Tokyo Bay, Tokyo Bay is a closed watershed, so it is low to be inspected. Three items of COD, nitrogen and phosphorus were verified.

For areas with high emissions, automatic measurement is carried out, and management is always done by the source telemeter. I have my information sent over the telephone line and check it. This telemeter is unique to Kawasaki. Regulation of continuous measurement is in the law, but checking it with a telemeter is the initiative of Kawasaki City and business operators.

Oriental Consultant) About exhaust gas etc of car. About the measurement of exhaust gas, does the city invest as the city of Kawasaki and measuring it?

Director) There are nine measuring stations in Kawasaki city. It is installed in an area where 144 square kilometers are divided almost by 9. Kawasaki city has seven districts of administrative districts and one place in each district, but the coastal area has added two places to the industrial area. Automobile exhaust gas detection. Regarding PM 2.5, there is a provision of the country for the installation place, there are conditions of the surrounding environment, and several places are set up in the place meeting it.

Collected data is gathered in this laboratory and it is now being able to be seen in terrestrial digital broadcasting in real time.

Oriental Consultant) How do you think the reasons for not meeting standards?

Director) Although measures against PM 2.5 are not taken, measures for particulate matter have been set in 2000 and countermeasures have been taken, SPM measures are effective for PM 2.5, and it is on a downward trend.

2. **Ukishima-waste treatment plant, Rycling plant, Solar PV plant**

Explained the facilities by office staff.。

3. **reception**

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Life science environment research center</td><td>Ukishima-waste treatment plant</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Solar PV plant</td><td>Recycling plant</td></tr>
</table>

＜DAY2_28-Jul＞

IV. 【Session 4: Strategy for good outcome by promoting city to city collaboration】

1. Joint Crediting Mechanism (JCM) and JCM Financing Program

・Explain the outline and current status of JCM projects

○Q&A

Ho Chi Minh City) How do you select target companies? There is a demonstration experiment of 5 million biogas power generation, but after two years the local organization can not raise funds, and four years pass without being an entrepreneur.

GEC) In JCM financing programme, it is important to locate the local company and it is necessary to select a firm. At the JCM financing programme, it is a mechanism that it is impossible to subsidize that the country itself introduces facilities. However, it is possible to utilize assistance for local governments and public corporations.

Ho Chi Minh City) In the Hitachi Zosen ship project, we are implementing a private project, but we must obtain permission from the local government. The asset belongs to the local government, and how should we pay the tax? How is the Japanese government conducting tax calculations? How about taxes on equipment, subsidies for environmental, global warming countermeasures projects?

Ministry of the Environment) Which taxes do you cover for taxes? MOE will pay subsidies for equipment.

Ho Chi Minh City) It is a story about how to do 50% of equipment assistance. Regarding policy, JCM belongs to the government, but the JCM scheme is a limited company. The JCM case belongs to the government, but what about the conflict around it. Who owns facilities / facilities?

Ministry of the Environment) In Yangon's example of waste heat recovery power generation, the city of Yangon owns the equipment, and Yangon City, the owner, pays tax. In the case of Ho Chi Minh, as the ownership of the biogas power generation facilities after the verification test was not clearly decided, it seems that they are also paying taxes. Thank you for sharing it as Lesson & Learnt.

2. ADB　JFJCM Fund

Explanation of ADB and JFJCM Fund

Exporting low-carbon technology by ADB's financial support, and aim for Japan's credit acquisition.

The budget for 2017 is 1 billion yen, and it supports two kinds of projects. One is sovereign assistance, one is nonsovereign, that is, funding for the private sector, and the subsidiary limits are different.

· Introduction of case examples (introduction of EMS incidental equipment in Maldives)

3. Energy cost reduction technology

It is energy saving data for enterprises. It has a technology of IOT and AI, has 12 places in Japan, and overseas has a station in Jakarta. We have reduced equipment energy costs by replacing facilities and improving operations for more than 2,000 companies in Japan. Evaluated and received awards. The domestic share of real-time monitoring and operational improvement is 28%, top share. Cost reduction contributed 10% reduction. Reduce costs by reducing the chore of human work.

It is pointed out that not only installing facilities but also consulting to the operation after introduction will not lead to actual reduction.

Moderator) What specific areas do you consider energy saving overseas?

Hirokawa) Energy conservation related to air conditioning is a strength. In the case of Japan, we may not use air conditioning, but we think that there is a potential for air conditioning management in Asia.

Ministry of the Environment) To what extent is the collection period of facilities assumed

Hirokawa) Regarding collection of equipment auxiliary projects, it is not an introduction of expensive equipment but operation improvement. In the case of airport projects in Indonesia, we are thinking about investing about 3 years.

V. 【Session 5: Introduction of the activities for low carbon society by foreign cities】

1. Chiang Mai Ms.Pakawan Sangree (Chiang Mai Provincial Office)

Introduction on waste management. Kitakyushu is referred to as a role model.

W to E, explanation of the project of biogas power generation

○ Q & A

Kataoka) What are the standards for selecting local companies?

Chiang Mai) case was introduced in the city, and companies were recruited.

2. Ho Chi Minh City

Climate change action plan 2017-2020, toward 2030

Regarding transportation, construction, waste, agriculture, citizen's perception.

3. Quezon City

Biogas, PV, EV bus and other energy saving strategies introduced.

In the future we are thinking about W to E.

4. Phnom Penh Mr. Dek Vimeanreaksmey (MOE) & Sajith Edirisuriya (Chip mong)

4-1. MOE Waste :

The overlapping part of the presentation of Cambodia of the other day is omitted.

Landfill garbage problem

There is a problem that 2020 is full of processing plants.

We are doing campaign activities on garbage disposal along the road.

We plan to make ordinances concerning plastic back.

4-2. Chip Mong Insee Cement :

Produce an amount that accounts for one-third of Cambodia's cement production.

As a strategy to lower CO2, three initiatives ① Electric power use ② Use of alternative raw materials ③ Development of sustainable products.

We plan to introduce 6.5 MW class WHR and lower 25% of electricity. Estimated CO2 reduction is 30000 CO2 / year

5. Mandalay Mr.Sou Lin (MCDC)

Introduction of rural electrification using biomass power generation

6. Q&A

Kataoka) There are various activities about Quezon, but about future prospects

Quezon) In cooperation with Osaka, I would like to create a GHG reduction road map. Among the mid- and long-term targets, specific projects are necessary, and I expect the Osaka city technical support (especially in the priority order). We place importance on the energy sector in the reduction of GHG and emphasize reduction of energy efficiency in industry.

Kataoka) Although I mentioned the initiative of the state in the slide, what is the private incentive? Benefits of participating in the initiative.

We are under coordination with the private sector and we are considering incentives for them to participate.

VI. Closing Remark

Closing by Mr. Sai from the Ministry of Environment.

I would like to set a clear goal for the closing of the project at the end of February.

I want to continually recommend this program next year, and create clear output.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Chiang Mai</td><td>Chip Mong Insee Cement</td></tr>
<tr><td>  </td><td> 
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<tr><td>MCDC</td><td>Phnom Penh MOE</td></tr>
</table>

＜Day 2. 28-Jul Afternoon Site visit＞

1. corelex 13:45

○Company description at training room

It is a factory made 15 years ago, making toilet paper.

Features are found in the raw materials making toilet paper. Usually, we make paper from wood, but this factory uses only used paper. Waste paper is also wide, but this factory finished using documents. Fifty percent of the current situation is placed in a file and is put in a cardboard box with each file and arrives at the factory. I handle this mix of metal and paper without emptying the contents of the box. For each box, take it without opening it and put it in the water. The process is divided into three stages.

In the first stage all the machinery is bracketed. The one with the most number is a stapler. The separated metal is put out for sale from the factory.

The second stage, plastics which are not heavy, but shape remains. Since plastic can not be sold, it is incinerated and recovered to be used as heat of a dryer that dries paper. It burns in a large incinerator, but a large amount of ash remains. The ash should be used in neighboring cement factories. There is no waste at all.

Third stage, ink. Collect and collect ink using foam. Because it is not worth the utility, it burns in an incinerator.

I get these three steps in a day and a half and become toilet paper.

The flow to see today is the above process.

Customers own highly confidential documents such as tax offices and the Metropolitan Police Department.

The remaining half of the materials are paper waste from the house of Kawasaki city. Other than that, there is raw material to collect money. It is a milk carton. In Japan, milk cartons are treated with great care. The reason is that the fibers used are soft and beautiful fibers are used. Even if you withdraw money, mixing the milk carton with the waste paper such as documents will increase the quality of the toilet paper.

How many milk cartons are needed when making toilet paper with milk carton alone?

It can be made from 5 sheets.

Paper is traded by weight. The weight of one roll is 125 g. One milk carton is 25 g.

Other targets for train tickets. The white paper is inside the ticket, even if you collect it you can make toilet paper. In the past it was all abandoned.
It is most important to reuse things we have thrown away without discarding them.

Finally, about the water used in the factory. A large amount of water is used in factories that make paper. Therefore, whether there is a big river, or whether there are a lot of cheap and clean water. But this place does not fill it. There is seawater, but it can not be used at the factory. Therefore, we use a large amount of sewage discharged from home. There is dirt, but it is reused.

I also have a factory in Hanoi, Vietnam.
The factory in Hanoi is also exactly the same system as Kawasaki. However, waste paper is not gathered as much as in Japan.
Coreless toilet paper is used in public toilets and the like. Can we compete with general products at factories in Vietnam? → Because toilet paper is not mainstream in Vietnam, it is still to come.

○Q&A

Oriental Consultant) What is the color of the paper?
Officials) 95% have received orders, but products that are in the conference room are our original. There are many products in Japan, but I think that it is not necessary to have such a kind.
NDK) Do materials are separated by quality?
Staff) I have not divided. I make dozens of kinds while using the same product. We change the thinness etc., aroma, etc.
Mr. Tho) After seeing the picture of Vietnam, I understand that there is a good relationship, but what is the brand name in Hanoi?
Staff) Vietnamese people are 25 of 110 employees. Besides, people from the Philippines, Brazil, Iran and Ghana come.

○Factory tour

2. <u>petrefinetechnology　15:30-17:00</u>

○Company description at training room

It is the only resin recycling law manufacturer in Japan. Introduction of recycling cycle process of PET bottle.

○Factory tour

	
corelex	petrefinetechnology
	
Factory Tour 1	Factory Tour 2

以上、

（Memo 2）

City to City Collaboration Project Workshop in Tokyo
Minutes of Meeting

30-Jan-2018
At Kaiun Club

Minutes of Open seminar

30-Jan-2018
At Kaiun Club

(1) Opening Remarks: Mr. Yasuo Takahashi, Vice Minister for Global Environmental Affairs, MOEJ

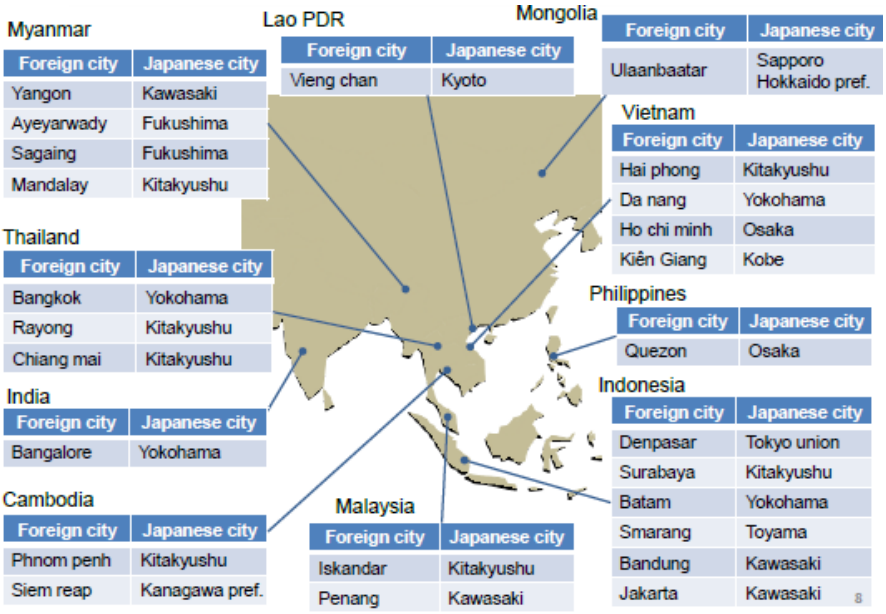
- Urban population concentration 70%. Two thirds of the world's energy resources are consumed in urban areas. Environmental measures in urban areas are important.
- Efforts on decarbonization in urban areas are progressing. We will strive to disseminate Japan's excellent low-carbon technology and support overseas cities.
- To achieve the goal as a Japanese government, it is important that different players collaborate to demonstrate Japan's comprehensive strength. In that sense, collaboration between cities that cooperate with each other is important.

(2) Support for creating low carbon society in Asia

- Increasing role of cities.
  - Paris COP 21 in 2015. We will recognize the activities of non-government actors. Collaboration between the central government and local governments.
  - Toyama G7 Environment Ministers Meeting.
  - SDD11
- City to City Collaboration Project
  - Relocate the low-carbon know-how owned by Japanese municipalities overseas. At that time, private and local governments will work

together to form a consortium.

- Participating cities since 2013 are as follows:



- Flow of composition of low-carbon project
  - Phase 1) Support for making master plan / action plan → Phase 2) Field survey → Phase 3) Investigation of specific project → Phase 4) Implementation stage
  - Fifteen projects were formed through collaboration among cities.
- JCM scheme
  - Appropriate evaluation of introduction of low-carbon technologies and GHG emission reductions, contributing to reduction of GHG emissions in Japan and local country.
  - 17 JCM signatory countries. The JCM auxiliary project is cumulative 112 projects.
- Introduction of city to city cooperation projects
  - Yokohama City and Da Nang City
  - Kitakyushu city and Phnom Penh city
  - Kawasaki City and Yangon City

(3) Recent development of strengthening city-to-city collaboration by Japanese cities

① Yokohama City

- We are pursuing the Y-Port project.
  - We have established Y-Port Center three years ago. Composition centering on city enterprises.
  - Opened a citizen partnership office with Minatomirai. We reside experts to support expertise.
  - YUSA: Yokohama Urban Solution Alliance was launched. I believe that by working in a corporate group, not administrative, we can provide solutions that emerging countries are looking for in packages. By having a juridical personality, YUSA can proceed by concluding a contract to carry out overseas business directly.

    I would like to promote collaboration with emerging cities and support small and medium-sized enterprises' overseas expansion in the future.

② City of Kitakyusyu

- Establishment of Asia Low carbonization Center based on Green Frontier Plan
  - Utilizing administrative know-how, we are promoting low carbonization in the Asian region.
  - We have done 154 projects. Cooperate with 106 companies in the city. 57 cities
  - We have been conducting inspections of many important people in various countries, and environmental education for trainees. I recently joined the MOU with the World Bank on the theme of green growth and waste management. The Kitakyushu model called know-how is being made, and it is entering and developing from planning in the Asian region. In the MOU with the World Bank, we are trying to collaborate in the field of flood control measures newly.

(4) Panel Discussion

① IGES (coordinator)

② Mizuho Information Research Institute (panelist)

③ Malaysia ·Iskandar Regional Development Agency (panelist)

④ Tokyo Metropolitan Environment Bureau (panelist)

⑤ Tokyo Metropolitan Environment Bureau (panelist)

- Asia-Pacific Integrated Model (AIM) Activities: We are not only planning but also supporting institution building.
- Malaysia ·Iskandar Regional Development Agency is a region where growth is very advanced. I have cooperated with Japan to make Blueprint. 12 actions. Building Energy Monitoring & Reporting System (BEMRS) was developed
- Tokyo has been engaged in international cooperation in the field of climate change, waste management, air pollution.
- Tokyo BEEP Model: Building Energy Efficiency Policy. ① It covers existing / new construction, large and small, various buildings. ② three stages of Hop, Step & Jump ③ It cooperates with various support measures, there are three features. We are carrying out a project to relocate this know-how to Malaysia.
- Energy efficiency in buildings is a big challenge, so I think that the approach of developing things like this case in various regions will become more important in each region, so let's pick up this time.

(5) Summary of Climate Change Policy and Intercity Collaboration Needs in Asian Cities

- Publication of country contribution towards achievement of Paris Agreement 2 ℃ target. The same applies to Asian countries.
- 70% of GHG emissions are generated from cities. The susceptibility to environmental damage is also concentrated in cities. Therefore, it is important to deal with urban areas.

(6) Asian cities' low carbon policy and implementation trend：

① Phnom Penh

- After Pol Pot regime, I have continued reconstruction. In Phnom Penh city, various countermeasures are taken against problems such as drainage, transportation, waste management. The amount of waste is increased by about 20% every year. We have enacted laws and regulations and are trying to solve them. Under the support of Kitakyushu city, we have formulated a climate change action plan. I plan to conduct a pilot project.

② Batam City

- We are collaborating with BIFZA (Batam Indonesia Free Zone Authority) and Yokohama City for the project. There is a plan of LRT as green traffic. As the green waste, the first phase of the sewage facility project is in progress. Dam maintenance plan is ongoing. I am developing a new hospital as a green building.

③ Jakarta City

- In Jakarta, emission of 34.67 miliion tonCO 2 in 2005. We have prepared various action plans to reduce GHG emissions by 2030. There is also plan of Transit Oriented Development (TOD). We are also planning an intermediate treatment facility for waste. We are promoting energy conservation and energy conservation such as LED and solar panel.

④ Yangon City

- Work on waste disposal. The amount of waste per person is 0.41 kg. Since methane gas is generated from the waste and released to the atmosphere, we plan to recover and generate electricity.

⑤ Quezon City

- The largest city in the Philippines. I am pursuing a clean and clean environment in a religious city, green. Participate in ICLEI, C40 and CITYNET. In collaboration with Osaka city, we are promoting the project. We are developing a climate change action plan. We also conducted biogas plant project and solar project.

⑥ Bangkok Port ・Laem Chabang Port (PAT)

- Introduction of Green Port development by PAT (Port Authority of Thailand). Thailand aims to reduce GHG emissions by 20% by 2030. Contribute to this reduction goal. We incorporate wind power generation and are doing various development. The amount of emissions has been made visible on the tablet, and it is updated daily.

⑦ Chiang Mai Province

- As for waste management, we have been doing various efforts with

Kitakyushu city which builds cooperative relations since 2000. We are developing policies to create environmentally friendly areas, utilize bioresources for sustainable development, and capacity building for citizens.

⑧ Hai Phong City

- Up to now, we have prepared four environmental legal systems and 17 action plans. I learned from the experience of Kitakyushu city and have worked on environmental measures. In April 2014 Kitakyushu city and Haiphong city partnered with sister cities. Since then, Kitakyushu City has been supporting the Green City Plan. There are 15 pilot projects. One of the success stories is composting household waste. Another demonstration of the electric bus at Katba Island.

⑨ Ho Chi Minh City

- Greatly affected by climate change, average humidity is 78-82%. During the rainy season, flooding occurs. As a legal framework, HCMC established the Climate Change Committee in 2009. Under the support of Osaka city, we made an activity plan for 2015 in 2015. We are planning a project in 10 fields. As a countermeasure to the transportation sector, we are progressing construction of Metro and BRT.

(7) Closing remarks

- It was nice to hear the announcement of various projects. I will present three comments on the summary. The first point, stable progress can be seen, not only the plan but also real projects are progressing. Secondly, concrete activities such as diversity, transportation, buildings, waste, etc are becoming extremely diverse. The third point, the effectiveness of JCM inter-city cooperation, the results of the inter-city collaboration so far have yielded very successful results.

Minutes of Closed Seminar

2018/1/30

At Kaiun Club

(1) Opening remarks:

- In the morning, discussions focused on low carbonization by cities, but in the afternoon we would like to have a lively discussion on the efforts of each group.
- It is an environment infrastructure that is lower in carbon and promotes environmental infrastructure for environmental preservation. It is important for intercity collaboration projects not only to simply formulate projects but also how to spread to society through it and how to develop horizontally.
- Since Prime Minister Abe and the ASEAN countries are also asking for a call for these initiatives, the efforts of city-to-city collaboration is an important project. We will exchange effective opinion opinions and expect to be a developmental discussion.

(2) Progress report of city-to-city collaboration projects for low-carbon society

① Chiang Mai Project

(Background / Overview)

- Chiang Mai is the main water source in Thailand. The project is managed with sufficient consideration of the surrounding environment.
- Through consultations between Chiang Mai prefecture and Kitakyushu city, we set integrated waste management in Chiang Mai province as a cooperative field. We grasped the current situation in each area and examined the action from the gap with target setting. Specifically, support for the formulation of the master plan is the primary movement.
- Authority in Thailand is owned by individual municipalities in the prefecture, so it is necessary to cooperate with individual local governments. Efforts are being made according to the characteristics of 210 local governments in the prefecture. As many municipalities showed interest, we decided to introduce W to E and Bio Digester.

（Biomass Digester）

- As for Biomass Digester, we are considering the utilization of Japanese price management technology, and are considering the introduction and examination concretely

（Waste power generation）

- Waste generation is under consideration in the southern part of Hort. We are

investigating the quality and quantity of garbage and the surrounding infrastructure situation.

- Introduction technology is planned to introduce technology of Nippon Steel Sumikin Engineering

② Hai Phong city

- Haiphong city has a sister city relationship with Kitakyushu City, and with the support of Kitakyushu city, he has formulated a master plan and is supporting pilot projects. Until now, we have implemented three JCM equipment auxiliary projects. Based on these outcomes, we conducted three activities this fiscal year.
- ① W to E, ② waste heat recovery from the cement plant, ③ institutional proposal of the EV bus.

（W to E）

- We are considering a stoker type high efficiency incinerator. Although it is common to monetize with a set with a chipping fee, this project is blessed with location, so we are planning to diversify our revenue sources including steam sales

（Waste heat recovery power generation）

- Vietnam is experiencing rapid progress in economic development and construction of cement factories is also prosperous. It is a case focused on such a background. We are talking about two cases. One is establishing the SPC and thinking of a BOT type scheme where private equipment owns equipment. One is conventional. Hopefully it will lead to an assistance application for next year.

（EV bus）

- Support for environmental promotion activities on remote islands. As Vietnam, we are also considering registration of World Heritage sites.
- It is an EV bus and the power supply is also considering utilization of PV, assumed to be from soft energy Control Company in Kitakyushu city. It was introduced in the absence of local regulations.
- Because it is a city famous for sightseeing, it is considering whether it can be used as business funds by collecting money from tourists. Because it is institutional improvement, it takes time. I am planning to proceed with a set of institutional aspects and projects.

③ Phnom Penh City

- Phnom Penh is in collaboration with Kitakyushu City in the field of water supply and has been a sister city relationship since 2016.

- They are working on two activities. One is energy waste heat recovery to cement plants as a reduction in energy costs. The other is considering the introduction of ESCO type business model with solar power generation facilities.
- We are conducting a three-way travel survey so far.

（W to E）

- Working with a cement factory in Cambodia to uncover the project. I applied for this year's secondary public invitation.
- An annual CO2 reduction of 20,000 tons was expected, but a Chinese company awarded in WHR bid.

（ESCO type business model with solar power generation）

- We are considering introducing lightweight panels in cooperation with local hospitals. As the scale is small, we are searching for other projects and are working with Phnom Penh Water Supply Authority.

（Status of follow-up of strategic plan）

- A ceremony to hand out the action plan for the previous fiscal year was implemented.
- Separation support at home, composting, and optimization of final disposal site.

④ Mandalay City

- Kitakyushu city and NTT Data Management Institute are implementing it at three companies.
- □Mandalay is the second city located in the north of Yangon. It has a population of 1.3 million people.
- Since 2009, Kitakyushu City has provided support to the city in the waste field, and it is a project that has been formed under collaboration relations.
- This project is a two-part study on energy conservation field and biomass utilization field.

（Renewable energy and energy saving field）

- We conduct multiple project investigation. Among them, we are discussing with each other aiming to formulate projects on energy conservation at international airports.

（Biomass Utilization Field）

- While conducting investigations repeatedly, difficulties in raising funds, the rise of Indian companies, and declining electricity charges are hurdles.
- In this trend, we focus on water treatment facilities and are investigating projects.
- Specifically, we are considering introducing an anaerobic membrane methane fermentation system. We plan to improve water quality by improving methane recovery efficiency and introducing MBR.

- We are also considering the possibility of using BDF for restaurants.

⑤ Semarang City

（Outline of Toyama City）

- Introduction of Toyama City. This is the first JCM project. Located in the north is a sea and the mountain in the south is similar to the city of Semarang.
- The city aims to make it compact city, and it carries out aggregation of the expanded suburbs. Since the city is an environmental future city, it is an area that is popular with small hydroelectric power generation, so we also operate an agricultural facility training center that makes use of it.
- Both Toyama City and Semarang City are included in 100 Resilient Cities. We met with Semarang city at the Resilient City meeting and we have repeated cooperation agreements in the transportation field.

（about JCM）

- ① Re-energy such as small hydraulic power, solar power, biomass, ② Public transport: Study of natural gasification of BRT ③ Study of energy conservation.
- Projects that are likely to be realized are small hydropower projects. There is a large-scale dam, and introduction possibility is high. Electric power of about 80 kW can be generated.
- PV has a case to be installed on the rooftop of the university.
- Public transportation has not yet been developed for BRT lanes, but passengers are extending, so there is a plan to expand the route. There is a plan for hybridization of diesel and natural gas.

⑥ Ayawadi Project ･Zagaine Project

- Knowing Fukushima when Ayahawadi district director came to Japan in 2015 and sending cooperation request to Fukushima city is the beginning. After repeated consultations over and over again this year we are aiming to materialize the project.
- Regional cooperation is also taken into consideration, and Zagaine Division is also in addition to discussions.
- In the Zagain district, we are seeking possibilities such as rice hull power generation. We are seeking a mega solar project in Ayahawadi district.
- We also conducted inspections between cities, and we invited them to Fukushima and conducted inspections on biomass power generation facilities and solar power generation facilities that utilized wastewater from the food factory

⑦ Bangkok Port ・Laem Chabang Project:

- About the partnership between Yokohama City and the port director of Thailand. Thailand is an important shipping destination for Yokohama Port. We have been working together such as seminars and personnel exchanges.
- There is a history that PAT and Yokohama port whale have respectively implemented environmental promotion.
- We are investigating the possibility of low carbonization by replacing the fuel of the gantry crane with a hybrid from diesel.
- Energy saving by installing LED lighting, high efficiency air conditioning equipment etc. at the car loading and unloading terminal.

⑧ Batam Project

- About intercity cooperation between Batam City and Yokohama City. Batam Island is an hour from Singapore by ferry. I would like to solve the urban problem of the island in its entirety in Yokohama. MOU signed three years ago.
- Batam city is not entering from the master plan. What is entering from JCM is characteristic in the Yokohama municipal project.
- As a feature, it is to introduce Yokohama city experience and technology in a way that suits Batam. Beginning cooperation between cities since 2015, it has been organized into six pillars. This year we are implementing F / S on 2 green buildings and green traffic.
- We are conscious of agreeing individual projects and green plans so that we can broaden the project actually made in plan.
- As a result, consideration is being made by installing Smart LED street lights in the industrial park together with PV.
- As for green building, we are discussing with JCM at shopping mall.

⑨ Ho Chi Minmin Project ・Quezon Project

（Ho Chi Minh）

- Cooperation between Osaka and Ho Chi Minh has been in effect 3 or 4 years ago. We have been supporting the formulation of an action plan for climate change.
- We have implemented plans to introduce heat exchangers and boiler facilities to fiber factories.

（Quezon）

- Quezon City has continued collaboration between cities, but there is still room for energy conservation and energy conservation.

- Itroduction of mega solar and examination of energy conservation of factory as well as Ho Chi Minh

⑩ Yangon Project

- Kawasaki city is implementing four inter-city collaborations. Three of them are implemented in Yangon and one in Jakarta.
- Beginning JCM city-to-city collaboration in 2015 was the start of relations between cities. There are three main pillars of MOU: (1) cooperating with each other to achieve low carbon, (2) supporting low carbonization in Yangon City, and (3) creating a new environmental business.
- As individual projects, introduction of high efficiency pumps to the water treatment plant and waste power generation facilities. Regarding the pump business, it is a project to replace the old pump of the 1980s with a high-efficiency pump made in Japan, and the project implementation players are almost decided and discussions are under way.
- Regarding W to E, we will consider further investigating whether the introduction of past waste power generation facilities can be further expanded. It aims at solving simultaneous solution of garbage problem solving and energy problem solving. It is a case leading to multi benefits.

⑪ Jakarta Project

- It is a project adopted in the secondary public invitation. The goal is to promote green innovation in Jakarta Special State. (1) to formulate JCM projects, and (2) to form green innovation projects. Also, we will promote the part of urban problems not directly related to JCM.
- We will focus on three areas of green building, waste, and energy conservation. This fiscal year, I will focus on green building and will formulate projects.

⑫ Phnom Penh Project

- This is the first project related to the Ministry of the Environment.
- By performing methane fermentation using raw garbage, it is possible to reduce the amount of garbage collected at the disposal site in Phnom Penh, and also to suppress methane fermentation in the garbage disposal site.
- In this project, waste treatment from the market of 50 ton / day is assumed.
- We plan to investigate in a dry methane fermentation plant.

(3) Summary of Comments from partner cities

- We conducted a preliminary questionnaire. There are two question contents, learning by participating in one project. 2 What is the problem of each city?
- The answers on 1. are as follows. Understanding of significance and know-how of international cooperation projects, understanding of Japanese technology, etc.

- There were various answers about 2. The major classifications include issues such as legal regulation, policy, technology, budget, human resources, cooperation with stakeholders, and awareness raising, as described below. Among them, many answered that they felt the problem in the transportation field. There was also a voice that the proposal of Japan is separate from the actual situation of the site, and there was an answer that filling up the gap is an issue.

(4) Financial support for city to city collaborative projects

- IGES is investigating what type of domestic funds can be used for inter-city collaboration.
- Those that Japanese municipalities can apply directly.
  - Local Authority Internationalization Association CLAIR: "Local Government Official Cooperation Exchange Project" "Local Government International Cooperation Expert Dispatch Project" "Local Government International Cooperation Promotion Project (Model Project)" "Overseas Sales Channel Development Support Project"
  - □JICA: "Grassroots Technical Cooperation Project (Regional Revitalization Special Framework)" "(Grant Assistance for Local Authorities) Grant Aid"

- Municipalities in Japan can not apply directly, but can apply in cooperation with other organizations.
  - JICA: "SDGs business survey" "Small and medium enterprise overseas development support project (basic → FS → demonstration)" "overseas investment loan" "technical cooperation project"
  - Ministry of the Environment: "Asia Water Environment Improvement Model Project"
  - NEDO: "International Demonstration Project of Japanese Technology that contributes to Energy Efficiency Increase, etc."
    And so many.
- It is thought that it is possible to procure fund length by combining them。

(5) Closing Remark
- This time we received more than 150 participants from the general public. We are expecting the effect of spreading out in plan in the future, expecting the effect of deriving from city-to-city collaboration such as institutional design and capacity building in local governments.
- There are two points to keep in mind. One thing is that "cooperation" is important. Among the many stakeholders, it is demand for cooperation to be successful. Secondly, I would like you to clearly share the strategy and goals.
- Please do your best for the rest of the term and let us know the results that will lead to the future.

環境省　国際協力室　御中

NTT DATA
Global IT Innovator

平成29年度　低炭素社会実現のための都市間連携事業「プノンペン都における省エネ・再エネの導入促進による低炭素化推進事業（北九州市-プノンペン都連携事業）」キックオフミーティング用資料

2017年5月16日
NTTデータ経営研究所
社会・環境戦略コンサルティングユニット

[目次]

1. 都市間連携の概要と本事業での目標

【北九州市ープノンペン都間の連携】

プノンペンの奇跡 （浄水分野）
配水ブロック技術移転
⇒ 無収水量率：72% → 8%、2005年：飲用可能宣言

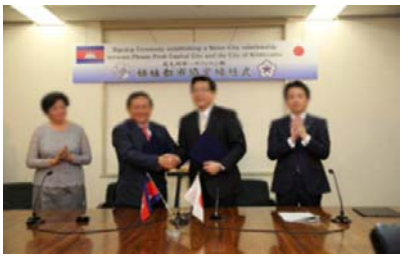
2015年7月フンセン首相 が北九州市を訪問。

「プノンペン都との姉妹都市締結」について、首相より提案を受ける

姉妹都市締結に向け、プノンペンにおけるニーズ把握のための基礎調査を実施
（廃棄物、エネルギー、下水道、環境保全）

2016年3月29日に姉妹都市締結定

北九州市 ⟷ プノンペン都



【実現済の事業：平成28年度都市間連携事業】

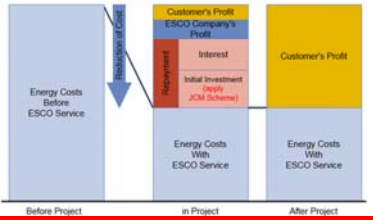
エネルギー分野での案件発掘
(NTTデータ経営研究所、北九州市)
平成28年度JCM設備補助事業として、「大型ショッピングモールへの1MW太陽光発電と高効率チラーの導入」事業が認定された。

プノンペン都気候変動適応行動計画策定支援
(日建設計シビル、北九州市)

【実現途上の事業、案件調査時の事業：本年度事業】

活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動

活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動

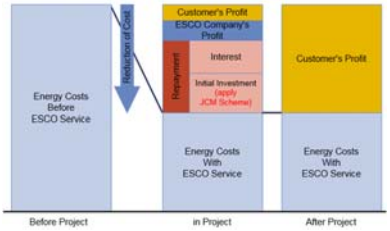


【将来像】

- カスタマイズ提案による大規模GHG排出削減案件の創出。
- ESCO型ビジネスモデルの確立により、省エネ・再エネ設備の導入の急速な拡大が期待される。
- 東南アジア等での横展開が期待される。

2. 想定しているプロジェクト概要

本事業では、カンボジア王国プノンペン市と北九州市の協力関係のもと、2つのタイプのプロジェクトに関して調査を実施する。

想定事業	活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動	活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動
プロジェクト内容	セメント工場等を対象に、廃熱回収発電設備等の導入について可能性を調査し、大幅なCO2削減を目指す。	太陽光発電システムなどの機器と、金融サービスとパッケージ化し、ユーザーの負担なしで機器を導入するESCO型サービスのビジネスモデル確立を目指し調査する。
想定導入技術	廃熱回収発電システム （5ページを参照）	太陽光発電システム（5ページを参照）
実施スキーム	6ページを参照	
想定している契約方式	随意契約を想定	随意契約を想定
補助金見込額、費用対効果	7ページを参照 調査結果を踏まえて、詳細検討	一例を、8ページに記載 調査結果を踏まえて、詳細検討
課題	9ページを参照	10ページを参照
イメージ図		

3. 想定している技術と導入実績

[廃熱回収発電]:

セメントプラントにおいて、未利用のまま捨てれている排ガスから熱を回収し、発電を行う設備であり、削減した電力を通じてCO2排出を削減する。

[太陽光発電]:

いずれも国内外で実績が豊富な機器である。JCM適用実績が豊富であることから、MRV方法論は既存のものを参照するなど、迅速なJCM化を目指す。

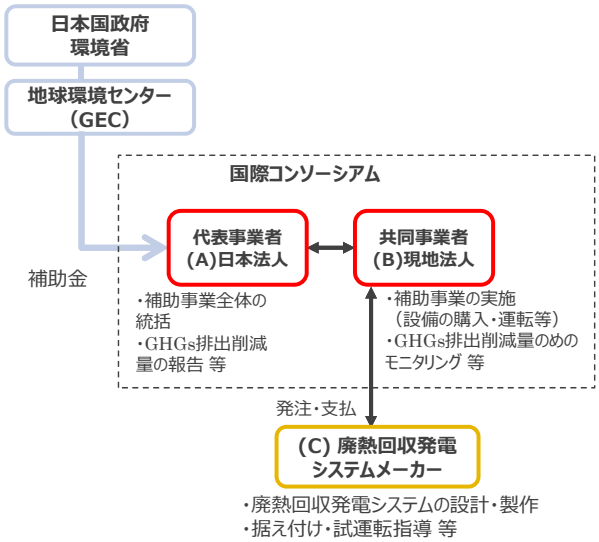
上記技術に関する、NTTデータ経営研究所のJCM設備補助事業の実績を、以下に示す。

実施期間	導入技術	納入場所	体制	概要説明
平成27年4 月～平成29年1月	太陽光発電	マレーシア	代表事業者	クアラルンプールに存する新設ビルの屋上に高効率太陽電池を設置し、CO2の排出削減を実現する。
平成28年9月～平成29年10月	廃熱回収発電	タイ	代表事業者	バンコクの郊外のセメント工場を対象に、廃熱回収発電システムを導入し、CO2排出削減につなげる。
平成28年2月～平成28年9月	太陽光発電、高効率チラー	ベトナム	設備補助申請、MRV及びPDD支援	ホーチミン近郊に新設される大型ショッピングモールを対象に太陽光発電システムを導入し、CO2排出削減を実現する。
平成28年10月～平成30年6月	太陽光発電	コスタリカ	代表事業者	ベレン市において、大規模太陽光発電所の導入を通じてCO2の排出削減を実現する。
平成28年11月～平成31年1月	太陽光発電	カンボジア	設備補助申請、MRV及びPDD支援	プノンペン都に新設される大型ショッピングモールの屋上に、太陽光発電システムを導入し、CO2排出削減を実現する。
平成29年3月～平成29年11月	太陽光発電	チリ	共同事業者	サンチャゴ市に位置するカトリック系大学に屋根置き太陽光発電システムを導入し、CO2の排出削減を実現する。

4. 想定している事業実施スキーム等

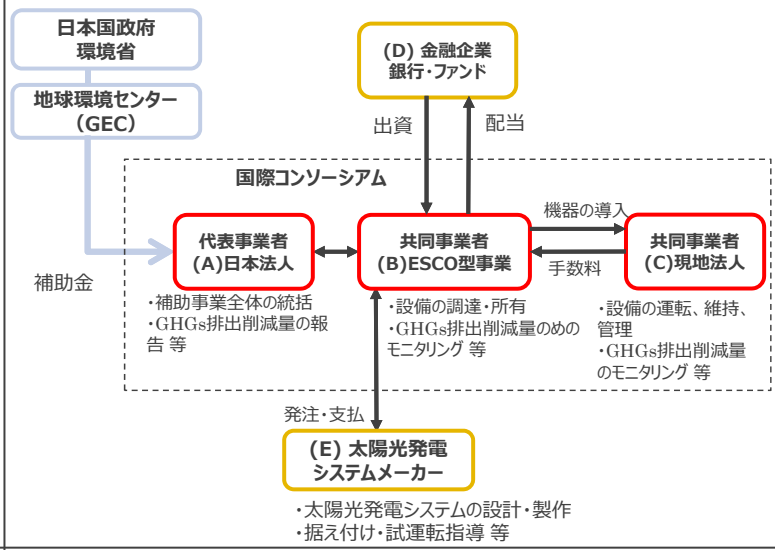
想定している事業実施スキーム、国際コンソーシアムの構成等を以下に示す。

活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動



A) NTTデータ経営研究所（想定）
B) Chip Mong Insee Cement 等
C) コンチ川崎 等

活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動



A) さつき株式会社（想定）
B) 特別事業会社（Special Purpose Company）を案件ごと設立
C) サンライズジャパン病院、クメール・ソビエト友好病院 等
D) サタパナ銀行、アクレダ銀行 等
E) Next Energy、京セラ、パナソニック 等

5. 排出削減総量、補助金の見込み額、費用対効果 [活動1]

セメント工場への廃熱回収発電システムは8MW規模を想定している。
初期投資額は、概算14.6億円を想定。そのうち、最大50%(約7.3億円)をJCM設備補助事業で調達することを想定している。

○排出削減総量（想定）

・想定年間発電量 (MWh/年)＝ 63,360 (= 8 MW x 24 時間 x 330 日)
・年間排出削減量 (t-CO2/年)＝ 40,000
(≒ 63,360 [想定年間発電量(MWh/年)] × 0.641 [カンボジアのグリッド係数(ton-CO2/MWh)])
・排出削減総量 (t-CO2)＝ **360,000**
(= 40,000 [想定年間削減量(t-CO2/年)] × 9 [耐用年数(年)])

○CO2排出削減に関わる補助金額の費用対効果（想定）

CO2排出削減の費用対効果 (円/t-CO2)＝ **2,027**
(= 730,000,000 [想定補助金額(円)] ÷ 360,000 [排出削減総量 (t-CO2)])

○GHG排出削減に関わる補助金額の費用対効果（想定）

GHG排出削減の費用対効果 (円/t-CO2)＝ **2,027**
(= 730,000,000 [想定補助金額(円)] ÷ 360,000 [排出削減総量 (t-CO2)])

6. 排出削減総量、補助金の見込み額、費用対効果 [活動2]

昨年度検討を行ったS病院へ太陽光発電システムを導入した際の、想定太陽電池容量は81.4kWである。
初期投資額は、概算2000万円を想定。そのうち、最大30%(約600万円)をJCM設備補助事業で調達することを想定している。

○排出削減総量（想定）

・想定年間発電量 (MWh/年)＝ 110
(公益財団法人　地球環境センター 応募フォームより試算)
・年間排出削減量 (t-CO2/年)＝ 70
(≒ 110 [想定年間発電量(MWh/年)] × 0.641 [カンボジアのグリッド係数(ton-CO2/MWh)])
・排出削減総量 (t-CO2)＝ **1,050**
(= 70.5 [想定年間削減量(t-CO2/年)] × 15 [耐用年数(年)])

○CO2排出削減に関わる補助金額の費用対効果（想定）

CO2排出削減の費用対効果 (円/t-CO2)＝ **5,714**
(≒ 6,000,000 [想定補助金額(円)] ÷ 1,050 [排出削減総量 (t-CO2)])

○GHG排出削減に関わる補助金額の費用対効果（想定）

GHG排出削減の費用対効果 (円/t-CO2)＝ **5,714**
(≒ 6,000,000 [想定補助金額(円)] ÷ 1,050 [排出削減総量 (t-CO2)])

7. プロジェクト実現に向けた課題 [活動1]

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1	現地セメント企業との直接協議	ＪＣＭ事業実施の候補となるセメント企業に連絡を取り、JCM案件形成の可能性調査の継続の合意を図る。(5月まで)	NTT	現地セメント企業	Chip Mong Insee Cementに連絡を取り、JCM制度を改めて説明し、JCM事業参画への意思を確認する。
2	実運転データを元に、要求仕様等の技術検討を実施	現地セメント工場の実運転データを元に、技術検討を行い、機器仕様を固める(12月まで)	NTT	現地セメント企業	8月中旬にセメント工場運転開始。12月中旬～1月中旬に計画運転停止を行う予定。8月から12月の廃熱温度等の運転実データから技術検討を行い、機器仕様を固める。
3	要求仕様に基づく技術検討の実施	要求仕様をもとに、ベンダー等と機器検討をする。(2月まで)	NTT、現地セメント企業	ベンダー等	上記2で検討した機器仕様をもとに、ベンダー等に仕様を満たす機器のスペックを確認する。
4	設備導入にかかる経済性検討	設備導入による省エネに伴い、投資回収期間等の条件が許容範囲であることを確認する(2月まで)	NTT	現地セメント企業、ベンダー等	ベンダー等から得た見積もりおよび性能をもとに、投資回収期間の算定を行う。
5	CO2削減効果算出方法、モニタリング方法に関する検討	設備導入によるCO2排出削減量の算出を行う(2月まで)	NTT	ベンダー等	ベンダー等から得た性能と、既存の承認済みMRV 方法論をもとに、CO2排出削減量の計算を行う。
6	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7	JCM事業実施に向けた意思決定	調査結果を元に、現地セメント企業のJCM事業実施の意思を確認する。(2月まで)	NTT	現地セメント企業	上記1～6で検討した内容を説明し、JCM事業実施に向けた意思決定をサポートする。
8	現地制度などの確認	案件化に影響を及ぼす現地制度等の有無の確認 (2月まで)	北九州市	プノンペン都側	案件化に影響を及ぼす現地法制度等があるかどうか、プノンペン都側と確認する。

8. プロジェクト実現に向けた課題 [活動2]

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1	ESCO型サービスの提供体制づくりのための現地金融機関等との直接協議	ESCO型サービスの提供者候補となる現地金融機関等との直接協議により、ビジネスモデル実現の可能性の検証を行う。(8月まで)	NTT	現地金融機関等	ネットワーク済みの現地金融機関（サタパナ銀行、アクレダ銀行等）と直接協議を行い、JCM制度、ESCO事業について改めて説明し、ESCO型サービスのへ提供体制作りを行う。
2	ESCO型サービスの提供体制づくりのための新たな連携金融機関の発掘	ESCO型サービスの提供者候補となる新たな連携金融機関の発掘を行う。(8月まで)	NTT	リース会社、ファンド運営会社等	現地リース会社、東南アジア地域のファンド運営会社や、国内最大手のリース会社等との協議を想定している。JCM制度、ESCO事業の仕組みを説明し、ESCO型サービスのへ提供体制作りを行う。
3	ESCO型サービスの利用者の候補となる新たな現地企業等の発掘	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。（10月まで）	NTT、北九州市	現地企業等	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。
4	ESCO型サービスの利用者の現地候補病院等との直接協議	ESCO型サービスの利用者候補となる現地病院等との直接協議を実施する。(10月まで)	NTT	現地病院、現地企業等	ESCO型サービスの利用者として、上記3で発掘した現地企業、および、ネットワーク済みの現地病院（クメール-ソビエト友好病院、サンライズジャパン病院等）と直接協議を行う。
5	JCM事業形成に向けた検討の実施	ESCO型サービス提供者候補と利用者候補との協議を行い、ESCO型サービス確立に向け検討する。(2月まで)	NTT、ESCO型サービス提供者	現地病院、現地企業等	上記1,2で検討したESCO型サービスの利用者と、上記3,4で検討した現地企業等とをすり合わせ、案件形成に向けた支援を行う。
6	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7	プノンペン都気候変動適応行動計画のフォローアップ	昨年度策定した「プノンペン都気候変動適応行動計画」をプノンペン都側に提出し、フォローアップを行う。(2月まで)	北九州市	プノンペン都	昨年度策定した「プノンペン都気候変動適応行動計画」をもとに、北九州市ープノンペン都間の連携を深め、案件化を促進する。

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環境省　国際協力室　御中

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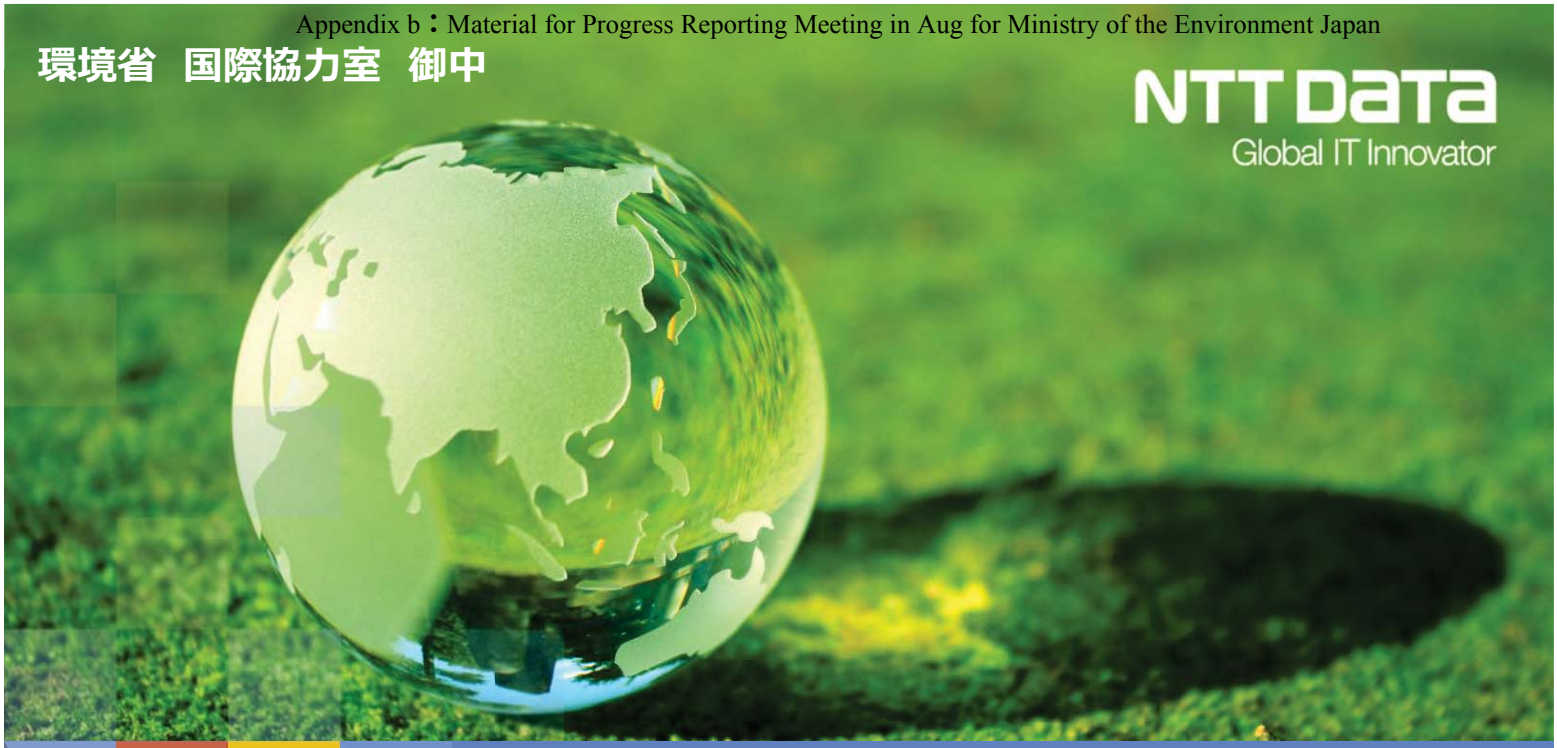

平成29年度　低炭素社会実現のための都市間連携事業「プノンペン都における省エネ・再エネの導入促進による低炭素化推進事業（北九州市-プノンペン都連携事業）」8月進捗報告会用資料

2017年8月30日
NTTデータ経営研究所
社会・環境戦略コンサルティングユニット

[目次]

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1. 都市間連携の概要と本事業での目標(キックオフ時と同じ資料)

【北九州市ープノンペン都間の連携】

プノンペンの奇跡 （浄水分野）
配水ブロック技術移転
⇒ 無収水量率：72% → 8%、2005年：飲用可能宣言

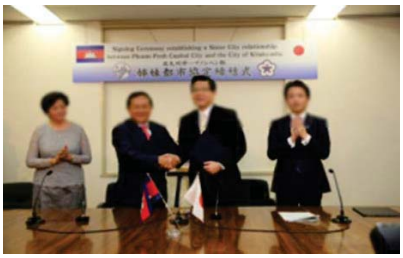
2015年7月フンセン首相 が北九州市を訪問。

「プノンペン都との姉妹都市締結」について、首相より提案を受ける

姉妹都市締結に向け、プノンペンにおけるニーズ把握のための基礎調査を実施
（廃棄物、エネルギー、下水道、環境保全）

2016年3月29日に姉妹都市締結

北九州市 ⟷ プノンペン都



【実現済の事業：平成28年度都市間連携事業】

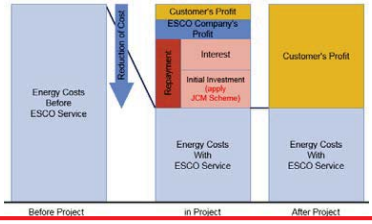
エネルギー分野での案件発掘
(NTTデータ経営研究所、北九州市)
平成28年度JCM設備補助事業として、「大型ショッピングモールへの1MW太陽光発電と高効率チラーの導入」事業が認定された。

プノンペン都気候変動適応行動計画策定支援
(日建設計シビル、北九州市)

【実現途上の事業、案件調査時の事業：本年度事業】

活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動

活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動



【将来像】

- カスタマイズ提案による大規模GHG排出削減案件の創出。
- ESCO型ビジネスモデルの確立により、省エネ・再エネ設備の導入の急速な拡大が期待される。
- 東南アジア等での横展開が期待される。

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2. 7月・8月のイベント報告

【第一回現地調査】

2017年7月3日～7月6日

<主な訪問先>

- Chip Mong Insee Cement
- サンライズジャパン病院
- イオンモールカンボジア
- プノンペン都国際連携室
- カンボジア環境省
- カンボジア大使館


カンボジア環境省


プノンペン都国際連携室

<主な成果>

- [活動①] Chip Mong Insee Cement と JCM設備補助事業へ向けた具体的協議を行い、前倒しで平成29年度の二次公募への応募できないか、検討を開始した。


Chip Mong Insee Cement

- [活動②]サンライズジャパン病院へ訪問し、ESCO型ビジネスモデルの利用者として前向きに連携を検討いただいた。

【都市間連携ワークショップ】

2017年7月25日～7月26日@北九州市
2017年7月27日～7月28日@川崎

<北九州市でのワークショップの主な訪問先>

- エコタウンセンター　・環境ミュージアム
- EVバス試乗/太陽光発電設備見学
- ゴミ焼却発電設備見学
- 廃熱回収発電設備見学
- 計器工場訪問
- ロボット工場訪問


EVバス / 太陽光発電設備

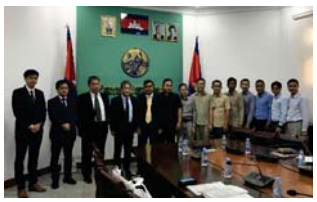
【北九州市-プノンペン都セレモニー】

2017年8月3日～8月6日

平成28年度、北九州市が策定支援を行った**「プノンペン都気候変動戦略行動計画」**を手渡し、概要について説明を行なった。

(←)北九州市環境局長から、プノンペン都SUY副知事へ手渡し

(→)集合写真



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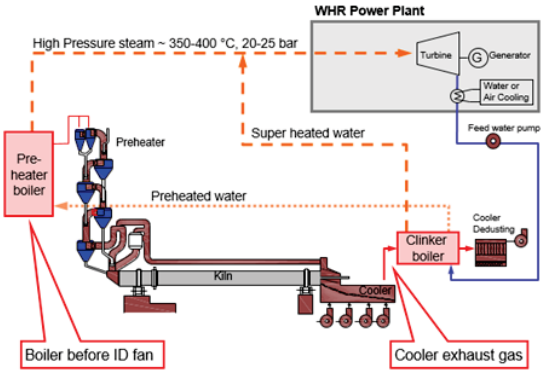
3. プロジェクト進捗 ①セメント工場への廃熱回収設備の導入検討

事業の概要

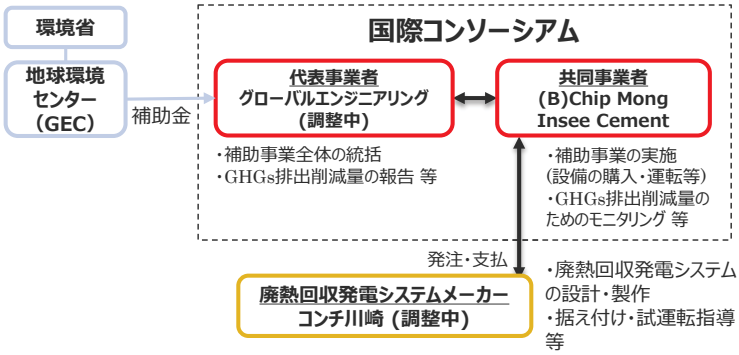
- カンボジアのセメント製造会社 CHIP MONG INSEE CEMENTと**廃熱回収発電システム**の導入を検討中。
- CHIP MONG INSEE CEMENTは、Chip Mong Group (CMG)：60%、Siam City Cement Company (SCCC)：40% の合弁会社である。
- 2017年第4四半期にセメント生産開始予定。
- 廃熱回収発電の想定規模：**6.5 MW**
  （プラントの消費電力の約25%に相当）
- 想定CO2排出削減量：**30,000 tCO2/年**
- 7月の第一回現地調査での協議の結果、計画を前倒しして、平成30年度のJCM設備補助事業ではなく、**平成29年度の二次公募への応募の検討を進めている。**
- 初期投資額の**最大50%**をJCM設備補助事業で調達することを想定。
- 廃熱回収発電システムの概要、および、想定実施体制図、は右図の通り。

廃熱回収発電システム概要



出典：Chip Mong Insee Cement 発表資料より

想定実施体制図



4.課題進捗 ①セメント工場への廃熱回収設備の導入検討

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1 **済**	現地セメント企業との直接協議	JCM事業実施の候補となるセメント企業に連絡を取り、JCM案件形成の可能性調査の継続の合意を図る。(5月まで)	NTT	現地セメント企業	Chip Mong Insee Cementに連絡を取り、JCM制度を改めて説明し、JCM事業参画への意思を確認する。
2	実運転データを元に、要求仕様等の技術検討を実施 **検討中**	現地セメント工場の実運転データを元に、技術検討を行い、機器仕様を固める(12月まで)	NTT	現地セメント企業	8月中旬にセメント工場運転開始。12月中旬～1月中旬に計画運転停止を行う予定。8月から12月の廃熱温度等の運転実データから技術検討を行い、機器仕様を固める。
3	要求仕様に基づく技術検討の実施 **検討中**	要求仕様をもとに、ベンダー等と機器検討をする。(2月まで)	NTT、現地セメント企業	ベンダー等	上記2で検討した機器仕様をもとに、ベンダー等に仕様を満たす機器のスペックを確認する。
4	設備導入にかかる経済性検討 **検討中**	設備導入による省エネに伴い、投資回収期間等の条件が許容範囲であることを確認する(2月まで)	NTT	現地セメント企業、ベンダー等	ベンダー等から得た見積もりおよび性能をもとに、投資回収期間の算定を行う。
5	CO2削減効果算出方法、モニタリング方法に関する検討 **検討中**	設備導入によるCO2排出削減量の算出を行う(2月まで)	NTT	ベンダー等	ベンダー等から得た性能と、既存の承認済みMRV 方法論をもとに、CO2排出削減量の計算を行う。
6 **済**	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7	JCM事業実施に向けた意思決定 **最終調整中**	調査結果を元に、現地セメント企業のJCM事業実施の意思を確認する。(2月まで)	NTT	現地セメント企業	上記1～6で検討した内容を説明し、JCM事業実施に向けた意思決定をサポートする。
8	現地制度などの確認 **確認中**	案件化に影響を及ぼす現地制度等の有無の確認 (2月まで)	北九州市	プノンペン都側	案件化に影響を及ぼす現地法制度等があるかどうか、プノンペン都側と確認する。

5. プロジェクト進捗 ②ESCO型ビジネスモデルの検討

進捗状況

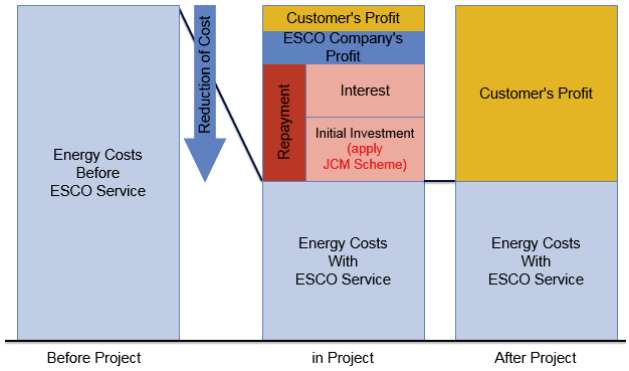
【ESCO型ビジネスモデルの提供者発掘】

- 提供者として、MGM Sustainable Energy Fundと協議中。
- 早ければ2017年12月ごろに第二号ファンドを立上げ予定で、出資枠の1割を東南アジアへ投資する予定である。
- 代表事業者の候補企業として、設立済のMGMイノヴァ・キャピタル・ジャパンを想定。

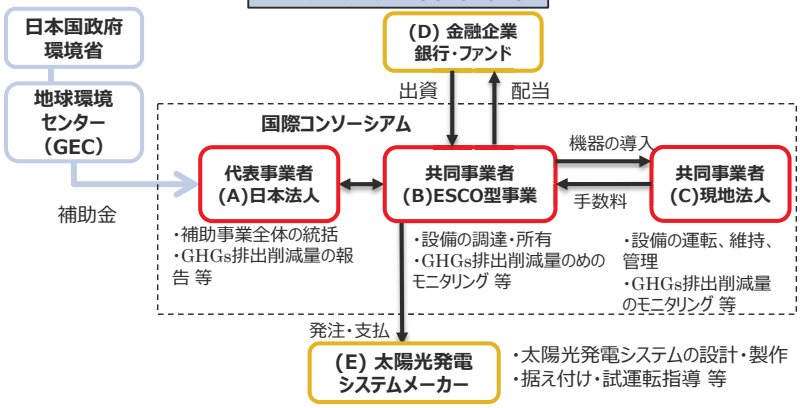
【ESCO型ビジネスモデルの利用者発掘】

- 7月3日にサンライズジャパン病院を再訪問し、ESCO型ビジネスモデルの利用者として前向きに連携を検討いただいている。太陽光パネルの導入が想定規模としては、約80kWと比較的小さいため、他利用候補者の発掘を継続中。
- 想定している発掘先は、以下の通り：
  - 大型ショッピングモール等
  - 大型病院等
  - 大型建設デベロッパー等

ESCO型ビジネスモデルのイメージ図



想定実施体制図



6. 課題進捗 ②ESCO型ビジネスモデルの検討

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1 済	ESCO型サービスの提供体制づくりのための現地金融機関等との直接協議	ESCO型サービスの提供者候補となる現地金融機関等との直接協議により、ビジネスモデル実現の可能性の検証を行う。(8月まで)	NTT	現地金融機関等	ネットワーク済みの現地金融機関（サタパナ銀行、アクレダ銀行等）と直接協議を行い、JCM制度、ESCO事業について改めて説明し、ESCO型サービスのへ提供体制作りを行う。
2	ESCO型サービスの提供体制づくりのための新たな連携金融機関の発掘 **発掘済・継続協議中**	ESCO型サービスの提供者候補となる新たな連携金融機関の発掘を行う。(8月まで)	NTT	リース会社、ファンド運営会社等	現地リース会社、東南アジア地域のファンド運営会社や、国内最大手のリース会社等との協議を想定している。JCM制度、ESCO事業の仕組みを説明し、ESCO型サービスのへ提供体制作りを行う。
3	ESCO型サービスの利用者の候補となる新たな現地企業等の発掘 **発掘継続中**	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。(10月まで)	NTT、北九州市	現地企業等	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。
4	ESCO型サービスの利用者の現地候補病院等との直接協議 **済・継続協議中**	ESCO型サービスの利用者候補となる現地病院等との直接協議を実施する。(10月まで)	NTT	現地病院、現地企業等	ESCO型サービスの利用者として、上記3で発掘した現地企業、および、ネットワーク済みの現地病院（クメール-ソビエト友好病院、サンライズジャパン病院等）と直接協議を行う。
5	JCM事業形成に向けた検討の実施 **継続協議中**	ESCO型サービス提供者候補と利用者候補との協議を行い、ESCO型サービス確立に向け検討する。(2月まで)	NTT、ESCO型サービス提供者	現地病院、現地企業等	上記1,2で検討したESCO型サービスの利用者と、上記3,4で検討した現地企業等とをすり合わせ、案件形成に向けた支援を行う。
6 済	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7 済	プノンペン都気候変動適応行動計画のフォローアップ **継続中**	昨年度策定した「プノンペン都気候変動適応行動計画」をプノンペン都側に提出し、フォローアップを行う。(2月まで)	北九州市	プノンペン都	昨年度策定した「プノンペン都気候変動適応行動計画」をもとに、北九州市ープノンペン都間の連携を深め、案件化を促進する。

7. 調査実施スケジュール (8月末時点進捗)

活動項目	2017年 4月	5月	6月	7月	8月	9月	10月	11月	12月	2018年 1月	2月	3月
1.エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動	• セメント工場との直接協議			• 現地制度の確認 • 代表事業者の抽出	• 実運転データの取得、および、機器使用検討				• 技術検討 • 経済性検討 • CO2削減効果検討		• JCM実施に向けた支援	
2.金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動	• ESCO型サービス**提供者**の発掘 ➢ 現地金融機関等へのヒアリング（継続） ➢ リース会社、ファンドの発掘（新規） • ESCO型サービス**利用者**の発掘 ➢ 現地病院等へのヒアリング（継続） ➢ 候補企業・施設の発掘（新規）			• プノンペン都気候変動適応行動計画のフォローアップ • 代表事業者の抽出		• ESCO型サービスの**提供者**と**利用者**のすり合わせ、合意形成					• JCM実施に向けた支援	
○ 現地調査				☆	☆	☆		☆		☆		
○ 国内会議				☆						☆		
○ 現地ワークショップ					☆					☆		
○ 報告書の作成							☆（中間ドラフト）			☆（最終ドラフト） ☆（最終報告書）		

NTT DATA

NTT DATA
Global IT Innovator

環境省　国際協力室　御中

NTT DATA
Global IT Innovator

平成29年度　低炭素社会実現のための都市間連携事業「プノンペン都における省エネ・再エネの導入促進による低炭素化推進事業（北九州市-プノンペン都連携事業）」12月進捗報告会用資料

2017年12月18日
NTTデータ経営研究所
社会・環境戦略コンサルティングユニット

[目次]

NTT DATA

1. 都市間連携の概要と本事業での目標【再掲】

【北九州市ープノンペン都間の連携】

プノンペンの奇跡 （浄水分野）
配水ブロック技術移転
⇒ 無収水量率：72% → 8%、2005年：飲用可能宣言

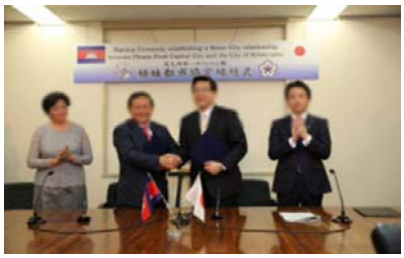
2015年7月フンセン首相 が北九州市を訪問。

「プノンペン都との姉妹都市締結」について、首相より提案を受ける

姉妹都市締結に向け、プノンペンにおけるニーズ把握のための基礎調査を実施
（廃棄物、エネルギー、下水道、環境保全）

2016年3月29日に姉妹都市締結定

北九州市 ⟷ プノンペン都



【実現済の事業：平成28年度都市間連携事業】

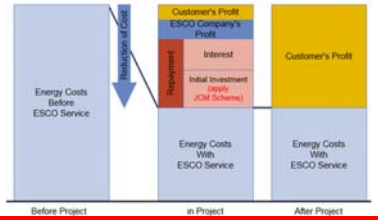
エネルギー分野での案件発掘
(NTTデータ経営研究所、北九州市)
平成28年度JCM設備補助事業として、「大型ショッピングモールへの1MW太陽光発電と高効率チラーの導入」事業が認定された。

プノンペン都気候変動適応行動計画策定支援
(日建設計シビル、北九州市)

【実現途上の事業、案件調査時の事業：本年度事業】

活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動

活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動



【将来像】

- カスタマイズ提案による大規模GHG排出削減案件の創出。
- ESCO型ビジネスモデルの確立により、省エネ・再エネ設備の導入の急速な拡大が期待される。
- 東南アジア等での横展開が期待される。

2. 7月・8月のイベント報告【再掲】

【第一回現地調査】

2017年7月3日～7月6日

<主な訪問先>

- Chip Mong Insee Cement
- サンライズジャパン病院
- イオンモールカンボジア
- プノンペン都国際連携室
- カンボジア環境省
- カンボジア大使館


カンボジア環境省


プノンペン都国際連携室

<主な成果>

- [活動①] Chip Mong Insee Cement と JCM設備補助事業へ向けた具体的協議を行い、前倒しで平成29年度の二次公募への応募できないか、検討を開始した。
- [活動②]サンライズジャパン病院へ訪問し、ESCO型ビジネスモデルの利用者として前向きに連携を検討いただいた。


Chip Mong Insee Cement

【都市間連携ワークショップ】

2017年7月25日～7月26日@北九州市
2017年7月27日～7月28日@川崎

<北九州市でのワークショップの主な訪問先>

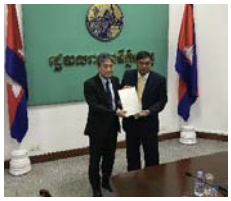
- エコタウンセンター　・環境ミュージアム
- EVバス試乗/太陽光発電設備見学
- ゴミ焼却発電設備見学
- 廃熱回収発電設備見学
- 計器工場訪問
- ロボット工場訪問


EVバス / 太陽光発電設備

【北九州市-プノンペン都セレモニー】

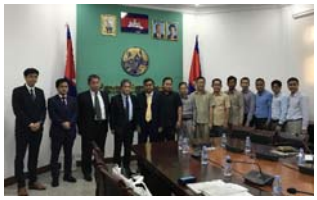
2017年8月3日～8月6日

平成28年度、北九州市が策定支援を行った**「プノンペン都気候変動戦略行動計画」**を手渡し、概要について説明を行なった。



(←)北九州市環境局長から、プノンペン都SUY副知事へ手渡し

(→)集合写真



3. 9月～ 11月のイベント報告

【第二回現地調査】

2017年9月1日

<主な訪問先>

- 【共同事業者】Chip Mong Insee Cement

<同行者>

- 【代表事業者】(株)グローバルエンジニアリング: 高橋氏
- 【EPCコントラクター】コンチ川崎：浜田氏
- 【PDD等支援】NTTデータ経営研究所：村岡

<主な成果>

- [活動①] Chip Mong Insee Cement と平成29年度JCM設備補助事業の二次公募への応募に向けた具体的協議を行った。
- [活動①] 現地での議論を踏まえ、技術検討、経済性検討、CO2削減効果検討を行い、平成29年度の二次公募へ応募した。

【第三回現地調査】

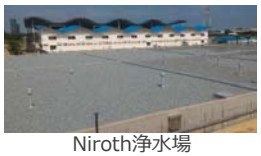
2017年11月20日～11月22日

<主な訪問先>

- サンライズジャパン病院
- プノンペン都国際連携室 廃棄物管理局
- 水道公社オフィス
- Chroy Changvar浄水場
- Niroth浄水場
- 新菱カンボジア
- カンボジア大使館

プノンペン都国際連携室・廃棄物管理局

Chroy Changvar浄水場



Niroth浄水場

<主な成果>

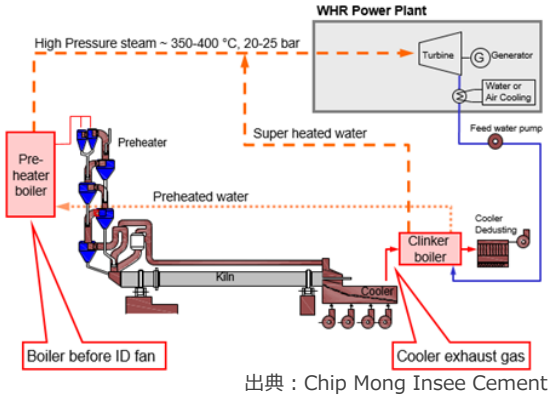
- [活動②] 昨年度北九州市が策定支援を行った「プノンペン都気候変動戦略行動計画」に関して、フォローアップを行なった。
- [活動②] ESCO型ビジネスモデルの利用者候補として、水道公社との議論および浄水場2ヶ所の現地視察を行なった。現在、レイアウト図面の提供を依頼中。

4. プロジェクト進捗 ①セメント工場への廃熱回収設備の導入検討

事業の概要

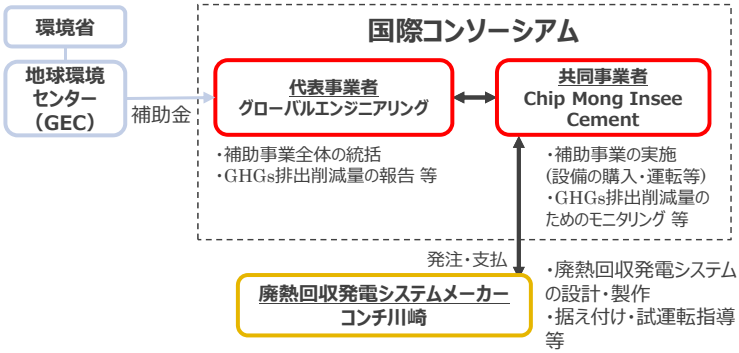
- カンボジアのセメント製造会社 CHIP MONG INSEE CEMENTと**廃熱回収発電システム**の導入を検討し、**平成29年度のJCM設備補助事業の二次公募へ応募した**。(「条件付き入札」での応募)
- CHIP MONG INSEE CEMENTは、Chip Mong Group (CMG)：60%、Siam City Cement Company (SCCC)：40% の合弁会社である。
- 代表事業者：(株)グローバルエンジニアリング
- 廃熱回収発電システムメーカー：コンチ川崎
- 蒸気タービン発電機の発電容量：**8,000 kW**（プラントの消費電力の約25%に相当）
- 想定CO2排出削減量：**20,860 tCO2/年**
- 想定初期投資額：**約15億円**（約40%をJCM設備補助事業で調達することを想定）
- 想定費用対効果：**3,039/tonCO2**
- 廃熱回収発電システムの概要、および、想定実施体制図、は右図の通り。
- Chip Mong Insee Cementによる入札の結果、技術的・経済的・スケジュール的な総合判断により、提案していたコンチ川崎ではなく、中国EPCコントラクターが落札する結果となってしまい、取り下げることとなった。

廃熱回収発電システム概要



出典：Chip Mong Insee Cement 発表資料より

想定実施体制図



5.課題進捗 ①セメント工場への廃熱回収設備の導入検討

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1 済	現地セメント企業との直接協議	ＪＣＭ事業実施の候補となるセメント企業に連絡を取り、JCM案件形成の可能性調査の継続の合意を図る。(5月まで)	NTT	現地セメント企業	Chip Mong Insee Cementに連絡を取り、JCM制度を改めて説明し、JCM事業参画への意思を確認する。
2 済	実運転データを元に、要求仕様等の技術検討を実施	現地セメント工場の実運転データを元に、技術検討を行い、機器仕様を固める(12月まで)	NTT	現地セメント企業	8月中旬にセメント工場運転開始。12月中旬～1月中旬に計画運転停止を行う予定。8月から12月の廃熱温度等の運転実データから技術検討を行い、機器仕様を固める。
3 済	要求仕様に基づく技術検討の実施	要求仕様をもとに、ベンダー等と機器検討をする。(2月まで)	NTT、現地セメント企業	ベンダー等	上記2で検討した機器仕様をもとに、ベンダー等に仕様を満たす機器のスペックを確認する。
4 済	設備導入にかかる経済性検討	設備導入による省エネに伴い、投資回収期間等の条件が許容範囲であることを確認する(2月まで)	NTT	現地セメント企業、ベンダー等	ベンダー等から得た見積もりおよび性能をもとに、投資回収期間の算定を行う。
5 済	CO2削減効果算出方法、モニタリング方法に関する検討	設備導入によるCO2排出削減量の算出を行う(2月まで)	NTT	ベンダー等	ベンダー等から得た性能と、既存の承認済みMRV 方法論をもとに、CO2排出削減量の計算を行う。
6 済	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7 済	JCM事業実施に向けた意思決定	調査結果を元に、現地セメント企業のJCM事業実施の意思を確認する。(2月まで)	NTT	現地セメント企業	上記1～6で検討した内容を説明し、JCM事業実施に向けた意思決定をサポートする。
8 済	現地制度などの確認	案件化に影響を及ぼす現地制度等の有無の確認 (2月まで)	北九州市	プノンペン都側	案件化に影響を及ぼす現地法制度等があるかどうか、プノンペン都側と確認する。

6. プロジェクト進捗 ②ESCO型ビジネスモデルの検討

進捗状況

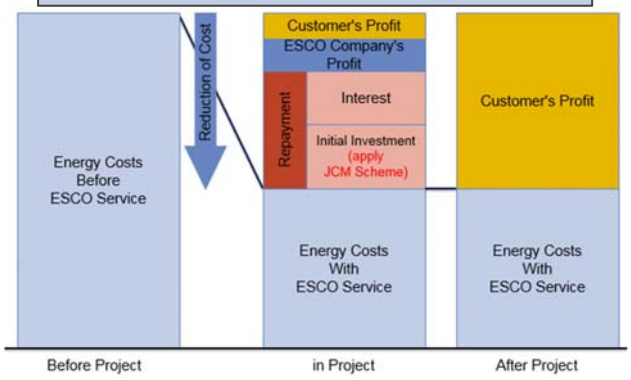
【ESCO型ビジネスモデルの提供者発掘】

- 提供者として、MGM Sustainable Energy Fundと協議中。第二号ファンドを立上げ予定で、出資枠の1割を東南アジアへ投資する予定。立上げ時期について2月以降を予定しているとのこと。
- 代表事業者の候補企業として、設立済のMGMイノヴァ・キャピタル・ジャパンを想定。

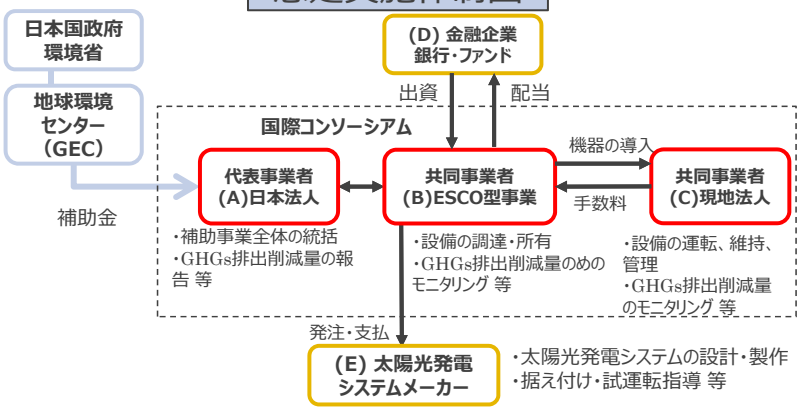
【ESCO型ビジネスモデルの利用者発掘】

- 11月20日に**サンライズジャパン病院**を再訪問し、ESCO型ビジネスモデルの利用者として前向きに連携を検討いただいている。太陽光パネルの導入が想定規模としては、約80kWと比較的小さいため、他利用候補者の発掘も継続中。
- 11月21日に**水道公社**に訪問し、太陽光パネル導入の可能性についての議論した。既設の浄水場2ヶ所が候補地として挙げられ、現地視察も行なった。ESCO型ビジネスモデルを紹介したところ、同様のスキームで台湾系などの別企業も提案を受けているとのこと。月々の返済額などの条件を比較して判断したいとの回答。**現在、試算を進めるため、レイアウト図面の提供を依頼中。**

ESCO型ビジネスモデルのイメージ図



想定実施体制図



7. 課題進捗 ②ESCO型ビジネスモデルの検討

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1 **済**	ESCO型サービスの提供体制づくりのための現地金融機関等との直接協議	ESCO型サービスの提供者候補となる現地金融機関等との直接協議により、ビジネスモデル実現の可能性の検証を行う。(8月まで)	NTT	現地金融機関等	ネットワーク済みの現地金融機関（サタパナ銀行、アクレダ銀行等）と直接協議を行い、JCM制度、ESCO事業について改めて説明し、ESCO型サービスのへ提供体制作りを行う。
2	ESCO型サービスの提供体制づくりのための新たな連携金融機関の発掘 **発掘済・継続協議中**	ESCO型サービスの提供者候補となる新たな連携金融機関の発掘を行う。(8月まで)	NTT	リース会社、ファンド運営会社等	現地リース会社、東南アジア地域のファンド運営会社や、国内最大手のリース会社等との協議を想定している。JCM制度、ESCO事業の仕組みを説明し、ESCO型サービスのへ提供体制作りを行う。
3	ESCO型サービスの利用者の候補となる新たな現地企業等の発掘 **発掘継続中**	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。(10月まで)	NTT、北九州市	現地企業等	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。
4	ESCO型サービスの利用者の現地候補病院等との直接協議 **済・継続協議中**	ESCO型サービスの利用者候補となる現地病院等との直接協議を実施する。(10月まで)	NTT	現地病院、現地企業等	ESCO型サービスの利用者として、上記3で発掘した現地企業、および、ネットワーク済みの現地病院（クメール-ソビエト友好病院、サンライズジャパン病院等）と直接協議を行う。
5	JCM事業形成に向けた検討の実施 **継続協議中**	ESCO型サービス提供者候補と利用者候補との協議を行い、ESCO型サービス確立に向け検討する。(2月まで)	NTT、ESCO型サービス提供者	現地病院、現地企業等	上記1,2で検討したESCO型サービスの利用者と、上記3,4で検討した現地企業等とをすり合わせ、案件形成に向けた支援を行う。
6 **済**	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7 **済**	プノンペン都気候変動適応行動計画のフォローアップ **継続中**	昨年度策定した「プノンペン都気候変動適応行動計画」をプノンペン都側に提出し、フォローアップを行う。(2月まで)	北九州市	プノンペン都	昨年度策定した「プノンペン都気候変動適応行動計画」をもとに、北九州市ープノンペン都間の連携を深め、案件化を促進する。

8. 調査実施スケジュール (8月末時点進捗)【再掲】

活動項目	2017年 4月	5月	6月	7月	8月	9月	10月	11月	12月	2018年 1月	2月	3月
1.エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動	• セメント工場との直接協議			• 現地制度の確認 • 代表事業者の抽出	• 実運転データの取得、および、機器使用検討				• 技術検討 • 経済性検討 • CO2削減効果検討		• JCM実施に向けた支援	
2.金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動	• ESCO型サービス**提供者**の発掘 ➢ 現地金融機関等へのヒアリング（継続） ➢ リース会社、ファンドの発掘（新規） • ESCO型サービス**利用者**の発掘 ➢ 現地病院等へのヒアリング（継続） ➢ 候補企業・施設の発掘（新規）			• プノンペン都気候変動適応行動計画のフォローアップ • 代表事業者の抽出		• ESCO型サービスの**提供者**と**利用者**のすり合わせ、合意形成					• JCM実施に向けた支援	
○ 現地調査				☆	☆	☆		☆		☆		
○ 国内会議				☆						☆		
○ 現地ワークショップ					☆					☆		
○ 報告書の作成							☆（中間ドラフト）			☆（最終ドラフト）	☆（最終報告書）	

9. 調査実施スケジュール (11月末時点進捗)

活動項目	2017年 4月	5月	6月	7月	8月	9月	10月	11月	12月	2018年 1月	2月	3月
1.エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動	• セメント工場との直接協議				• 実運転データの取得、および、機器使用検討				• 技術検討 • 経済性検討 • CO2削減効果検討		• JCM実施に向けた支援	
				• 現地制度の確認 • 代表事業者の抽出								
2.金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動	• ESCO型サービス**提供者**の発掘 ➢ 現地金融機関等へのヒアリング（継続） ➢ リース会社、ファンドの発掘（新規）					• ESCO型サービスの**提供者**と**利用者**のすり合わせ、合意形成					• JCM実施に向けた支援	
	• ESCO型サービス**利用者**の発掘 ➢ 現地病院等へのヒアリング（継続） ➢ 候補企業・施設の発掘（新規）											
				• プノンペン都気候変動適応行動計画のフォローアップ • 代表事業者の抽出								
○ 現地調査				☆	☆	☆		☆		☆		
○ 国内会議				☆						☆		
○ 現地ワークショップ					☆					☆		
○ 報告書の作成							☆（中間ドラフト）			☆（最終ドラフト） ☆（最終報告書）		

NTT DATA

Global IT Innovator

環境省　国際協力室　御中

NTT DATA
Global IT Innovator

平成29年度　低炭素社会実現のための都市間連携事業「プノンペン都における省エネ・再エネの導入促進による低炭素化推進事業（北九州市-プノンペン都連携事業）」最終報告会用資料

2018年2月20日
NTTデータ経営研究所
社会・環境戦略コンサルティングユニット

[目次]

NTT DATA

1. 都市間連携の概要と本事業での目標【再掲】

【北九州市ープノンペン都間の連携】

プノンペンの奇跡 （浄水分野）
配水ブロック技術移転
⇒ 無収水量率：72% → 8%、2005年：飲用可能宣言

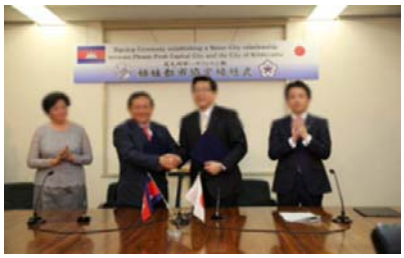
2015年7月フンセン首相 が北九州市を訪問。

「プノンペン都との姉妹都市締結」について、首相より提案を受ける

姉妹都市締結に向け、プノンペンにおけるニーズ把握のための基礎調査を実施
（廃棄物、エネルギー、下水道、環境保全）

2016年3月29日に姉妹都市締結

北九州市 ⟷ プノンペン都



【実現済の事業：平成28年度都市間連携事業】

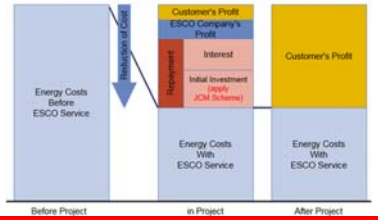
エネルギー分野での案件発掘
(NTTデータ経営研究所、北九州市)
平成28年度JCM設備補助事業として、「大型ショッピングモールへの1MW太陽光発電と高効率チラーの導入」事業が認定された。

プノンペン都気候変動適応行動計画策定支援
(日建設計シビル、北九州市)

【実現途上の事業、案件調査時の事業：本年度事業】

活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動

活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動



【将来像】

- カスタマイズ提案による大規模GHG排出削減案件の創出。
- ESCO型ビジネスモデルの確立により、省エネ・再エネ設備の導入の急速な拡大が期待される。
- 東南アジア等での横展開が期待される。

2. 7月・8月のイベント報告【再掲】

【第一回現地調査】

2017年7月3日～7月6日

<主な訪問先>

- Chip Mong Insee Cement
- サンライズジャパン病院
- イオンモールカンボジア
- プノンペン都国際連携室
- カンボジア環境省
- カンボジア大使館


カンボジア環境省


プノンペン都国際連携室

<主な成果>

- [活動①] Chip Mong Insee Cement と JCM設備補助事業へ向けた具体的協議を行い、前倒しで平成29年度の二次公募への応募できないか、検討を開始した。
- [活動②]サンライズジャパン病院へ訪問し、ESCO型ビジネスモデルの利用者として前向きに連携を検討いただいた。


Chip Mong Insee Cement

【都市間連携ワークショップ】

2017年7月25日～7月26日@北九州市
2017年7月27日～7月28日@川崎

<北九州市でのワークショップの主な訪問先>

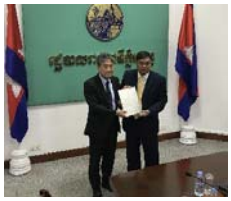
- エコタウンセンター　・環境ミュージアム
- EVバス試乗/太陽光発電設備見学
- ゴミ焼却発電設備見学
- 廃熱回収発電設備見学
- 計器工場訪問
- ロボット工場訪問


EVバス / 太陽光発電設備

【北九州市-プノンペン都セレモニー】

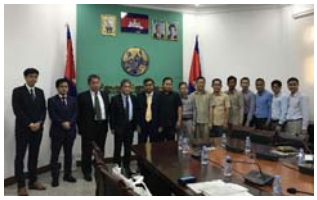
2017年8月3日～8月6日

平成28年度、北九州市が策定支援を行った**「プノンペン都気候変動戦略行動計画」**を手渡し、概要について説明を行なった。



(←)北九州市環境局長から、プノンペン都SUY副知事へ手渡し

(→)集合写真



3. 9月～11月のイベント報告【再掲】

【第二回現地調査】

2017年9月1日

<主な訪問先>

- 【共同事業者】Chip Mong Insee Cement

<同行者>

- 【代表事業者】(株)グローバルエンジニアリング: 高橋氏
- 【EPCコントラクター】コンチ川崎：浜田氏
- 【PDD等支援】NTTデータ経営研究所：村岡

<主な成果>

- [活動①] Chip Mong Insee Cementと平成29年度JCM設備補助事業の二次公募への応募に向けた具体的協議を行った。
- [活動①] 現地での議論を踏まえ、技術検討、経済性検討、CO2削減効果検討を行い、平成29年度の二次公募へ応募した。

【第三回現地調査】

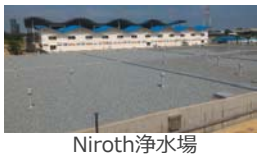
2017年11月20日～11月22日

<主な訪問先>

- サンライズジャパン病院
- プノンペン都国際連携室 廃棄物管理局
- 水道公社オフィス
- Chroy Changvar浄水場
- Niroth浄水場
- 新菱カンボジア
- カンボジア大使館

プノンペン都国際連携室・廃棄物管理局

Chroy Changvar浄水場



Niroth浄水場

<主な成果>

- [活動②] 昨年度北九州市が策定支援を行った「プノンペン都気候変動戦略行動計画」に関して、フォローアップを行なった。
- [活動②] ESCO型ビジネスモデルの利用者候補として、水道公社との議論および浄水場2ヶ所の現地視察を行なった。現在、レイアウト図面の提供を依頼中。

4. 12月～2月のイベント報告

【都市間連携ワークショップ】

2018年1月30日@東京
2018年1月31日～2月2日@北九州市

<東京での都市間連携ワークショップ>

- 公開セミナー
- 非公開セミナー

プノンペン都 ケオ氏のご発表

北九州市-プノンペン都連携事業の発表

<北九州市でのワークショップの主な訪問先>

- ゴミ収集現場視察
- ゴミ処理中間施設視察
- ゴミ焼却発電工場視察
- 最終処分場視察
- 自動車リサイクル工場
- EVバス試乗
- 太陽光発電設備見学

ゴミ収集現場の視察

最終処分場の視察

【第四回現地調査】

2018年2月7日～2月10日

<主な訪問先>

- プノンペン水道公社
- サンライズジャパン病院
- カンボジアホテル協会
- スターツホテルカンボジア
- プノンペン都-北九州市 市民啓発WSへの参加

プノンペン都-北九州市 市民啓発WS

<主な成果>

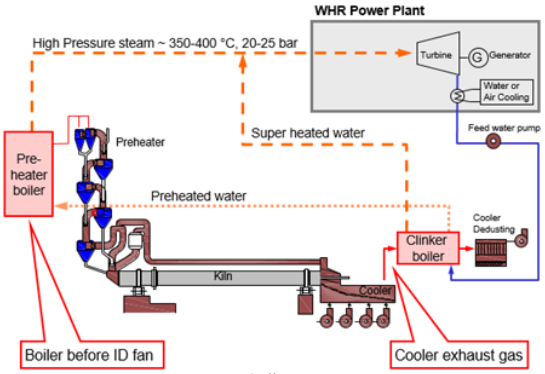
- [活動②] プノンペン水道公社へ訪問し、浄水場2ヶ所への太陽光発電設備導入の技術検討、経済性検討、CO2削減効果検討の結果を報告した。
- [活動②] 新規案件の発掘として、カンボジアホテル協会に訪問し、案件形成協力を依頼した。
- [活動②] 「プノンペン都気候変動戦略行動計画」のフォローアップとして、上下水・環境分野の市民啓発WSへ参加した。

5. プロジェクト進捗 ①セメント工場への廃熱回収設備の導入検討

事業の概要

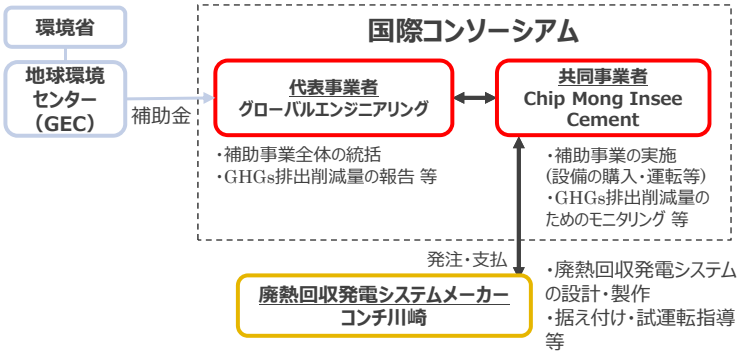
- カンボジアのセメント製造会社 CHIP MONG INSEE CEMENTと**廃熱回収発電システム**の導入を検討し、**平成29年度のJCM設備補助事業の二次公募へ応募した**。(「条件付き入札」での応募)
- CHIP MONG INSEE CEMENTは、Chip Mong Group (CMG)：60%、Siam City Cement Company (SCCC)：40% の合弁会社である。
- 代表事業者：(株)グローバルエンジニアリング
- 廃熱回収発電システムメーカー：コンチ川崎
- 蒸気タービン発電機の発電容量：**8,000 kW**
  (プラントの消費電力の約25%に相当)
- 想定CO2排出削減量：**20,860 tCO2/年**
- 想定初期投資額：**約15億円** (約40%をJCM設備補助事業で調達することを想定)
- 想定費用対効果：**3,039/tonCO2**
- 廃熱回収発電システムの概要、および、想定実施体制図、は右図の通り。
- Chip Mong Insee Cementによる入札の結果、親会社であるChip Mong Groupの判断により、提案していたコンチ川崎ではなく、中国EPCコントラクターが落札する結果となってしまい、取り下げることとなった。

廃熱回収発電システム概要



出典：Chip Mong Insee Cement 発表資料より

想定実施体制図



6.課題進捗 ①セメント工場への廃熱回収設備の導入検討

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1 済	現地セメント企業との直接協議	JCM事業実施の候補となるセメント企業に連絡を取り、JCM案件形成の可能性調査の継続の合意を図る。(5月まで)	NTT	現地セメント企業	Chip Mong Insee Cementに連絡を取り、JCM制度を改めて説明し、JCM事業参画への意思を確認する。
2 済	実運転データを元に、要求仕様等の技術検討を実施	現地セメント工場の実運転データを元に、技術検討を行い、機器仕様を固める(12月まで)	NTT	現地セメント企業	8月中旬にセメント工場運転開始。12月中旬～1月中旬に計画運転停止を行う予定。8月から12月の廃熱温度等の運転実データから技術検討を行い、機器仕様を固める。
3 済	要求仕様に基づく技術検討の実施	要求仕様をもとに、ベンダー等と機器検討をする。(2月まで)	NTT、現地セメント企業	ベンダー等	上記2で検討した機器仕様をもとに、ベンダー等に仕様を満たす機器のスペックを確認する。
4 済	設備導入にかかる経済性検討	設備導入による省エネに伴い、投資回収期間等の条件が許容範囲であることを確認する(2月まで)	NTT	現地セメント企業、ベンダー等	ベンダー等から得た見積もりおよび性能をもとに、投資回収期間の算定を行う。
5 済	CO2削減効果算出方法、モニタリング方法に関する検討	設備導入によるCO2排出削減量の算出を行う(2月まで)	NTT	ベンダー等	ベンダー等から得た性能と、既存の承認済みMRV 方法論をもとに、CO2排出削減量の計算を行う。
6 済	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7 済	JCM事業実施に向けた意思決定	調査結果を元に、現地セメント企業のJCM事業実施の意思を確認する。(2月まで)	NTT	現地セメント企業	上記1～6で検討した内容を説明し、JCM事業実施に向けた意思決定をサポートする。
8 済	現地制度などの確認	案件化に影響を及ぼす現地制度等の有無の確認 (2月まで)	北九州市	プノンペン都側	案件化に影響を及ぼす現地法制度等があるかどうか、プノンペン都側と確認する。

7. プロジェクト進捗 ②ESCO型ビジネスモデルの検討 (1/3)

進捗状況

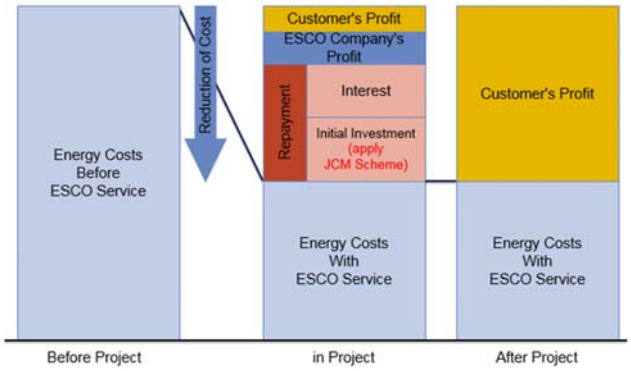
【ESCO型ビジネスモデルの提供者発掘】

- 提供者として、MGM Sustainable Energy Fundと協議中。第二号ファンドを立上げ予定で、出資枠の1割を東南アジアへ投資する予定。立上げに向けた調整が続いているとのこと。
- 代表事業者の候補企業として、設立済のMGMイノヴァ・キャピタル・ジャパンを想定。

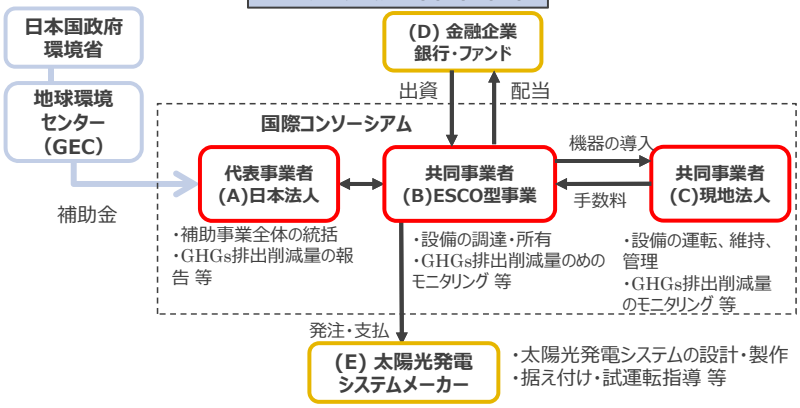
【ESCO型ビジネスモデルの利用者発掘】

- サンライズジャパン病院：屋根スペース、駐車場スペースを活用した太陽光パネルの導入の検討を進めている。詳細は別シートにて説明。
- 水道公社：既設の浄水場2ヶ所の候補地を視察し、入手したレイアウト図面に基づいて、太陽光パネルの導入の検討を実施。詳細は別シート。
- ホテル業界：新規発掘として、カンボジアホテル協会に訪問した。会員の現地ホテルと月に一度程度定期的な会合を開催しており、次回訪問する際には、JCM事業の説明する機会を調整してくれるとの合意を得た。また、スターツホテルカンボジアも紹介いただき、JCM事業の説明を行なった。案件形成に前向きに協力いただけるとの回答。

ESCO型ビジネスモデルのイメージ図



想定実施体制図

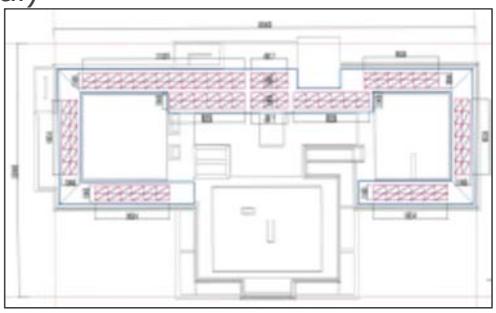


7. プロジェクト進捗 ②ESCO型ビジネスモデルの検討 (2/3)

事業の概要(想定)

想定されるプロジェクト(Sunrise Japan Hospital)

■日揮、産業革新機構、北原病院グループによる合弁会社。
■日本政府の「病院輸出」の成長戦略と同じ目的を有する事業。2016年9月20日に開院。
■病院の屋根スペース、駐車場スペースに、太陽光パネルの設置することを想定。



太陽光パネルの施工エリア

期待される効果(想定)

おおまかな試算をした結果は以下のとおり：
■導入パネル規模：およそ80 kW
■年間発電量：およそ110,000 kWh/year
■年間電気代削減額：およそ20,000 USD
■年間CO2排出削減量： およそ70 tCO2/年

資金調達方法(想定)

■おおまかな試算をした想定初期投資額：200,000 USD
■イニシャルコストの30%程度をJCM設備補助事業で調達することを想定する。
■事業者へのヒアリングの結果、開院したばかりのため、自己資金で調達は困難とのこと。
■初期投資負担の検討として、現地銀行と、ESCOやリース事業の検討を開始した。
■事業者は、発電によって削減した電気代に見合った額のリース料を、月々返済することを想定。

7. プロジェクト進捗 ②ESCO型ビジネスモデルの検討 (3/3)

事業の概要(想定)

想定されるプロジェクト(プノンペン水道公社)

■プノンペン水道公社の2ヶ所の浄水場に太陽光パネルの導入を検討。検討結果は下記の通り。
■初期投資ゼロをし、削減した電気代からリース代を返済するESCO型ビジネスモデルを検討中。


Choy Changvar WTP


Niroth WTP

期待される効果(想定)

想定サイト	Choy Changvar WTP	Niroth WTP
想定太陽光パネルエリア		
想定太陽光パネル規模	**約550kW**	**約1,850kW**
想定年間発電量	**約740,000 kWh/Year**	**約2,530,000 kWh/Year**
概算初期投資コスト	**約1,100,000 USD**	**約3,750,000 USD**
想定年間削減電力コスト	**約124,000 USD/Year**	**約424,000 USD/Year**
想定年間CO2排出削減量	**約260 tCO2/Year**	**約895 tCO2/Year**

8. 課題進捗 ②ESCO型ビジネスモデルの検討

No.	調査で解決したい課題	獲得目標（いつまでに）	担当	相手方	調査の内容
1 済	ESCO型サービスの提供体制づくりのための現地金融機関等との直接協議	ESCO型サービスの提供者候補となる現地金融機関等との直接協議により、ビジネスモデル実現の可能性の検証を行う。(8月まで)	NTT	現地金融機関等	ネットワーク済みの現地金融機関（サタパナ銀行、アクレダ銀行等）と直接協議を行い、JCM制度、ESCO事業について改めて説明し、ESCO型サービスのへ提供体制作りを行う。
2 済	ESCO型サービスの提供体制づくりのための新たな連携金融機関の発掘	ESCO型サービスの提供者候補となる新たな連携金融機関の発掘を行う。(8月まで)	NTT	リース会社、ファンド運営会社等	現地リース会社、東南アジア地域のファンド運営会社や、国内最大手のリース会社等との協議を想定している。JCM制度、ESCO事業の仕組みを説明し、ESCO型サービスのへ提供体制作りを行う。
3 済	ESCO型サービスの利用者の候補となる新たな現地企業等の発掘	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。（10月まで）	NTT、北九州市	現地企業等	ESCO型サービスの利用者として、候補となる現地企業等を発掘する。
4 済	ESCO型サービスの利用者の現地候補病院等との直接協議	ESCO型サービスの利用者候補となる現地病院等との直接協議を実施する。(10月まで)	NTT	現地病院、現地企業等	ESCO型サービスの利用者として、上記3で発掘した現地企業、および、ネットワーク済みの現地病院（クメール-ソビエト友好病院、サンライズジャパン病院等）と直接協議を行う。
5 済	JCM事業形成に向けた検討の実施	ESCO型サービス提供者候補と利用者候補との協議を行い、ESCO型サービス確立に向け検討する。(2月まで)	NTT、ESCO型サービス提供者	現地病院、現地企業等	上記1,2で検討したESCO型サービスの利用者と、上記3,4で検討した現地企業等とをすり合わせ、案件形成に向けた支援を行う。
6 済	代表事業者の抽出・働きかけ	JCM事業化の際、国際コンソーシアムの代表事業者となる日本企業を発掘する(2月まで)	NTT	国内企業	JCM事業実施に向けた、代表事業者となりうる企業の抽出し、働きかけを行う。
7 済	プノンペン都気候変動適応行動計画のフォローアップ	昨年度策定した「プノンペン都気候変動適応行動計画」をプノンペン都側に提出し、フォローアップを行う。(2月まで)	北九州市	プノンペン都	昨年度策定した「プノンペン都気候変動適応行動計画」をもとに、北九州市ープノンペン都間の連携を深め、案件化を促進する。

9. 調査実施スケジュール (11月末時点進捗)

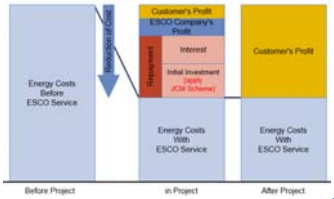
活動項目	2017年 4月	5月	6月	7月	8月	9月	10月	11月	12月	2018年 1月	2月	3月
1.エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動	• セメント工場との直接協議			• 現地制度の確認 • 代表事業者の抽出	• 実運転データの取得、および、機器使用検討				• 技術検討 • 経済性検討 • CO2削減効果検討		• JCM実施に向けた支援	
2.金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動	• ESCO型サービス**提供者**の発掘 ➢ 現地金融機関等へのヒアリング（継続） ➢ リース会社、ファンドの発掘（新規） • ESCO型サービス**利用者**の発掘 ➢ 現地病院等へのヒアリング（継続） ➢ 候補企業・施設の発掘（新規）			• プノンペン都気候変動適応行動計画のフォローアップ • 代表事業者の抽出		• ESCO型サービスの**提供者**と**利用者**のすり合わせ、合意形成					• JCM実施に向けた支援	
○ 現地調査				☆	☆	☆		☆		☆		
○ 国内会議				☆						☆		
○ 現地ワークショップ					☆					☆		
○ 報告書の作成							☆（中間ドラフト）			☆（最終ドラフト）	☆（最終報告書）	

10. H30年度 都市間連携事業（北九州市-プノンペン都）
①同一機器の多ユーザー展開型リースモデルの可能性検討

同一仕様の機器を複数のユーザーに展開するリースモデルの可能性を検討する。

- JCM設備補助事業、ESCO型ビジネスモデルとも組み合わせることで、下図に示すような複数のメリットが提供可能。
- 単独では規模が小さくこれまではJCM化が難しかった案件でも、今回のモデルでは、案件形成の可能性が拡がる。
- これまでの発掘してきた現地法人とのチャネルも活かすことが可能。（病院・水道公社・ホテルなど）

○現地法人は、初期投資ゼロで機器導入可能。月々の削減電力量の一部からリース代を返却するモデル（ESCO型ビジネスモデル）。
○電気代の高いカンボジアでは有効。



想定リーススキームモデル

10. H30年度 都市間連携事業（北九州市-プノンペン都）
②食品廃棄物や家畜糞尿を利用したバイオマスエネルギーの面的利用の可能性検討

大型ホテル・大型ショッピングモール等から出る食品廃棄物や、プノンペン周辺における畜産の家畜糞尿を利用した、バイオマスエネルギーの面的利用の可能性を検討する。

- **大型ホテル・大型ショッピングモール等**では、ある程度まとまった量の**食品廃棄物が発生**すると予想される。
  また、これら施設は、**熱需要、電気需要も多く、バイオマスエネルギーの利用者**ともなりうる。
  想定している事業者で、イオンモールカンボジアや、ホテルカンボジアーナ、Sohkaホテルグループなどで、直接ヒアリング等を行い、食品廃棄物の量・成分、熱需要・電気需要を把握したい。
- **プノンペンを中心に養豚や肉牛などの畜産業もおこなわれている。**
  プノンペンに近いコンポンスプー州(Kampong Speu)に多くの養豚場があるとの情報を得ている。
  また、近年新たな投資も行なわれており、現地財閥系企業が養豚事業に6000万ドル投資するニュースや、日本企業の掛川酵母が100万ドルの投資で大型養豚場を建設予定という情報もある。
  これらの候補企業を中心に、ヒアリング等を行い、家畜糞尿の量・成分等を把握し、バイオマスエネルギーの活用可能性を検討したい。
- また、プノンペンから離れるが、**シアヌークビル周辺でも、リゾートホテルが多く**、周辺に現地財閥系企業(Mong Rithy Group)が営む**大型養豚場**がある。こちらのエリアでの横展開の可能性も視野に入れて調査を行ないたい。

候補となる施設(想定)

イオンモールカンボジア


Sohkaホテルグループ


ホテルカンボジアーナ

NTT DATA
Global IT Innovator

NTT DATA
Global IT Innovator

FY2017 City-to-City Collaboration Projects
City of Kitakyushu – Phnom Penh Capital City
Explanation of JCM (Joint Crediting Mechanism)

Jul-2017
NTT Data Institute of Management Consulting, Inc.
Socio & Eco Strategic Consulting Unit

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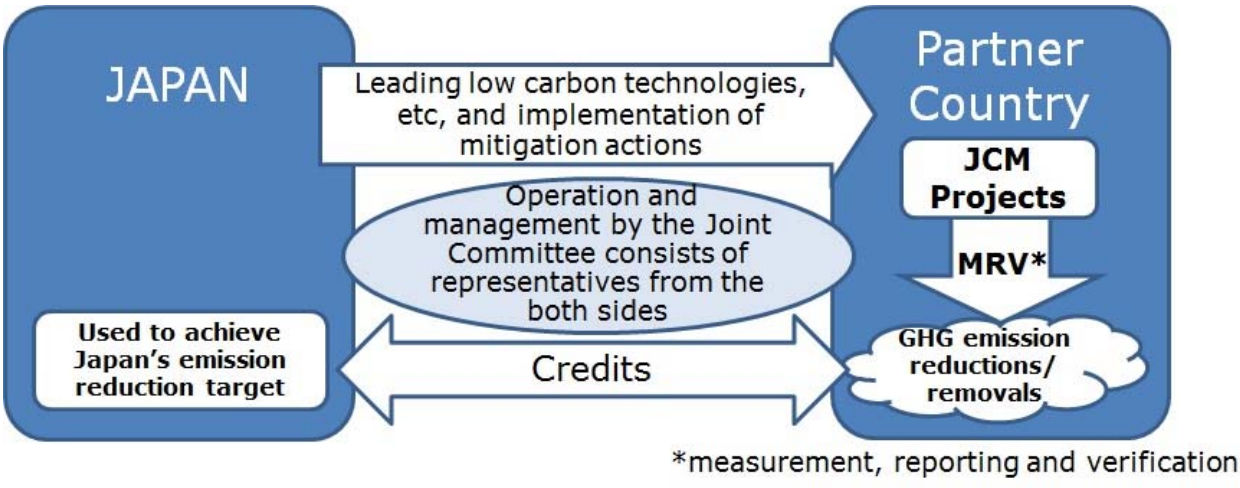
1. Basic Concept of the JCM (Joint Crediting Mechanism)

- Facilitating diffusion of leading low carbon technologies, products, systems, services and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries;
- Appropriately evaluating contributions from Japan to GHG)emission reductions or removals in a quantitative manner, and use them to achieve Japan's emission reduction target;
- Contributing to the ultimate objective of the UNFCCC by facilitating global actions for GHG emission reductions or removals



Source : GEC's Homepage (http://gec.jp/jcm/about/)

2. JCM Financing Program

The draft budget for projects starting from FY 2016 is 6.7 billion JPY (approx. USD 56 million) in total by FY2018

※Budget will be fixed after approval by the Parliament

Government of Japan

※Includes collaboration with projects supported by JICA and other governmental-affiliated financial institute.

Finance part of an investment cost (less than half)

Conduct MRV and expected to deliver at least half of JCM credits issued

International consortiums (which include Japanese entities)

- Scope of the financing: facilities, equipment, vehicles, etc. which reduce CO_2 from fossil fuel combustion as well as construction cost for installing those facilities, etc.
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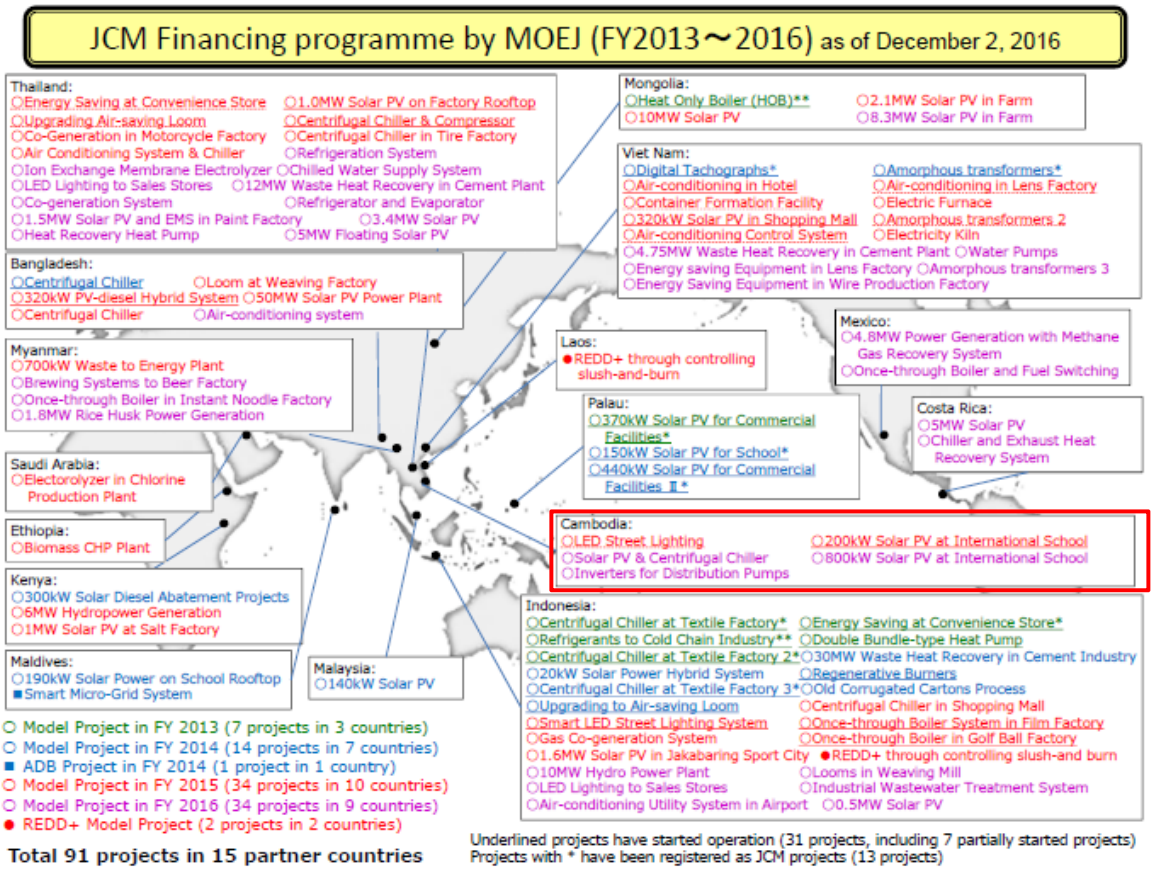

Source：GEC Homepage

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Phnom Penh miracle (Water purification field)
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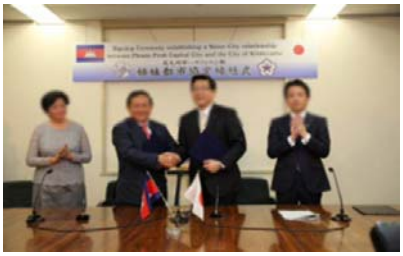

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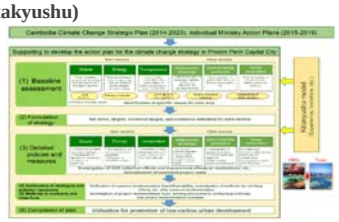

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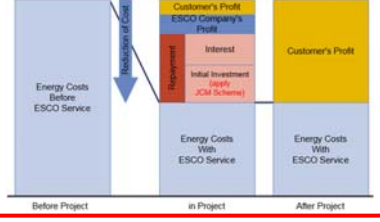

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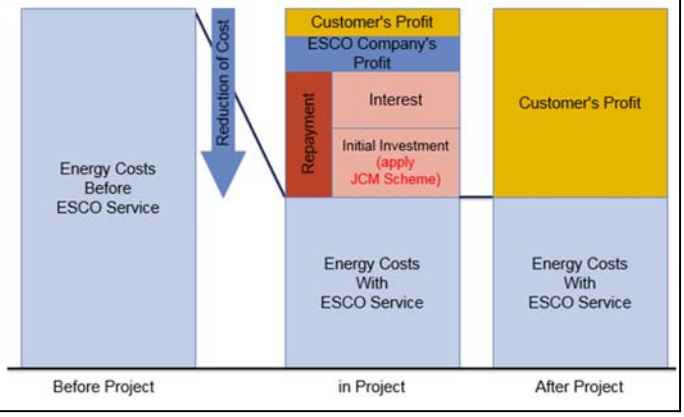
Image	 Cement Plant	

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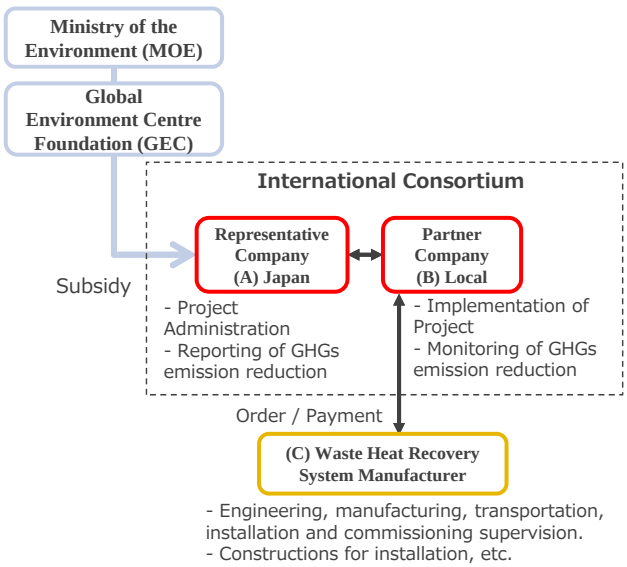

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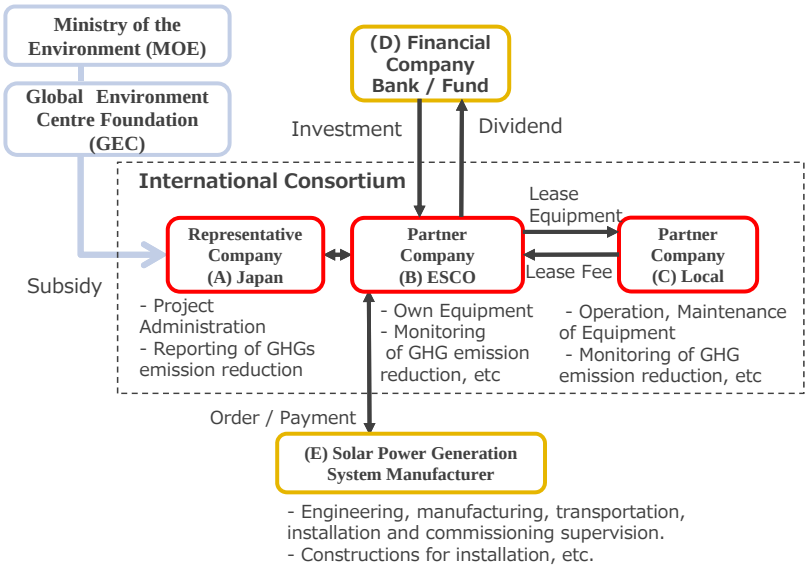

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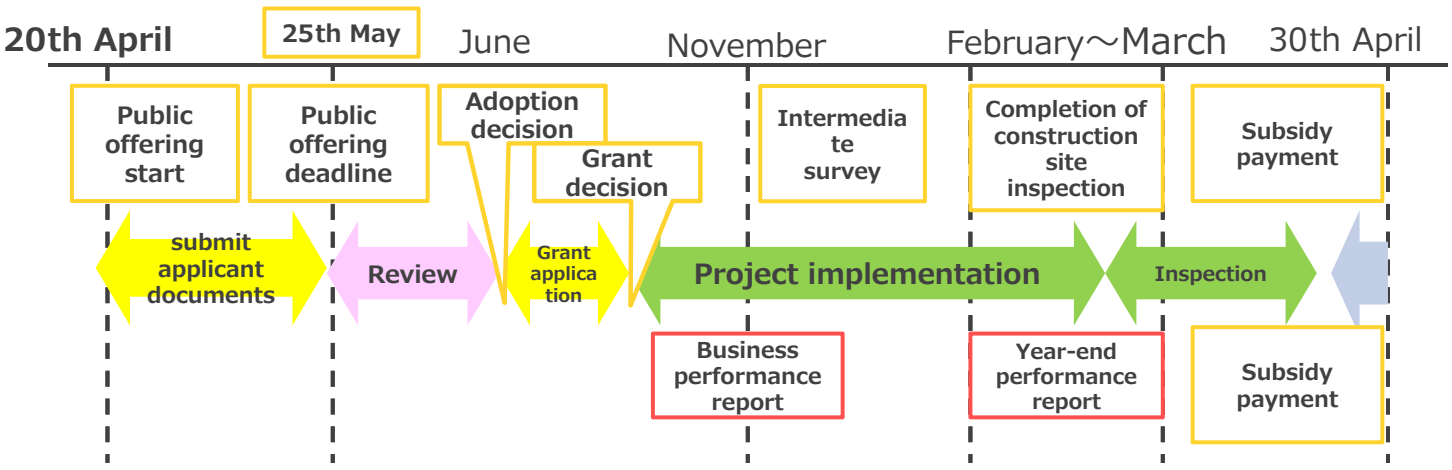

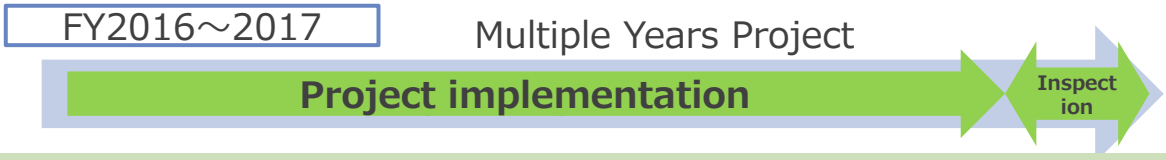

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Dear Chip Mong Insee Cement

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FY2017 City-to-City Collaboration Projects City of Kitakyushu – Phnom Penh Capital City Explanation of JCM (Joint Crediting Mechanism) ~ For Chip Mong Insee Cement ~

Jul-2017

NTT Data Institute of Management Consulting, Inc.
Socio & Eco Strategic Consulting Unit

[Index]

1. JCM Financing Program

The draft budget for projects starting from FY 2016 is 6.7 billion JPY (approx. USD 56 million) in total by FY2018

※Budget will be fixed after approval by the Parliament

Government of Japan

Finance part of an investment cost (less than half)

Conduct MRV and expected to deliver at least half of JCM credits issued

※Includes collaboration with projects supported by JICA and other governmental-affiliated financial institute.

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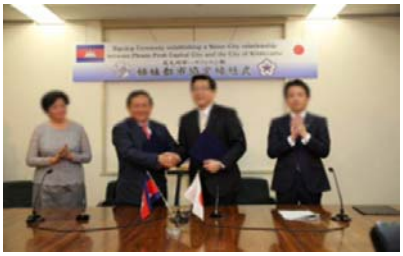

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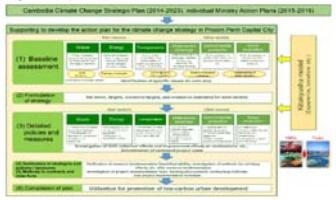

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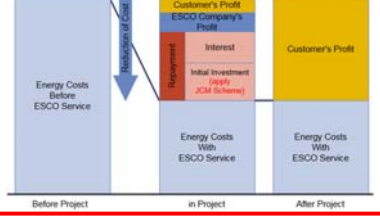

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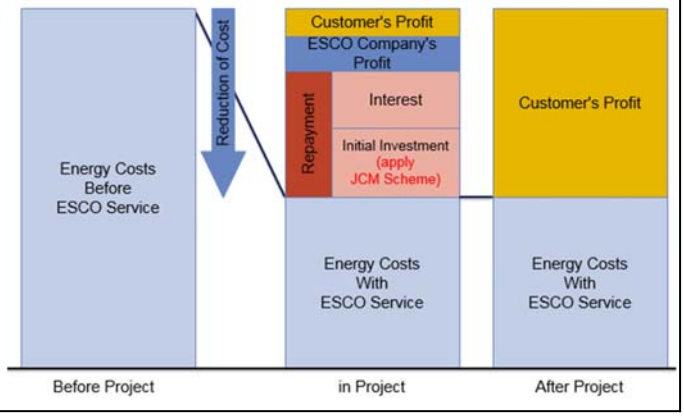
Image	 Cement Plant	

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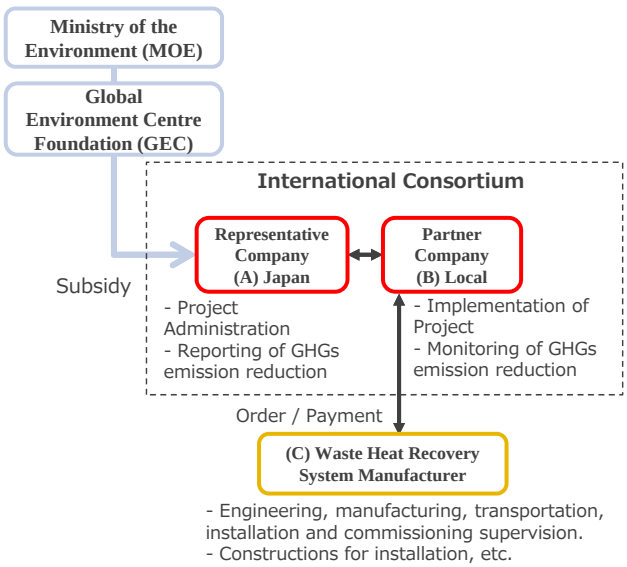

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Q1) Do you have any candidates of WHR manufacturers?

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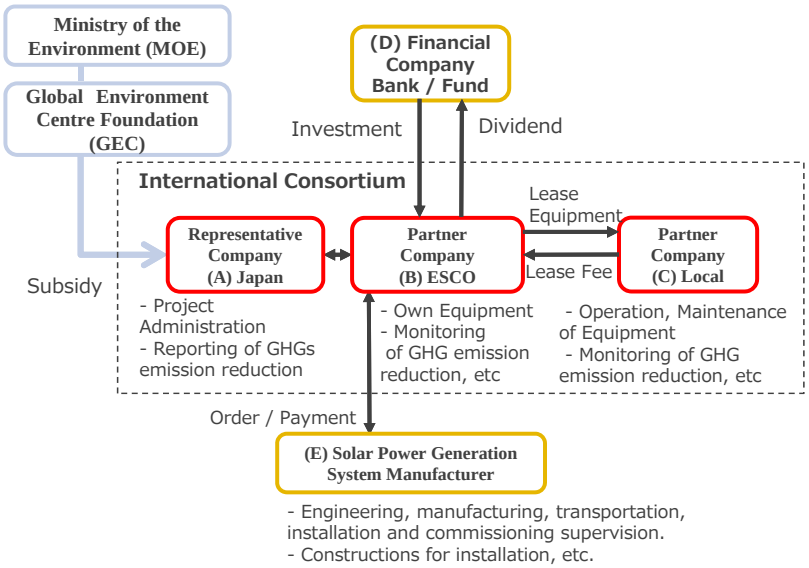

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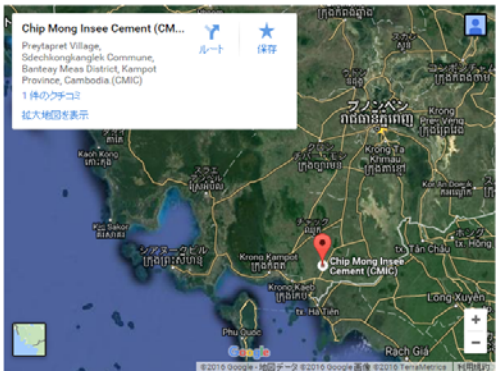
6. Summary of Introduction of WHR System for CMIC

Project overview (assumed)

Assumed project (CHIP MONG INSEE CEMENT CORPORATION)

- We conduct feasibility study of a JCM subsidized project for cement plant which have high potential for the CO2 reduction by using waste heat recovery power generation system.
- CHIP MONG INSEE CEMENT is a joint venture company of Chip Mong Group (CMG): 60% and Siam City Cement Company (SCCC): 40%.
- The plant will start production in mid Q4/2017.
- Around mid 2018, tendering exercise for suppliers of waste heat recovery (WHR) system will be stated.
- Commissioning of WHR system is expected in Q1 to Q2 of 2020.



Google Map: Cement Plant in Kampot (125km from Phnom Penh)

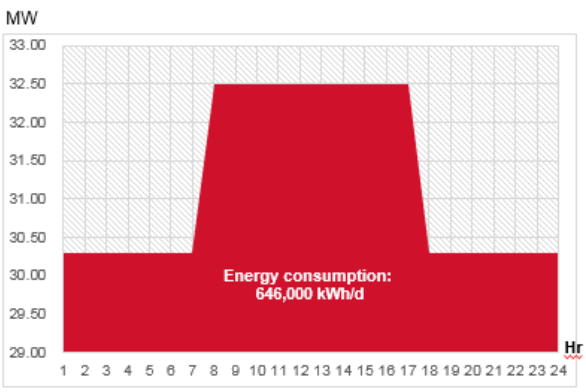
Expected effects (assumed)

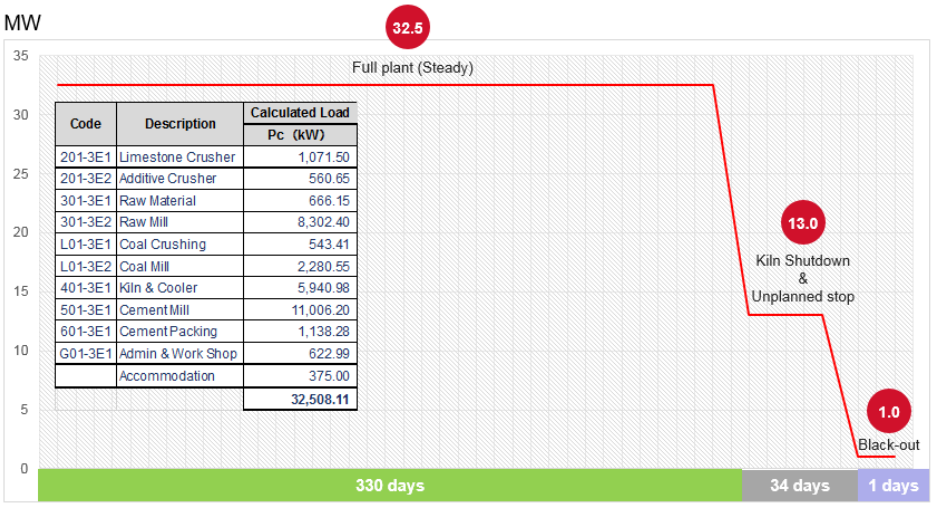
- Power generation of around 8MW of electrical power is expected.
- Yearly CO_2 Emission Reduction of around 30,000 tCO_2/year is expected.

Funding procurement methods (assumed)

- Initial cost of equipment would be financed by the cement company.
- It is assumed that 50% of the initial cost, as maximum, is subsidized by JCM Financing Program.

7. Estimated Electrical Energy Consumption





Code	Description	Calculated Load Pc (kW)
201-3E1	Limestone Crusher	1,071.50
201-3E2	Additive Crusher	560.65
301-3E1	Raw Material	666.15
301-3E2	Raw Mill	8,302.40
L01-3E1	Coal Crushing	543.41
L01-3E2	Coal Mill	2,280.55
401-3E1	Kiln & Cooler	5,940.98
501-3E1	Cement Mill	11,006.20
601-3E1	Cement Packing	1,138.28
G01-3E1	Admin & Work Shop	622.99
	Accommodation	375.00
		32,508.11

Code	Description	Calculated Load Pc (kW)	Hrs	kWh
Production Area				
201-3E1	Limestone Crusher	1,071.50	12.00	12,858.85
201-3E2	Additive Crusher	560.65	12.00	6,728.65
301-3E1	Raw Material	666.15	12.00	7,994.65
301-3E2	Raw Mill	8,302.40	20.50	170,200.05
L01-3E1	Coal Crushing	543.41	6.00	3,261.31
L01-3E2	Coal Mill	2,280.55	18.30	41,734.92
401-3E1	Kiln & Cooler	5,940.98	24.00	142,584.37
501-3E1	Cement Mill	11,006.20	20.50	225,627.95
601-3E1	Cement Packing	1,138.28	15.00	17,075.05
Admin Area				
G01-3E1	Admin & Work Shop	622.99	24.00	13,456.58
	Accommodation	375.00	12.00	4,500.00
		32,508.11		**646,022.38**

* Source: Presentation Material by Chip Mong Insee Cement

- Electrical energy consumption is 646 MWH/day for normal operation @330 day/year.
- Electrical energy consumption is 260MWH/day during kiln shutdown and unplanned stop @34 day/year.

Q2) In power supply contract between EDC and CMIC, are there any agreements for reduction of power supply after introduction of WHR and PV panels?

8. Schedule of Our Project

Activities	2016 Jul	Aug	Sep	Oct	Nov	Dec	2017 Jan	Feb	Mar	Apr	May	Jun
CMIC's Schedule		☆ Plant Start-up				Planned Shut Down & Collection of Data				・Place Orders in Q2/2018 ・Have WHR running by Q3/2019		
Schedule of FY2017 City-to-City Collaboration Projects (Feasibility Study)		Project Duration										
		Discussion with CMIC	Data Collection → Requirements of WHR will be determined.				・Technica Evaluation ・Economical Study ・Study for CO2 Emission Reduction					
Our Visit to Phnom Penh (Plan)	☆	☆			☆		☆					
Schedule of FY2018 JCM Financing Program									Preparation	Public Offering Submit Applicant Documents	GEC's Review	

Q3) What kind of data will be collected to determine specification of WHR?

Q4) Timing Place Order of WHR shall be after JCM's grant decision (approx. Oct-2017). To be discussed.

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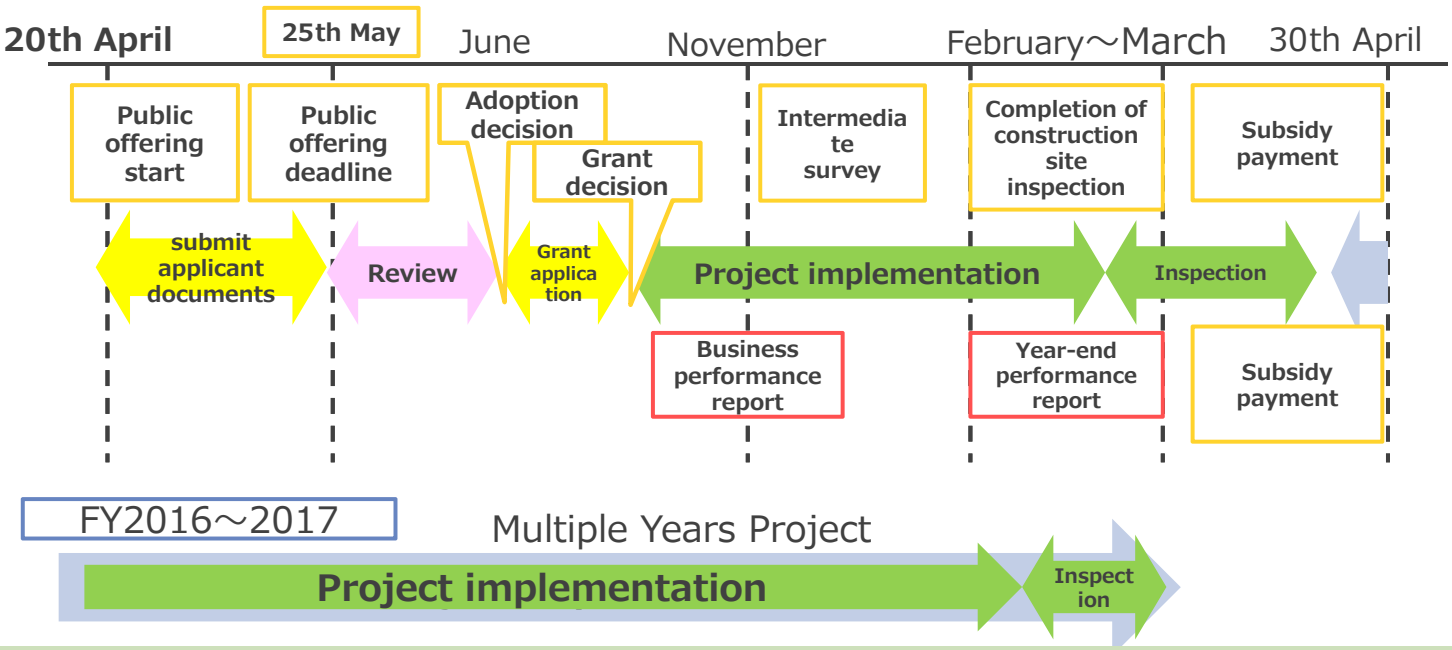

FY2016～2017 Multiple Years Project

- Grant application is needed from the adoption unofficial **within 3 months.**
- pay estimate to the end of each FY year, the settlement payment in the final year

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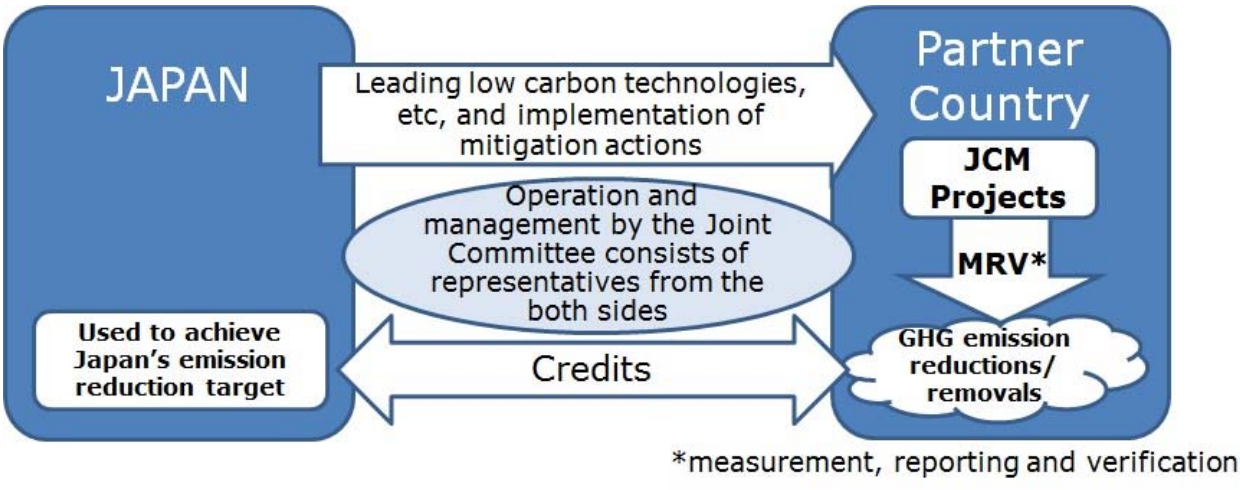
(Ref) Basic Concept of the JCM (Joint Crediting Mechanism)

- Facilitating diffusion of leading low carbon technologies, products, systems, services and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries;
- Appropriately evaluating contributions from Japan to GHG)emission reductions or removals in a quantitative manner, and use them to achieve Japan's emission reduction target;
- Contributing to the ultimate objective of the UNFCCC by facilitating global actions for GHG emission reductions or removals



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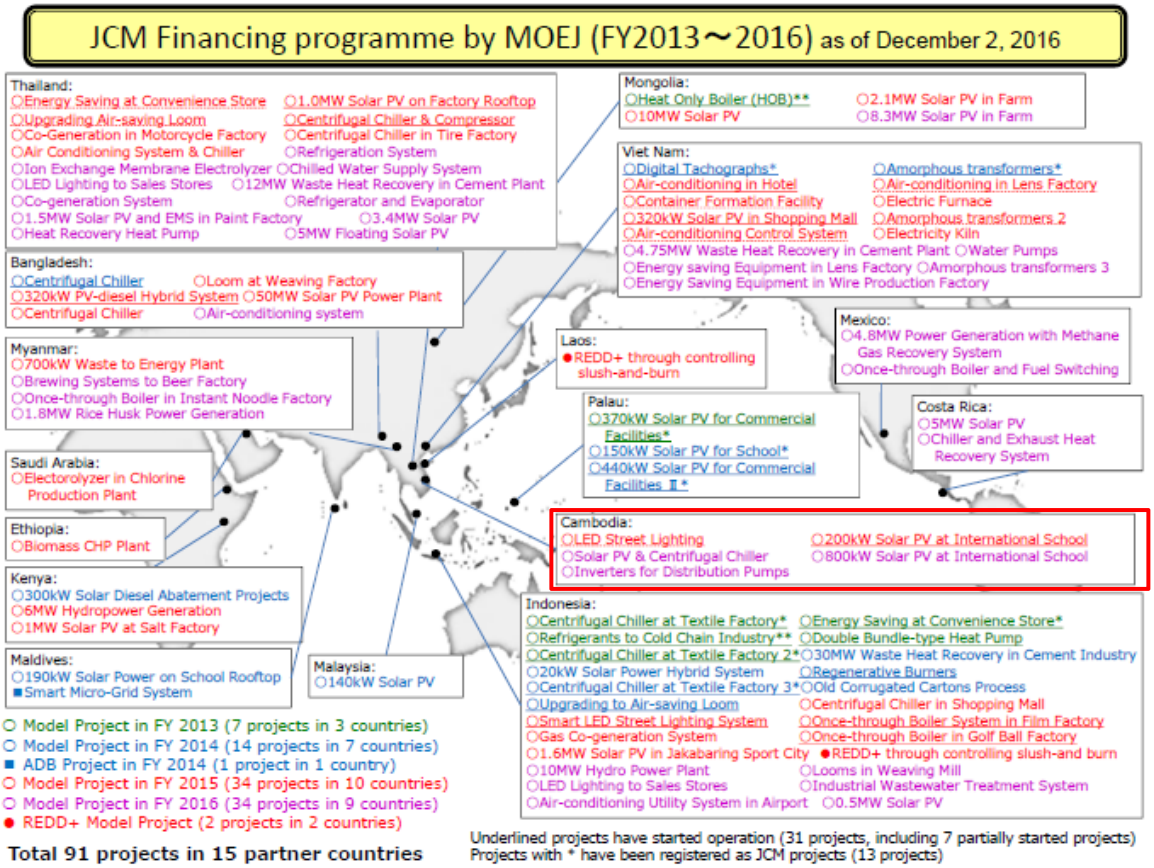

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サンライズジャパン病院 御中

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平成29年度　低炭素社会実現のための都市間連携事業「プノンペン都における省エネ・再エネの導入促進による低炭素化推進事業（北九州市-プノンペン都連携事業）」～サンライズジャパン病院様向け資料～

2017年11月
NTTデータ経営研究所
社会・環境戦略コンサルティングユニット

[目次]

NTT DATA

1. JCM設備補助事業の概要

2017年度予算（案）：
2017年度から開始する事業に対して、3か年で合計60億円

環境省

JICAなど政府系金融機関が支援するプロジェクトと連携した資金支援を含む

初期投資費用の1/2以下を補助

MRVの実施によりGHG排出削減量を測定。クレジットの発行後は1/2以上を日本政府に納入

国際コンソーシアム
（日本の民間団体を含む）



出典：GEC資料

補助対象者
（日本の民間団体を含む）国際コンソーシアム

事業実施期間
最大3年間

補助対象
エネルギー起源CO2排出削減のための設備・機器を導入する事業（工事費、設備費、事務費等を含む）

補助対象要件
補助交付決定を受けた後に設備の設置工事に着手し、3年以内に完工すること。また、JCMプロジェクトとしての登録及びクレジットの発行を目指すこと

2. 北九州市-プノンペン都間の連携、および、本調査での活動

【北九州市ープノンペン都間の連携】

プノンペンの奇跡 （浄水分野）
配水ブロック技術移転
⇒ 無収水量率：72% → 8%、2005年：飲用可能宣言

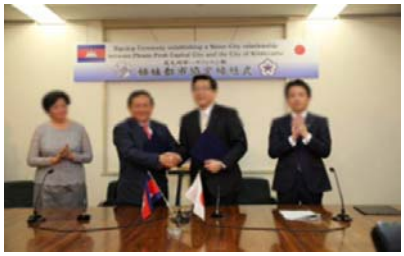
2015年7月フンセン首相 が北九州市を訪問。

「プノンペン都との姉妹都市締結」について、首相より提案を受ける

姉妹都市締結に向け、プノンペンにおけるニーズ把握のための基礎調査を実施
（廃棄物、エネルギー、下水道、環境保全）

2016年3月29日に姉妹都市締結

北九州市 ⟷ プノンペン都



【実現済の事業：平成28年度都市間連携事業】

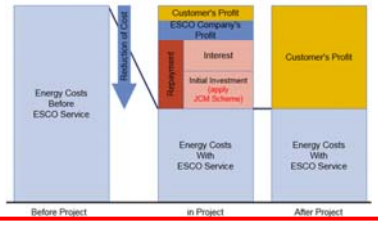
エネルギー分野での案件発掘
(NTTデータ経営研究所、北九州市)
平成28年度JCM設備補助事業として、「大型ショッピングモールへの1MW太陽光発電と高効率チラーの導入」事業が認定された。

プノンペン都気候変動適応行動計画策定支援
(日建設計シビル、北九州市)

【実現途上の事業：本年度調査事業での2つの活動】

活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動

活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動

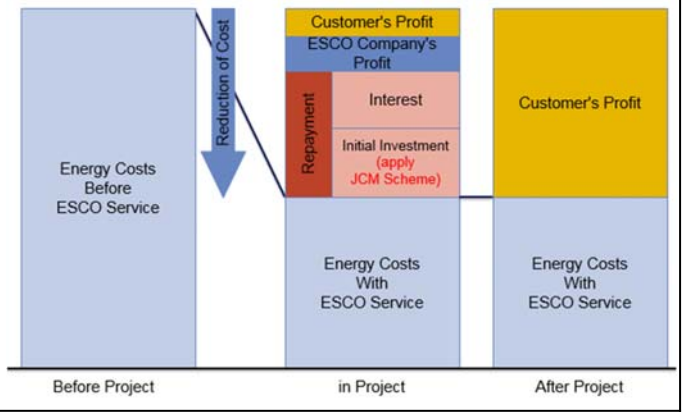


【将来像】

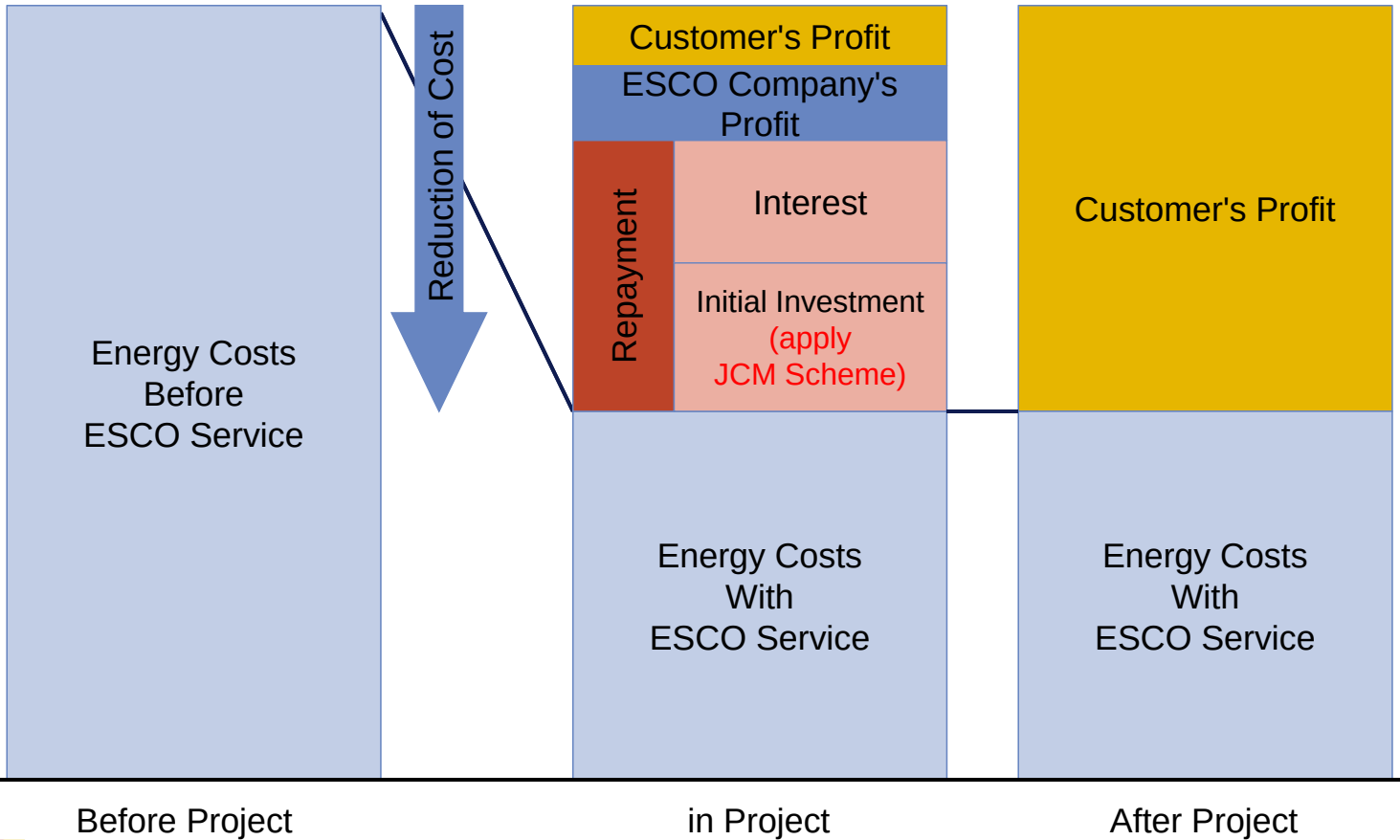
- カスタマイズ提案による大規模GHG排出削減案件の創出。
- ESCO型ビジネスモデルの確立により、省エネ・再エネ設備の導入の急速な拡大が期待される。
- 東南アジア等での横展開が期待される。

3. 都市間連携事業におけるプノンペンでの調査活動の概要

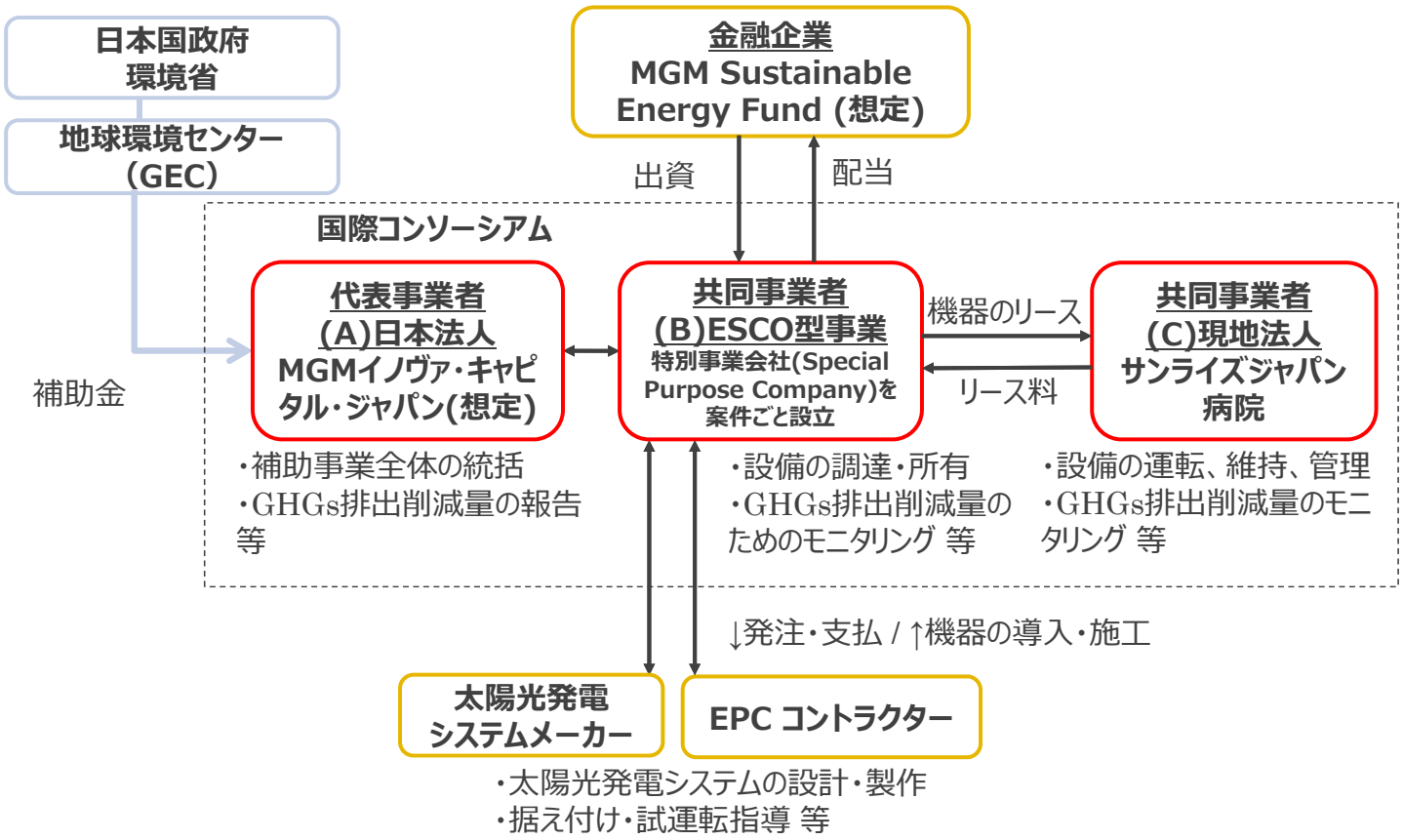
本事業では、カンボジア王国プノンペン市と北九州市の協力関係のもと、2つのタイプのプロジェクトに関して調査を実施する。

想定事業	活動1：エネルギーコスト削減ニーズの高い大企業向けカスタマイズ型提案活動	活動2：金融サービスをパッケージ化したESCO型ビジネスモデルの提案活動
プロジェクト内容	セメント工場等を対象に、廃熱回収発電設備等の導入について可能性を調査し、大幅なCO2削減を目指す。	太陽光発電システムなどの機器と、金融サービスとパッケージ化し、ユーザーの負担なしで機器を導入するESCO型サービスのビジネスモデル確立を目指し調査する。
想定導入技術	廃熱回収発電システム	太陽光発電システム など
イメージ図	 想定しているセメント工場	

4. ESCO型ビジネスモデル



5. 想定実施体制図



6. サンライズジャパン病院様向け太陽光パネルの導入検討

事業の概要(想定)　想定されるプロジェクト(Sunrise Japan Hospital)

■日揮、産業革新機構、北原病院グループによる合弁会社。
■日本政府の「病院輸出」の成長戦略と同じ目的を有する事業。2016年9月20日に開院。
■病院の屋根スペース、駐車場スペースに、太陽光パネルの設置することを想定。

期待される効果(想定)

おおまかな試算をした結果は以下のとおり：
■導入パネル規模：およそ80 kW
■年間発電量：およそ110,000 kWh/year
■年間電気代削減額：およそ20,000 USD
■年間CO2排出削減量： およそ38.7 tCO2/年

＊本結果は、想定に基づく数値である。
事業化には、メーカー、施工会社等を含めた詳細検討が必要。

資金調達方法(想定)

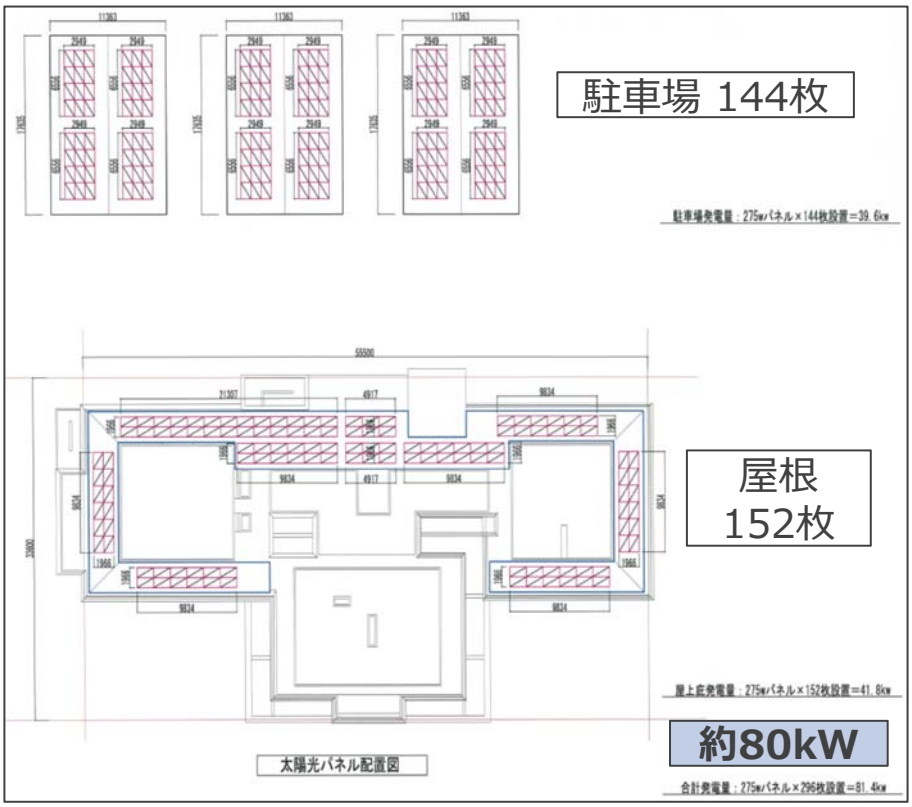
■おおまかな試算をした想定初期投資額：200,000 USD （2300万円）
■イニシャルコストの10%程度をJCM設備補助事業で調達することを想定する。
■事業者へのヒアリングの結果、開院したばかりのため、自己資金で調達は困難とのこと。
■初期投資負担の検討として、現地銀行と、ESCOやリース事業の検討を開始した。
■事業者は、発電により削減した電気代に見合った額のリース料を、月々返済することを想定。

7. 太陽光パネルの設置スペース、および、割付図

➢ 駐車場スペース

➢ 屋根スペース

➢ 太陽光パネル割付図



8. 補助率の上限

➢ 対象国での「類似技術」の採択案件数により、補助率が異なる。

事業を実施する国における「類似技術」のこれまでの採択案件	0 (初の導入事例)	1件以上 3件以下	4件以下
補助率の上限	Maximum 50 %	Maximum 40%	Maximum 30%

➢ カンボジアでの補助率の上限は以下の通り。

技術	冷凍機 (空調用)	LED街路灯 (調光システム含む)	ポンプ制御用 インバーター	太陽光発電
採択案件数	1	1	1	3
補助率の上限	Max. 40%	Max. 40%	Max. 40%	Max. 40%

9. 費用対効果、および、投資回収年数

- 申請した案件の審査にあたり、(1)費用対効果、および、(2)投資回収年数の2点が審査項目として確認される。

(1) 費用対効果については、4,000円/tCO_2。

「補助金額 ÷ 導入する設備の日本の補助対象設備の法定耐用年数期間中の累計温室効果ガス削減量(CO2換算) = 温室効果ガス 1トン(CO2換算)の削減にかかる補助金額」

(2) 投資回収年数については、3年以上。

「(総事業費 – 補助金額)÷年間の運転費用削減額」
または
「(総事業費 – 補助金額)÷(年間収入 – 年間運転費用)」

10. JCM設備補助事業申請時に使用するCO2排出削減係数

- 平成28年度からJCM設備補助事業申請時に使用するCO2排出削減係数が設定され、より厳しい値を使うことになった。費用対効果のクライテリアに影響有。

(t-CO_2/MWh)

Operating margin from 2007-2009	0.6257
Build margin 2009	0.6878
Combined margin : Wind and solar power generation project activities for the first crediting period and for subsequent crediting periods	**0.6413**
Combined margin: All other projects for the first crediting period	**0.6568**
Combined margin: All other projects for the second and third crediting periods	**0.6723**

Source: IGES「Grid Emission Factor of the Phnom Penh Electricity Grid」

【注記】本一覧表はJCM設備補助事業の審査に際して用いられるものであり、JCでの決定等を予断するものではありません。

H29年度JCM設備補助事業（二次公募） 電力CO2排出係数(tCO2/MWh)一覧表

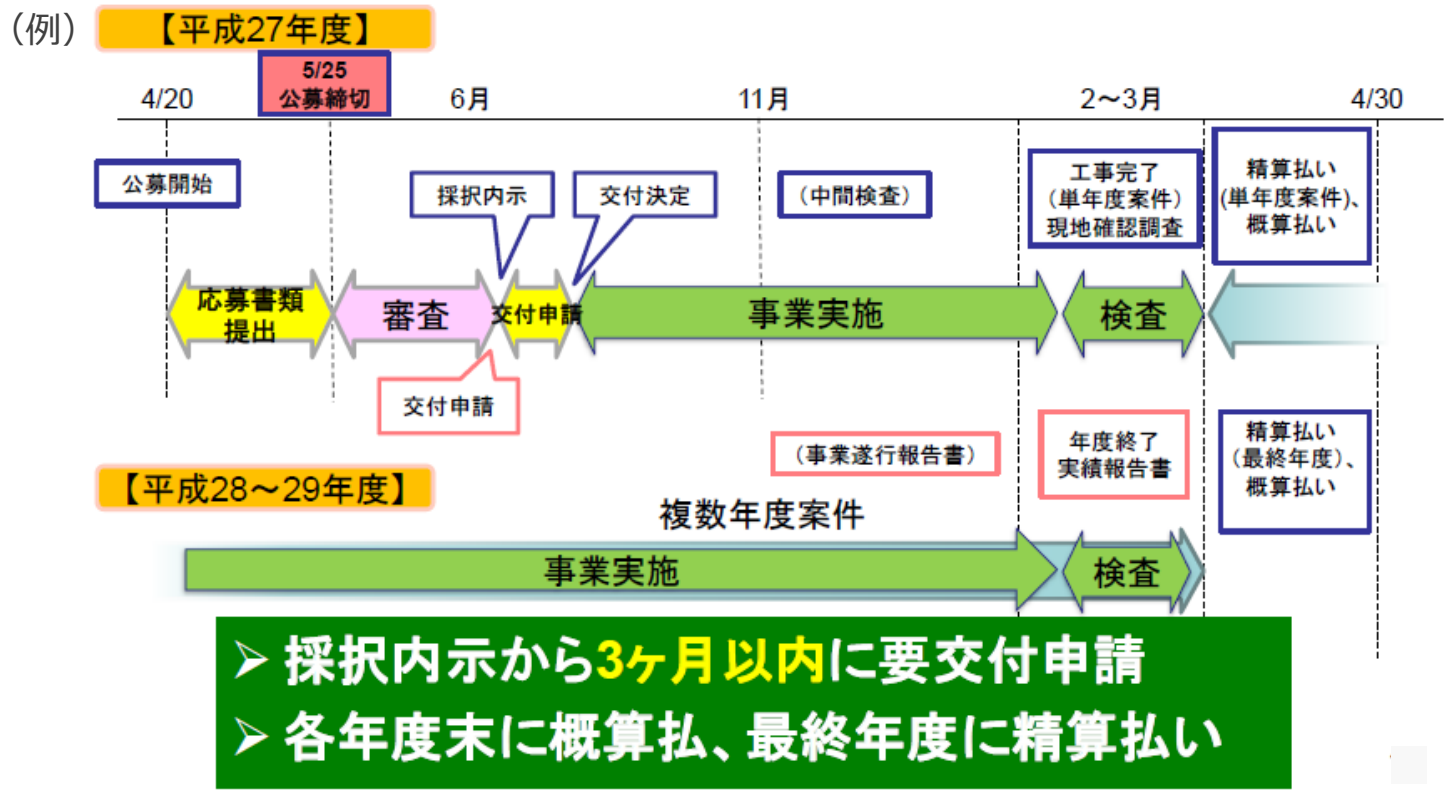
No.	パートナー国	省エネルギー			再生可能エネルギー(PV、風力、水力等)		
		全ての場合	右記以外の場合	所内自家発電のみを代替する場合	全ての場合	右記以外の場合	所内自家発電のみを代替する場合
11	カンボジア	ー	別表3参照	0.8	ー	0.353	0.533

別表3 カンボジア

No.	グリッド	省エネルギー
1	ナショナルグリッド	0.384
2	Kampot-Sihnoukグリッド	0.643
3	Kampong Chamグリッド	0.724

Source: GEC「H29年度JCM設備補助事業（二次公募）電力CO2排出係数(tCO2/MWh)一覧表」

11. JCM設備補助事業申請から事業実施までのスケジュール



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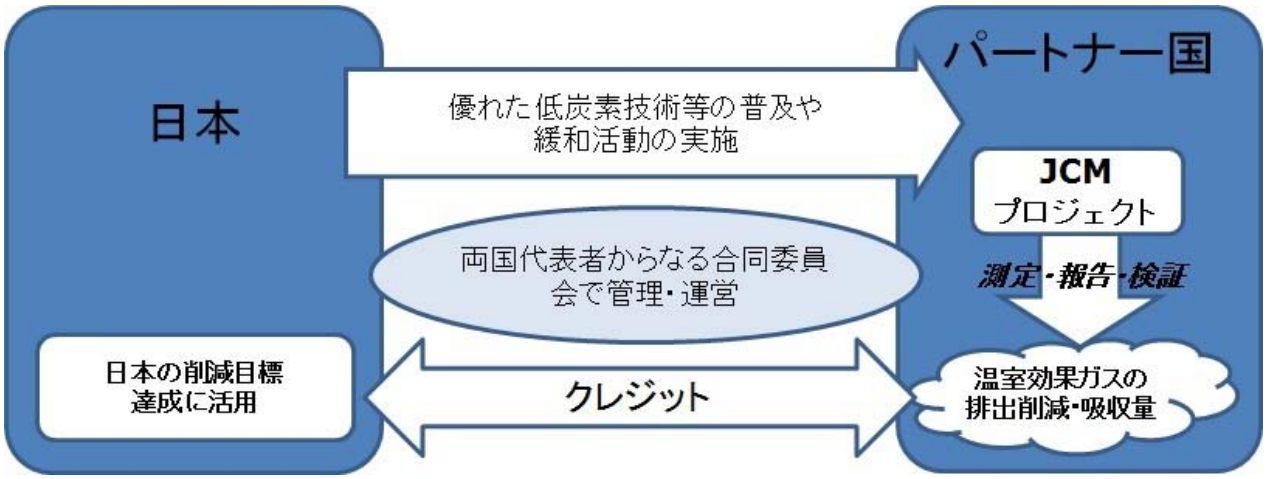
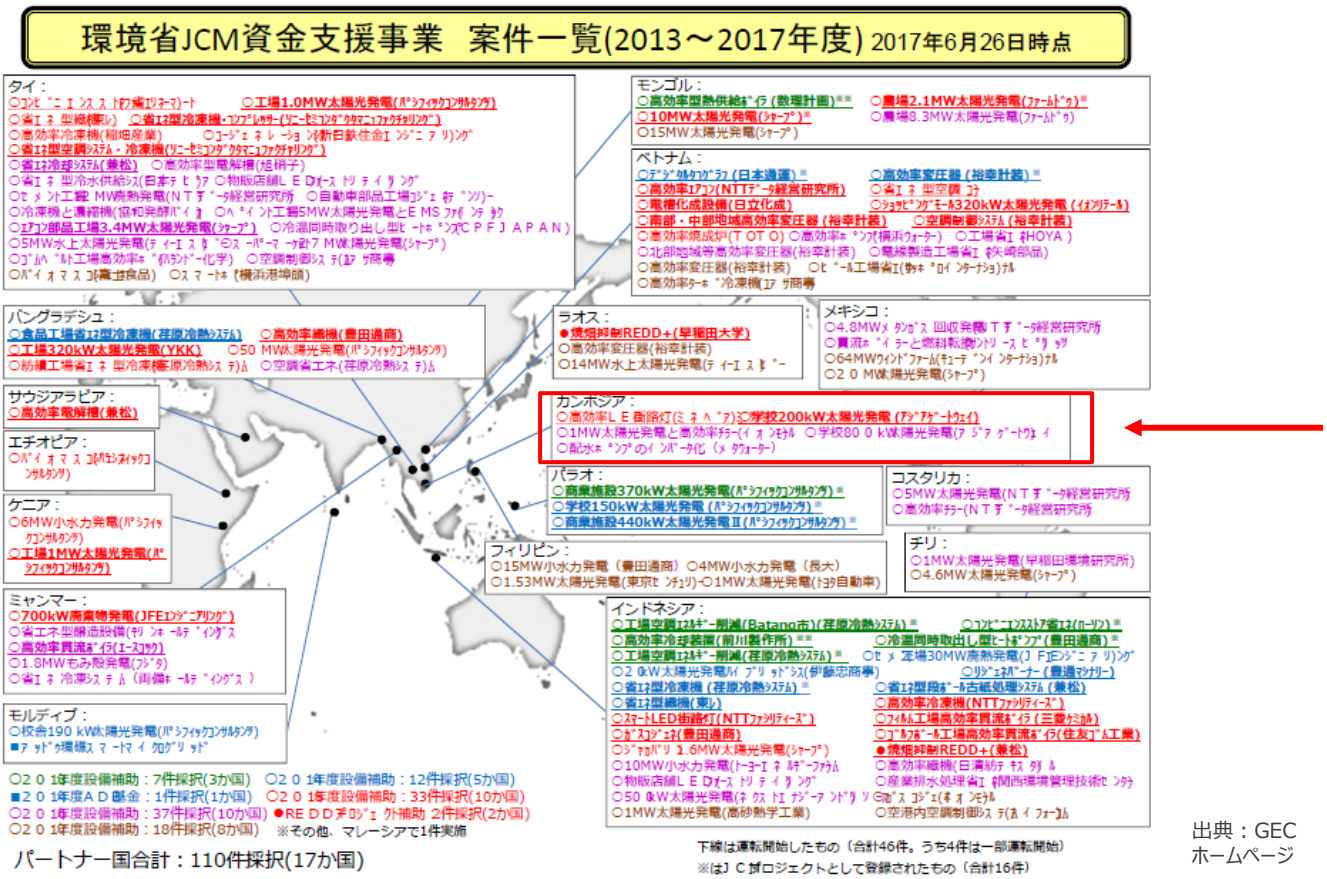
(参考) JCM (Joint Crediting Mechanism) の基本概念

- 優れた低炭素技術・製品・システム・サービス・インフラの普及や緩和活動の実施を加速し、途上国の持続可能な開発に貢献する。
- 温室効果ガス排出削減・吸収への日本の貢献を、定量的に評価するとともに、日本の排出削減目標の達成に活用する。
- 地球規模での温室効果ガス排出削減・吸収行動を促進することにより、国連気候変動枠組条約の究極的な目標の達成に貢献する。



出典：GECホームページ (http://gec.jp/jcm/jp/about/)

(参考) 環境省の補助を受けて実施した案件



出典：GEC
ホームページ

Dear Phnom Penh Water Supply Authority

NTT DATA
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FY2017 City-to-City Collaboration Projects
City of Kitakyushu – Phnom Penh Capital City
Explanation of JCM (Joint Crediting Mechanism)

Feb-2018

NTT Data Institute of Management Consulting, Inc.
Socio & Eco Strategic Consulting Unit

[Index]

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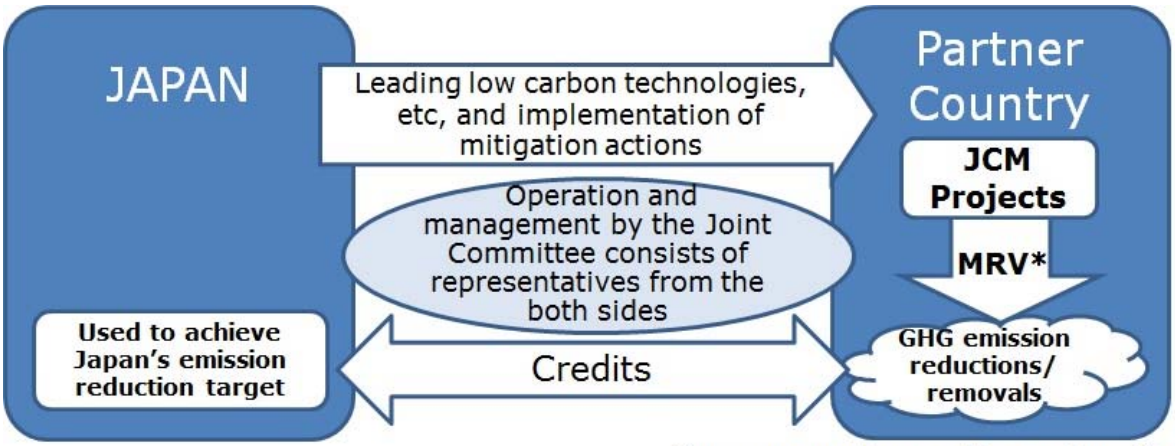
1. Basic Concept of the JCM (Joint Crediting Mechanism)

- Facilitating diffusion of leading low carbon technologies, products, systems, services and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries;
- Appropriately evaluating contributions from Japan to GHG)emission reductions or removals in a quantitative manner, and use them to achieve Japan's emission reduction target;
- Contributing to the ultimate objective of the UNFCCC by facilitating global actions for GHG emission reductions or removals



Source : GEC's Homepage (http://gec.jp/jcm/about/)

2. JCM Financing Program

The draft budget for projects starting from FY 2016 is 6.7 billion JPY (approx. USD 56 million) in total by FY2018

※Budget will be fixed after approval by the Parliament

Government of Japan

※Includes collaboration with projects supported by JICA and other governmental-affiliated financial institute.

Finance part of an investment cost (**less than half**)

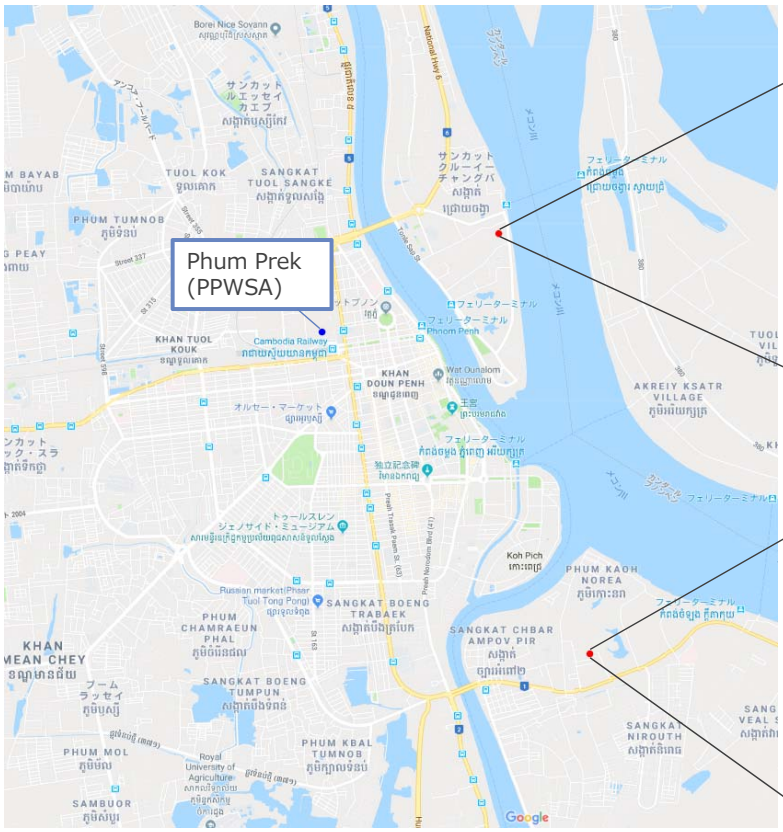
Conduct MRV and expected to deliver at least half of JCM credits issued

International consortiums (which include Japanese entities)

- Scope of the financing: facilities, equipment, vehicles, etc. which reduce CO_2 from fossil fuel combustion as well as construction cost for installing those facilities, etc.
- Eligible Projects : starting installation after the adoption of the financing and finishing installation within three years.

Source : GEC's Homepage (http://gec.jp/jcm/about/)

3. Location of Water Treatment Plants (1/3)



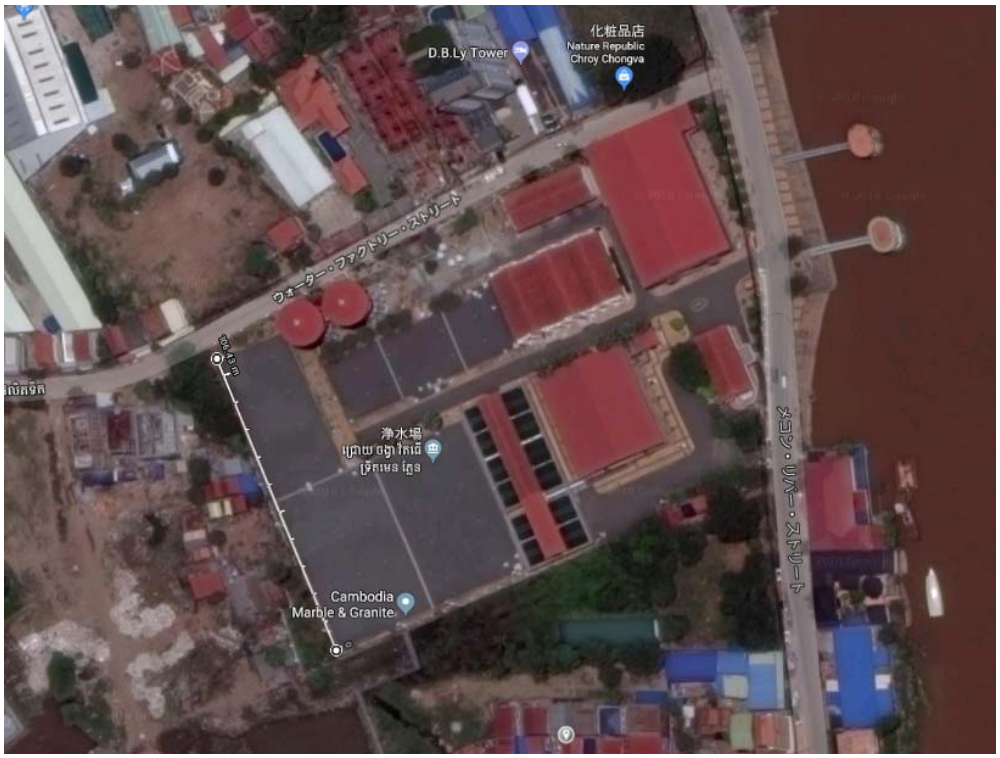
Chroy Changvar WTP

Niroth WTP

Source: Google Map

3. Location of Water Treatment Plants (2/3)

Chroy Changvar WTP



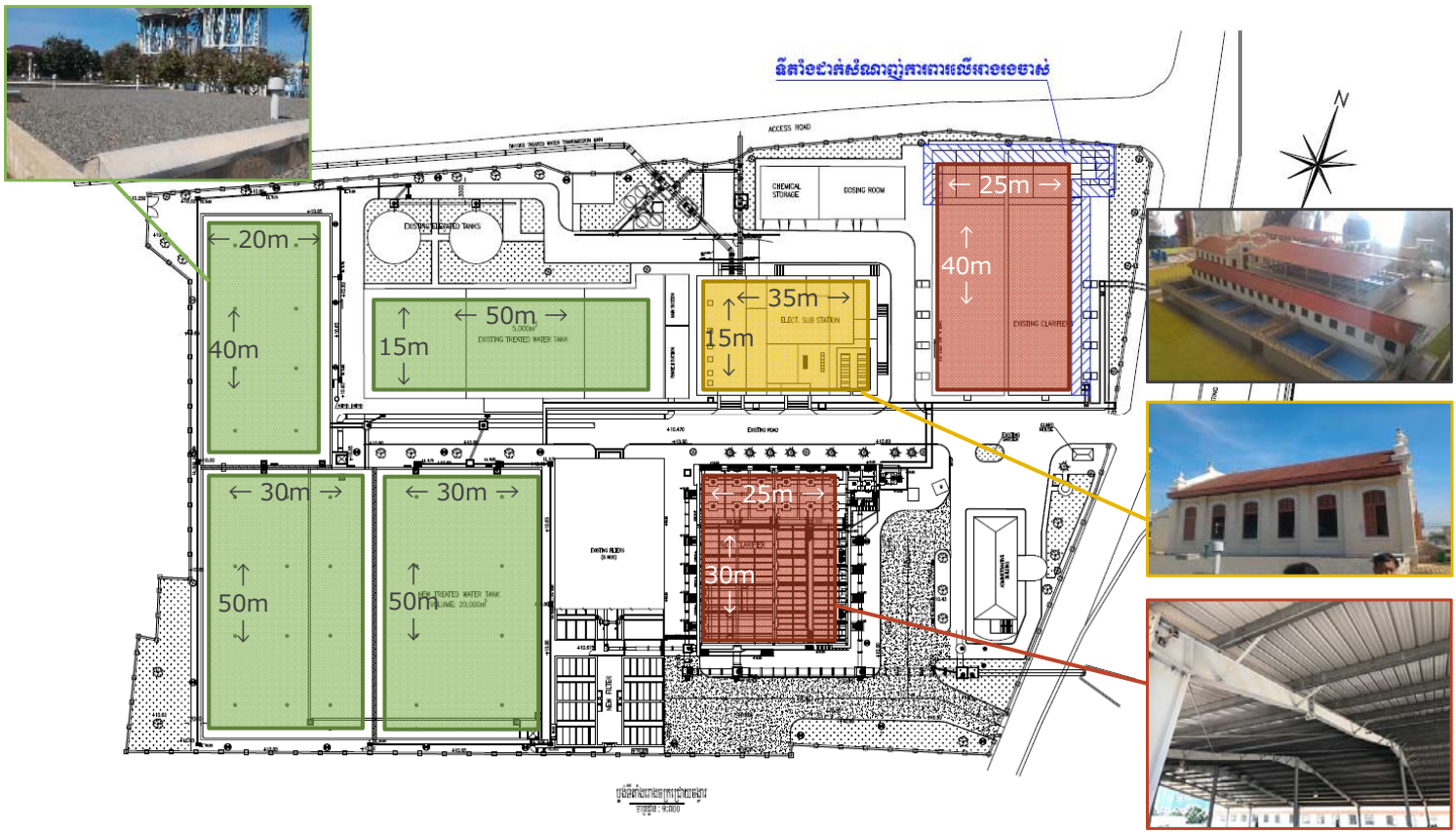
Source: Google Map

3. Location of Water Treatment Plants (3/3)

Niroth WTP

Source: Google Map

4. Available Space of Chroy Changvar WTP (1/3)



4. Available Space of Chroy Changvar WTP (2/3)

There are 3 types of areas as follows.
We assumed that PV panel type and available space for each types.

[Area A]
Green-shaded Area

- PV panels installed on ground.
- Conventional type PV Panels can be used.
- We assume that 60% of space can be used for PV panel installation.
- Approx. 2,700 m² is available for PV panel installation.
  (20x40 + 50x15 + 30x50 + 30x50) x 60%

[Area B]
Yellow-shaded Area

- PV panels installed on building roof (rigid roof).
- Conventional type PV Panels can be used.
- We assume that 40% of space can be used for PV panel installation.
- Approx. 200 m² is available for PV panel installation.
  (35x15) x 40%

[Area C]
Red-shaded Area

- PV panels installed on folded plate roof (weak roof).
- Light-weight type PV Panels are to be used.
- We assume that 40% of space can be used for PV panel installation.
- Approx. 700 m² is available for PV panel installation.
  (25x40 + 25x30) x 40%

4. Available Space of Chroy Changvar WTP (3/3)

There are 3 types of areas as follows.
We assumed that PV panel type and available space for each types.

[Area A]
Green-shaded Area

- PV panels installed on ground.
- Conventional type PV Panels can be used.
- We assume that 60% of space can be used for PV panel installation.
- Approx. 2,700 m² is available for PV panel installation.
  (20x40 + 50x15 + 30x50 + 30x50) x 60%

[Area B]
Yellow-shaded Area

- PV panels installed on building roof (rigid roof).
- Conventional type PV Panels can be used.
- We assume that 40% of space can be used for PV panel installation.
- Approx. 200 m² is available for PV panel installation.
  (35x15) x 40%

[Area C]
Red-shaded Area

- PV panels installed on folded plate roof (weak roof).
- Light-weight type PV Panels are to be used.
- We assume that 40% of space can be used for PV panel installation.
- Approx. 700 m² is available for PV panel installation.
  (25x40 + 25x30) x 40%

Since right-weight PV panels is expensive, this option is not to be considered. For implementation, detail investigation by EPC contractor is needed.

5. Available Space of Niroth WTP (1/3)

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5. Available Space of Niroth WTP (2/3)

There are 3 types of areas as follows.
We assumed that PV panel type and available space for each areas.

[Area A] Green-shaded Area

- PV panels installed on ground.
- Conventional type PV Panels can be used.
- We assume that 60% of space can be used for PV panel installation.
- Approx. 5,100 m² is available for PV panel installation.
  (85x50 + 85x50) x 60%

[Area B] Yellow-shaded Area

- PV panels installed on ground, but there are material storage areas.
- Conventional type PV Panels can be used.
- We assume that 25% of space can be used for PV panel installation.
- Approx. 4,800 m² is available for PV panel installation.
  (150x110 + 50x55) x 25%

[Area C] Red-shaded Area

- PV panels installed on rounded shaped plate roof (weak roof).
- Light-weight type PV Panels are to be used.
- We assume that 25% of space can be used for PV panel installation.
- Approx. 750 m² is available for PV panel installation.
  (75x20 + 75x20) x 25%

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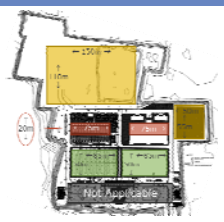
5. Available Space of Niroth WTP (3/3)

There are 3 types of areas as follows.
We assumed that PV panel type and available space for each areas.



[Area A] Green-shaded Area

- PV panels installed on ground.
- Conventional type PV Panels can be used.
- We assume that 60% of space can be used for PV panel installation.
- Approx. 5,100 m² is available for PV panel installation.
  (85x50 + 85x50) x 60%

[Area B] Yellow-shaded Area

- PV panels installed on ground, but there are material storage areas.
- Conventional type PV Panels can be used.
- We assume that 25% of space can be used for PV panel installation.
- Approx. 4,800 m² is available for PV panel installation.
  (150x110 + 50x55) x 25%

[Area C] Red-shaded Area

- PV panels installed on rounded sha
- A
  installation.
  (75x20 + 75x20) x 25%

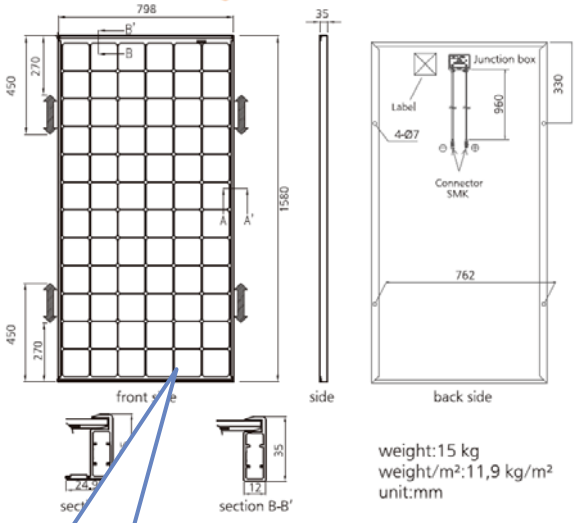
Since right-weight PV panels is expensive, this option is not to be considered. For implementation, detail investigation by EPC contractor is needed.

6. Specification of Solar Panel (Example)

Capacity of one Panel : 240W

- As an example, specifications of Model: VBHN240SJ25 (Panasonic HIT solar panel) are shown.

Dimensions and weight



weight:15 kg
weight/m²:11,9 kg/m²
unit:mm

Size of one Panel : 1.26m²

Electrical data (at STC)	VBHN245SJ25	VBHN240SJ25	VBHN235SJ25
Max. power (Pmax) [W]	245	240	235
Max. power voltage (Vmp) [V]	44.3	43.6	43.0
Max. power current (Imp) [A]	5.54	5.51	5.48
Open circuit voltage (Voc) [V]	53.0	52.4	51.8
Short circuit current (Isc) [A]	5.86	5.85	5.84
Max. over current rating [A]		15	
Production tolerance power [%]		+10/-5*	
Max. system voltage [V]		1000	

Note: Standard Test Conditions: Air mass 1.5; Irradiance = 1000W/m²; cell temp. 25°C

Temperature characteristics			
Temperature (NOCT) [°C]		44.0	
Temp. coefficient of Pmax [%/°C]		-0.29	
Temp. coefficient of Voc [V/°C]	-0.133	-0.131	-0.130
Temp. coefficient of Isc [mA/°C]	1.76	1.76	1.75

At NOCT (Normal Operating Conditions)			
Max. power (Pmax) [W]	187.4	183.2	178.4
Max. power voltage (Vmp) [V]	42.5	41.7	41.0
Max. power current (Imp) [A]	4.41	4.39	4.35
Open circuit voltage (Voc) [V]	50.3	49.7	48.9
Short circuit current (Isc) [A]	4.71	4.71	4.70

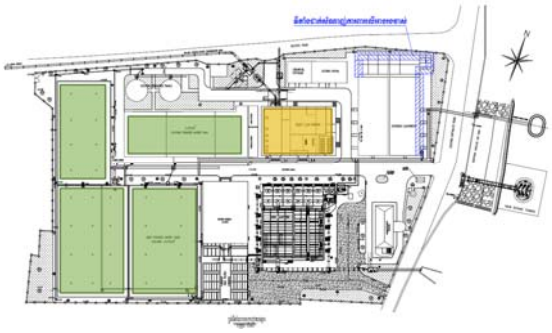
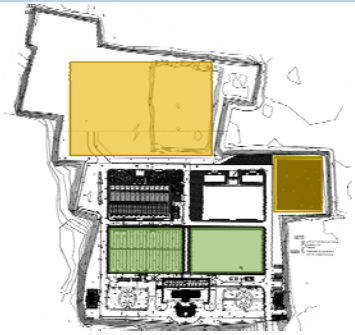
Note: Nominal Operating Cell Temp.: Air mass 1.5; Irradiance = 800W/m²
Air temperature 20°C; wind speed 1 m/s

At low irradiance (20%)			
Max. power (Pmax) [W]	47.0	45.9	45.0
Max. power voltage (Vmp) [V]	43.2	42.2	41.6
Max. power current (Imp) [A]	1.09	1.09	1.08
Open circuit voltage (Voc) [V]	49.6	49.0	48.4
Short circuit current (Isc) [A]	1.17	1.17	1.17

Note: Low irradiance: Air mass 1.5; Irradiance = 200W/m²; cell temp. = 25°C

7. Expected Number of Panels and Capacity of PV Modules

Expected number of panels and capacity of PV modules are calculated as follows:

Site	Chroy Changvar WTP	Niroth WTP
Map		
Available Space	**2,900m²** (= [Area A] 2,700 m² + [Area B] 200m²)	**9,900m²** (= [Area A] 5,100 m² + [Area B] 4,800m²)
Expected Number of Panels	**2,300pcs** (≒ 2,900 / 1.26)	**7,850pcs** (≒ 9,900 / 1.26)
Expected Capacity of PV Module	**552kW** (≒ 2,300 x 240 /1000)	**1,884kW** (≒ 7,850 x 240 /1000)

8. Expected Annual Power Generation (1/2)

Expected Annual Power Generation for Chroy Changvar WTP is Approx. 744,000 kWh/Year.

Capacity of PV module	552	(kW)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average daily solar radiation per day (value at implementation site: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Daily average effective sunlight per day (Correction value at azimuth, installation angle: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Temperature correction factor (when there is no loss = 1.0)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Loss factor by shadow (1.0 if not)	1	1	1	1	1	1	1	1	1	1	1	1
Power conditioner conversion efficiency (rated load power efficiency)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Other loss (when nothing: 1.0) (module dirt, transmission loss, aged deterioration etc.)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Estimated generated electric energy per day (kWh / day)	2,025	2,016	2,186	1,970	2,243	2,219	2,257	2,206	1,928	1,799	1,729	1,876
Average daily power consumption on the working day of factory etc. (kWh / day)	39,079	39,079	39,079	39,079	39,079	39,079	39,079	39,079	39,079	39,079	39,079	39,079
Average surplus electricity amount on the working day of factory etc. (kWh / day)	0	0	0	0	0	0	0	0	0	0	0	0
Number of days during which the amount of power generation is the total amount of surplus power on non-working days												
Actual effective days	31	28	31	30	31	30	31	31	30	31	30	31
) Monthly estimate surplus electric energy (kWh / month)	0	0	0	0	0	0	0	0	0	0	0	0
Estimated monthly active generation Electric energy (kWh / month)	62,769	56,438	67,772	59,096	69,531	66,561	69,961	68,398	57,845	55,773	51,865	58,158
Estimated effective total generated electricity per year	744,166	kWh/year										

Source: JCM Application Form

8. Expected Annual Power Generation (2/2)

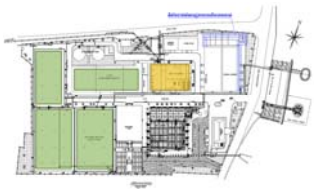
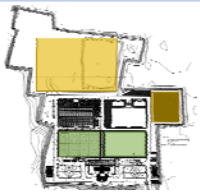
Expected Annual Power Generation for Niroth WTP is Approx. 2,539,000 kWh/Year.

Capacity of PV module	1,884	(kW)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average daily solar radiation per day (value at implementation site: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Daily average effective sunlight per day (Correction value at azimuth, installation angle: kWh / ㎡ · day)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
Temperature correction factor (when there is no loss = 1.0)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Loss factor by shadow (1.0 if not)	1	1	1	1	1	1	1	1	1	1	1	1
Power conditioner conversion efficiency (rated load power efficiency)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Other loss (when nothing: 1.0) (module dirt, transmission loss, aged deterioration etc.)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Estimated generated electric energy per day (kWh / day)	6,911	6,879	7,462	6,723	7,655	7,572	7,703	7,530	6,581	6,141	5,901	6,403
Average daily power consumption on the working day of factory etc. (kWh / day)	62,313	62,313	62,313	62,313	62,313	62,313	62,313	62,313	62,313	62,313	62,313	62,313
Average surplus electricity amount on the working day of factory etc. (kWh / day)	0	0	0	0	0	0	0	0	0	0	0	0
Number of days during which the amount of power generation is the total amount of surplus power on non-working days												
Actual effective days	31	28	31	30	31	30	31	31	30	31	30	31
) Monthly estimate surplus electric energy (kWh / month)	0	0	0	0	0	0	0	0	0	0	0	0
Estimated monthly active generation Electric energy (kWh / month)	214,235	192,625	231,310	201,696	237,313	227,174	238,780	233,444	197,427	190,357	177,017	198,494
Estimated effective total generated electricity per year	2,539,872	kWh/year										

Source: JCM Application Form

9. Expected Initial Cost and Annual Cost Reduction

Expected initial cost and annual cost reduction are calculated as follows:

Site	Chroy Changvar WTP	Niroth WTP
Map		
Expected Capacity of PV Module	**552kW**	**1,884kW**
Expected Annual Power Generation	**744,000 kWh/Year**	**2,539,000 kWh/Year**
Expected Initial Cost (Very Rough)	**1,104,000 USD** (≒ 552 kW x Price per capacity 2,000 USD/kW)	**3,768,000 USD** (≒ 1,884 kW x Price per capacity 2,000 USD/kW)
Expected Annual Cost Reduction	**124,000 USD/Year** (≒ 744,000 kWh/Year x Electricity Price 0.167 USD/kWh)	**424,000 USD/Year** (≒ 2,539,000 kWh/Year x Electricity Price 0.167 USD/kWh)
Payback Period	**8.9 Year** (≒ 1,104,000 USD / 124,000 USD/Year)	**8.9 Year** (≒ 3,768,000 USD / 424,000 USD/Year)

10. Expected CO2 Emission Reduction and Amount of Subsidy

Expected CO2 emission reduction are calculated as follows:

Site	Chroy Changvar WTP	Niroth WTP
Expected Initial Cost	**1,104,000 USD**	**3,768,000 USD**
Expected Annual CO2 Emission Reduction	**262 tCO2/Year** (≒ Annual Power Generation 744,000 kWh/Year / Grid Factor 0.353 tCO2/MWh /1000)	**896 tCO2/Year** (≒ Annual Power Generation 2,539,000 kWh/Year / Grid Factor 0.353 tCO2/MWh /1000)
Expected CO2 Emission Reduction in Project Period	**4,454 tCO2** (≒ 262 kWh/Year X Statutory durable years in Japanese law 17 Years)	**15,232 tCO2** (≒ 896 kWh/Year X Statutory durable years in Japanese law 17 Years)

There is a criteria for selection of the proposed JCM applications. It is that cost effectiveness (vs CO2 emission reduction) is less than 4000JPY/tCO2 (approx. 35USD/tCO2).
To achieve this criteria, expected amount of subsidy is:

Site	Chroy Changvar WTP	Niroth WTP
Expected Amount of Subsidy as per Cost Effectiveness Criteria	**155,890 USD** (≒ Expected CO2 Emission Reduction in Project Period 4,454 tCO2 X 35 USD/tCO2)	**533,120 USD** (≒ Expected CO2 Emission Reduction in Project Period 15,232 tCO2 X 35 USD/tCO2)

Approx. 14% of Initial Cost

11. ESCO Type Business Model

We are consulting with Financial Company, (D) shown in the Image of Organization, for detail investigation for ESCO type business model.
At the moment, could you please advise if our simulation is competitive with the other competitors.

Image of Organization

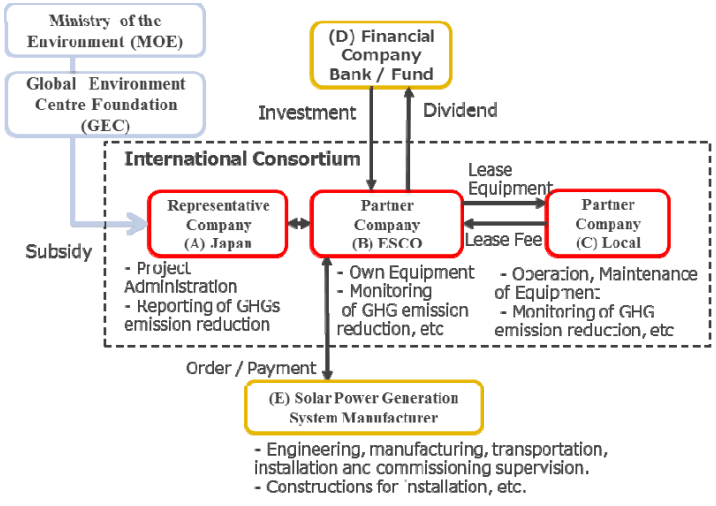
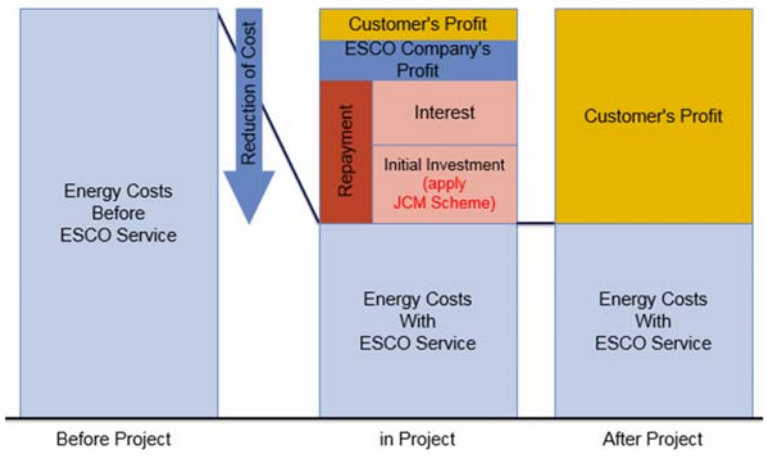


Image of ESCO Type Business Model



NTT DATA
Global IT Innovator

Ref) Collaboration between Kitakyushu & Phnom Penh and Activities of the Survey Project

【Collaboration between City of Kitakyushu and Phnom Penh Capital City】

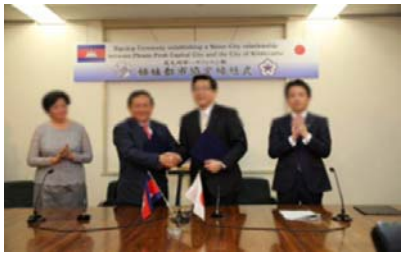
Phnom Penh miracle (Water purification field)
Water distribution block technology transfer
⇒ Unaccounted-for water rate: 72% → 8%
2005: Declaration of drinkability

July 2015: Prime Minister Hun Sen visits Kitakyushu
Prime Minister proposes the conclusion of **sister-city agreement with Phnom Penh.**

Toward conclusion of sister-city agreement
Conducting of basic survey to grasp needs of Phnom Penh (Waste management, energy, sewerage, environmental protection)

Sister City Agreement was signed on 29-Mar-2016

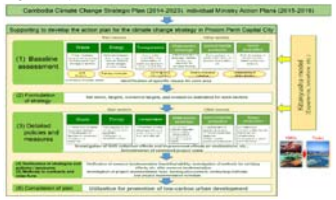
City of Kitakyushu ⟷ Phnom Penh Capital City



【Completed Project: FY2016 City-to-City Collaboration Projects】

Feasibility Study in Energy Sector
(NTT Data Institute of Management Consulting, Inc. / City of Kitakyushu)
"Introduction of 1MW Solar Power System and High Efficiency Centrifugal Chiller in Large Shopping Mall" was approved as FY2016 JCM subsidy project.

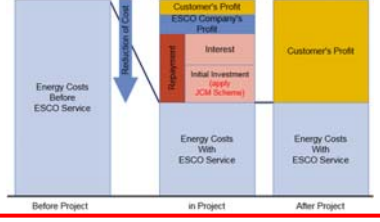
Supporting project to develop the action plan for the climate change strategy in Phnom Penh Capital City
(Nikken Sekkei Civil Engineering / City of Kitakyushu)



【Under Survey Project: Two Activities in FY2017】

(1) Customized proposal for large enterprises which have needs for energy cost reduction

(2) proposal of ESCO type business model packaged with financial services

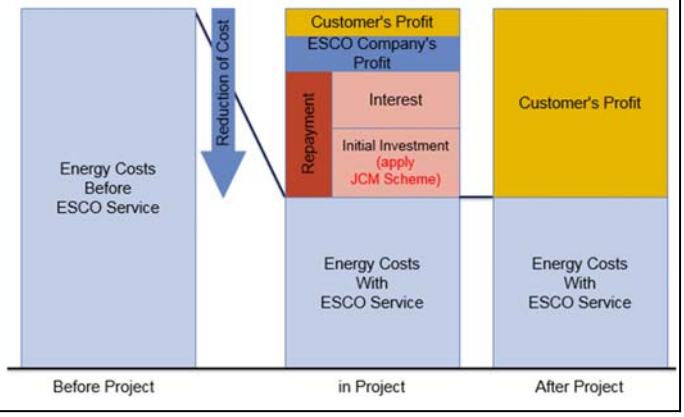


【Future Vision】

- Customized proposals make new projects which reduce GHG emissions drastically.
- Establishment of ESCO type business model leads rapid expansion of projects introducing energy saving equipment and/or renewable equipment.
- Horizontal expansion in south east Asia is expected.

Ref) Overview of the Survey Project

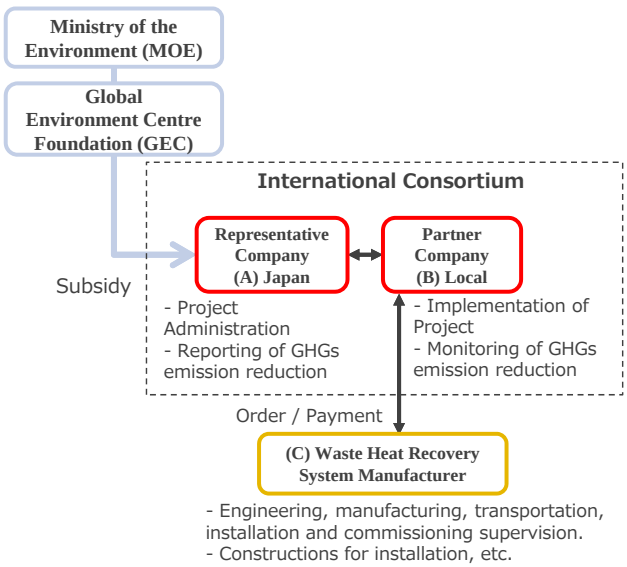
In this project, we will conduct two types of project, utilizing collaboration between City of Kitakyushu and Phnom Penh Capital City.

Activities	(1) Customized proposal for large enterprises which have needs for energy cost reduction	(2) Proposal of ESCO type business model packaged with financial services
Detail	Feasibility studies of waste heat recovery system for cement plant to aim large CO2 emission reduction	Feasibility studies of ESCO type business by packaging PV power generation system, etc. and financial services
Technology	Waste Heat Recovery System, etc.	Solar Power Generation System, etc.
Image	 Cement Plant	

Ref) Organization at Implementation Phase

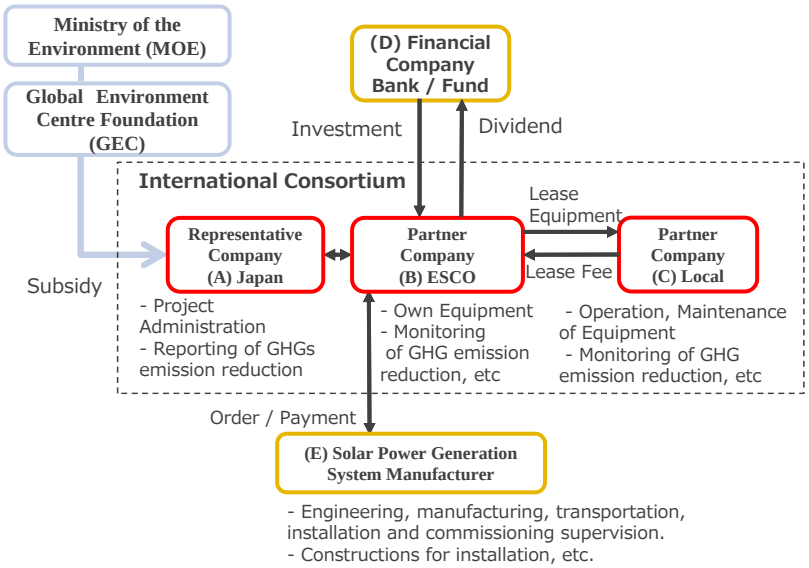
Organization at implementation phase are shown in below:

(1) Customized proposal for large enterprises which have needs for energy cost reduction



A) **MGM Innova Captal Japan. (Tentative)**
B) **Chip Mong Insee Cement, etc.**
C) **CONCH Kawasaki, etc.**

(2) proposal of ESCO type business model packaged with financial services



A) **MGM Innova Captal Japan. (Tentative)**
B) **Establish SPC(Special Purpose Company) for each Project**
C) **Sunrise Japan Hospital, Water Supply Authority, etc.**
D) **MGM sustainable Energy Fund (Tentative)**
E) **Next Energy, Kyocera, Panasonic, etc.**

Ref) Technology and Experiences

[Waste Heat Recovery System]:

WHR is a facility that collects heat from unused exhaust gases and generates electricity in cement plant.

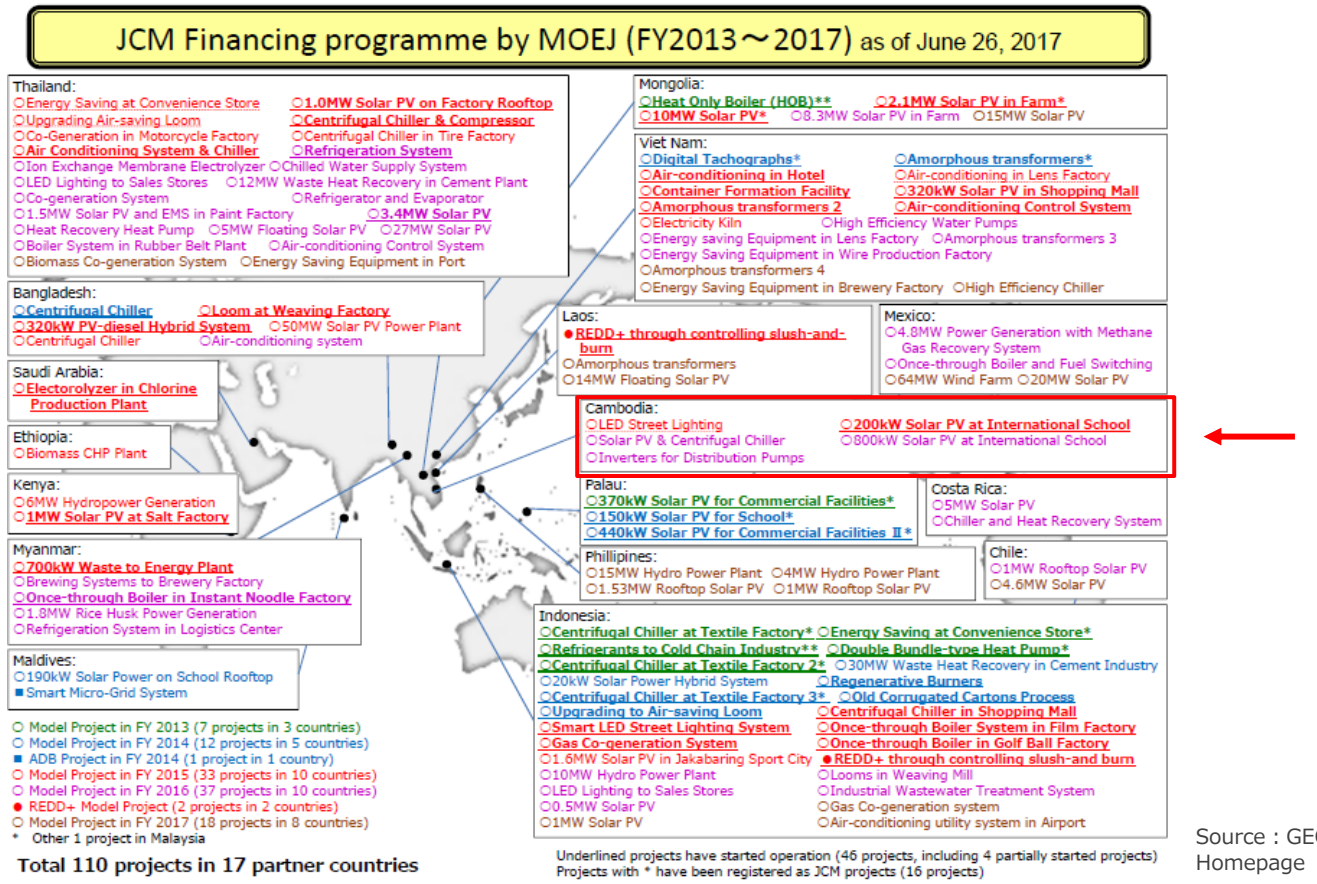
[Solar Power Generation System]:

There are many experience of JCM projects.

The following table shows JCM experiences of NTT Data Institute of Management Consulting, Inc.

Duration	Technology	Country	Role	Description
2015.04 – 2017.01	Solar Power Generation	Malaysia	Representative Company	PV panels on new building are installed.
2016.09 – 2017.10	Waste Heat Recovery System	Thailand	Representative Company	Waste Heat Recovery System are installed on cement plant
2016.02 – 2016.09	Solar Power Generation	Vietnam	Consulting Company	PV panels on the large shopping mall are installed.
2016.10 – 2018.06	Solar Power Generation	Costa Rica	Representative Company	Mega solar plant project in Costa Rica.
2016.11 – 2019.01	Solar Power Generation	Cambodia	Consulting Company	PV panels and High efficiency chiller are installed for large shopping mall.
2017.03 – 2017.11	Solar Power Generation	Chile	Representative Company	PV panels are installed on the roof of schools.

Ref) Projects by JCM Financing Program by MOEJ



Source : GEC Homepage

Ref) Upper Limit of Subsidy Rate

- **Subsidy rate varies depending on the number of projects using similar technology in the country.**

The number of projects using similar technology in the country	0 (first case)	From 1 to 3	Over 4
Upper Limit of Subsidy Rate	Maximum 50 %	Maximum 40%	Maximum 30%

- **In Cambodia, upper limits of subsidy are as follows:**

Technology	Chiller	LED Street Lighting with Dimming System	Frequency Inverter for Pump	Solar Power Plant
Number of Projects	1	1	1	3
Upper Limit of Subsidy Rate	Max. 40%	Max. 40%	Max. 40%	Max. 40%

Ref) Cost-Effectiveness and Payback Period

- **During review of applied proposal, (1) Cost-effectiveness and (2) Payback period are checked.**

(1) Cost effectiveness should be less than 4000JPY/t-CO2 (approx. 35USD/t-CO2)

"Subsidy amount ÷ Total GHG emission reduction in project duration (i.e. legal durable years of the installed equipment in Japanese law) = Aubsidy amount per 1 ton CO2"

(2) Payback period should be longer than three years.

"(Total project cost - Subsidy amount) ÷ Annual operating cost reduction"
Or
"(Total project cost - Subsidy amount) ÷ (Annual Revenue - Annual Operating Cost)"

Ref) CO2 Emission Reduction Factor for JCM Application

- After FY2017, new figures for CO2 emission reduction factor for JCM application are set and they are very conservative.

(t-CO_2/MWh)

Operating margin from 2007-2009	0.6257
Build margin 2009	0.6878
Combined margin : Wind and solar power generation project activities for the first crediting period and for subsequent crediting periods	**0.6413**
Combined margin: All other projects for the first crediting period	**0.6568**
Combined margin: All other projects for the second and third crediting periods	**0.6723**

Source: IGES「Grid Emission Factor of the Phnom Penh Electricity Grid」

[Note] This list is used to application of JCM Financing Program and does not predict JC's decision.

FY2017 JCM Financing Program: List for CO2 emission factor (tCO2/MWh)

No.	Contory	Energy Efficiency			Renewable Energy		
		All	Other than left	When replacing in-house generation	All	Other than left	When replacing in-house generation
11	Cambodia	—	See table 3	0.8	—	0.353	0.533

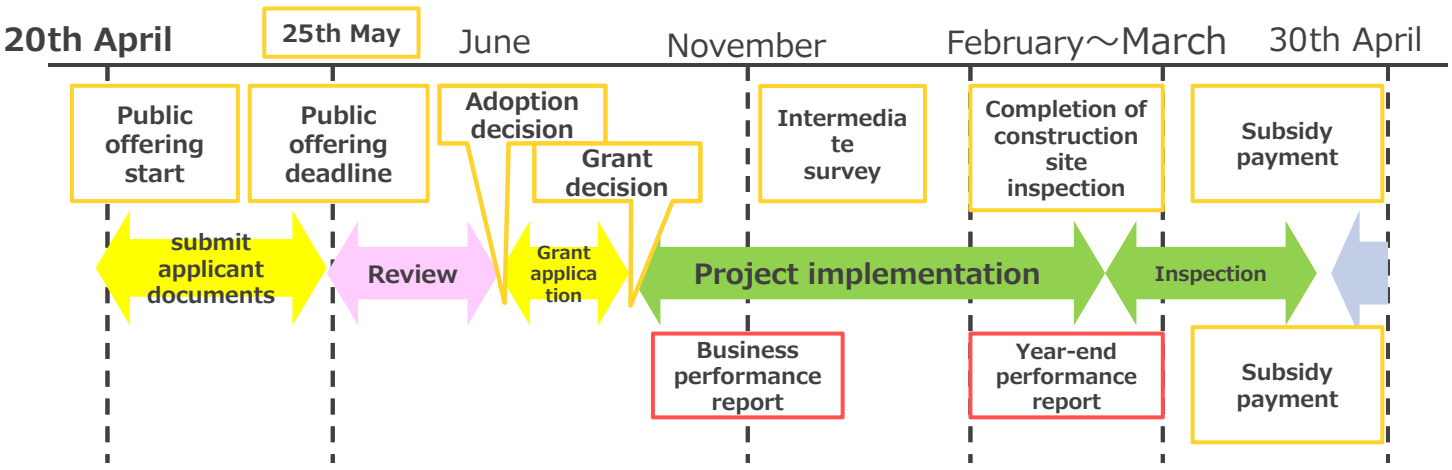
Table 3 Cambodia

No.	Grid	Energy Efficiency
1	National Grid	0.384
2	Kampot-Sihnouk Grid	0.643
3	Kampong Cham Grid	0.724

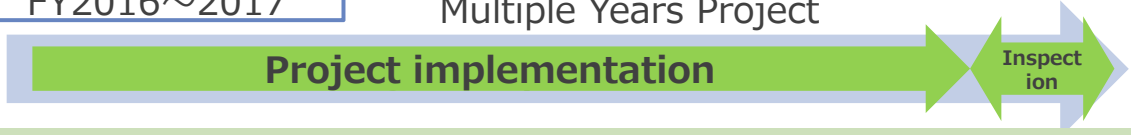
Source: GEC「FY2017 JCM Financing Program: List for CO2 emission factor (tCO2/MWh)」

Ref) Schedule from Application to Project Implementation

(Example) FY2015



FY2016～2017 Multiple Years Project



- **Grant application is needed from the adoption unofficial within 3 months.**
- **pay estimate to the end of each FY year, the settlement payment in the final year**

Workshop on City to City Collaboration
for Low Carbon Society in Kawasaki, Japan
27th-28th July 2017

Improvement of Solid Waste Management in Cambodia toward the Low Carbon Society

Dek Vimeanreaksmey
Deputy Director, Department of Solid Waste Management,
General Directorate of Environmental Protection

1

1. Introduction

- Cambodia is a developing country dependent on agriculture and highly vulnerable to the impact of climate change.
- Cambodia is one of the most climate vulnerable countries in the world.
- JCM Signing Ceremony Between

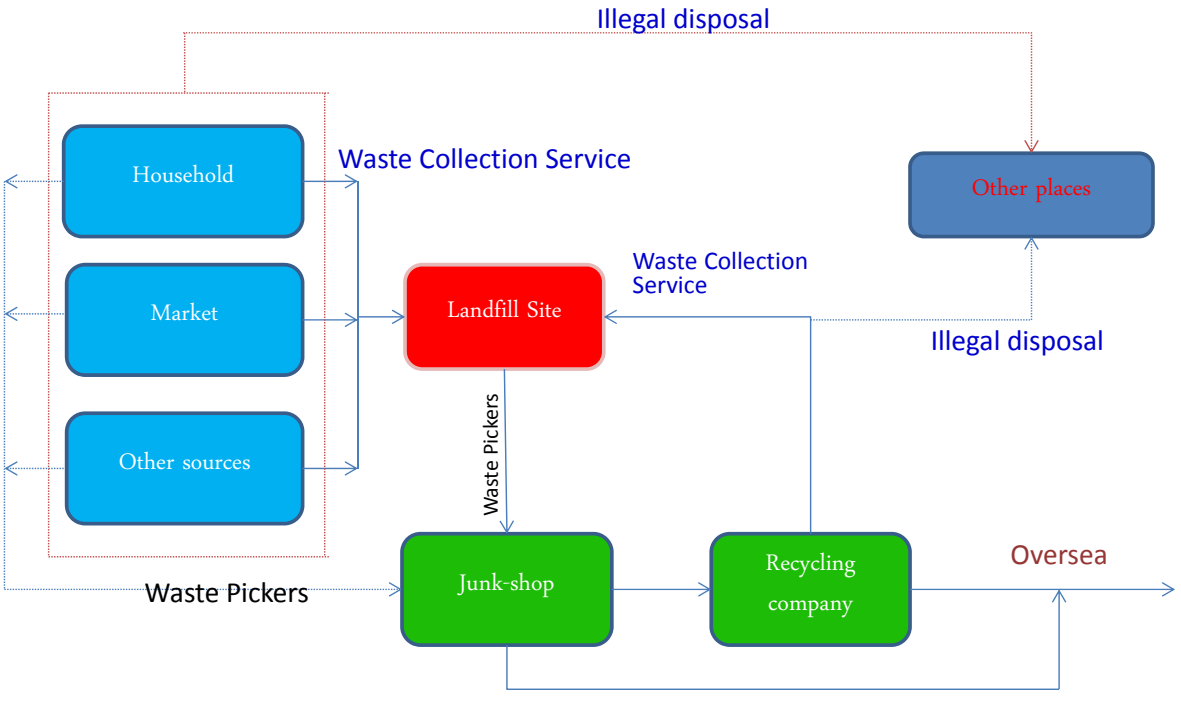
Cambodia-Japan, 11 April 2014

2. Solid Waste Management

- Solid wastes are sources of greenhouse gases (GHGs), methane (CH4) when disposed in dump or even in landfills.
- One of environmental problems in Cambodia is huge generation of solid waste.

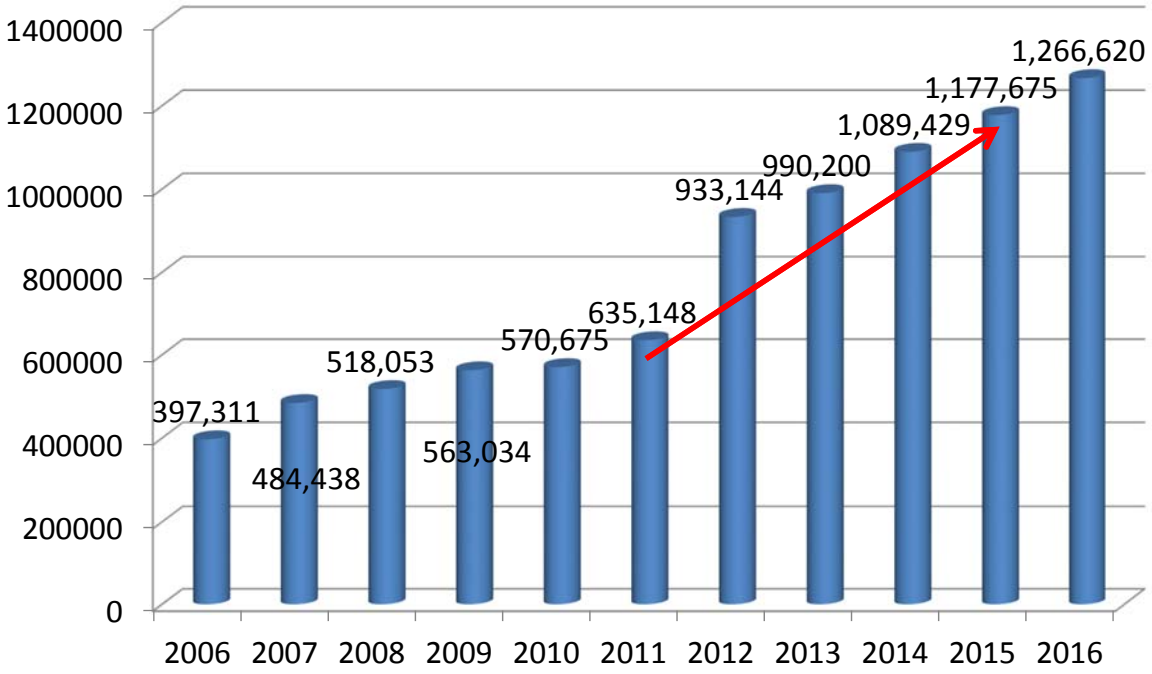
3

Waste Flow in Phnom Penh



4

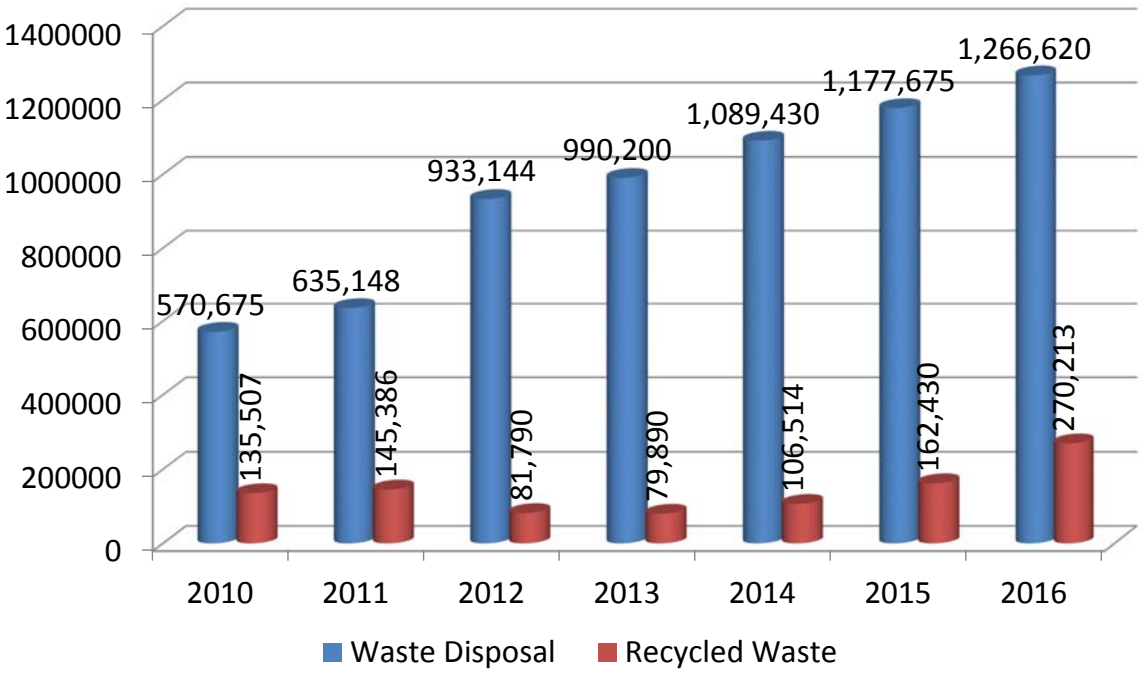
Solid Waste Generation in Cambodia (ton/year)



5

Source: MoE, 2017

Amount of waste dispoal vs recycle waste (ton/year)



6

Source: MoE, 2017

Current situation of open dumping site in Phnom Penh




7

Composting Activities in Cambodia









8

Plastics and Papers Recycling Activities



9

Junk Shop




10

3. Improving of Solid Waste Management

- In order to improve the waste management capabilities of the city of Cambodia , RGC established Sub-Decree No 113 on Municipal Solid Waste Management
- Decentralized roles and responsibilities on MSWM from national level to sub-national level:

  Quality, Equity, Sustainability and Accountability
- Provided the environmental hygiene fund to sub-national level for improving waste management.

11

Repairing drainage system





Installing Incinerator at Kompong Sam Province




13

Key activities in solid waste management

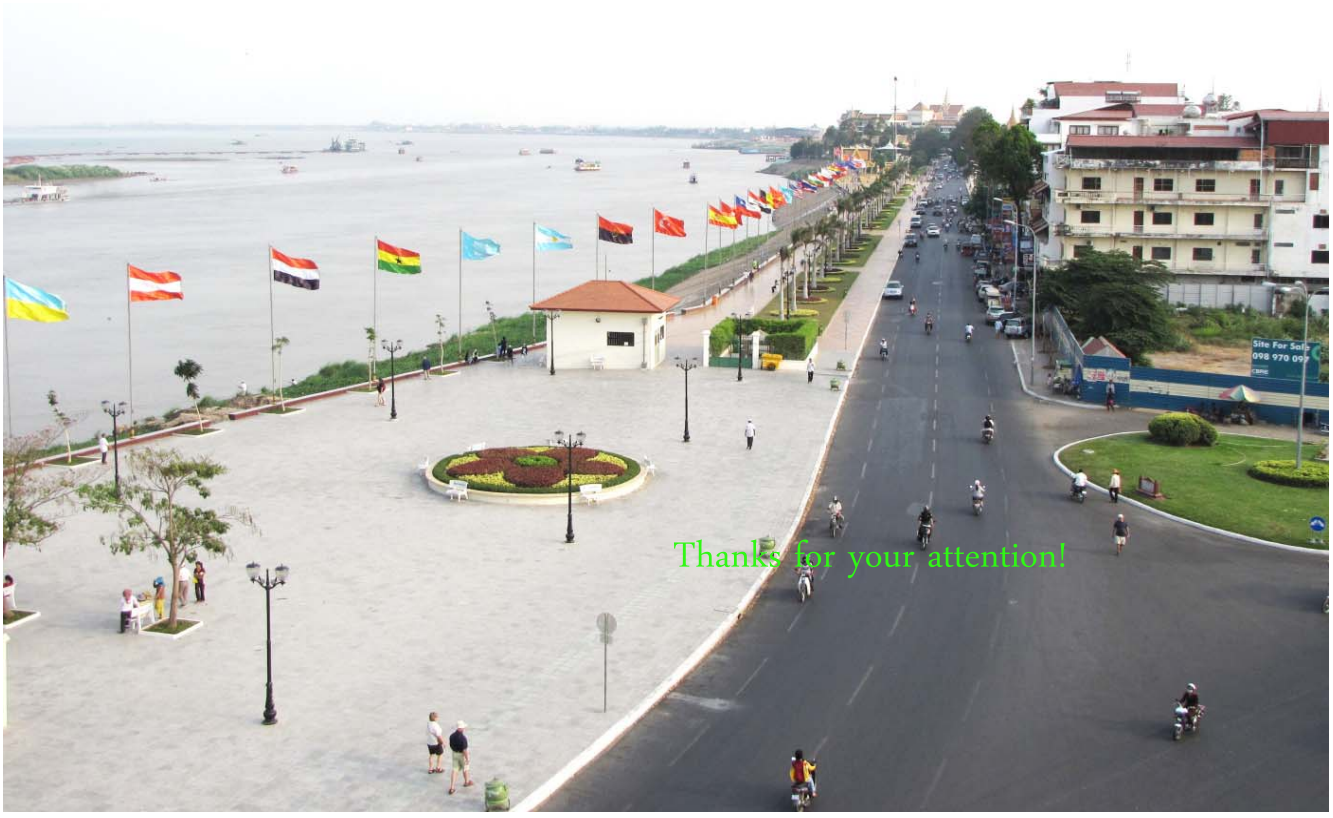
- Decentralized on SWM from National level to sub-national level.
- Provided the annual environmental hygiene budget to local governors
- Awareness and Campaign
- Eco-school program
- Waste collection activities at public places
- Yellow receipt at super market
- Law enforcement.


14

4. Next activities

- Continue to implement the sub-decree 113 on Municipal Solid Waste Management
- Technical assistance and landfill technologies
- Continue to prepare the Technical Guideline for SWM
- Continue to prepare the Sub-decree on Plastic Bag Managment
- Promote 3R activities
- Prepare the National Waste Management Strategy and Action Plan for Cambodia

15



Email: smeydek@yahoo.com

16

City to City Collaboration for Low Carbon Society in Kawasaki

CHIP MONG INSEE CEMENT CORPORATION (CMIC)- CAMBODIA

Agenda

- Introduction to Chip Mong Insee Cement Corporation
- Introduction of CMIC Cement Plant Project
- Our approach to reduce CO_2 emissions in cement production
- Project Background – Waste Heat Recovery
- Basic technical concept of Waste Heat Recovery

Chip Mong Insee Cement Corporation

60%

40%

CMIC was founded on November 2015 as a joint venture between Chip Mong Group and the Siam City Cement PCL, under name ***Chip Mong Insee Cement Corporation (CMIC)***

CHIP MONG GROUP

Strong performance in distribution channels in construction material and consumer products

- CMG started importing and distributing steel in 1982 and become well know in the industry by consistently offering the best products and services.
- Later on CMG started to offer a vast array of construction material; cement, ceramic tiles as well as consumer products such as cooking oil and cookies too.
- In 2008, CMG started Chip Mong Concrete as cement distribution channels in Phnom Penh. CMC currently operates 8 batching plants with strong presence as major concrete supplier in Phnom Penh.
- In 2011, CMG started Khmer brewery also know as Cambodia beer, which currently sells more than 1.4 million hectoliters, which accounted for 20-25% of total consumption within the country.
- In 2014, KHB constructed3rd expansion line for Khmer Brewery, which will account for 40% of production capacity of the country.
- In 2014. CMG started Chip Mong Land, and began to develop residential area of 20 hectares called “The Park Land” in Sangkat Phnom Penh.
- In 2015, CMG started to construction of roof tile factory,
- In 2016, CMG signed a management agreement with Hyatt Hotels Corporation for Hyatt Regency Hotel in Phnom Penh,

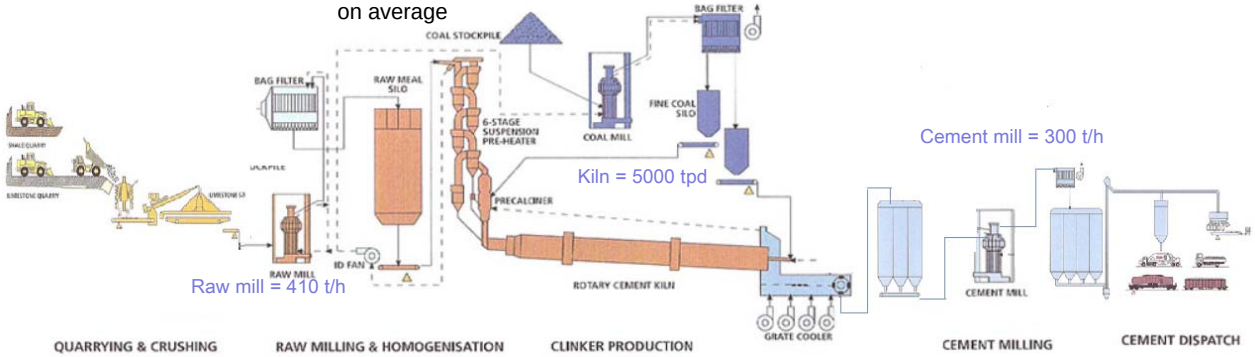
Siam City Cement PCL

More than 40 years of experience in cement business.

- The company was first established in 1969 and become listed company in the Stock Exchange of Thailand in 1977.
- As of today, SCCC has three cement plants with six kilns in Kang Koi District, Saraburi Province.
- SCCC introduced state of art waste heat recovery system in 2010 which converts heat capture from kiln to produce electricity, one of the biggest in SE Asia.
- In 1996 the annual production capacity exceeds 12 million tons.
- In 2000, SCCC launch of webSALES system to handle online product purchasing.
- Siam City Cement through its three subsidiaries, Siam City Concrete, Conwood, Insee superblock is engaged in cement-based building materials, wood replacement products and light-weight concrete block.
- Recently SCCC is expanding their business internationally with acquisition of CEMEX Thailand, and Bangladesh, Holcim Sri Lanka, and Vietnam

Introduction of CMIC Cement Plant Project

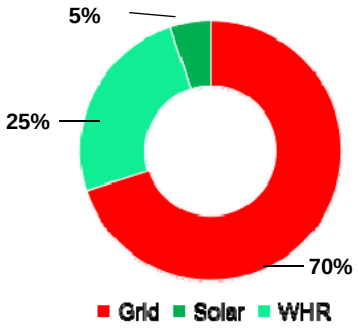
Project Name	: 5,000 tpd (clinker) CMIC Cement Plant Project in Cambodia
Project Location	: Touk Meas Commune , Kampot Province Cambodia
Production Capacity	: 5,000 Tons per days (tpd -Clinker)
Project Schedule	: Project start : Dec. ,2015 Project finish : Nov ., 2017 Duration : 23 months
Main EPC Contractor	: CITIC Heavy Industries Co.Ltd, China
Project Background	: Chip Mong Insee Cement Corporation (CMIC), a joint venture between Siam City Cement Public Company Limited (Thailand) and Chip Mong Group (Cambodia), has registered company in Cambodia. To build a greenfield 5,000 t/d cement plant contains complete clinker and cement production lines which requires the electrical power of approx 31.4 MW on average



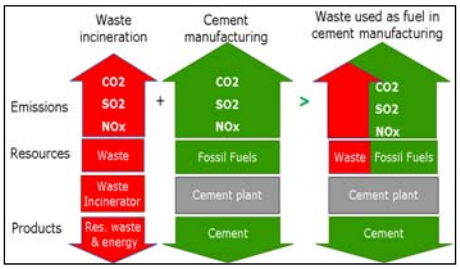
Cement plant diagram

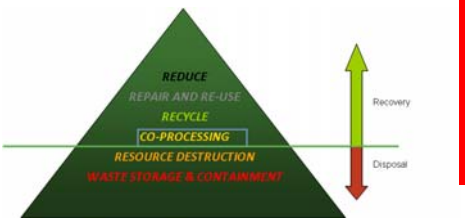
Cutting-edge approaches to reducing CO_2 emissions in cement production

Sustainable electricity power usage



Alternative Fuel & Raw material



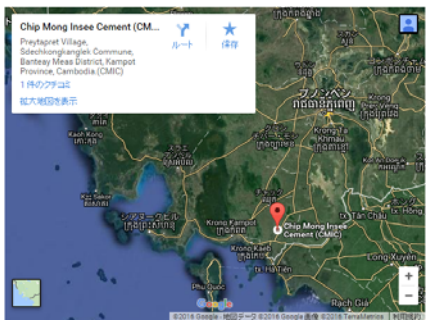


Sustainable products

Our focus is to composite cements with reduced Clinker content, by adding mineral components such as limestone, fly ash and slag. Product innovation is helping to develop more sustainable construction solutions.

Project background – Waste Heat recovery

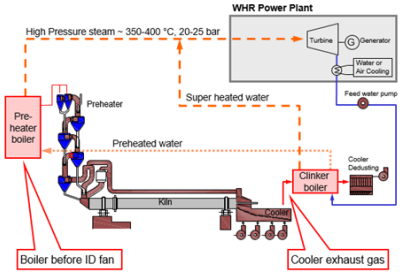
- NTT conduct feasibility study of a JCM subsidized project for CMIC cement plant which have high potential for the CO2 reduction by using waste heat recovery power generation system.
- The plant will start production in mid Q4/2017.
- August to October 2017, tendering exercise for suppliers of waste heat recovery (WHR) system will be stated.
- Commissioning of WHR system is expected in Q1 2019.



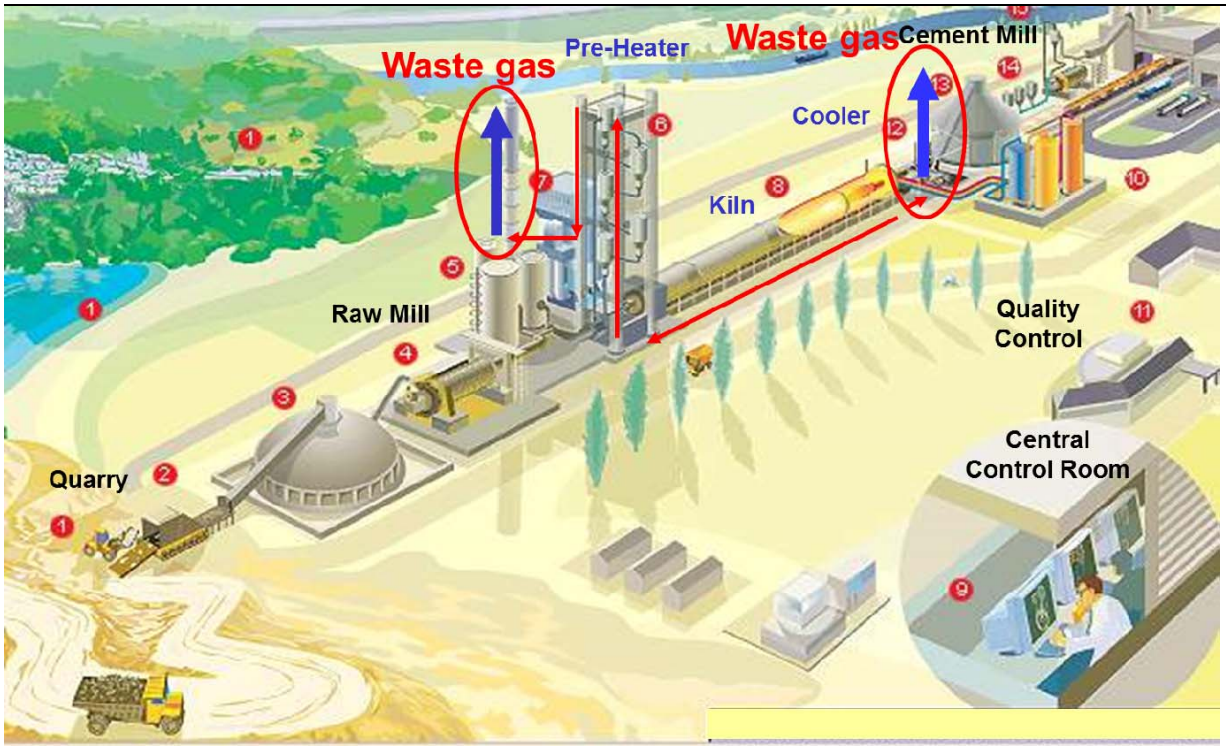
Google Map: Cement Plant in Kampot (125km from Phnom Penh)

Expected effects (assumed)

- Power generation of around 6.5MW (Gross) of electrical power is expected.
- Yearly CO_2 Emission Reduction of around 30,000 tCO_2/year is expected.

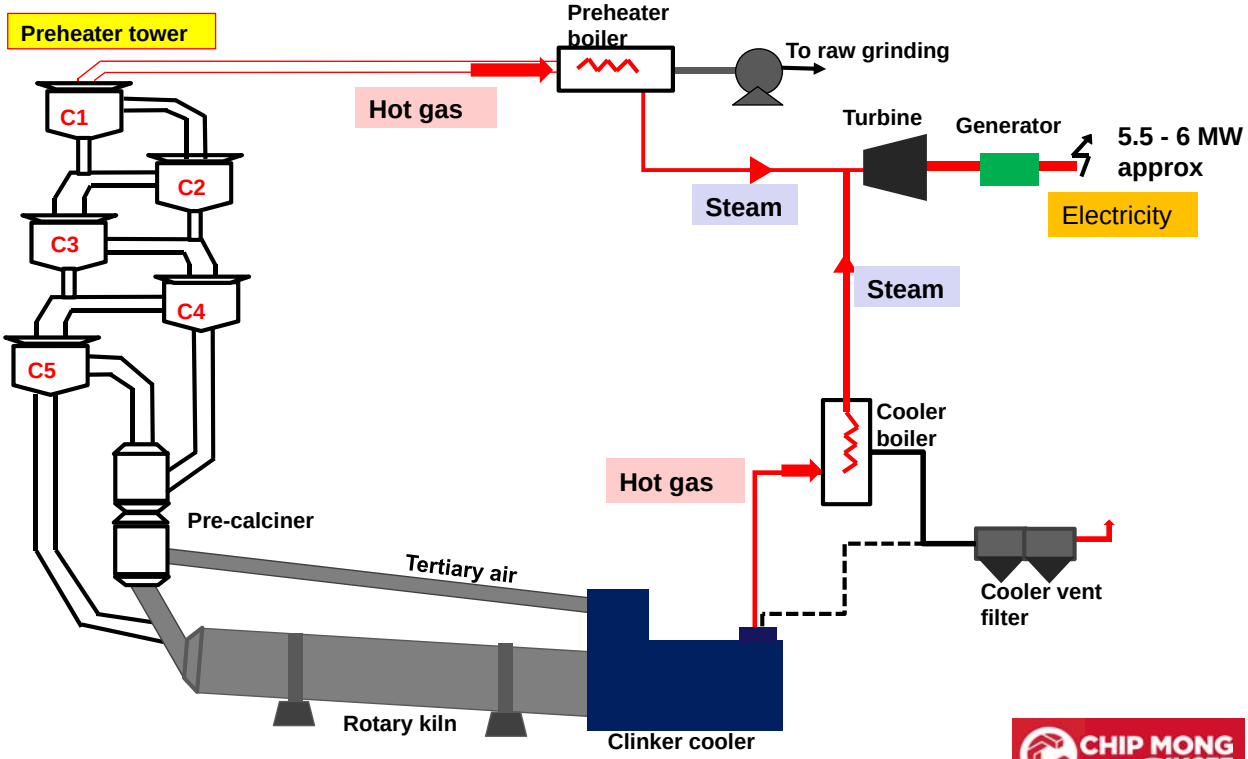


Waste gas from cement process



Waste Heat Recovery (WHR) at Touk Meas Plant

Approx 5.5 – 6 MW net power output



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FY2017 City-to-City Collaboration Projects City of Kitakyushu – Phnom Penh Capital City Cooperation Project

30-Jan-2018
City of Kitakyushu, Kitakyushu Asian Center for Low Carbon Society
NTT Data Institute of Management Consulting, Inc.

[Index]

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4. Collaboration between Kitakyushu & Phnom Penh and Activities of the Survey Project

【Collaboration between City of Kitakyushu and Phnom Penh Capital City】

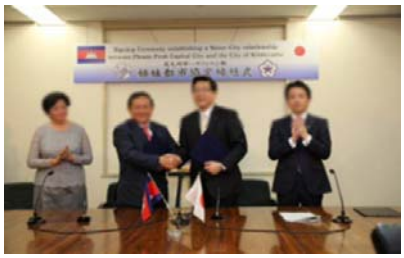
Phnom Penh miracle (Water purification field)
Water distribution block technology transfer
⇒ Unaccounted-for water rate: 72% → 8%
2005: Declaration of drinkability

July 2015: Prime Minister Hun Sen visits Kitakyushu
Prime Minister proposes the conclusion of **sister-city agreement with Phnom Penh.**

Toward conclusion of sister-city agreement
Conducting of basic survey to grasp needs of Phnom Penh (Waste management, energy, sewerage, environmental protection)

Sister City Agreement was signed on 29-Mar-2016

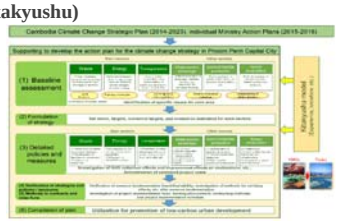
City of Kitakyushu ⟷ Phnom Penh Capital City



【Completed Project: FY2016 City-to-City Collaboration Projects】

Feasibility Study in Energy Sector
(NTT Data Institute of Management Consulting, Inc. / City of Kitakyushu)
"Introduction of 1MW Solar Power System and High Efficiency Centrifugal Chiller in Large Shopping Mall" was approved as FY2016 JCM subsidy project.

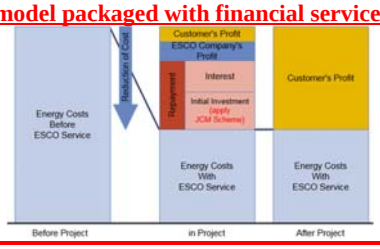
Supporting project to develop the action plan for the climate change strategy in Phnom Penh Capital City
(Nikken Sekkei Civil Engineering / City of Kitakyushu)



【Under Survey Project: Two Activities in FY2017】

(1) Customized proposal for large enterprises which have needs for energy cost reduction

(2) proposal of ESCO type business model packaged with financial services

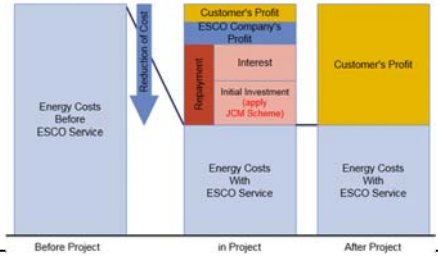


【Future Vision】

- Customized proposals make new projects which reduce GHG emissions drastically.
- Establishment of ESCO type business model leads rapid expansion of projects introducing energy saving equipment and/or renewable equipment.
- Horizontal expansion in south east Asia is expected.

2. Overview of the Survey Project

In this project, we will conduct two types of project, utilizing collaboration between City of Kitakyushu and Phnom Penh Capital City.

Activities	(1) Customized proposal for large enterprises which have needs for energy cost reduction	(2) Proposal of ESCO type business model packaged with financial services
Detail	Feasibility studies of waste heat recovery system for cement plant to aim large CO2 emission reduction	Feasibility studies of ESCO type business by packaging PV power generation system, etc. and financial services
Technology	Waste Heat Recovery System, etc.	Solar Power Generation System, etc.
Organization	Refer to other Sheet	
Type of Contract	Negotiated Contract (tentative)	Negotiated Contract (tentative)
Estimated subsidy Cost-effectiveness	To be calculated based on feasibility study	To be calculated based on feasibility study
Image		

3. Event in July and August

【1st Survey at Phnom Penh】

3rd to 6th , July-2017

<Meeting>

- Local Cement Company
- Local Japanese Hospital
- Large Shopping Mal
- Phnom Penh Capital City Administration Division
- Ministry of the Environment, Cambodia
- Embassy of Japan

Ministry of the Environment

Phnom Penh Capital City

<Outcome>

- [Activity①] Discussion with local cement company for JCM application 2nd call in FY2017.
- [Activity②] Discussion with local Japanese hospital for feasibility study for ESCO type business model.

Local Cement Company

【Seminar on City-to-City Collaboration】

25th & 26th , July-2017@City of Kitakyushu
25th & 26th , July-2017@Kawasaki

<Workshop in City of Kitakyushu>

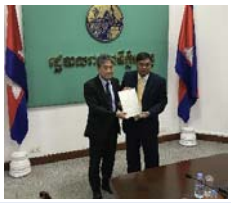
- Ecotown Center ・Environment Museum
- EV Bus / Solar power plant
- Incineration, Power generation plant
- Cement factory
- Instrument factory
- Robot factory

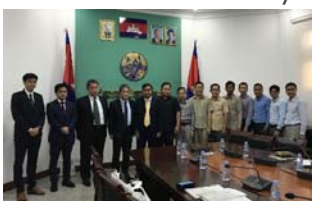
EV Bus / Solar power plant

【Ceremony between Kitakyushu and Phnom Penh】

3rd to 6th , August-2017

"Phnom Penh Capital City Strategic Action Plan for Climate Change" was handed over to Phnom Penh and outline was explained in the ceremony.





4. Event in September to November

【 2nd Survey at Phnom Penh 】

1st of September-2017

<Meeting>

- Local Cement Company

<Outcome>

- [Activity①] Detailed study with local cement company for JCM application 2nd call in FY2017.
- [Activity①] Based on discussion in local office, technical studies, economical evaluation and CO2 emission reduction evaluation were conducted. Then, proposal for JCM application 2nd call in FY2017 was submitted.

【 3rd Survey at Phnom Penh 】

20th to 22nd , November-2017

< Meeting >

- Local Japanese Hospital
- Phnom Penh Capital City Administration Division and Waste Management Division
- Water Supply Authority and water purification Plants
- Embassy of Japan

Phnom Penh Capital City

water purification plant A

water purification plant B

< Outcome >

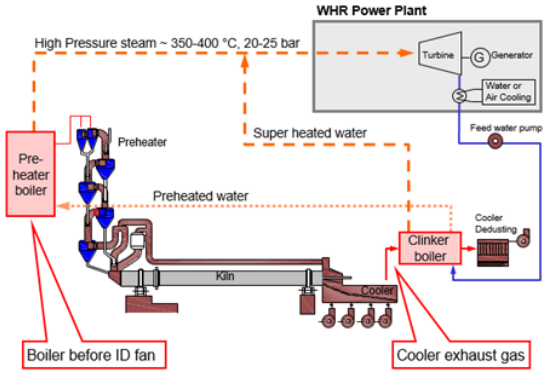
- [Activity②] Follow-up for "Phnom Penh Capital City Strategic Action Plan for Climate Change."
- [Activity ②] Discussion with water supply authority for feasibility study for ESCO type business model.

5. Progress of Activity ①Introduction of WHR for Cement Plant

Overview

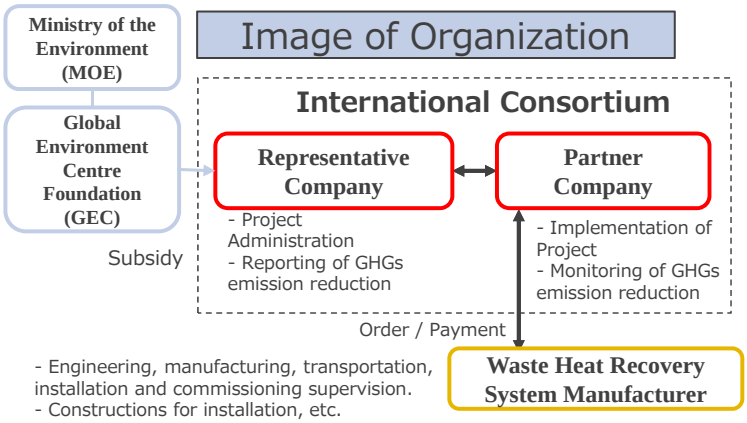
- Introduction of Waste Heat Recovery Unit (WHR) for Cement plant was studied with local cement company and proposal for JCM application 2nd call in FY2017 was submitted.
- Expected Capacity of Steam Turbine: 8,000 kW (approx. 25% of electricity consumption in whole plant)
- Expected CO2 Emission Reduction: approx. 20,860 tCO2/year
- Expected Initial Investment Cost: approx. 1.5 billion JPY ≒ approx. 13.5 million USD
- Expected Cost-effectiveness : 3,039/tonCO2
- Image of WHR system and project organization are shown in right figures.
- As result of Tendering for EPC Contractors for WHR systems, Parent Company of Cement Company decided an EPC Contractor other than our proposed Japanese EPC Contractor. Therefore, our proposal to JCM application was withdrawn.

Image of WHR system



Source: Presentation material of local cement company

Image of Organization



6. Progress of Activity ②ESCO Type Business Model

Overview

【Searching Candidate User】

- We visited local Japanese hospital and discussed feasibility introduction of solar power generation system using ESCO type business model. Expected capacity of PV panels are approx. 80kW which is relatively small. Hence, we are searching for other candidates.
- We visited Phnom Penh Water Supply Authority and discussed feasibility of introduction of solar power generation system. We also conducted site tour of candidates of potential water purification plants. We are conducting rough calculation of introduction of PV panels using layout drawings.

Image of ESCO Type Business Model

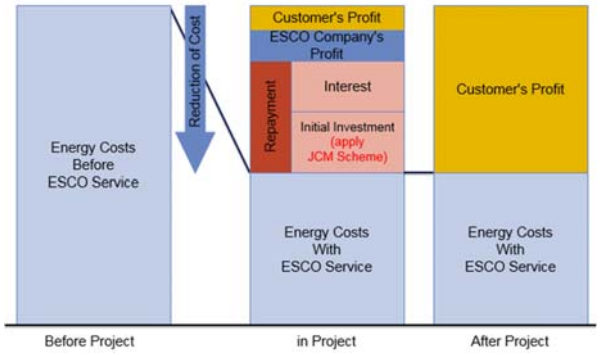
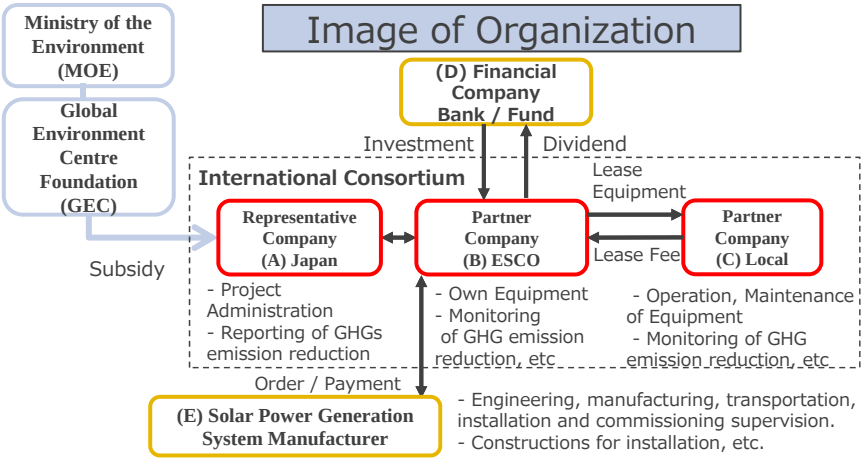


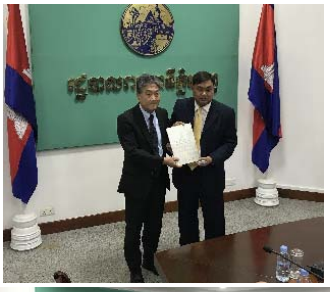
Image of Organization

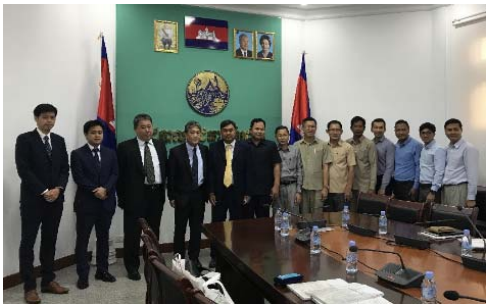


7. Follow-up for Phnom Penh Capital City Strategic Action Plan for Climate Change

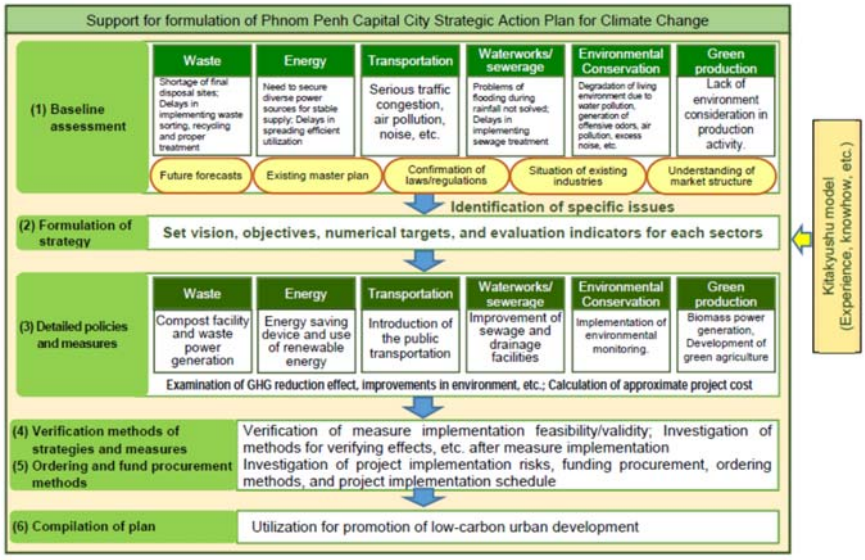
"Phnom Penh Capital City Strategic Action Plan for Climate Change" was handed over to Phnom Penh and outline was explained in the ceremony.

【 Ceremony between City of Kitakyushu and Phnom Penh Capital City 】

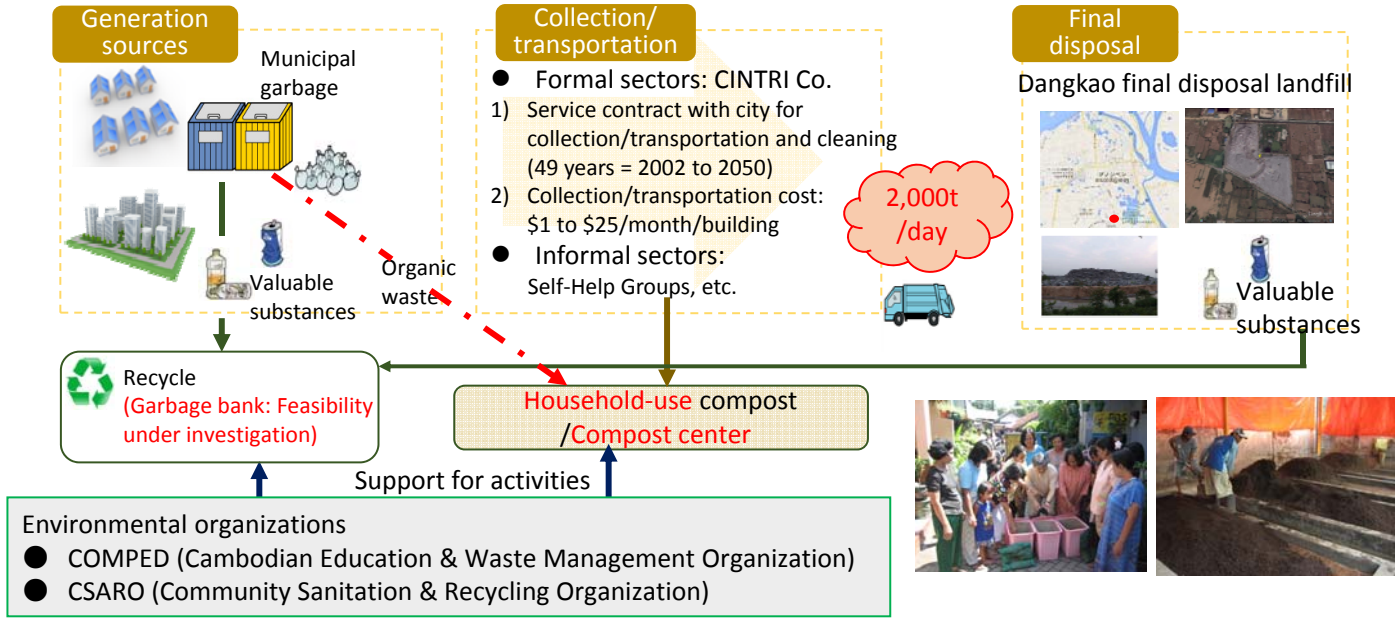




【 Phnom Penh Capital City Strategic Action Plan for Climate Change 】



7. Follow-up for Phnom Penh Capital City Strategic Action Plan for Climate Change ～ Pilot Project in waste field ～



This project is intended to promote waste recycling and reduction in a model district under governmental guidance with the cooperation of residents and resident organizations. Thereafter, the model district will be gradually expanded throughout the city.

1. In the model district, composting of household waste will be popularized through suitable sorting of municipal waste.
2. Distribution of household-generated compost shall also be an objective, and compost centers targeting markets, etc. which produce regular quantities of raw garbage will be constructed.
3. In local communities, garbage banks will be constructed to promote the sorting and collection of valuable substances such as plastic, cans, bottles, metals, etc. generated by households, etc.

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