FY2016 Project for Ministry of the Environment Japan

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 Cooperation Project)

Report

March 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

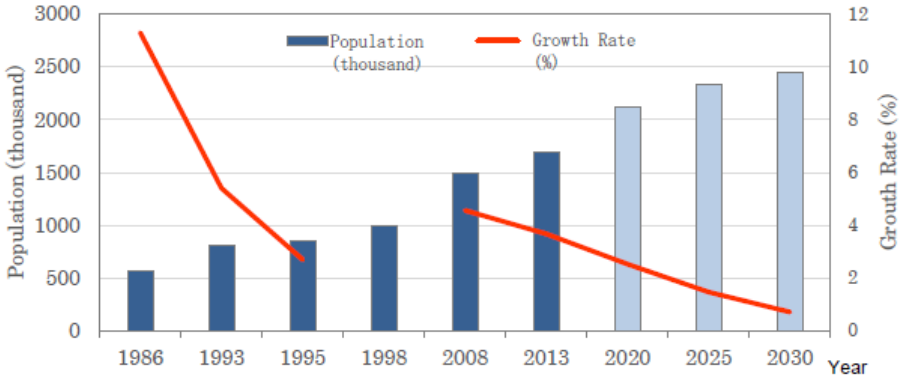
(1) General

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.

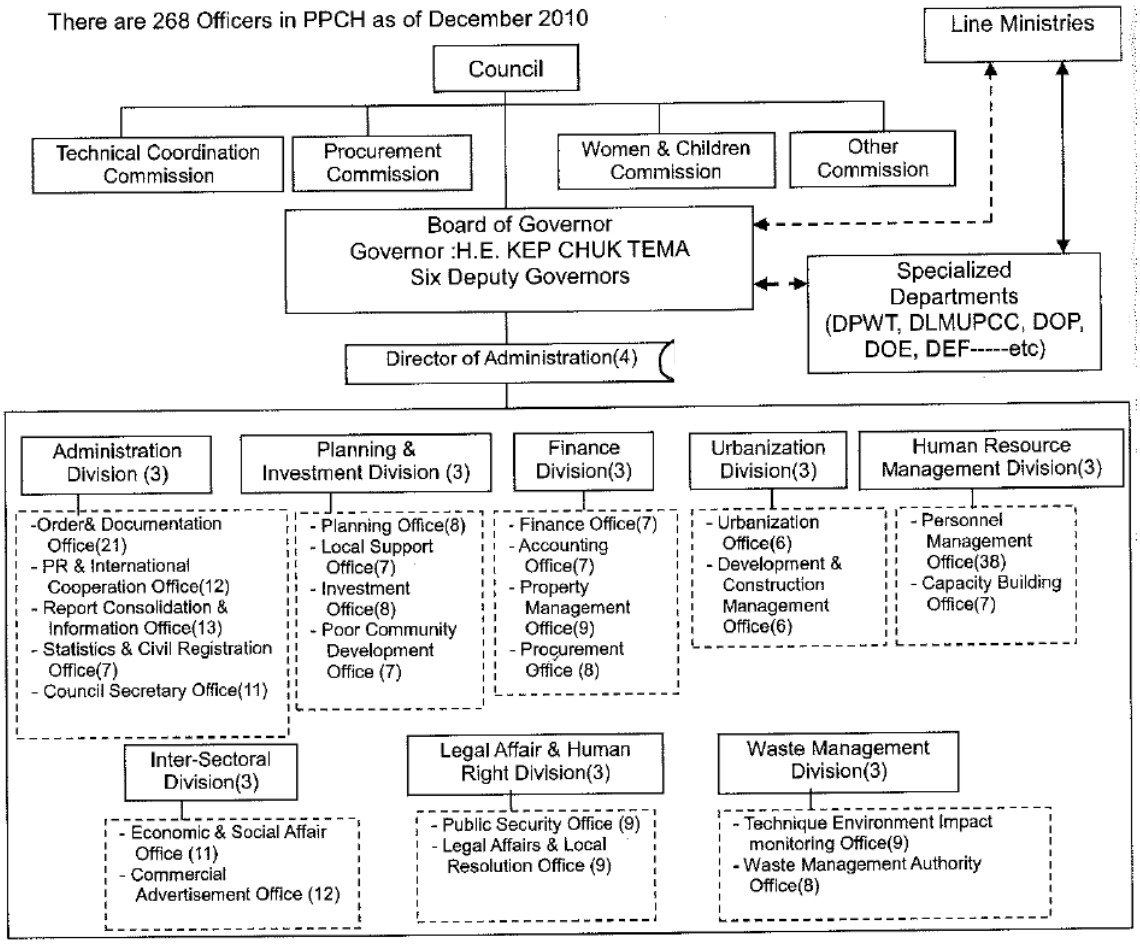


Figure 1.1-2 Administrative Organization of Phnom Penh City

(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.

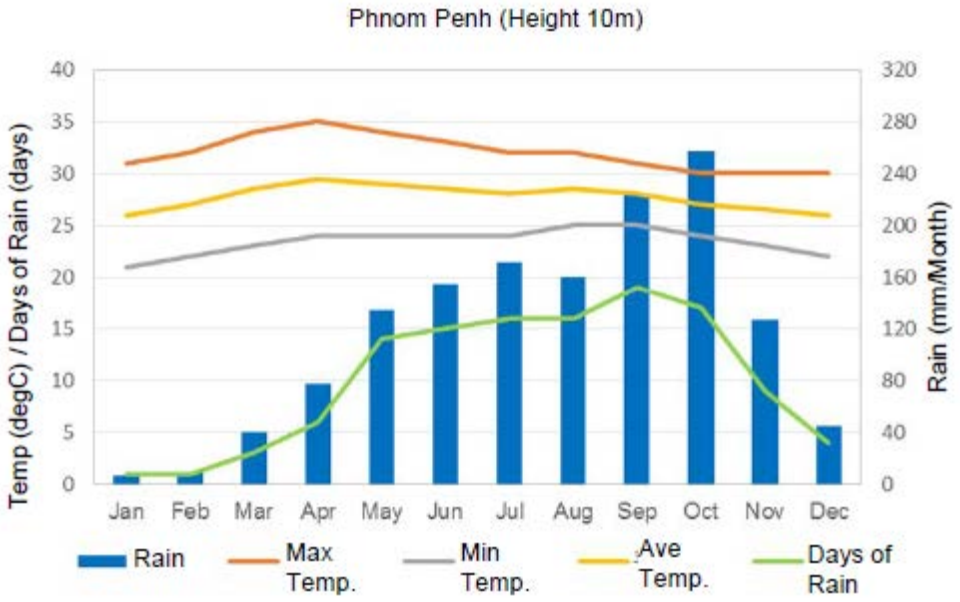


Figure 1.1-3 Climate of Phnom Penh City

(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.

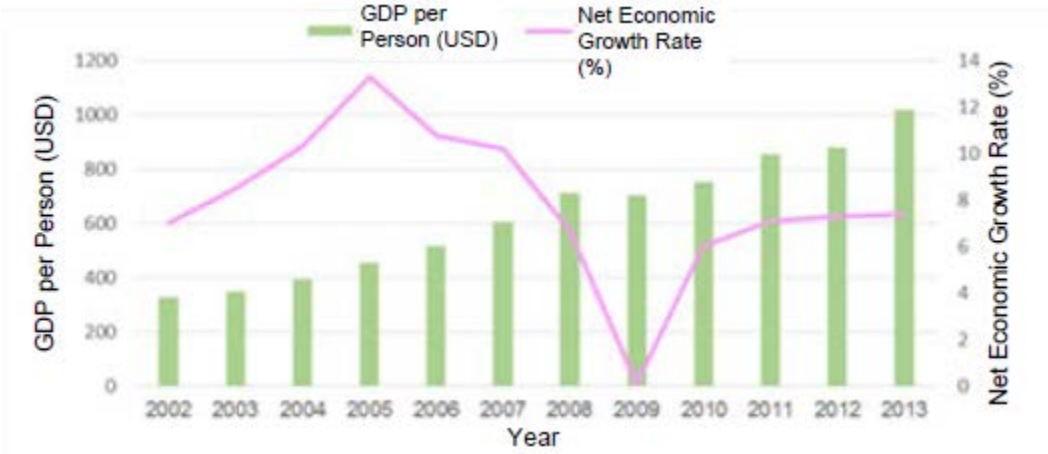


Figure 1.1-4 GDP per person in Cambodia

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. 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 will be conducted.

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

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2.1 Project Outline

In Japan, in July 2015, according to the draft promise submitted to the Secretariat of the United Nations Framework Convention on Climate Change, the realizable greenhouse gas reduction target consistent with energy mix is said to be at the level (Approx. 1,042 million t-CO 2) of 26.0% reduction compared with the FY 2013 level in FY 2030 (25.4% reduction compared with FY 2005 level) by securing domestic emission reduction and absorption volume.

Regarding the bilateral credit system (JCM), although it is not the basis for accumulation of reduction targets, through dissemination of greenhouse gas reduction technology, products, systems, services, infrastructure, etc. to developing countries and implementation of countermeasures, in order to utilize it to achieve Japan's reduction as well as quantitatively assess Japan's contribution to reduction and absorption of greenhouse gas emissions realized, by constructing and implementing JCM, it is expected to reduce and absorb 50 to 100 million tons of CO2 by cumulative until 2030 by the projects of the Japanese Government within the budget of each year separately from the contribution by private-sector business.

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.

2.2 Target Field and Applied Technology

(1) Target Field

Based on the results of the survey of needs in Phnom Penh city which was implemented in advance, the following three activities were taken as main activities.

① Low-carbon business by energy-saving facilities for large hospital

By targeting large hospitals, as one of the leading Phnom Penh city's high energy-consuming-type facilities, the aim is to make the hospital as a whole green by combining renewable energy such as solar power generation and energy-saving measures by introducing high-efficiency air conditioning etc. Investigation of the feasibility of this project will be conducted (Examination of project implementation system and fund composition scheme, investigation of project profitability, CO2 reduction amount and cost effectiveness, etc.).

② Low-carbon business by energy-saving facilities for shopping mall, etc.

By targeting facilities such as large-scale shopping malls, the feasibility of introducing energy saving equipment such as cooling facility and solar power generation system will be studied (Examination etc. of project implementation organization, fund composition scheme, investigation of project profitability, CO2 reduction amount and cost effectiveness), and the possibility of JCM application will be explored.

③ Introduction of waste heat recovery power generation system for cement plant

In Cambodia where economic development continues, cement factories are being developed in Phnom Penh city and its surrounding areas, and the number is increasing even now.

In this survey, by targeting cement plants, the possibility of introducing a waste heat recovery power generation system with a large effect of reducing CO2 emissions will be investigated (Examination etc. of project implementation organization, fund composition scheme, investigation of project profitability, CO2 reduction amount and cost effectiveness).

(2) Applied Technology

The technology to be applied in this survey project was selected from the results of the needs survey in Phnom Penh city which was implemented in advance. Techniques selected as introduction candidates are as shown in the table below.

Figure2.2-1 Target facilities and Technology applied

Category	Target facility	Technology applied
Activity 1	Large hospitals	Solar power system Solar thermal system High efficiency air conditioning
Activity 2	Large Shopping Malls	Solar power system High Efficiency Chiller
Activity 3	Cement factories	Waste heat recovery power generation system Solar power system

2.3 Implementation Organization

The survey implementation organization of this project is shown below.

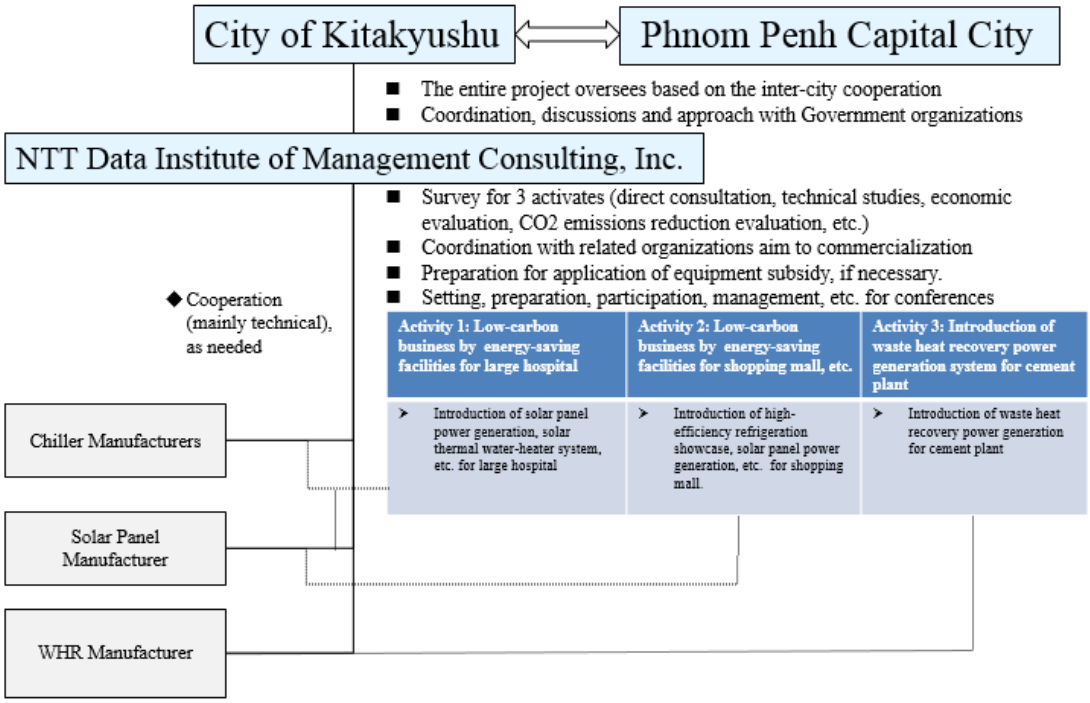


Figure2.3-1 Implementation Organization

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.

In addition, preparation and holding of the whole conference between Kitakyushu City and Phnom Penh city was conducted in cooperation with Nikken Sekkei Co., Ltd. Civil Co., Ltd. and NTT Data Institute of Management Consulting, Inc. Four seminars were held in total.

In addition, when considering the introduction of photovoltaic power generation system, Cooperation was received from experts in construction of photovoltaic panels in Japan in terms of trend of field survey, technical advice, investigation of power generation scale, 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) When selecting facilities to be surveyed, coordination with facilities of high possibility of CO2 emission reduction was conducted through the introduction of national hospitals and information provision by utilizing the environment of intercity collaboration between Kitakyushu City and Phnom Penh city and direct appointments by independent survey etc.

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

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆ (final draft)	☆ (final report)	

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 fifth 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: Low-carbon business by energy-saving facilities for large hospital.), Section 3.3 (Activity 2: Low-carbon business by energy-saving facilities for shopping mall, etc.), and Section 3.4 (Activity 3: Introduction of waste heat recovery power generation system for cement plant).

3.1.1 The First Field Survey

(1) Schedule

The first field survey was conducted from Monday, 9-May to Thursday, 12-May in 2016. 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	5/9 (Mon)	5/10 (Tue)	5/11 (Wed)	5/12 (Thu)	Time
09:00	Pre Meeting	Embassy of Japan	AEON Mall Cambodia	Kick Off Meeting	09:00
10:00					10:00
11:00		Water Supply Authority			11:00
12:00					12:00
13:00			AEON Mall Cambodia 2nd		13:00
14:00	Phnom Penh Urbanization Davison		Kalmet National Hospital	Ministry of Water Resources and Meteorology	14:00
15:00		Ministry of Mine and Energy			15:00
16:00	Phnom Penh Planning and Investment Davison	Ministry of Public Works and Transport		[JICA]	16:00
17:00			Khmer-Soviet Friendship Hospital		17:00
18:00				Flight to Japan	18:00
19:00					19:00

(2) Visiting Participants from Japan

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

・Nikken Sekkei Civil Engineering Ltd.

・NTT Data Institute of Management Consulting, Inc.

(3) Main Agenda, Activities

・As the first on-site survey, we visited each relevant ministry agency, survey target hospitals / enterprises, etc., and explained the outline, background, purpose of this research project, etc.

・On Thursday, May 12, 2016, as the first seminar, we held a kick-off seminar at the Phnom Penh Metropolitan Government (see Figure 3.1.1-2). About 20 people including Deputy Governor from Phnom Penh side participated.

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

・As there is also a background that the sister city of City of Kitakyushu and Phnom Penh city was concluded on March 29, 2016, by utilizing the relationship of sister cities, City of Kitakyushu and Phnom Penh city

confirmed and agreed to cooperate with each other in the projects of "Phnom Penh city Metropolitan Government Climate Change adaptation action plan development support project" (Nikken Sekkei Civil Engineering Ltd. is in charge) and " Project Formation Potential Study utilizing JCM equipment financing project in energy field" (NTT Data Management Institute, Inc. is in charge). The state of the seminar is shown in Figure 3.1.1-3.

Figure3.1.1-3 Kick-off seminar with the entire relevant ministries

・We visited Kalmet National Hospital, and Khmer-Soviet Friendship Hospital, which are the targets of the large-scale hospitals of Activity 1, and conducted hearing about energy conservation and energy-saving / reengineering technologies that have possibility to be introduced. Discussion Details are explained in Section 3.2.

・We visited AEON Mall, which is the target of the large shopping malls of Activity 2, and conducted coordination on application for JCM equipment financing projects in FY2016 and improved the understanding of JCM framework by participants in the projects. In addition, we confirmed the situation of the site planned for construction of Aeon Mall Cambodia No. 2 store. For details, please see section 3.3

3. 1. 2 The Second Field Survey

(1) Schedule

The second field survey originally assumed 3rd and 4th weeks of July, but due to the circumstances of Phnom Penh city, it was postponed to September. Ultimately, the schedule of the second field survey was conducted from Monday, 26-September to Thursday, 29-September in 2016. Meeting schedule and the place of visits are shown in Figure 3.1.2-1.

Figure3.1.2-1 2nd Field Survey Schedule

Time	9/26(Mon)	9/27 (Tue)	9/28(Wed)	9/29 (Thu)	Time
09:00	Phnom Penh Administration		Ministry of Mine and Energy (Phnom Penh)		09:00
10:00	Phnom Penh Urbanization Divison	Kalmet National Hospital		Ministry of Mine and Energy	10:00
11:00	Phnom Penh Planning and Investment Divison				11:00
12:00				Ministry of Industry and Handcraft	12:00
13:00					13:00
14:00	2nd Seminar	Car	[JETRO]	Sathapana Bank	14:00
15:00		PPSEZ			15:00
16:00		Car		[JICA]	16:00
17:00					17:00
18:00			Sunrise Japan Hospital		18:00
19:00					19:00

(2) Visiting Participants from Japan

・City of Kitakyushu, Kitakyushu Asian Center for Low Carbon Society
・Nikken Sekkei Civil Engineering Ltd.
・NTT Data Institute of Management Consulting, Inc.

(3) Main agenda, activities

・On the first day of the visit on Monday, September 26, 2016, the second seminar was held at the Phnom Penh Metropolitan Government. Approximately 20 people including Vice Governor from Phnom Penh side participated. The state of the seminar is shown in Figure 3.1.2-2

・Nikken Sekkei Civil Engineering Ltd. Explained the plan to formulate "Phnom Penh City Climate Change Adaptation Action Plan", and exchanged opinions with Phnom Penh city. NTT Data Institute of Management Consulting, Inc. explained the current status of "JCM project formulation survey in energy field" and explained JCM equipment financing projects and asked for introduction of candidate institutions / companies etc.

Figure3.1.2-2 The state of 2nd seminar with the entire relevant ministries

・In parallel with the request from the Phnom Penh city for the duration and introduction of the company, we visited the Phnom Penh Special Economic Zone and the JETRO Phnom Penh Office to explain this research project and JCM equipment financing projects. It was decided for them to cooperate in advising on the situation on the site and introducing candidate companies. Discussion For details, please see 3.2 and 3.3.

・During the field survey, we arranged the visits to Sunrise Japan Hospital and Satapana Bank for visits and realized them. We explained this research project and JCM equipment financing projects and we were able to discuss positively for future cooperation. Discussion For details, please see 3.2 and 3.3.

3. 1. 3 The Third Field Survey

(1) Schedule

From the Friday, 9th December, 2016 to Friday, 16th December, 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	12/9 (Fri)	12/12 (Mon)	12/13 (Tue)	12/14 (Wed)	12/15 (Thu)	12/16 (Fri)	Time
09:00				Car			09:00
		Phnom Penh Administration	PPSEZ at Hotel			Phnom Penh Waste Management Divison	
10:00				Midori Techno Park Cambodia	3rd Seminar		10:00
11:00	Sathapana Bank	Phnom Penh Urbanization Divison					11:00
12:00				Car			12:00
			Car				
13:00							13:00
14:00			[SUMI Wiring Cambodia]		Ministry of the Environment	Ministry of Mine and Energy	14:00
		[Kingdom Breweries]	Car				
15:00	[CHIP MONG INSEE Cement]				Ministry of the Environment		15:00
16:00		Water Supply Authority				Ministry of Industry and Handcraft	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

・Nikken Sekkei Civil Engineering Ltd.

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

(*): December 9 (Fri) is a survey only by NTT Data Institute of Management Consulting, Inc.

(3) Main agenda, activities

・On Thursday, December 15, 2016, the third seminar was held at the Phnom Penh Government Office. Approximately 35 people including Vice Governor from Phnom Penh side participated. The Japanese side announced

the survey progress based on the previous survey and exchanged opinions with Phnom Penh city. The state of the seminar is shown in Figure 3.1.3-2

Figure3.1. 3-2 The state of seminar with the entire relevant ministries

・We visited SUMI (CAMBODIA) WIRING SYSTEMS CO., LTD and MIDORI TECHNO PARK Cambodia, introduced from the Phnom Penh Special Economic Zone and the JETRO Phnom Penh Office, and investigated the possibility of horizontal development.

・In this visit, we visited Chip Mong Insee Cement and were able to proceed with the discussion of the introduction of waste heat recovery power generation system to cement factories of Activity 3. For the discussion details, please see section 3.4.

3. 1. 4 The Fourth Field Survey

(1) Schedule

The fourth field survey was conducted from Tuesday, January 1 to Wednesday, January 18 in 2017. The meeting schedule and the place of visits are as shown in Figure 3.1.1-1.

Figure3.1.4-1 the 4th field survey schedule

Time	1/17 (Tue)	1/18 (Wed)	Time
07:00	Flight		07:00
08:00		Move to Cement Factory	08:00
09:00			09:00
10:00		[Chip Mong Insee Cement] Site Tour Technical Discussion	10:00
11:00			11:00
12:00			12:00
13:00	Sathapana Bank		13:00
14:00		Move to Airport	14:00
15:00			15:00
16:00			16:00
17:00		[Chip Mong Insee Cement] Meeting with CEO	17:00
18:00	Sunrise Japan Hospital		18:00

(2) Visiting participants from Japan

・NTT Data Institute of Management Consulting, Inc.

・Kawaguchi Steel Industry Co., Ltd. (*)

(*): Participated in a meeting with Sunrise Hospital and Chip Mong Insee Cement

(3) Main agenda, activities

・As we received a request from Chip Mong Insee Cement at the 3rd site survey to conduct the estimation and calculation of the scale of introduction of photovoltaic power generation system to cement factory, this time we were accompanied by a specialist in construction of photovoltaic power generation system. We visited Sunrise Japan Hospital and a cement factory of Chip Mong Insee Cement which was under construction and discussed the installation possibility of solar panels, obtaining drawings, confirmation of power consumption etc. Discussion details are explained in Sections 3.2 and 3.4.

3. 1. 5 The Fifth Field Survey

(1) Schedule

From Monday, February 13 to Thursday, February 16 in 2017, the fifth field survey was conducted. Meeting schedule and the place of visits are as shown in Figure. 3.1.5-1.

Figure 3.1.5-1 5th field survey schedule

Time	2/13 (Mon)	2/14 (Tue)	2/15 (Wed)	2/16 (Tue)	Time
09:00	Phnom Penh Administration	Sunrise Japan Hospital		Move to Cement Factory	09:00
10:00					10:00
11:00	Embassy of Japan				11:00
12:00					12:00
13:00				[Chip Mong Insee Cement]	13:00
14:00		4th Seminar			14:00
15:00				Move to Airport	15:00
16:00					16:00
17:00			AEON Mall Cambodia 2nd		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

・Nikken Sekkei Civil Engineering Ltd.

・NTT Data Institute of Management Consulting, Inc.

(3) Main agenda, activities

・At the Phnom Penh Metropolitan Government on Tuesday, February 14, 2017, the 4th general seminar was held. Approximately

20 people including Vice Governor from Phnom Penh side participated. The Japanese side announced the results of the survey conducted so far and exchanged opinions with Phnom Penh city. The state of the seminar is shown in Figure 3.1.5-2

Figure3.1. 5-2 The state of seminar with the entire relevant

・We examined introduction of solar power generation system and economic consideration for Sunrise Japan Hospital and Chip Mong Insee Cement. Discussion Details are explained in Section 3.2 and 3.4

・We visited the site of Aeon Mall, Cambodia's second mall, and confirmed the report of the survey project in this fiscal year and the possibility of construction progress and transverse expansion. For details, please see section 3.3

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

3.2.1 Overview of Survey

(1) Outline of survey contents

As a result of a survey of needs in Phnom Penh city that was implemented in the past, it is found out that a certain national hospital has 500 MWh to 700 MWh of electricity consumption per month, and that the electricity charge per month amounts to 100 thousand US dollars per month. Also, in a hospital, a steam cleaning / disinfecting device (steam riser) is utilized for sterilization of medical instruments and the like, and steam demand also exists in a certain amount. Natural gas cogeneration and the like are effective when electrothermal demand exists, but in Cambodia that relies on importing fossil fuels, it is not easy to introduce gas cogeneration etc. at present

Therefore, we will make effective use of solar energy abundantly present in the area, and investigate the possibility of introducing solar power generation and solar thermal utilization system etc.

In addition, in the Phnom Penh city where the average temperature exceeds 25 ° C throughout the year, the demand for cooling is large, so we will also consider energy saving by introducing highly efficient air conditioning.

For large hospitals, one of the most energy-intensive facilities in Phnom Penh City, we aim to make the hospitals as a whole green by combining renewable energy such as solar power generation and energy-saving measures by introducing high-efficiency air conditioning etc. For the time being we will investigate the feasibility of this project (Examination of project implementation system and fund composition scheme, investigation of project profitability, examination of CO2 reduction amount and cost effectiveness, etc.). The activity items and contents of activities are summarized in Figure 3.2.1-1.

Figure 3.2.1-1 Activity items and contents of activities

	Activity item	contents of activities
①	Extraction and encouragement of applicable local hospitals	Make the best use of the cooperation between City of Kitakyushu and Phnom Penh City to introduce the hospital concerned.
②	Visit to the local hospitals・Hearing	Confirm the scale of air conditioning, the installation area of photovoltaic power panels, etc and examine the technology introduced.
③	Implementation of technical review based on required specifications	Based on the requirement specification of the local company, confirm with each vendor the equipment that meets the specification.
④	Economic consideration for equipment introduction	Economic evaluation such as investment collection period based on estimates and performance obtained from vendors,
⑤	Study on calculation method of CO2 reduction effect and monitoring method	Calculate CO2 emission reduction based on performance obtained from vendor and existing approved MRV methodology
⑥	Extraction and encouragement of representative business	Extract and encourage companies that can become representative companies to implement JCM projects.
⑦	Support a decision making for JCM Project Implementation	explain the JCM framework and the results of the study, and support the decision-making for JCM project implementation
⑧	Confirmation of contract method of national hospitals	Conduct hearing directly to the local hospitals and confirm the contract method.

(2) Outline of survey target site

Under the cooperation between the cities of City of Kitakyushu and Phnom Penh city, we were introduced "Khmer - Soviet Friendship Hospital" and "Calmet National Hospital" which are facilities of intensive energy consumption.

Through the field survey, we also visited "Sunrise Japan Hospital" which has the same purpose as the growth strategy of the Japanese government's hospital export, and conducted hearing directly.

The overview of each hospital is shown below.

① Khmer - Soviet Friendship Hospital

location 場所：Yothapol Khemarak Phomin (St. 271), Phnom Penh

Facility owner: Ministry of Health, (support: Russian government)

Establishment: 1960

Number of beds: about 500 beds

Number of patients: about 37,000 people / year

Figure3.2.1-2 Khmer - Soviet Friendship Hospital

② Calmet National Hospital

location 場所：No. 3, Preah Monivong Blvd (93), 12201, Phnom Penh

Facility owner: Ministry of Health, (support: French government)

Establishment: 1950

Number of beds: about 530 beds

Number of patients: about 31,500 people / year

Figure3.2.1-3 Calmet National Hospital

③ Sunrise Japan Hospital

Location 場所：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

Number of beds: 50 beds (10 beds of ICU, general beds, VIP beds)

Supplement：

・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. .

Figure3.2.1-4 Sunrise Japan Hospital

3.2.2 Technical Study Based on Required Specification

① Khmer - Soviet Friendship Hospital

・When conducted hearing directly to the Khmer - Soviet friendship hospital, it was found out that the electricity bill was 100,000 USD per month (≈ 10 million yen or more), about half of which was due to air conditioning. For that reason, the hospital was interested in discussing the reduction of electricity bills through introduction of energy saving equipment ・reenergine equipment, and was also very interested in JCM equipment financing projects.

・The current status and results of investigation on high efficiency air conditioning equipment, solar hot water system, photovoltaic power generation system are summarized below.

・In conclusion, although the possibility of introducing high-efficiency air conditioning equipment and solar hot water system is low, it turned out that there is a possibility of considering introduction of solar power generation system.

【Air-conditioning equipment】

・The air conditioning in the facility is not a chiller system, but consists of about 600 separate air conditioning for each rooms. The air conditioning equipment currently in use was introduced about five years ago, and it is said that they are using Sharp, LG, etc. In addition, the same number of indoor units and outdoor units are installed (one to one correspondence)

・There is no maintenance philosophy such as periodic simultaneous exchange, and it means, when it breaks, that repair and replacement etc. are supported by each device. When asked about the possibility of switching to a high-efficiency air conditioning equipment, it was said that, as it was just introduced about five years ago, it is not supposed to exchange yet.

・Although there are no plans for new facilities at the moment, there is a room to consider introducing highly efficient air conditioning equipment when new facilities are constructed.

・The possibility of introducing highly efficient air conditioning equipment immediately is low

【Solar hot water system】

・Heat demand was confirmed. Steam is made with electricity as a heat source.

・We tried hearing the possibility of the solar hot water system, but since it is necessary to use pure water for medical hot water, it turned out that it is difficult to use warm water by the solar hot water system

【Solar power system】

・We asked, as a candidate for solar power generation system, if the roof of the hospital building could be used. The answer was that the strength would be sufficient because there was nothing on the roof.

Below, the introduction technology is examined assuming that solar panels are to be installed on the roof space of the hospital building.

・The available roof area is 1,800 m 2 (150 m x 12 m), assuming that solar panels can be installed in about half of the site (900 m 2), the panel size, and power generation amount, etc. are estimated. Therefore, the corresponding area is shown in Figure 3.2.2-1

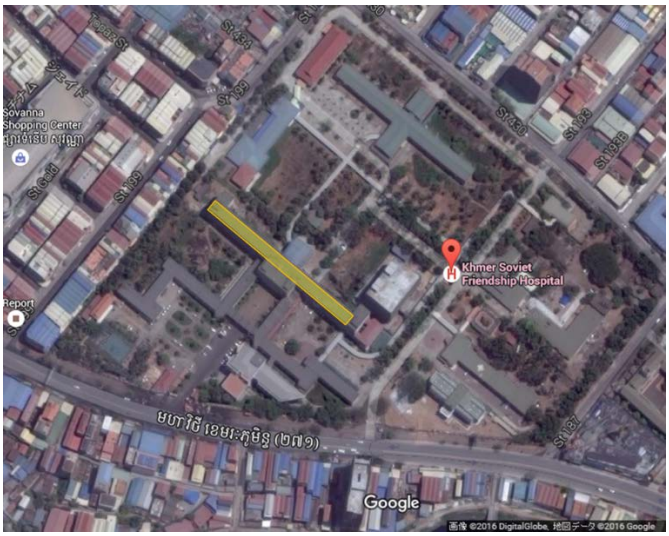
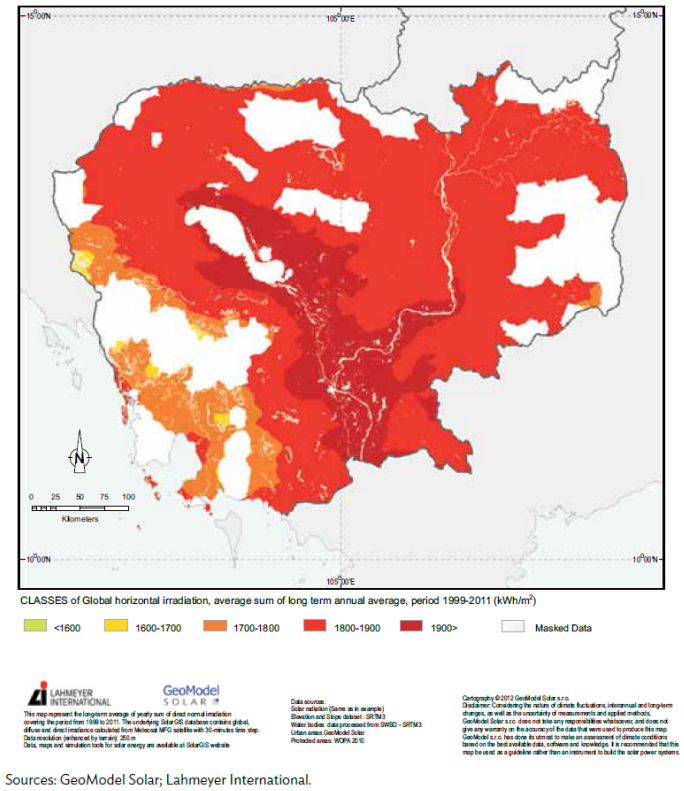


Figure3.2.2-1 Roof area of Khmer - Soviet Friendship Hospital

(Source：Google Map)

・Cambodia is blessed with solar energy and is said to be suitable for solar power generation as shown in Figure 3.2.2-2. Cambodia's annual average total solar insolation (GHI) is as high as 1,450 to 1,950 kWh / m 2, according to ADB's published "RENEWABLE ENERGY DEVELOPMENTS AND POTENTIAL IN THE GREATER MEKONG SUBREGION, 2015, ADB." Cambodia's 65% Of the land is over 1,800 kWh / m 2 annual average total solar insolation (GHI). Also, the annual average direct solar radiation (DNI) is also high, which is 1,100-1, 300 kWh / m 2.

・On the economic front, PV power equalization power cost (LCOE) in the country is set at $ 0.166 / kWh ~ $ 0.175 / kWh. On the other hand, the unit price of electricity is as high as $ 0.18 / kWh ~ $ 1 / kWh, and it is said that PV can compete with conventional electric power on price side and business viability may be secured



Sources: GeoModel Solar; Lahmeyer International.

Figure 3.2.2-2 Solor Irridation Map
(Source: ADB, 2015 "RENEWABLE ENERGY DEVELOPMENTS AND POTENTIAL IN THE GREATER MEKONG SUBREGION")

・Estimated annual power generation amount estimated from solar panel installable area and sunshine degree in Cambodia is about 250,000 kWh / year. Estimated by the following formula

・Approximate annual power generation (kWh / year) = solar panel installable area (m 2) x the intensity of illumination per 1 m 2 (kWh / m 2 / year) x panel efficiency x system efficiency

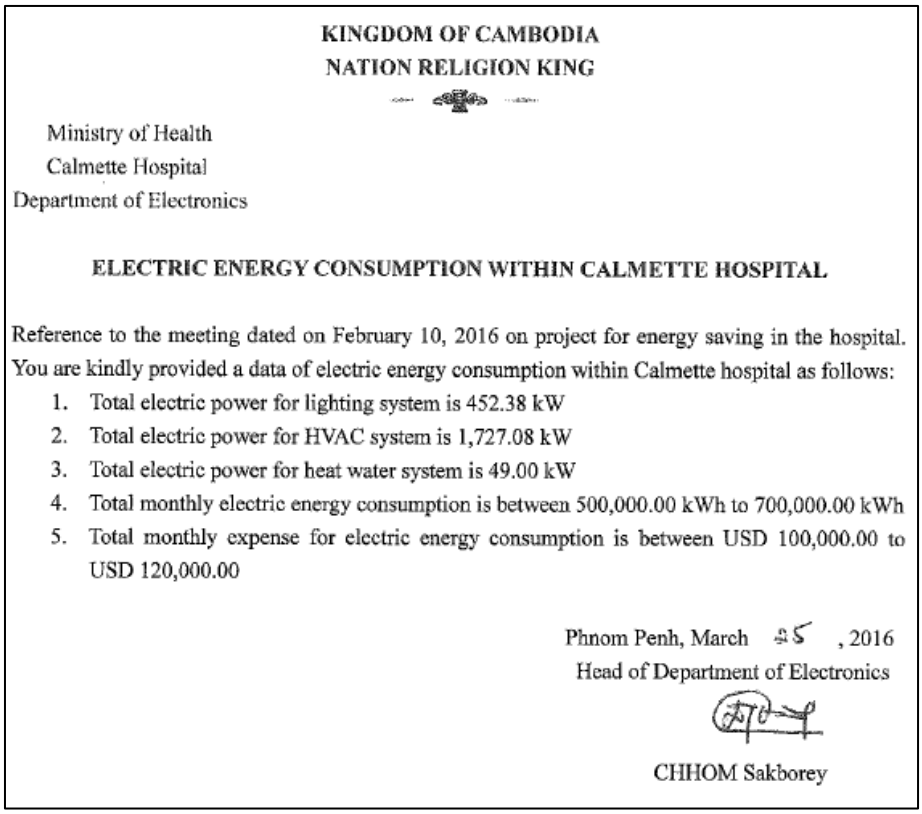
(900 m 2 x 1800 kWh / m 2 / year x 0.194 x 0.8 ≈ 250,000 kWh / year)

※ This result is an assumed value for grasping the scale of the project, and detailed study including solar panel manufacturers and construction

companies etc. is necessary for promoting implementation.

② Calmet National Hospital

・When direct hearing was conducted to Calmet National Hospital, it was found that the electricity consumption was about 500 MWh ~ 700 MWh per month and paid 100,000 USD per month (≈ 10 million yen or more) as electricity fee. Among the power consumption, it was also found that the air conditioning equipment is 1,727 kW, which is the highest consumption amount compared to others. Please see Figure 3.2.2-3.



KINGDOM OF CAMBODIA
NATION RELIGION KING

Ministry of Health
Calmette Hospital
Department of Electronics

ELECTRIC ENERGY CONSUMPTION WITHIN CALMETTE HOSPITAL

Reference to the meeting dated on February 10, 2016 on project for energy saving in the hospital. You are kindly provided a data of electric energy consumption within Calmette hospital as follows:

1. Total electric power for lighting system is 452.38 kW
2. Total electric power for HVAC system is 1,727.08 kW
3. Total electric power for heat water system is 49.00 kW
4. Total monthly electric energy consumption is between 500,000.00 kWh to 700,000.00 kWh
5. Total monthly expense for electric energy consumption is between USD 100,000.00 to USD 120,000.00

Phnom Penh, March 25, 2016
Head of Department of Electronics

CHHOM Sakborey

Figure 3.2.2-3 Energy consumption of the Calmette National Hospital
(Source: excerpt from materials obtained from Calmet National Hospital)

・Air conditioning facilities in the hospital are mixed with facilities equipped with individual cooling in each room and facilities equipped with total cooling by the chiller system. 5 to 6 facilities are individual cooling, and 3 facilities are cooling by chiller system.

・The oldest one of the facilities that introduced the chiller system is the CIAT chiller system introduced in 1997. Please see Figure 3.2.2-4.

Figure 3.2.2-4 Existing CIAT chiller system

・In addition, new facilities are scheduled to be completed at the end of 2016, which adopts air conditioning by the chiller system, but construction is already in progress, and it cannot be subject to JCM equipment financing projects due to the timing of public offering.

・As explained in the next paragraph, since the facility owner wishes to fully subsidize by ODA etc., It is difficult to make the case as the JCM financing projects because it is necessary for the facility owner to bear the initial investment amount once.

③ Sunrise Japan Hospital

・The monthly electricity consumption is, as the result in October, about 111,500 kWh, about 3 million yen. Because the monthly electricity fee is expensive, it was interested in discussing reduction of electricity bill by introduction of energy saving equipment / reenergine equipment, and it became also very interested in JCM equipment financing projects.

・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】

・ In order to investigate the introduction of solar panels, 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 3.2.2-5, 3.2.2-6, 3.2.2-7 show the solar panel installation candidate spaces.

Figure 3.2.2-5 Roof of building (Rest space)

Figure 3.2.2-6 Roof of building (roof of sun shade)

Figure 3.2.2-7 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 3.2.2-8.

Figure 3.2.2-8 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 3.2.2-9, Figure 3.2.2-10

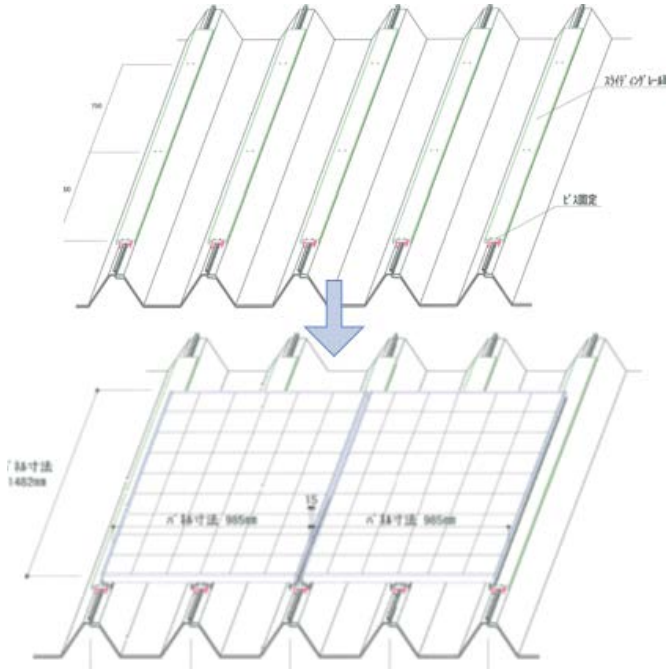


Exhibit 3.2.2-9 Ultra light installation method (folded-plate roof)

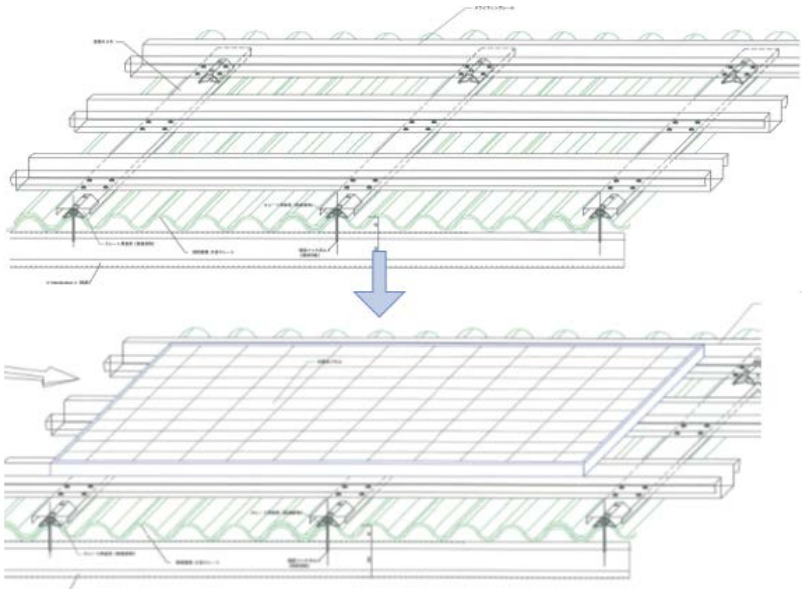


Figure 3.2.2-10 Ultra light installation method (slate roof)

(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 3.2.2-11.

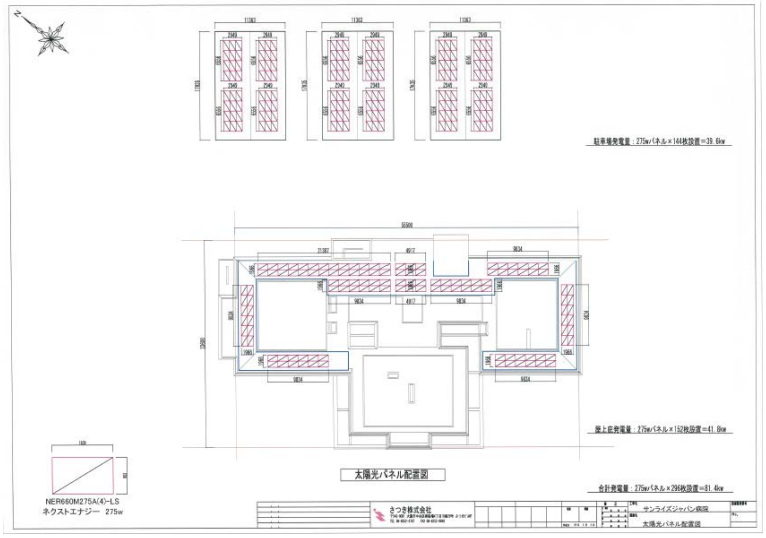


Figure 3.2.2-11 Assignment of solar panels (Sunrise Japan Hospital)

・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 3.2.2-12.

・As a result of trial calculation, the estimated total effective power

generation per year was about 110,000 (kWh / year).

Figure 3.2.2-12 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 3.2.2-12). 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.

3.2.3 Economic Consideration for Installation Facilities

① Khmer - Soviet Friendship Hospital

・As explained in the previous section, although the possibility of introducing high-efficiency air-conditioning equipment and solar hot water system is low, it turned out that there is a possibility of considering introduction of solar power generation system. We will examine the economic efficiency related to the introduction of photovoltaic power generation system.

【Approximate initial investment amount】

・Although solar panel manufacturers and construction companies vary the cost of initial investment, in order to grasp the approximate initial investment amount, the initial investment amount was estimated by multiply the unit price per wattage with the solar cell capacity (wattage) to be introduced.

・Calculate the installable panel size by referring to the catalog value of a certain manufacturer's product. In the catalog value, the area per module is 1.26 (m 2), and the maximum output per sheet is 240 (Wp). Assuming that 900 (m 2) of the hospital's roof space is an installable space, the number of panels is approximately 714 and the solar battery capacity is 170 kW.

・Assuming the unit price per wattage is 1.8 (USD / W), the initial investment amount is approximately 300,000 (USD).

※This estimate is an estimated estimate for grasping the scale of the project, and detailed study including solar panel manufacturers, construction companies, etc. is necessary to promote implementaiton.

【Approximate annual electricity reduction amount】

・The approximate annual power generation amount estimated in 3.2.2 was about 250,000 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.

・The electricity charge per kWh contracted by Khmer - Soviet Friendship Hospital is approximately 0.19 (USD / kWh), so the electricity cost that can be reduced by solar power generation will be 47,500 (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)

(250,000 kWh / year x 0.19 USD / kWh ≒ 47,500 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.

【Hearing to the hospital】

・Based on the above approximate results, hearing was conducted to the hospital side. The situation of the meeting is shown in Figure 3.2.3-1.

Figure 3.2.3-1 Hearing to Khmer - Soviet Friendship Hospital

・As for the Estimated annual electricity reduction, they became interested and the reply was that it is very attractive.

・On the other hand, concerning the burden of initial investment, as they showed hesitancy, it was said that it was necessary to coordinate with related parties. When we asked the results at a later date, the answer was that the burden of initial investment is difficult.

・The Ministry of Health is responsible for ensuring the budget, and as, when deciding a large investment, not only the Ministry of Health but also members of the committee, including the Ministry of the Environment, the Ministry of the Environment, the Phnom Penh city, the Ministry of Industry, etc., will discuss the case, it seems that procurement by their own funds is very difficult.

・Regarding the burden of initial investment, we are considering whether collaboration with local banks can be performed. We are considering whether it is possible to combine the monthly repayment fee for the fee corresponding to the monthly reduced electricity charge with the burden of the initial investment amount of the project as zero. There are also issues peculiar to the locality, and we believe that further discussion is also necessary for cooperation with this bank after the next fiscal year.

【Bidding condition】

・We asked about the necessity of bidding. It is an answer that bidding is essential, which is decided by the aforementioned committee.

・If it is a small investment, after consulting with the in-house member's committee, bid will be conducted to the construction companies. The large investment will also be decided by the committee with additional members of, such as the Ministry of the Environment, Phnom Penh city, the Ministry of Health, the Ministry of Industry, etc.

② Calmet National Hospital

・When discussing directly, we explain that it is possible to subsidize up to 50% of the initial investment amount of target equipment by utilizing the JCM framework, but the hospital side explained "we want 100% subsidies instead of 50%. " Because it is a national hospital established with the Cambodian government and French funds, it seems that they are accustomed to receiving subsidies.

・When we proposed the way to utilize ESCO (Energy Service Company) type project to cover expenses related to equipment installation with electricity cost reduction, the reaction from the hospital side is not so positive, and the reply was " we would like you to assist us to get the total amount by subsidy through ODA etc. "

・With the JCM financing projects scheme where the partner need to bear once the initial investment amount, making projects is very difficult. For this reason, the discussion on the subsequent sections is omitted.

・The situation of the meeting is shown in Figure 3.2.3-2.

Figure 3.2.3-2 Hearing to Calmet National Hospital

③ Sunrise Japan Hospital

・As explained in Section 3.2.2, Sunrise Japan Hospital is a new hospital opened in September 2016, and it is difficult to introduce new energy-saving equipment. We will 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 3.2.3-3.

Figure 3.2.3-3 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 3.2.2, 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 3.2.2 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】

・Based on the above approximate results, hearing was conducted to the hospital side.

・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, regarding the burden of initial investment, we are considering whether collaboration with local bank can be performed. We are considering whether it is possible to combine the monthly repayment fee for the fee corresponding to the monthly reduced electricity fee with the burden of the initial investment amount of the project as zero. There are also issues peculiar to the locality, and we believe that further discussion is also necessary for cooperation with this bank from the next fiscal year.

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

① Khmer - Soviet Friendship Hospital

【Approximate CO2 reduction effect】

・As explained in Section 3.2.2, although the possibility of introducing high-efficiency air conditioning equipment and solar hot water system is low, it turned out that there is a possibility of considering introduction of solar power generation system. Here, we will 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 3.2.2 was about 250,000 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 3.2.4-1.

Ministry of Environment Cambodia

IGES Institute for Global Environmental Strategies

Grid Emission Factor of

the Phnom Penh Electricity Grid

	($t\text{-}CO_2/MWh$)
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**

Date: March2011
Baseline methodology:
ACM0002/Version 12.1.0.
ASM I.D./Version 16.
Tool to calculate the emission factor for an electricity system/Version 02

Figure 3.2.4-1 Grid emission factor in Cambodia (Source: GEC)

・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.

・As a result of trial calculation, the estimated CO2 reduction effect is 160 ton-CO2 / year.

Figure 3.2.4-2 Estimated CO2 Reduction Effect (Khmer - Soviet Friendship Hospital)

Estimated effective total generated electricity per year	250,000	kWh/yr

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

CO2 emission factor of self power consumption	0.641	(ton-CO2/MWh)

Reference CO2 emissions Re1	160.325	ton-CO2/yr
1Project CO2 emissions Pj1	0	ton-CO2/yr

CO2 emission reduction amount Q1=(Re1-Pj1)	160.325	ton-CO2/yr

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

② Calmet National Hospital

・As explained in the preceding paragraph, it is difficult to formulate a project in the JCM financing projects scheme, which requires the project operator to bear the initial investment amount once because it wishes full subsidy through ODA etc.

③ Sunrise Japan Hospital

【Approximate CO2 reduction effect】

・As estimated in Section 3.2.2, the approximate annual power generation

amount was approximately 110,000 kWh / year. Since this power generation amount is smaller than the hospital power consumption amount, the generated power as a whole is used as self power consumption, and the amount of electric power procured from the conventional Grid power may be reduced. Through this reduction, CO2 emissions are reduced by reducing the amount of electricity procured from fossil fuels.

・As mentioned above, the grid emission factor of Cambodia is 0.641 (ton - CO 2 / MWh) (please see figure 3.2.4 - 1).

・For the introduction of photovoltaic power generation systems, a method for calculating a certain CO2 reduction effect has already been established. According to the worksheet at the Public Interest Foundation Corporation Global Environment Centre Foundation, the CO2 reduction effect by realizing this project was calculated. The calculation result is shown in Figure 3.2.4-3.

・As a result of trial calculation, the estimated CO2 reduction effect is 70 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	0.641	(ton-CO2/MWh)

Reference CO2 emissions Re1	70.543	ton-CO2/yr
1Project CO2 emissions Pj1	0	ton-CO2/yr

CO2 emission reduction amount Q1=(Re1-Pj1)	70.543	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

① Khmer - Soviet Friendship Hospital

・As explained in Section 3.2.3, it is difficult to bear the initial investment burden by its own funds, and it is necessary to consider the method of funds financing.

・Assuming that local banks are added to consortium members as a method, we are studying the mechanism of ESCO-type projects that repay the fee in proportion to the monthly reduced electricity fee on a monthly basis with no burden of the initial investment by the facility. The image of the ESCO type project is shown in figure 3.2.5-1

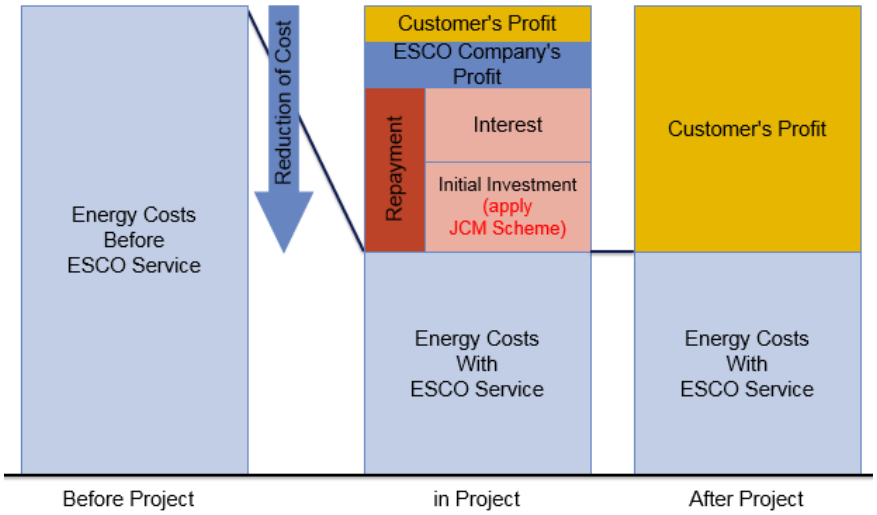


Figure3.2.5-1 The image of the ESCO type project

・Figure 3.2.5-2 shows an image of the organization assumed by JCM implementation.

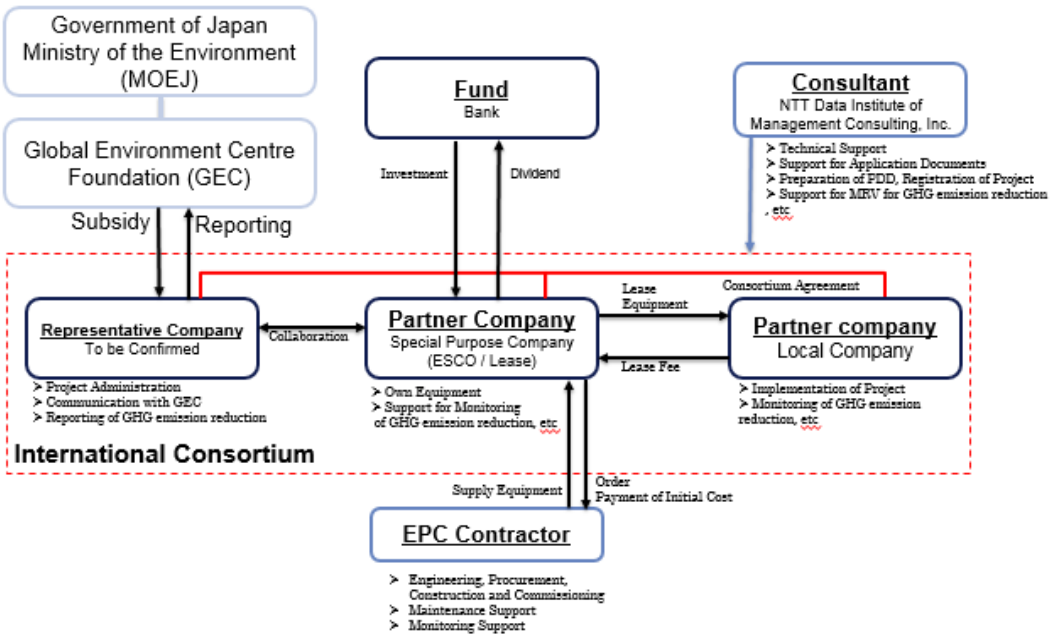


Figure 3.2.5-2 Assumed Implementation Organization Figure

② Calmet National Hospital

・Described in Section 3.2.3, since the hospital wishes to fully subsidize by ODA etc., it is difficult to formulate a project based on the JCM equipment financing project scheme because the hospital is required to bear the initial investment burden once.

③ Sunrise Japan Hospital

・Since it was only opened in September 2016, it is difficult to make a large initial investment by its own funds at the present time. Therefore, regarding the burden of initial investment, we are considering whether we can collaborate with local banks. Please see Figure 3.2.5-1 and Figure 3.2.5-2 above.

3.2.6 Issues in Implementation of JCM

① Khmer - Soviet Friendship Hospital

・Issues for JCM imlementalization are summarized below.

- Consideration on how to bear the initial investment amount
- Extraction and encouragement of representatives
- Review of the timing of starting bidding
- Detailed design and examination with photovoltaic panel manufacturers and construction companies
- Support for decision-making for JCM project implementation

② Calmet National Hospital

・Described in Section 3.2.3, since the hospital wishes to fully subsidize thourhg ODA etc., it is difficult to formulate a project based on the JCM equipment financing project scheme, which requires the hospital to bear the initial investment once.

③ Sunrise Japan Hospital

・Issues for JCM implementation are summarized below.

- Consideration on how to bera the initial investment amount
- Extraction and encouragement of representatives
- Detailed design and examination with photovoltaic panel manufacturers and construction companies
- Support for decision-making for JCM project implementation

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

3.3.1 Overview of Survey

(1) Outline of survey contents

We examined the feasibility of introducing energy saving equipment such as cooling equipment and solar power generation system for facilities such as large shopping malls that are supposed to have large energy consumption and investigated the possibility of applying JCM.

The shopping mall has a huge facility itself and there is not only a large cooling demand but also a refrigerated showcase is required at the Groceries section and so on, and a lot of lighting is used. Therefore, there is a possibility of introducing energy-saving equipment such as refrigerated showcase and cooling equipment and solar power generation system.

We will survey the feasibility of introducing energy-saving equipment such as cooling facilities and solar power generation system for facilities such as large-scale shopping malls (Study of project implementation organization and fund composition scheme, investigation of project profitability, examination of cost effectiveness of CO2 reduction amount etc.). The activity items and activity contents are summarized in Figure 3.3.1-1.

Figure 3.2.1-1 Activity items and activities

	Activity item	activity contents
①	Survey on participation awareness of local shopping malls in JCM equipment financing projects	Contact AEON Mall to explain the JCM scheme and confirm intention to JCM business participation.
②	Implementation of technical review based on required specifications	Based on the requirement specification of the local mall, confirm the equipment that meets the specification with each vendor.
③	Economic consideration for equipment introduction	Based on estimates and performance obtained from vendors, economic evaluation such as investment collection period is carried out.
④	Study on calculation method of CO2 reduction effect and monitoring method	Calculate CO2 emission reduction based on performance obtained from vendor and existing approved MRV methodology.
⑤	Confirmation of decision on submission to JCM equipment financing project public offering in FY2016	Explain the JCM scheme and the results of the review, and confirm the decision making for implementing the JCM project.
⑥	Improve project related personnel's understanding of JCM scheme	Visit AEON Mall Headquarter, the first shopping mall shop, the planned construction site of the second shop, etc. and explain the JCM scheme.
⑦	Investigation of possibility of Transverse expansion to other facilities such as shopping mall	Utilizing the collaboration between City of Kitakyushu and Phnom Penh City, we will uncover local companies that can develop horizontally.

(2) Overview of survey target site

・Currently, the first store of Aeon Mall Cambodia's shopping mall has opened in Phnom Penh city, boasting over 15 million visitors a year. Targeting Aeon Mall Phnom Penh 2 store, aiming to drastically reduce the total electricity consumption of buildings by introducing mega solar class "photovoltaic power generation system" and "high efficiency chiller", the investigation was conducted.

・According to the News Release issued by AEON Mall Co., Ltd. on June 27, 2016, the planned construction site is located 10 km north from the center of Phnom Penh city (about 40 minutes by car), within "New Town

Development" PONG PEAY CITY Project", which LYP Group is developing. As further development can be expected in the surrounding area such as "New World", already developed residential area, and new housing development advanced, and, also in the traffic environment, with the main road connecting the outside of the city to the north and south on the western side of the planned place Hanoi Road runs, its access is good from the center of Phnom Penh and neighborhood, and is in the location environment where y customers can be expected. A summary of the building is summarized in Figure 3.3.1-2.

Figure 3.2.1-2　Building overview

Mall Name	Aeon Mall Cambodia No. 2 Store (tentative name)
Location	Cambodia Kingdom Phnom Penh city Pong Peay City
Site area	approx.100,000 m^2
Total floor area	approx.167,000 m^2 (including multistory parking lot)
Total rental area	approx.80,000 m^2
Anchor　store	AEON (GMS [Comprehensive supermarket])
Number of specialty stores	Approx.200 stores scheduled
Building structure	Reinforced concrete building 4th floor
Building installer	AEONMALL (CAMBODIA) CO., LTD.
Building design and construction	HYUNDAI Engineering CO., LTD.
Number of parking cars	cars：approx.2500cars Motorcycles：approx.2000units
Scheduled opening date	Summer in 2018

(Source: Created from AEON Mall Co., Ltd. Issued June 27, 2016 News Release "About Construction of "Aeon Mall Cambodia No. 2 Store" ")

・As a result of survey and support in this survey, including direct hearing, consideration of project implementation organization, review of introduction technology, study of economic efficiency, consideration of CO2 reduction effect etc., An application was submitted to JCM equipment financing

projects in FY2016, and was successfully selected as a project.

Through introduction of renewable energy (solar power generation) and energy saving (high efficiency chiller), reduction of greenhouse gas emissions is realized by reducing the emission of CO 2 from the combustion of fossil fuel at the stage of generating grid electricity. The energy conservation concept of the second AEON Mall Cambodian store is summarized in Figure 3.3.1-3.

Figure 3.3.1-3 The energy conservation concept of the second AEON Mall Cambodian store

3.3.2 Technical Study Based on Required Specification

【Solar power system】

・We are planning to introduce solar power generation system to the building's rooftop space. Figure 3.3.2-1 shows the places to install solar panels on the rooftop space.

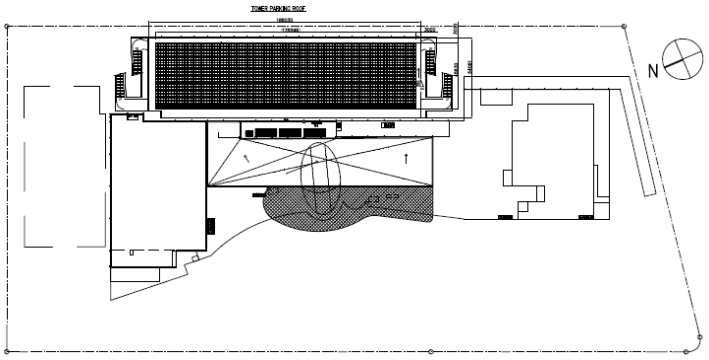


Figure 3.3.2-1 Scheduled installation location of solar panel

・The solar module is planned to be a product of KK 270 P - 3 CDCG manufactured by Kyocera. Figure 3.3.2-2 shows the product specifications.

Figure 3.3.2-2 KyoceraKK270P-3CDCG product specification

Model	KK270P-3CD3CG
Nominal maximum power (Pmax)	270 W
Nominal maximum output operating current (Imp)	8.71 A
Nominal maximum output operating voltage (Vmp)	31.0 V
Nominal short circuit current (Isc)	9.43 A
Nominal release voltage (Voc)	38.3 V
Module conversion efficiency	16.4 %
Nominal mass	19.0 kg
Nominal size	W990 mm x H1662 mm x D 46 mm
Cell type	polycrystal

(Source: From Kyocera KK 270 P - 3 CDCG product brochure)

・A solar power generation system with an installed number of modules of

3840 and 1036.8 kW is planned to be introduced. (270 W Panel x installing 3,840 sheets = 1036.8 kW)

・As explained in Section 3.2.2, for the introduction of photovoltaic power generation systems, a certain method for calculating the estimated annual estimated total generated electricity has already been established.

・Based on the calculation method of solar photovoltaic power generation worksheet prepared at JCM equipment financing project application to the Public Interest Foundation Corporation Global Environment Centre Foundation, annual estimated total effective power generation by this project realization was calculated. Calculation results are shown in Figure 3.3.2-3.

・Estimated total effective power generation per year is expected to be about 1,480,000 (kWh / year).

Figure3.3.2-3 Estimated effective total power generation

Project name	Introduction of 1MW Solar Power System and High Efficiency Centrifugal Chiller in Large Shopping Mall											
Implementation site	Address	Sangkat Kmounh and Sangkat Phnom Penh Thmey, Khan Sen Sok, Phnom Penh										
	N	11.6° N		E	104.9° E							
System solar battery capacity =	1038.8	(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)	5.25	5.19	5.61	5.03	5.72	5.66	5.77	5.64	4.95	4.64	4.47	4.86
Temperature correction factor (when there is no loss = 1.0)	0.875	0.867	0.861	0.86	0.862	0.868	0.869	0.871	0.876	0.877	0.88	0.877
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)	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981
Other loss (when nothing: 1.0) (module dirt, transmission loss, aged deterioration etc.)	0.875	0.875	0.875	0.875	0.875	0.875	0.875	0.875	0.875	0.875	0.875	0.875
Estimated generated electric energy per day (kWh / day)	4,089	4,001	4,298	3,852	4,390	4,374	4,465	4,370	3,859	3,623	3,500	3,791
Average daily power consumption on the working day of factory etc. (kWh / day)	71,335	73,650	79,962	85,282	85,429	86,237	85,666	81,424	81,245	81,035	82,834	76,235
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	0	0	0	0	0	0	0	0	0	0	0	0
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)	126,761	112,024	133,238	115,558	136,077	131,231	138,419	135,483	115,759	112,301	105,011	117,530
Estimated effective total generated electricity per year	1,479,393	kWh/年										

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

【High Efficiency Chiller】

・Reduce electricity consumption and CO2 emissions by adopting more efficient energy saving type chillers than general purpose chillers.

・A high-efficiency chiller that is supposed to be introduced assumes a total of five units, Hitachi's GFG model (1300 RT × 2, 1200 RT × 2, 500 RT × 1). Figure 3.3.2-4 shows the high-efficiency chiller to be introduced.

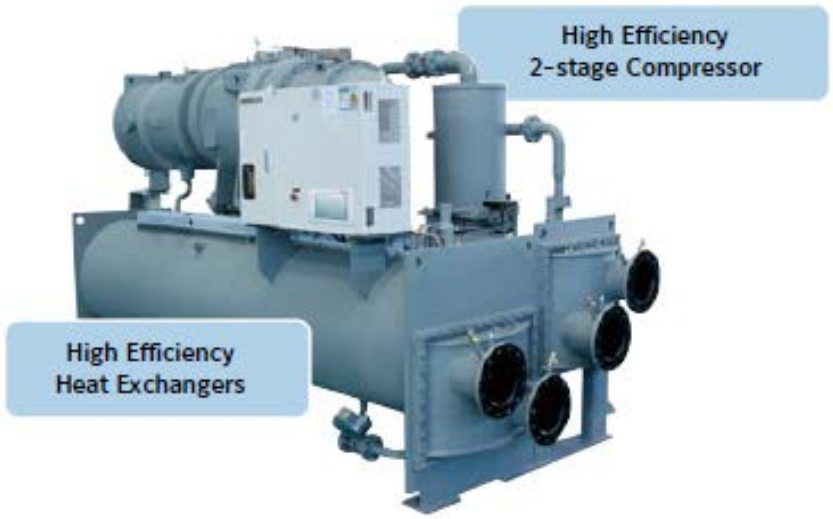


Figure 3.3. 2-4 COP comparison of Hitachi GFG and reference equipment

(Source: From GFG model product catalog by Hitachi)

・The Hitachi GFG model is a high efficiency chiller, an energy efficient type, and its COP is about 6.24 to 6.60. As a result of conducting a comparative survey of chillers circulating in Cambodia, the reference COP was approximately 5.36 to 5.81. The reference COP was set by comparing each company's brochures etc. It may be confirmed that the facilities introduced have overwhelmingly high energy-saving performance. Figure 3.3.2-5 shows the COP of the introduction model and the reference COP in Cambodia.

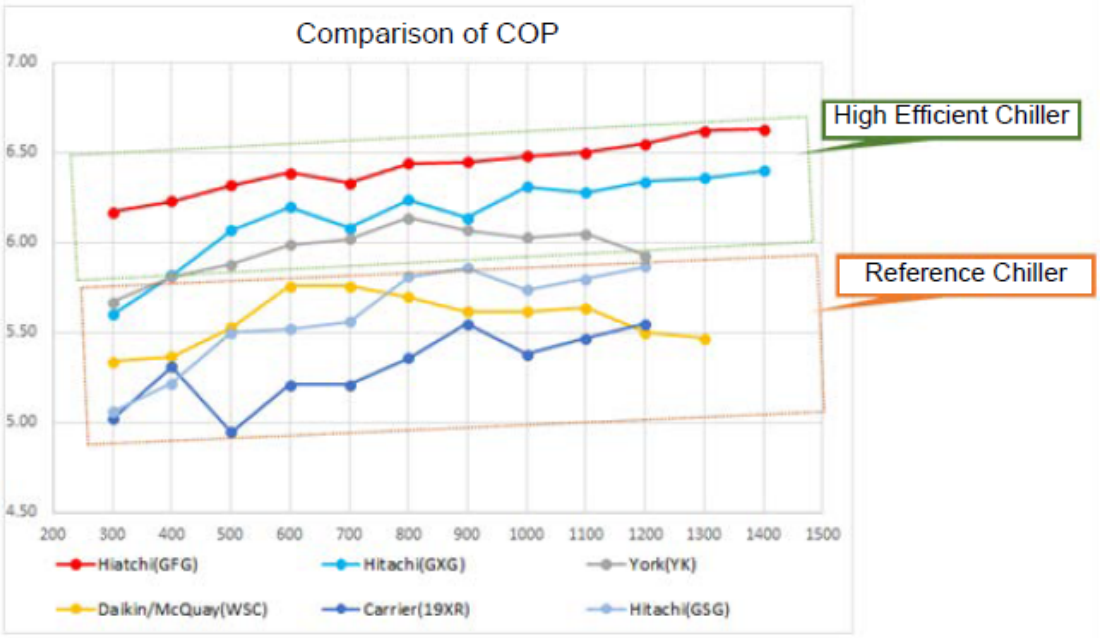


Figure 3.3. 2-5 COP comparison of Hitachi GFG and reference equipment

・Regarding the calculation method of the annual electricity reduction amount at the time of introducing the high efficiency chiller, a certain calculation method has already been established.

・As Public Interest Foundation Corporation Global Environment Centre Foundation publishes a worksheet to calculate annual estimated power reduction amount of high efficiency chiller and CO2 reduction effect when applying for JCM equipment financing project, the project's estimated annual power reduction amount was calculated based on the method. It was estimated that the estimated annual power reduction by introducing 5 high-efficiency chillers (1300 RT × 2, 1200 RT × 2, 500 RT × 1) will be about 937,000 (kWh / year).

3.3.3 Economic Consideration for Installation Facilities

【Examination of the cost of installing solar power generation system】

・We asked the manufacturer to make a quotation including equipment cost and construction cost. Equipment subsidy amount is approximately 290 million yen.

・It was adopted as JCM equipment financing projects in FY2016, and 40% of subsidy for equipment subsidy is planned.

【Examination of cost for introducing high efficiency chiller】

・We asked EPC contractor to create an estimate including equipment cost and construction cost. Equipment subsidy amount is approximately 230 million yen.

・It was adopted as a JCM equipment auxiliary project in FY2016, and it is planning subsidy of 50% of the equipment subsidized amount.

【Study of electricity cost reduction by introducing solar power generation system】

・As mentioned in the previous section, the estimated annual power generation by solar power generation system is expected to be about 1,480,000 kWh / year. Since this amount of power generation is smaller than the planned power consumption to be used for the entire shopping mall, the generated power as a whole is used as a self power consumption, which leads to a reduction in the amount of electric power purchased from the grid electric power.

・Since the electricity charge per kWh of contracted power is 0.1978 (USD / kWh), the electricity cost that can be reduced by introducing solar power generation will be 292,700 (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)

(1,480,000 kWh / year x 0.1978 USD / kWh ≒ 292,000 USD / year)

【Study of electricity cost reduction by introducing high efficiency chiller】

・As mentioned in the previous section, the estimated annual reduction electricity amount by the high efficiency chiller is estimated to be about 937,000 kWh / year.

・Since the reduced electric energy leads to a reduction in the amount of electricity purchased from the grid electric power, the electricity bill may be reduced.

・Since the electricity charge per kWh of contracted power is 0.1978 (USD / kWh), the electricity bill that may be reduced by introducing a high efficiency chiller will be 292,700 (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)

(937,000 kWh / year x 0.1978 USD / kWh ≒ 185,000 USD / year)

【Review of investment recovery years and internal rate of return】

・From the initial investment amount, annual electricity cost reduction amount, and annual operation cost, investment recovery years and internal rate of return were calculated. The results are summarized below.

- Investment recovery years (no subsidy) : 10.1 years
- Number of investment recovery years (with subsidy) : 5.6 years
- Internal rate of return (no subsidy): 5.4%
- Investment recovery years (with subsidy) : 15.8 %

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

【Calculation of CO2 reduction effect by introducing solar power generation system】

・As estimated in Section 3.3.2, the estimated annual power generation by solar power generation system was about 937,000 kWh / year. It is possible to reduce the amount of electric power procured from the conventional system power. Through this reduction, CO2 emissions are reduced by reducing the amount of electricity procured from fossil fuels.

・As mentioned above, the grid emission factor of Cambodia is 0.641 (ton - CO 2 / MWh). (please see Figure 3.2.4-1)

・For the introduction of photovoltaic power generation systems, a method for calculating a certain CO2 reduction effect has already been established. According to the worksheet at the Public Interest Foundation Corporation Global Environment Centre Foundation prepared for the application, the CO2 reduction effect by realizing this project was calculated. Calculation results are shown in Figure 3.3.4-1.

・As a result of the calculation, the estimated CO2 emission reduction amount is approximately 950 ton-CO2 / year.

Figure 3.3.4-1 Approximate CO2 reduction effect (solar power generation system)

Estimated effective total power generation per year	1,479,393	kWh/yr

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

CO 2 emission coefficient of self power consumption	0.641	(ton-CO2/MWh)

Reference CO2 emissions Re1	948.7	ton-CO2/yr
Project CO2 emissions Pj1 0	0	ton-CO2/yr

CO2 emission reduction amount Q1=(Re1-Pj1)	948.7	ton-CO2/yr

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

【Calculation of CO2 reduction effect by introducing high efficiency chiller】

・Reduce power consumption by introducing highly efficient chiller with high COP, compared to chillers that are generally distributed in Cambodia. This reduces CO2 emissions resulting from the combustion of fossil fuels at the stage of generating grid electricity.

・As described in Section 3.3.2, the Hitachi GFG model that is considering introduction is an energy saving type high efficiency chiller, and its COP is about 6.24 to 6.60. In general, the reference COP comparatively investigated from chillers circulating in Cambodia is about 5.36 to 5.81. (please see Figure 3.3.2-4)

・Regarding the calculation method of the CO2 reduction effect at the time of introduction of the high efficiency chiller, a certain calculation method has already been established, and with the worksheet for calculating the CO2 reduction effect of the JCM equipment financing project application form by the Public Interest Foundation Corporation Global Environment Centre Foundation, CO2 reduction effect was calculated. Annual estimated CO2 emission reduction by introducing five high-efficiency chillers (1300 RT × 2, 1200 RT × 2, 500 RT × 1) is approximately 615 ton-CO 2 / year.

・As a reference, the calculation result of the high efficiency chiller of 1300 RT is shown in Figure 3.3.4-2.

Caloration for CO2 Emision Reductin by Chiller (1300RT)					Fill-in	Auto Calc			
					PJ:	AEONMALL Cambodia 2nd Store			
Q	CO2 Emission Reduction	ton-CO2/Year						378	
	Q=Ry-Py								
Ry	ReferenceCO2 Emission	ton-CO2/Year							
Py	ProjectCO2 Emission	ton-CO2/Year							
●Calculation of required refrigeration capacity (air conditioning load etc.)									
	Since various cases are conceivable, please describe the load per hour								
RQy	Yearly Required refrig(MWh/Year							18002.53	MWh/Year
	RQy=Required refrigeration capacity per hour(kWh) ×Yearly Required refrigeration capacity(h/Year)/1000				(MW/Year)lequired refrigeration capacity per hour(kWh)		3523.00		
					Yearly Required refrigeration capacity (h/Year)		5110		
	RQy=3523(kW)×14×365/1000=18002.53MWh/Year								
●Calculation of ReferenceCO2 Emission									
	Ry=RQey×gef	ton-CO2/Year						2,162	
	RQey=Rqy/Rcop							3,291	
RQey	ReferenceYearly Power Consumption	MWh/Year							
Rcop	Reference Chiller COP					Reference Chiller COP	5.47		
gef	Grid CO2 Factor	ton-CO2/MWh	0.6568	Source	See Page 5				
●Calculation of ProjectCO2 Emission									
	Py=RQey×gef	ton-CO2/Year						1,783	
	PQey=Rqy/Pcop							2,715	
PQey	ProjectYearly Power Consumption	MWh/Year							
Pcop	Project Chiller COP					Project Chiller COP	6.63		
gef	Grid CO2 Factor	ton-CO2/MWh	0.6568	Source	See Page 5				

Figure 3.3.4-2 Reducing CO2 emissions by high efficiency chiller
(Source: Created from application form for Public Interest Foundation Corporation Global Environment Centre Foundation)

3.3.5 Consideration for Implementation of JCM

・Figure 3.3.5-1 shows the project implementation organization of the JCM equipment financing projects.

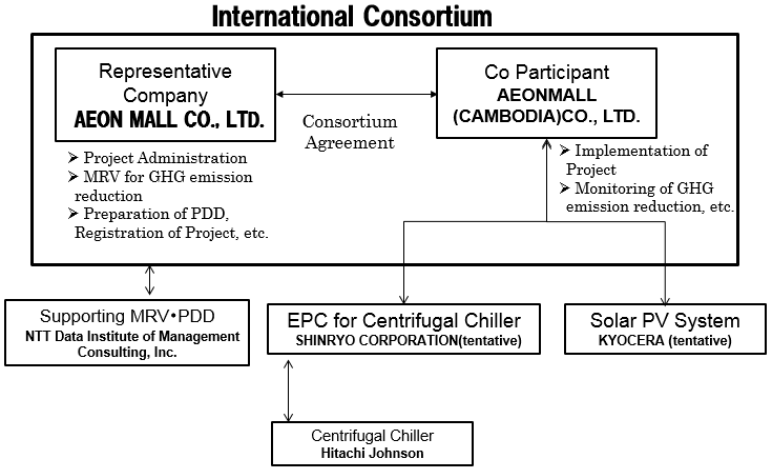


Figure 3.3.5-1 Implementation Organization Figure of JCM equipment financing projects

・During the 5th site survey, we visited the construction site of AEON MALL Cambodia No. 2 store, and asked about the progress of construction etc. The construction has been moving according to plan. The installation of photovoltaic power generation system and high efficiency chiller, which is the target equipment of financing projects, will be started after the building has been completed to a certain extent. The photo of the construction site as of February 2017 is shown in Figure 3.3.5-2.

Figure 3.3.5-2 Photo of construction site (as of February 2017)

・The assumed schedule of project implementation is shown in Figure 3.3.5-3.

Figure 3.3.5-3 Scheduled schedule for JCM equipment financing projects

Schedule	Plan
FY2016	
June 2016	Decision adopted
July - August 2016	Application for JCM financing projects · Grant decision
September 2016	[Solar power generation] Design start
November 2016	[High Efficiency Chiller] Design Started
December 2016	[High Efficiency Chiller] Design Completion
January 2017	[High Efficiency Chiller] Production Started
FY2017	
May 2017	[High Efficiency Chiller] Production completion / carried in
May 2017	[Solar power generation] Design completion
June 2017	[High Efficiency Chiller] On-site construction started
July 2017	[Solar power generation] Production started
July 2017	[Solar power generation] On-site construction started
May 2017	[High Efficiency Chiller] On-site construction completed
December 2017	[Solar power generation] Production completion / carried in
December 2017	[High Efficiency Chiller] Preparation for trial operation started
FY2018	
April 2018	[Solar power generation] On-site construction completed
April 2018	[Solar power generation] Preparation for commissioning started
May 2018	[Solar power generation] [High efficiency chiller] trial operation completed
July 2018	Aeon Mall Phnom Penh 2nd store PPC opened
July 2018	Monitoring started
September 2018	JCM equipment financing projects completed (inspection)

3.3.6 Issues in Implementation of JCM

・As a result of investigation / support in this survey, such as direct hearing, study of project implementation organization, examination of introduction technology, economic consideration, CO2 reduction effect study, the application was submitted to JCM equipment financing projects in FY2016, and selected as project to be adopted. Along with it, the construction progress is also smooth. There is no problem at present.

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

3.4.1 Overview of Survey

(1) Outline of survey contents

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 3.4.1-1.

Figure 3.4.1-1 Activity items and contents of activities

	Activity item	Content of activity
①	Extraction and encouragement of local companies	Utilize the collaboration between City of Kitakyushu and Phnom Penh City to discover and introduce relevant companies.
②	Hearing to the introduced private company	Contact the local company that introduced and explain the JCM framework. Confirm whether it is possible to form projects and whether local companies are interested in JCM financing projects.
③	consultation to a local corporation of interest	1) Conduct hearing about the scale of cement plant facilities and conditions of waste heat, etc. and study the scale etc. of waste heat recovery power generation. 2) Confirm the method of fund financing and investigate whether there is any financial obstacle.
④	Extraction and encouragement of a representative company	Extract and encourage companies that may become a representative company for JCM equipment financing projects.

(2) Outline of survey target site

・Information offering through Intercity cCollaboration between sister cities of City of Kitakyushu and Phnom Penh City, and as a result of our own investigation, it was found that there is a cement factory in Kampot State, about 125 km away from Phnom Penh city. We examined the possibility of introducing the waste heat recovery power generation project to Chip Mong Insee Cement, which is building a cement plant there. Figure 3.4.1-2 shows the location of the cement factory.

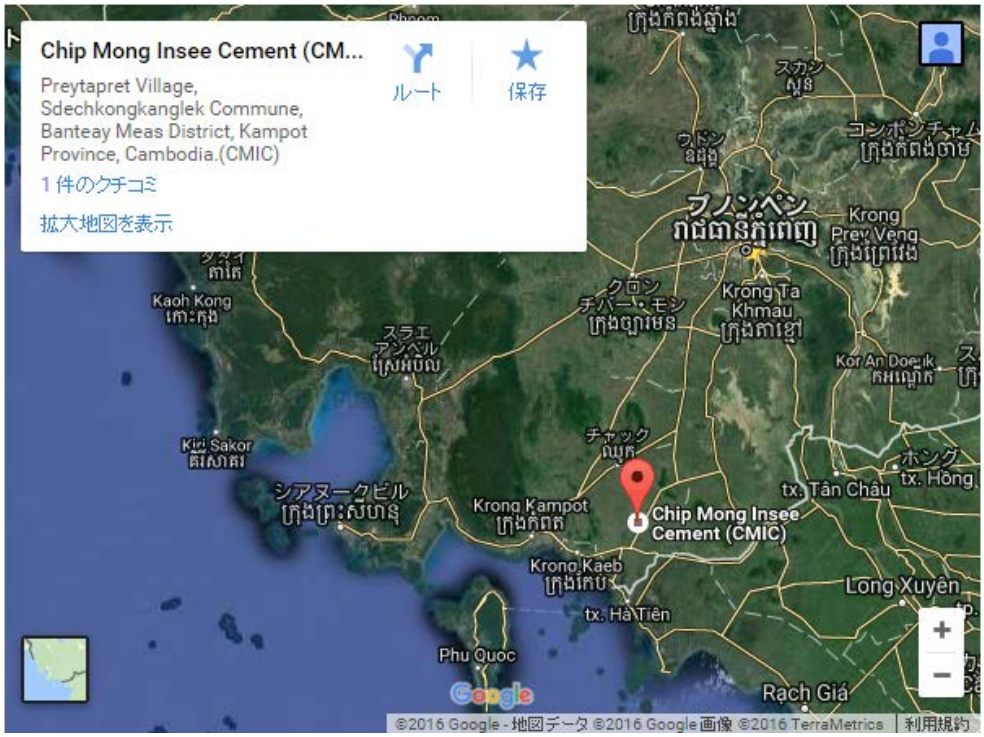


Figure 3.4.1-2 Cement factory site of Chip Mong Insee Cement
(Source：Google Map)

・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 3.4.1-3 shows the joint venture's ownership ratio and the logos of both companies.

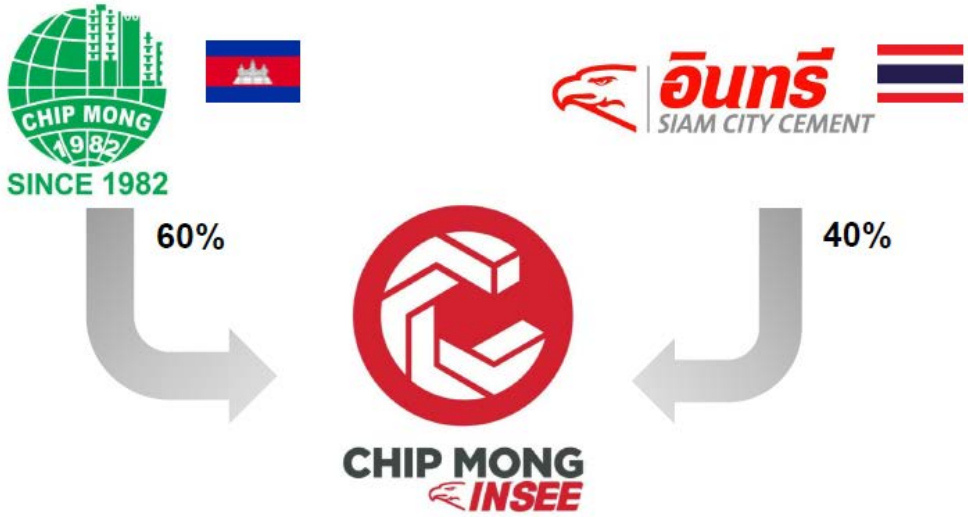


Figure 3.4.1-3 Ownership of Chip Mong Insee Cement
(Source: Prepared from presentation materials of Chip Mong Insee Cement)

3.4.2 Technical Study Based on Required Specification

・When direct hearing was conducted on Chip Mong Insee Cement, it was found out that the company want to consider the introduction of solar power generation system besides the examination of waste heat recovery power generation. Therefore, we will examine the Waste heat recovery power generation and photovoltaic power generation system respectively.

【Waste heat recovery power generation】

・Currently, a cement plant is under construction and the production of cement is scheduled to start at the end of 2017. Currently, cement sold by Chip Mong Group relies on imported whole quantity, but if cement production from this factory is started, it may be switched from imported products. Therefore, from the start of production, it is possible to operate a factory with high availability. Figure 3.4.2-1 shows the schematic layout of the cement factory.

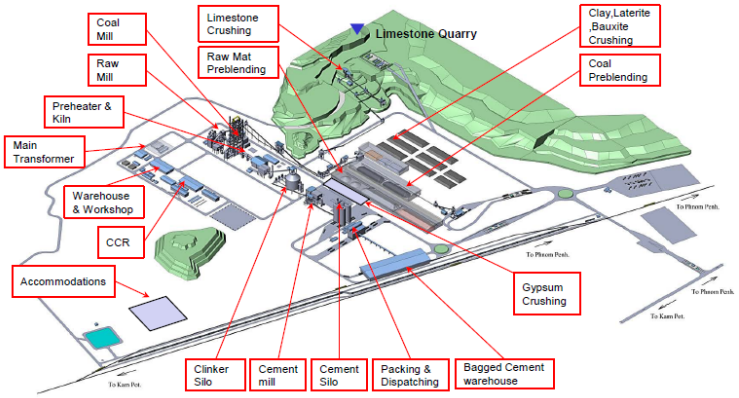


Figure 3.4.2-1 General layout of cement factory

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

・After cement production begins, we will grasp the waste heat scale based on the actual operation data and examine the waste heat recovery power generation system in detail. Bidding of the waste heat recovery power generation system will start in the middle of 2018, and the waste heat recovery power generation system will start trial operation from the beginning to the middle of 2020.

・The facility size of waste heat recovery power generation system currently assumed is about 8 MW class. Since detailed technical examination at present is difficult, we would like to continue to investigate

again from next fiscal year.

【Solar power system】

・Since there was a request to consider the introduction possibility of the photovoltaic power generation system as well when we visited in the third field survey in December 2016, as the fourth field survey in the following month of January 2017, together with solar panel construction experts, we visited and inspected the local cement factory construction site.

・In the production area, there are four raw material storage facilities, product packaging facilities, etc. In the management, residential areas, as there are the management building, the maintenance facility, the control room, the dining room, etc., there are many roof spaces. We investigated the possibility of introducing solar panels into these roof spaces and introducing floating type solar panels to reservoirs.

・Among them, the raw material storage area has a large roof space, and it is an arch-shaped roof. Figure 3.4.2-2 and 3.4.2-3 show photographs of raw material storage areas with arched roofs.

・In addition, this roof has a structure with a light slit. For this reason, we decided to conduct a study with the following three patterns.

A) In order to maximize the amount of power generation, all existing light slits is covered with solar panels.
B) In order to secure the internal brightness to some extent, some of the light slits are left and the remaining light slits are covered with solar panels.
C) While utilizing some of the existing light slits, install solar panels only on the part where there is no light slit.

Figure 3.4.2-2 Arched roof (as of January 2017)

Figure 3.4.2-3 Arched roof (as of February 2017)

・We calculated the strength of the building structure based on the drawings obtained from Chip Mong Insee Cement and found that it cannot bear the weight of general-purpose solar panel products.

・Therefore, introduction of the lightweight panels (product of Next Energy NER 660 M 275 A (4) - LS: Figure 3.2.2-8) introduced in Section 3.2.2 and the introduction of a super light installation method (Figure 3.2.2 - 9, Figure 3.2.2-10) should be adopted, and technical examination will be promoted based on these.

・In consideration of reservoirs, considering the fluctuation of the water level between the dry and rainy seasons, as it is not possible to introduce the solar panel to the entire reservoir, we considered to install it on only a part of the reservoir. Figure 3.4.2-4 shows a picture of the reservoir.

Figure 3.4.2-4 Water Pond (as of January 2017)

・We investigated the possibility of introducing solar panels to each facility with the support of solar panel construction experts. Figure 3.4.2-5 shows the solar panel scale of each facility.

Figure 3.4.2-5 Result of examination of solar panel scale of each facility Summary

No.	Name of facility	kW	Supplemental
1	Clay storage hall	580.80	Examination A) When covering all the light slits and maximizing the solar panel scale: 792.0 kW Examination B) Figure on the left is the estimate of the case with leaving behind half of the light slits Examination C) When all lightning slits are NOT covered: 378.4 kW
2	Coal storage hall	1,062.60	Examination A) Maximum solar panel scale covering all light slits: 1593.9 kW Examination B) Figure on the left is the estimate of the case with leaving behind half of the light slits Examination C) When all lightning slits are NOT covered: 581.9 kW
3	Premixed mat. storage hall	2,020.70	Examination A) Maximum solar panel scale covering all light slits: 3049.2 kW Examination B) Figure on the left is the estimate of the case with leaving behind half of the light slits Examination C) When all lightning slits are NOT covered: 1149.5 kW
4	Gypsum storage hall	184.80	
5	Part And Refractory Brick Warehouse	223.85	
6	Maintenance workshop building	220.00	
7	Central Control Room (CCR)	-	The trial calculation result is 31.9 kW. As it is a relatively small scale, it was excluded from the scope.
8	Canteen	-	The trial calculation result is 72.6 kW. As it is a relatively small scale, it was excluded from the scope.
9	Administrative Building	-	The trial calculation result is 57.2 kW. As it is a relatively small scale, it was excluded from the scope.
10	Cement Silo	-	Since the installation space is small and it also becomes high, it was excluded from consideration.
11	Baggaged Cement Palletizing	798.60	
12	Water Pond	500.50	Due to the water level fluctuation, detailed examination is necessary.
TOTAL		**5,591.85**	**kW**

・As a result of examination of the following three patterns of the roof with the light slits, the results of examination of the building 2: Coal Storage Hall is summarize below as an example.

A) In order to maximize the amount of electricity generated, all existing light slits are covered with a solar panel. ⇒ Calculation result: 1593.9 kW (see Figure 3.4.2-6)

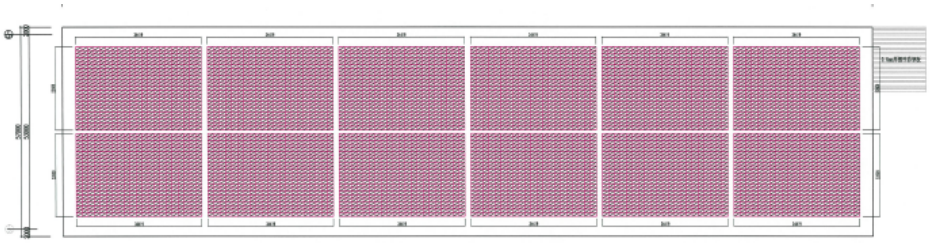


Figure 3.4.2-6 Examination A) Case of no light slit

B) In order to secure the internal brightness to some extent, some of the light slits are left and the remaining light slits are covered with solar panels. ⇒ Calculation result: 1062.6 kW (See Figure 3.4.2-7)

Figure 3.4.2-7 Examination B) Case of a half of light slits are left

C) While utilizing some of the existing light slits, install solar panel only on the part where there is no light slit. ⇒ Calculation result: 581.9 kW (please refer to Figure 3.4.2-8)

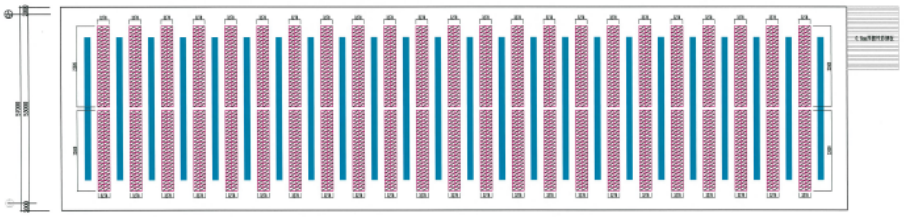


Figure 3.4.2-8 Examination C) Case of all light slits are left

・For examination of the water pond, the following two patterns were examined.

A) A solar panel is installed on the entire surface of the reservoir. However, because there is a change in the water level between the dry and rainy seasons, it cannot be adopted. ⇒ Calculation result: 2447.5 kW (please see Figure 3.4.2-9)

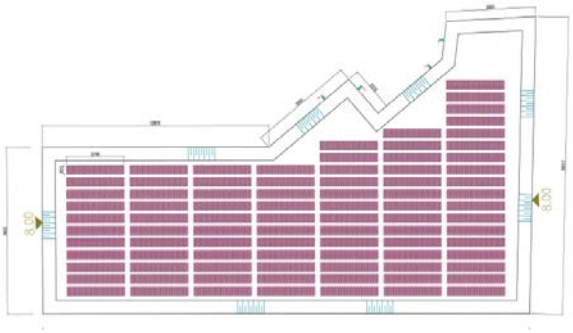


Figure 3.4.2-9 Examination A) Install solar panels across the water pond

B) In consideration of the water level fluctuation in the dry and the rainy seasons, assuming that only about one-third of the reservoir area is the solar panel installation area, calculation was tried. ⇒ Calculation result: 500.50 kW (Please see Figure 3.4.2-10)

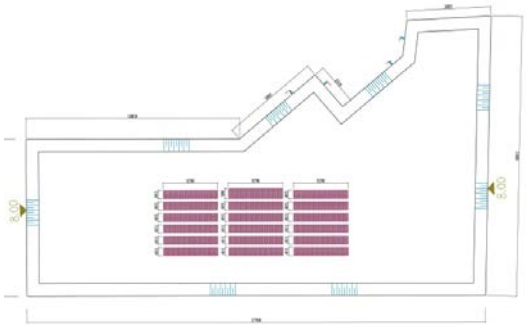


Figure 3.4.2-10 Examination B) considering the water level fluctuation in the dry and rainy seasons

・As an examination of the annual estimated effective total electricity generated, the annual estimated total effective power generation by the realization of this project was calculated by utilizing the worksheet of the photovoltaic power generation system at the Public Interest Foundation Corporation Global Environment Centre Foundation for JCM equipment financing project application . Calculation results are shown in Figure

3.4.2-11.

・As a result of trial calculation, the estimated total effective power generation per year was about 7,500,000 (kWh / year).

Figure 3.4.2-1 Estimation of Estimated Effective Total Electric Power Generation

Project name	Chip Mong Insee Cement											
Implementation site	address	Preytapret Village, Sdechkongkanglek Commune, Banteay Meas District, Kampot Province, Cambodia.(CMIC),										
	N	10° 38'27.1"N		E	104° 31'35.4"E							
System solar battery capacity =	5591.8	(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)	20512	20419	22147	19955	22721	22476	22862	22351	19533	18226	17513	19005
Average daily power consumption on the working day of factory etc. (kWh / day)	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000
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)	635,865	571,724	686,544	598,648	704,361	674,270	708,716	692,879	585,978	564,993	525,400	589,145
Estimated effective total generated electricity per year	7,538,525	kWh/年										

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

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

※For some figures, the assumed values are used (Orange shaded area in

Figure 3.4.2-11). 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, this result is used.

3.4.3 Economic Consideration for Installation Facilities

【Waste heat recovery power generation】

・The facility size of waste heat recovery power generation system currently assumed is about 8 MW class. After cement production begins, based on the actual operation data, after the waste heat scale is grasped, the waste heat recovery power generation system in detail is examined.

・The initial investment amount is scheduled to be raised by own fund of Chip Mong Insee Cement.

・If this project can be implemented as JCM equipment financing projects, this case will become the first one as the waste heat recovery power generation system project in Cambodia. Therefore, it is assumed that up to 50% of the initial investment amount is supported as JCM equipment financing projects.

【Solar power system】

・We asked solar panel construction experts accompanying on-site survey to calculate the initial investment per solar battery capacity. Approximate estimate is shown in Figure 3.4.3-1.

Figure 3.4.3-1 Estimate of initial investment per solar battery 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 shown in Figure 3.4.2-5, the assumed solar cell capacity is 5591.85 kW. Therefore, the approximate initial investment amount is approximately 1.58 billion yen (13.8 million USD).

(5591.85 kW x 283,200 yen / kW = 1,583,611,920 yen ≒ 13,800,000 USD)

(※ Calculated as 1 USD = 115 yen)

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

・Approximate annual electricity reduction amount is calculated from the estimated annual power generation amount estimated in the previous section and contract electricity charge.

・As mentioned above, the estimated annual power generation amount is approximately 7,500,000 (kWh / year). Since this amount of power generation is less than the amount of power consumed by the factory, the generated power as a whole is used as self power consumption, which leads to a reduction in the amount of electricity purchased from the grid electric power.

・Since the electricity charge per kWh contracted by Chip Mong Insee Cement is approximately 0.125 (USD / kWh), the electricity cost that can be reduced by solar power generation will be around 937,500 (USD / year) per year.

・Estimation was conducted by the following formula.

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

(7,500,000 kWh / year x 0.125 USD / kWh = 937, 500 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 to project implementation.

・Initial investment amount is assumed to be financed by its own fund of Chip Mong Insee Cement. We also assume subsidies of up to 30% of the initial investment amount by utilizing JCM equipment financing projects.

・We will also consider ESCO type projects introduced in Section 3.2.5. (please see Figure 3.2.5-1, Figure 3.2.5-2)

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

【Waste heat recovery power generation】

・It is a technology to recover waste heat discarded as unused and generate electricity. By introducing this technology, it is possible to reduce the amount of electricity purchased from the grid by the amount of electricity generated from the power generation system. The amount of greenhouse gas reduction is calculated as follows.

(Generation amount of waste heat recovery power generation system x Grid emission factor of Cambodia)

・Since the facility size of the waste heat recovery power generation system currently assumed is about 8 MW class, the power generation amount of 63,360 (MWh / year) is expected annually by the following calculation formula.

(amount of electricity generated: 8 MW x 24 hours x 330 days = 63, 360 (MWh / year)

・Since the grid emission factor for Cambodia is 0.641 (ton - CO 2 / MWh) (see Figure 3.2.4-1), the estimated CO 2 emission reduction is calculated as follows and the effect of 40,000 ton- CO 2 / Year) may be expected.

(63, 360 (MWh / year) x 0.641 (ton - CO 2 / MWh) = 40, 613 (ton - CO 2 / year))

・After cement production begins, as we will grasp the scale of waste heat based on the actual operation data and plan to further study the waste heat recovery power generation system, we will continue to investigate next year.

【Solar power system】

・As estimated in Section 3.4.2, the approximate annual power generation by solar power generation system was approximately 7,500,000 kWh / year. Since this amount of power generation is smaller than the amount of power planned to be consumed by the cement factory, the generated power as the whole is used as self power consumption and the amount of electric power procured from the conventional system power may be reduced. Through this reduction, CO2 emissions are reduced by reducing the amount of electricity

procured from fossil fuels.

・As mentioned above, the grid emission factor of Cambodia is 0.641 (ton - CO 2 / MWh). (Please see Figure 3.2.4-1)

・Regarding the introduction of photovoltaic power generation systems, a method for calculating a certain CO2 reduction effect has already been established. According to the worksheet at the application for the Public Interest Foundation Corporation Global Environment Centre Foundation, the CO2 reduction effect by realizing this project was calculated. The calculation result is shown in Figure 3.4.4-1.

・As a result of the calculation, the estimated CO2 emission reduction amount is approximately 4,800 ton-CO2 / year.

Figure 3.4.4-1 Approximate CO2 reduction effect

Estimated effective total power generation per year	7,538,525	kWh/yr

(1)In case of self-consumption only

CO 2 emission coefficient of self power consumption	0.641	(ton-CO2/MWh)

Reference CO2 emissions	4834.46	ton-CO2/yr
Project CO2 emissions Pj1	0	ton-CO2/yr

CO2 emission reduction amount Q1= (Re1-Pj1)	4834.46	ton-CO2/yr

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

3.4.5 Consideration for Implementation of JCM

【Waste heat recovery power generation】

・Figure 3.4.5-1 shows the project implementation organization of JCM equipment financing projects.

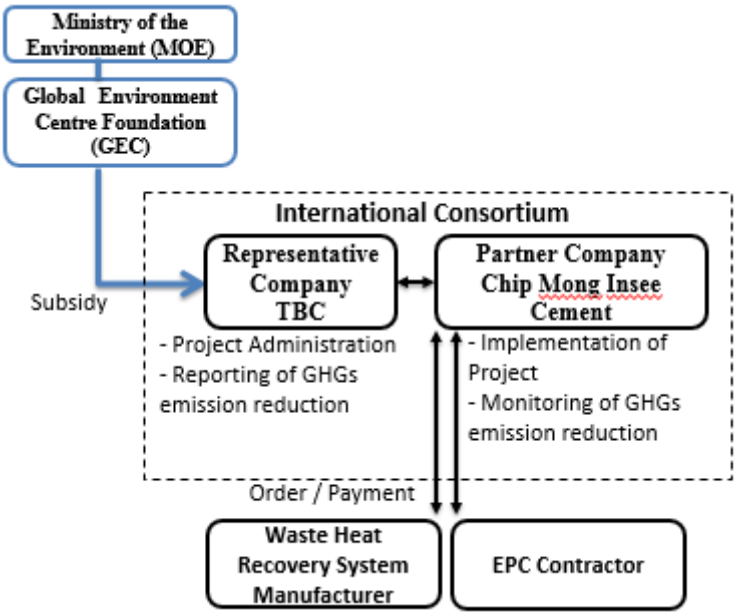


Figure 3.4.5-1 Assumed Implementation Organization Figure (Waste Heat Recovery Generator System)

【Solar power system】

・Figure 3.4.5-2 shows the project implementation organization of JCM equipment financing projects.

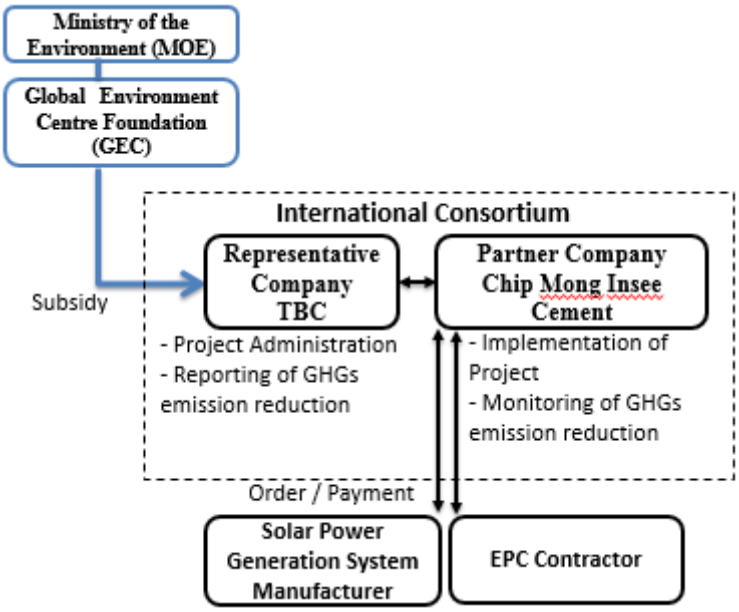


Figure 3.4.5-2 Assumed Implementation Organization Figure (Solar power system)

・In addition, regarding photovoltaic power generation systems, we will also consider ESCO type projects cooperated with local banks, introduced in Section 3.2.5. (please see Figure 3.2.5-1, Figure 3.2.5-2)

3.4.6 Issues in Implementation of JCM

・Issues for JCM implementation are summarized below.

【Waste heat recovery power generation】

- Grasp waste heat scale based on actual operation data after cement production started
- Detailed technical examination of waste heat recovery power generation system
- Detailed examination of economic efficiency for equipment introduction
- Detailed examination of calculation method of CO2 reduction effect and monitoring method
- Extraction and encouragement of representative companies
- Support for decision-making for JCM project implementation

【Solar power system】

- Detailed design and examination with photovoltaic panel manufacturers and construction companies
- E Study on the method of burden of initial investment including ESCO type project
- Extraction and encouragement of representative companies
- Support for decision-making for JCM project implementation

Chapter 4:　Holding Workshop

Chapter 4　Table of Contents

4.1 Workshop to be to be Held at the Location of Domestic Municipalities

(1) Overview

"Bilateral Credit (JCM) Intercity Collaboration Seminar" was held for domestic municipalities that have entrusted JCM project formation possibility research projects utilizing Intercity Collaboration, and staff and related companies of Asian municipalities. Organized by the Ministry of the Environment, the workshop was held in Kitakyushu City and Tokyo a total of twice in a year

(2) Date and time held

In Kitakyushu city: 9:30 to 17:45 on October 20, 2016
In Tokyo metropolitan area: 9:00 to 17:00 on January 23, 2017

(3) Contents

Each seminar was held in the following program.

① In Kitakyushu city

- Opening remarks
- JCM Intercity Collaboration project and JCM fund financing scheme
- Case study of JCM project by learning from successful examples of advancing JCM equipment financing projects
- Topic provides: Technical selection and budgeting in general waste disposal - Cases of general waste disposal -
- Case study of overseas municipalities participating in Intercity Collaboration projects in FY2008
- Discussion 1:Status of survey performance and issues in implementation etc. of F / S
- Discussion 2:Issues and solutions in survey performance and implementation of F / S
- Closing

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)

JCM City to City Collaboration workshop at Kitakyushu

Thursday, October 20, 2016
9:30~17:30
At: RIHGA Royal Hotel Kokura 3F

Participants: See attachments and handouts. Below all titles are omitted. Mr. Muraoka, Ms. Yamakawa (Record), NTT Data Institute of Management Consulting, Inc.,

Contents;

- Greeting from Ministry of the Environment (Mr. Mizutani, Manager, International Cooperation Office, Ministry of the Environment)
  - Expressing expectation for spread of Intercity Collaboration projects

- Explanation about JCM
  - Mr. Sai, International Cooperation Office, Ministry of the Environment
    - Explanation of JCM overview, Introduction of Intercity Collaboration FS
    - Vietnam is the most successful from the number of cases

  - Mr. Saito, GEC
    - Explanation of equipment financing projects, tasks in implementation
    - Number of cases expanded to 85 cases this year. However, the bias for each country remains large. For example, there are zero case in Chile, and there are other countries that only one or two projects have been implemented yet.
    - When the standard of cost effectiveness is not satisfied, subsidy reduction may occur.
    - The following issues may be raised up to now.
      - No representative company is found
      - Lack of understanding of partner participants
      - Financing Prospect for j partner participants (There are cases where loans were not really accepted)
      - Confirmation of contract conditions since it is a maximum of 3 years, it takes time to establish SPC although it is depending on a country, confirmation whether bidding is required or not

  - Mr. Ozawa, International Cooperation Office, Ministry of the

Environment

- ✧ about JFJCM（Japan Fund For JCM）
- ✧ Established fund in ADB from 2014 and contributed 1.2 billion to the fund in 2016
- ✧ Full amount of the project cannot be subsidized. It will serve as a grant for the addition of superior low-carbon equipment. The rest is supposed to use ADB's normal loan
- ✧ Target countries are 10 developing countries, which joins as ADB members, among JCM signatory countries (Bangladesh, Cambodia, Indonesia, Laos, Maldives, Mongolia, Palau, Vietnam, Myanmar, Thailand)
- ✧ Features, differences from JCM equipment financing
  - The subsidy rate is 10% of the total cost of the project (the denominator also includes parts that do not contribute to CO2 reduction)
  - Reception open all year round.
  - Local subsidiary may apply. The composition of the international consortium is unnecessary.
  - Verification can also be financially assisted through technical assistance scheme.
- ✧ About the application process
  - Depending on the maturity, it takes about half a year to 2 to 3 years to adopt. Suited for Infrastructure etc.
- ✧ Adopted case
  - There is only one case in the past: Smart Mal grid of Maldives.
  - The projects to be adopted soon are those that change transformers to amorphous in Mongolia

- Case study of JCM projects learned from equipment financing success example
  - ➢ Mr. Muraoka, NTT Data Institute of Management Consulting, Inc.
    - ✧ How to proceed with the survey project, Surabaya shopping mall and Vietnam foundry factory, cement waste heat recovery power generation were introduced
    - ✧ Challenges faced through the survey project
      - Financial statements do not come out in Indonesia
      - There are several financial statements found in Vietnam.
      - As for the monitoring for the statutory useful life: Mismatch of the life of the building and the service life of the facility
      - There is no certain rule about how to capture credit
      - Price negotiation is severe when introducing equipment
      - The issue of who will take foreign exchange risk.
      - The fact that consulting is necessary for technology theory

- Yokohama City - Batam
  - Yokohama City conducted consulting on improvement of operation of chiller
  - Issues
    - By personnel revision, when the person in charge is changed, the consultation started from scratch.
    - It takes time because the understanding of the other party's JCM financing program is inadequate
    - Confirmation of conditions requiring bidding is needed.

- Overall Q & A
  - Q:（from IGES）Relationship between Tam City and Yokohama City, contents of cooperation?
    - A:Because there is no credit from the Japanese company side, a mechanism to being trusted by the city involvement is under implementation. (Mr. Hirokawa)

  - Q: Would like to know details of JFJCM's Agri Project. (Asia Gateway)
    - A: As this project is not officially approved yet, it is too soft to be published at the present time(MOE)

  - Comment on NTT's presentation:
    Is the issue of schedule that the investment schedule and the application schedule do not match? If it is a bidding case, it may be said that it is conditionally adopted. In addition, there are secondary public invitations, I would like to be able to operate as flexible as possible. (MOE)
    - Understood.　In the case of private enterprises, there is a direction that they cannot wait for working under the rules such as having to sign a contract after receiving a grant decision. (Mr. Muraoka)

- Topic provision: Technology selection and budgeting in general waste disposal (Mr. Takeuchi)
  - Q: What is the most important thing in carrying out general waste disposal in ASEAN in the future? (Mr. Ozawa, MOE)
    - A: To gain an understanding to residents. (Mr. Takeuchi)
    - A: The problem that the plant made in Japan is high. However, when conducting maintenance for many years, they feel its high quality. Since introduction of an inexpensive plant leads to problems during maintenance such as not being able to operate stably, it is necessary to check the contents as well as the cost

  - Q: It is not only the cost but the contents, but what is the procedure for bidding?　(MOE)

- ✧ A: Manufacturer hearing should be open. As a city, 1. Presentation of furnace type incineration capability, 2. Schedule, 3. Hear from the budget. (Mr. Takeuchi)

- ✧ A: Based on this, created a deep specification document. Since a detailed proposal comes from the manufacturer, we will examine it based on the proposal. (Mr. Takeuchi)

➢ Q: It is said that 12 companies were bidding companies, but from what viewpoint a successful bidder was chosen? (MOE)
- ✧ A: It is a price. Whether to make a comprehensive evaluation is decided according to the situation. (Mr. Takeuchi)

➢ Q: When talking to the manufacturer, what kinds of information are presented such as garbage composition? (MOE)
- ✧ A: Present only a bare skeleton and collect widely applicable information. (Mr. Takeuchi)

● Introduction of participating local governments participating Intercity Collaboration

➢ Cambodia ・City of Phnom Penh: Mr. Para Sor
- ✧ In collaboration with Kitakyushu city, City of Phnom Penh is now proceeding the study for proper waste management, recycling, energy efficiency enhancement, green production etc.

➢ Cambodia ・City of Siem Reap: Mr. Sophean Ung
- ✧ Formulated policies aimed at lowering carbon emissions mainly focusing on waste disposal
- ✧ Hope to be able to learn techniques to realize low-carbon urban development through Intercity Collaboration

➢ Batam City, Indonesia Mr. Azril Apransyah
- ✧ Collaboration with Yokohama City. It is an island region and is considering JCM implementation centering on solar panel introduction

➢ Malaysia　Iskandar Regional Development Authority Mr. Velerie Siambun
- ✧ Collaboration with Kitakyushu City. As an Iskandar plan, we aim to reduce CO2 emissions by 40% compared to 2005 by 2025
- ✧ LOU was signed off, but it is a challenge to raise funds.

➢ Overall Q&A
- ✧ Please let me know if there are issues with high priority in each city.

(MOE)
- Garbage problem in Siem Reap. (Siem Reap)

- Mongolia ・Ulaanbaatar city Mr. Galymbek Khaltai
  - ✧ Collaboration with Hokkaido
  - ✧ Air pollution due to coal use in boilers and heating appliances is serious
  - ✧ We are building a system that can monitor the state of air pollution on the WEB network, but we would like to focus on creating a mechanism to control air pollution.

- Myanmar ・Ayahwadi Division Mr. Aung Khaing Soe
  - ✧ The country has established the Green Economic Policy Framework (GEPF), and there is a framework of development aiming for low carbon growth.
  - ✧ The main issue is lack of the proper disposal of waste and we are hoping for activities including capacity building from Intercity Collaboration.

- Myanmar Yangon City Mr. KO KO Kyaw Zywa
  - ✧ Collaborating with Kawasaki City
  - ✧ As part of the realization of a low-carbon society in Yangon, we are considering the construction of W2E plant
  - ✧ Also implemented solar panels as a pilot project.

- Thailand Rayong Province, Mr. Suriya Siriwat, Industrial Estate Authority Thailand, Ms. Husna
  - ✧ In Rayong prefecture, during the W2E study of municipal solid waste, 1000t is occurred daily, of which 56% is garbage.
  - ✧ We are considering introducing cogeneration at Map Ta Phut industrial park and introducing high efficiency chiller to eco center.

- Vietnam ・Hai Phong City Mr. Do Quang Hung
  - ✧ People's Committee and deputy director of the Finance Bureau participated.
  - ✧ We are hoping for Intercity Collaboration to help it grow as a green port city.

- Q&A
  - ✧ I want to know the current situation of the project being implemented in Rayong prefecture. (MOE)
    - As for the introduction of cogeneration, FS is continuously under implementation.
    - The Eco Center is pursuing consultations for budgeting.

- ✧ As for the waste power generation, what kind of technology is being considered as JCM? (Mr. Yokohama)
  - Power generation system for incineration. (Map Ta Phut City)
  - It is the power generation as part of the waste power generation plant. (Kitakyushu city)

- Discussion 1 FS situation and issues in implementation
  - ➢ As for the waste disposal and water treatment, etc., the primary concerns is whether local policies will be realized. Needing long-term support. (Fukushima City)
  - ➢ By taking long time axis, education of people is necessary. (Yokohama)
  - ➢ I understood that the municipality is carrying out capacity building as part of the master plan support. AS for the hope of devices with a long-term perspective, I would like to include it in future policy review by taking advantage of the JICA.

- Discussion 2 Issues and solutions in FS Investigation and implementation
  - ➢ Introduction of Intercity Collaboration cases (Kawasaki City, Yokohama City, Kitakyushu City)
  - ➢ Yokohama and Kawasaki have commonly implemented a water purification pump and solar panels of the Waterworks Bureau.
  - ➢ Issues of Intercity Collaboration
    - ✧ Output setting. I think that not only short-term things but also mid- and long-term perspectives are necessary. (Kawasaki City).
    - ✧ Differentiation from JICA is necessary. Under the participation of municipalities and private enterprises, separation of their own roles, efforts to establish as business. (Nippon Koei Co., Ltd)
    - ✧ I want to realize the application of JCM in B 2 B and B 2 G for the low carbonization of the entire city. (Kawasaki City)
    - ✧ Finetech Inc. is a member of YPORT's SME alliance that aims to reduce CO2 emissions by energy management and new materials. (Finetech Inc.)
    - ✧ With the project of Vietnam's cement factory waste heat recovery power generation, there was a problem that money did not flow to state enterprises. In addition to governmental administration + governmental administration, consideration with the country is necessary. (Kitakyushu city)
    - ✧ As for the timing of municipal garbage bidding, there are restrictions on equipment financing projects. (MOE)

End of the memo 1

(Memo 2)

JCM Intercity Collaboration Seminar at Tokyo
Discussion notes

Monday, January 23, 2017
Morning section: 9:00 to 11:00
At TKP Shinbashi Conference Center

Afternoon section: 14:00 to 17:00
At Iino Hall & Conference Center 4th floor Room B

Participants (titles omitted):
For attendees in the morning, see the list of participants
Approximately 150 participants in the afternoon
For both sections, Ms. Yamakawa and Mr. Ajiro participated from our company.

Contents
<Morning section>
● Part One
For details of discussion, refer to the handouts. The contents are briefly shown below.

- 【Asia Gateway Corporation: Cambodia · Siem Reap Province】
  - In cooperation with Kanagawa Prefecture and Siem Reap, we support three kinds of energy, transportation, municipal waste.
  - Introduction of photovoltaic power generation system to a hotel, Waste to Energy using hotel municipal waste, and E-TukTuk etc. are being studied. We are considering, through establishing SPV, introducing solar power generation system to hotel roof.

- 【JFE Engineering Co., Ltd.: Indonesia · Bali State】
  - We are considering garbage incineration power generation. We are conducting a survey of, including examination of MRV methodology, startup of SPV, Tipping Fee and assumption of revenue by FIT.
  - Funding, selection of EPC companies, detailed discussion of Tipping Fee, and confirmation of legal system are four issues.

- 【Mitsubishi Research Institute Co., Ltd.: Myanmar · Ayahawi Division】
  - We are considering waste and water treatment related in Pathein industrial city under construction. We are collaborating with Fukushima City. We plan to formulate projects such as rice husk power generation projects and introduction of photovoltaic power generation systems at

sewage treatment plants.

- 【Ex Research Institute Ltd.: Rayong Province, Thailand】
  - We are aiming for JCM project of waste disposal facility in Rayong prefecture in eastern Thailand to solve waste disposal task. Garbage sorting → Combustion of combustibles → Generation by combustion heat → Selling electricity to the grid is assumed. 1,500 tons of garbage occurred in the prefecture

- 【NTT Data Institute of Management Consulting, Inc. : Rayong province, Thailand】
  - Low carbonization, introduction of cogeneration into chemical plants. The exhaust heat recovery plant in Saraburi province was also JCM projected

- 【Nikken Sekkei Civil Co., Ltd.: Cambodia · Phnom Penh City】
  - Progress on the action plan was explained. In six areas we are organizing tasks, conducting an action plan, and discovering pilot projects, etc.

- 【NTT Data Institute of Management Consulting, Inc. Cambodia · Phnom Penh City】
  - Introduction of research proposals in the energy field. We are conducting surveys for large hospitals, large shopping malls and large cement factories.

- 【NTT Data Institute of Management Consulting, Inc. Haiphong City】
  - Introduction of research projects in the energy field. We are conducting surveys for large hospitals, large shopping malls and large cement factories.

- 【NTT Data Institute of Management Consulting, Inc. Malaysia · Iskandar District】
  - We are excavating projects based on LOU in Kitakyushu city and IRDA. We are considering introducing 5 MW cogeneration of low carbon technology to an industrial park.

●Part 2

For details of discussion, please refer to the handouts. The contents are briefly shown below.

- 【Public Interest Foundation Corporation Global Environment Centre Foundation JCM equipment financing projects】
  - Subsidy of up to 50% of the initial investment amount. The budget for fiscal year 2007 is about 6 billion yen. As for the country, there are many projects in Thailand, Indonesia and Vietnam. Solar panels, chillers and boilers are top 3 in technology. For cost-effectiveness, guidelines for evaluation are 4000 yen / tCO 2.

・ 【Asian Development Bank About JFJCM】

- Established with the support of the Ministry of the Environment of Japan. Investment of 42.6 Million USD from Ministry of the Environment between 2014-2016. One JCM partner country and 11 member countries of ADB will be target countries (Mongolia, Bangladesh, Maldives, Vietnam, Laos, Indonesia, Palau, Cambodia, Myanmar, Thailand, Philippines). In addition to the project of ADB, 10% of the project cost is subsidized as Grant or Interest Subsidy.

・ 【Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. Green Climate Fund】

- GCF: Green Climate Fund. 48 countries, 10.3 Billion USD fund.
  The fund is allocated equally to adaptation and mitigation.

Photo: Presentation for Phnom Penh, Cambodia

Afternoon section

- 【Greeting from Mr. Naruhiro Kajihara, Ministry of the Environment】
  - About 50% of the population is concentrated in urban areas, and more than 70% of CO2 emissions are generated from urban areas. It is extremely important to reduce CO2 in urban areas.

- 【Mr. Sai, Ministry of the Environment　About JCM Intercity Collaboration Project】
  - Myanmar was added to a partner country on January 12, 2017. A workshop in Kitakyushu city was held on 20 and 21 October 2016. Even at COP 22 in Makelash, Intercity Collaboration Project was introduced as a side event on November 8, 2016.
  - We are also looking for Intercity Collaboration projects for next fiscal year. Public announcement at the end of February, proposals in March, decisions taken at the end of March are planned.

- 【Mr. Bannai, Public Interest Foundation Corporation Global Environment Centre Foundation about JCM equipment financing projects】
  - Subsidy of up to 50% of the initial investment amount. The budget for fiscal year 2007 is about 6 billion yen. Public offering in early April, deadline for proposals in May, project selection at the end of July.
  - As for the achievements so far, many countries have Thailand, Indonesia and Vietnam projects. Solar panels, chillers and boilers are top 3 in technology. As cost-effectiveness, 4000 yen / tCO 2 is a guideline for evaluation

- 【Mr. Teshima, Asian Development Bank　About JFJCM】
  - Established with the support of the Ministry of the Environment of Japan. Investment of 42.6 Million USD from Ministry of the Environment between 2014-2016. One JCM partner country and 11 member countries of ADB will be target countries (Mongolia, Bangladesh, Maldives, Vietnam, Laos, Indonesia, Palau, Cambodia, Myanmar, Thailand, Philippines). In addition to the project of ADB, 10% of the project cost is subsidized as Grant or Interest Subsidy.

- 【Mr. Maruyama, Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. Green Climate Fund】
  - GCF : Green Climate Fund. 48 countries, 10.3 Billion USD Fund contribution. GCF operates under the guidance of COP. It is necessary to work closely with NDA (National Designated Authority) and AE (Accredited Entity). A wide range of support fields is characterized. Funds are equally allocated to adaptation and mitigation. Mitigation and adaptation, each of which has four fields of focus. The six metrics are ① Project impact ② Paradigm shift ripple effects ③ Sustainable ④ Is it matched to needs ⑤ National lead ⑥ efficiency and effectiveness. NDA and AE will judge whether it matches the national strategy. Please refer to handouts for AE ·and NDA, certification executing agencies.

・ 【Mr. Suzuki, Mr. Okuno, Yokohama City: Yokohama City's initiatives】
  - We are collaborating with Thailand · Bangkok (photovoltaic power generation system and EMS), Vietnam · Danang (high efficiency pump), Indonesia · Batam (air conditioning system), Philippine Cebu (currently JICA project). We are promoting PAT (Port Authority of Thailand) and Green Port 5-year project.

・ 【Mr. Aoung Min Naing, Myanmar / Mr. Shishido, Fukushima city: Activities of Myanmar · Aiyadhi Province Division】
  - There is a waste problem. Supporting policy formulation including recycling from Fukushima city. Based on experience in Fukushima city, we are cooperating in the field of reenergization and disposal

・ 【Mr. Nguyen Trung Hieu, Vietnam: Hai Phong City's initiatives】
  - Hai Phong City has a sister city with Kitakyushu City. Projects such as EV bus, household garbage composting etc. were introduced.

・ 【Mr. Amano, Kanagawa Prefecture: Siem Reap】
  - Securing electricity against rapid urbanization is a challenge. Kanagawa Smart energy plan and knowledge such as efforts from centralized power supply to decentralized power supply are also useful in Siem Reap

・ 【Mr.Ung Sophean, Siem Reap, Cambodia: Efforts at Siem Reap】
  - As a famous city as a tourist city and a population of 250,000 people, with 5 million tourists come, various problems are occurring. The city is aiming for the vision of the city, sustainable development. Securing water resources, ensuring green, the city of culture and education, the city of tourism resources. From the environmental point of view, it is necessary to establish an execution plan. We are promoting projects such as waste recycling and composting. We are aiming at dissemination of electric vehicles for tourists

・ 【 Mr. Urasaki, Hokkaido / Mr. Ohashi, Sapporo city: Efforts at Mongolia-Ulaanbaatar】
  - There are problems such as power tightness and waste disposal. We are cooperating from the geographical common point of cold district. We are considering solar power generation system, heat storage heater for heating, Waste to Energy of chicken feces. There are two patterns: the case where the government actively acts, and the case where the local enterprises actively act while the government supports it. Make cooperation dense. In Ulaanbaatar city, air pollution problems are occurring as 700,000 people in 200,000 households use coal for heating during the winter season.

・ 【Mr. Fukobei, Kawasaki City: Efforts at Yangon City】

- Cooperated with Yangon City by making full use of the experience of environmental improvement in Kawasaki City. As a JCM equipment financing project, we are promoting the introduction of high efficiency chillers and boilers. FS of the introduction of photovoltaic power generation system for water purification plant is also ongoing. Not only having the keyword "low-carbon society" but creating a concrete image with the common awareness of the direction to be aimed, planning is very important for subjective participation.

・ 【Mr. Sono, Kitakyushu city: Activities of Rayong Prefecture】

- Utilizing the knowledge and experience of Kitakyushu City which has been addressing environmental issues, it supports various countries. Doing environmental international research. Established Asia Low Carbonization Center and developing Kitakyushu model to Asia.
- With trusting relationships established, various support have been conducted for Surabaya, Hai Phong, Iskandar, Rayong and Phnom Penh as Intercity Collaboration. By utilizing Intercity Collaboration, The city may contribute in a wide range of fields from upstream such as master plan formulation, follow-up such as environmental education. Careful when planning to make it an achievable plan. Making a pilot project leads to a sense of realization and promotion of project promotion in the target counties.

・ 【panel discussion】

- Kanagawa - Siem Reap
  - Trigger of initiatives is that Siem Reap came to visit Fujisawa SST etc.
  - Taking advantage of utilization of reenergies and introduction of decentralized energy which is the characteristic of Kanagawa prefecture (sunlight, wind power, gas cogeneration)
  - Electric tuk tuk, simple open cars and buggy introduced with support of Asian gateway

- Hokkaido - Ulaanbaatar
  - Collaborate on the introduction of low-carbon technology in cold areas, based on past cooperative relationships on issues such as air pollution due to population increase in Ulaanbaatar. Also aim for jobs of local companies. Waste heat recovery etc. utilizing feces of poultry houses also implemented
  - Understanding is that there are two cases in Intercity Collaboration: one is that local governments with advanced cases proactively provide know-how and technology while the partners mainly operate, and the other is that municipalities are in a supportive position.
  - In the future, strengthen relationship continuation. The change in the counterpart is still an issue.

- Kawasaki City - Yangon
  - ✧ Implemented introduction of high efficiency boiler for sunlight, food factory.

- Kitakyushu City – Rayong Province
  - ✧ Introduction of Cambodia project, Thailand waste heat recovery power generation as advanced to equipment financing projects.
  - ✧ By providing comprehensive support from the upstream phase, it is possible to make a wide range of proposals. Long-term follow-up and personnel exchanges are considered a merit.
- Entire Discussion
  - ✧ What is the role of Siem Reap side? (Mr., Mizutani, Manager, Ministry of the Environment)
    - There are three. Implementation of the plan. Capacity for staff. Acquire appointments with private enterprises. (Siem Reap),

  - ✧ I want to hear if there is difficulty unique to Sapporo city: characteristics, considerations for cold regions. Also, I think that it is an unusual case involving two local governments (prefectures and municipalities).
  - ✧ For cold regions, I think that no country other than Mongolia is cold in JCM partner countries, but if it is cold, fermentation cannot be operable. On the other hand, it seems that there are cases concerning heating technologies which is not necessary in a warm country.
    - Regarding cooperation between Hokkaido Government Office and Sapporo City, companies are concentrated in Sapporo due to population composition. The business site may be outside the city. In addition to wanting to make it possible to provide multifaceted support, as we have been working together on a regular basis, this is the framework of this time.
    - Winter is long (from the end of October to the end of April) Air pollution is a problem because about 700,000 people (out of 3 million people) are warming with coal

  - ✧ Kawasaki city
    - We would like to establish the significance of the low carbon society as a common recognition with the Yangon side first. In addition, concrete images and actual projects are important
    - Respect for each other's view points and targets

  - ✧ Because Kitakyushu city has many project developments, it has a comprehensive model of Kitakyushu model, what kind of things do you do in realizing? Also, if you have the tips for cooperating with more than one. (Mr. Mizutani, Manager, Ministry of the Environment)
    - The point is that you cannot set goals that are too high for the plan. We aim to incorporate into the plan what we can

accomplish suited to ourselves. Based on the experiences I have witnessed in the case that only the plan is thick and not realized, set goals that can be realized in the medium to long term. It is also a point to do a pilot project. In case where we have visitors to Japan, we have them work with a pilot to understand what are really conducted.

- There are opportunities to have contacts with multiple local governments based on the fact that there are many environment related facilities in the city and there are many facilities to accept visitors. In addition, in cooperation with the International Technical Cooperation Association and IGES Kitakyushu City Urban Center, information sharing and follow-up may sometimes help. Cooperation with local governments as well as related organizations is a key to realizing projects with many cities.

✧ If there are any expectations from the Rayong prefecture side. (Mr. Mizutani, Manager, Ministry of the Environment)

- We anticipate plans for making Rayong prefecture eco-town in the future, and medium- to long-term initiatives. (Rayong County)

➢ How private enterprises participate in Intercity Cooperation

✧ Kanagawa

- Although specialized in JCM, there is a support organization for companies in the prefecture to expand overseas as well as the International Affairs Division, Kanagawa Industry Promotion Center Division. They are the windows as they are accepting request for consultations.

✧ Hokkaido

- Some companies in the province are entering Mongolia, and . as there is also a organization called the Economic Exchange Promotion Committee, others have contacts with companies interested through it.

✧ Kawasaki city

- We think that not only technology, hard, but also soft aspect of environmental administration is important. As a place to consult with the administration, Kawasaki Green Innovation Cluster is set up. While sharing information, we are accepting counseling concerning environmental business in the city.

✧ Kitakyushu city

- We are positively calling out to city group companies. There is a Kitakyushu Environmental Industry Promotion Council, which holds a regular meeting once every two months, and we perform public relations of JCM there. In addition, by disclosing the activities of the Asia Low Carbon Center to the mass media, we are creating new matching opportunities

- Questions from the venue
  - ✧ Waste in Indonesia
  - ✧ Questions about Haiphong E-Waste
  - ✧ About the problems of waste disposal, 3R trends
    - Due to time expiration, it is decided to respond to questions by each one informally. (Ministry of the Environment)
    - In the panel discussion, could not you see something like an answer? (Ministry of the Environment)
  - ✧ Is JCM's FS a proposal or an organizing scheme?
    - It is a proposal. (Ministry of the Environment)
  - ✧ Is an city to city agreement needed at the time of application?
    - It is good to have a sister city or a memorandum, or the expression of interest is the minimum. Please check the application procedure after next month. (Ministry of the Environment)

・ Paneled Cashion Summary (Mr. Mizutani, Manager, Ministry of the Environment)
- It is based on not repeating the experience of pollution that occurred in Japan
- The expansion of the city is characteristic of this year, and there were proposals from many municipalities
- I think that it is good to overlay Intercity Collaboration in Japan over those overseas: (Sapporo and Hokkaido), and collaboration in Nagoya and Kitakyushu city in the field of water supply.
- Expansion of stakeholders. While I often talk with the international Bureau and the Environment Bureau, there is a story of the Port Authority from Yokohama City. It seems interesting that there is a room for expansion.
- Fund financing schemes are also improving

End of the memo 2

環境省　国際協力室
御中

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）キックオフミーティング用資料

2016年5月17日
株式会社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

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平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）INDEX

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平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
0. 事業の背景

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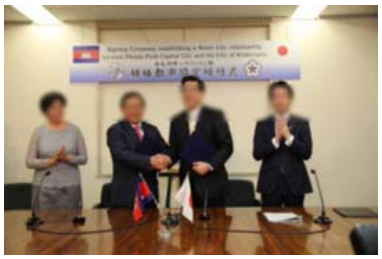

- ２０１６年３月２９日に、北九州市とプノンペン都の姉妹都市が締結された。
- カンボジア国気候変動戦略計画(2014-2023)やそれに基づく省別行動計画(2015-2018)を実現するため、「プノンペン都気候変動適応行動計画策定」を日建設計シビルが担当する。
- NTTデータ経営研究所が担当する本事業では、エネルギー分野でのJCMスキームを活用したパイロットプロジェクトの案件形成調査を行う。以下の３つが、主な活動内容である。

活動項目	活動内容
活動1：大型病院を対象とした省エネ対策等を通じた低炭素化の推進	**大型病院への高効率型の導入、インバータ機能付き空調の導入、太陽光パネル・太陽熱温水システムの設置**
活動2：ショッピングモール等の施設を対象とした省エネ対策等を通じた低炭素化の推進	**ショッピングモール等への高効率型冷蔵ショーケースやチラーの導入、太陽光パネルの設置**
活動3：セメント工場への廃熱回収発電システムの導入	**セメント工場における廃熱回収発電システムの導入**

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
1. 想定している技術とその先進性、国内外での普及状況

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●技術の概要

[活動1]大型病院　⇒ [太陽光発電] [高効率チラー] [高効率空調設備] の導入
[活動2]ショッピングモール ⇒ [太陽光発電] [高効率チラー] の導入
[活動3]セメント工場　⇒ [廃熱回収発電]の導入

●特徴

[太陽光発電] [高効率チラー]:
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。

[廃熱回収発電]: セメントプラントの排ガスから熱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。

●実績表

導入技術	年度	納入場所	概要説明
太陽光発電	平成27 年4 月～平成28年9月	マレーシア	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。
太陽光発電	平成28 年2 月～平成29年9月	ベトナム	ホーチーミン近郊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の排出削減を実現する。
高効率チラー	平成27 年10 月～平成28年10月	インドネシア	スラバヤにおいて既存の大型ショッピングモールに高効率チラーを導入することにより、CO2の排出削減を実現する。
廃熱回収発電	平成25年11月～平成27年3月	インドネシア	セメント焼成プロセスから排出される廃熱を廃熱回収発電設備によって電力エネルギーに転換し、現在使用している電力会社からの電力と代替する

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
2. 想定している事業実施スキーム、資金組成スキーム、事業実施採算性

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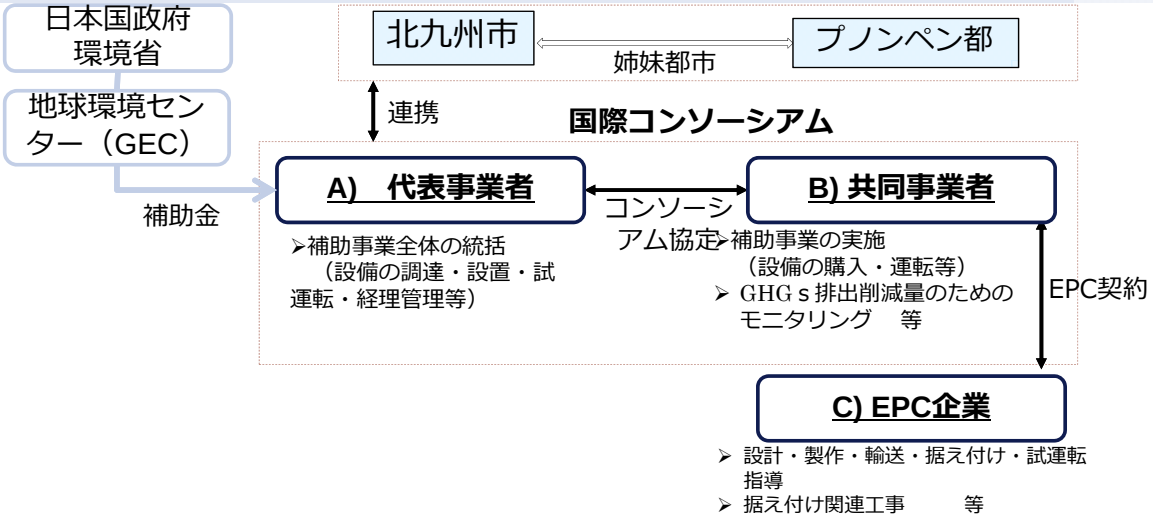

活動1：大型病院等を対象とした省エネ対策等を通じた低炭素化の推進	活動2：ショッピングモール等の施設を対象とした省エネ対策等を通じた低炭素化の推進	活動3：セメント工場への廃熱回収発電システムの導入
【想定事業体制】 A) 本調査にて決定 B) カルメット国立病院、クメール-ソビエト友好病院 C) 日系空調メーカー、日系太陽光パネルメーカー	【想定事業体制】 A) イオンモール B) イオンモール　カンボジア C) 日系チラーメーカー、日系太陽光パネルメーカー	【想定事業体制】 A) 本調査にて決定 B) 今後、調査 C) 廃熱回収発電メーカー

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
3. プロジェクト概要 ①大型病院

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●プノンペン都における有数のエネルギー多消費型施設である大型病院を対象として、太陽光等の再生可能エネルギーによるエネルギー供給と、高効率空調等の導入による省エネ対策を組合せて、病院全体のグリーン化を図る。

●北九州市とプノンペン都の姉妹都市連携を活かし、カルメット国立病院及びクメール-ソビエト友好病院を紹介していただく。

●空調の規模、太陽光発電パネル設置面積等を確認し、導入機器の検討を行う。

●その後、既存方法論などを参考に、経済性評価、CO2排出削減量評価を計算する予定。

●評価結果を踏まえて、現地病院のJCM事業実施に向けた意思決定を確認する。

●また、国際コンソーシアムの代表事業者となる日本企業の発掘も行う。


カルメット国立病院


クメール-ソビエト友好病院

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
3. プロジェクト概要 ②ショッピングモール

NTT DATA

●本調査案件採択後、イオンモールとの直接協議の結果、2018年7月オープン予定の「イオンモールプノンペン 2号店」を、平成28年度のJCM設備投資公募へ提出することとなった。4月、5月の短期間で、技術検討/経済性検討/CO2排出削減量評価等を行い、公募提出に至った。

●引き続き、関係者へのJCM設備補助の説明を行い、JCMの理解向上や役務確認等を図る。

●また、他案件への横展開の可能性も調査する。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
3. プロジェクト概要 ③セメント工場

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●経済発展が続くカンボジアでは、プノンペン都及びその周辺地域においてセメント工場が整備されており、現在も増加している。しかしながら、セメント工場には廃熱回収の仕組みがないものが多い。そこで、本調査では、CO2 排出削減効果の大きいセメント工場における廃熱回収発電システムの導入を目指す。

●北九州市とプノンペン都の姉妹都市連携を活かし、候補となる現地法人を紹介していただく。

●紹介いただいた現地法人にJCM設備補助事業を説明し、ヒアリング調査を行う。

●関心のある現地法人に対しては、直接協議の上、案件可能性を検討する。

●また、国際コンソーシアムの代表事業者となる日本企業の発掘も行う。

セメント工場イメージ

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
4.　想定している契約方式

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●契約方式

[活動1] 大型病院

✓ 入札なのか随意契約なのか要調査

✓ 事業形式はEPC

[活動2] ショッピングモール

✓ 随意契約

✓ 事業形式はEPCを想定

[活動3] セメント工場

✓ 随意契約

✓ 事業形式はEPCを想定

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
5.　排出削減総量及び補助金の見込み額、費用対効果 ①大型病院

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- プロジェクト実施時のCO2排出削減量と費用対効果についてはいずれも未定。
- 今後、空調の規模、太陽光発電パネル設置面積等を確認し、導入機器の検討を行う。
- その後、既存方法論などを参考に、リファレンスシナリオとの比較を行うことでCO2排出削減量を計算する予定である。

- **○エネルギー起源CO2排出削減量**

排出削減総量(t-CO2)＝
エネルギー起源CO2の年間排出削減量(tCO2/年）×耐用年数(年)

- **○エネルギー起源CO2排出削減に関わる補助金額の費用対効果**

CO2削減コスト(円/t-CO2)＝
補助金（円）÷（エネルギー起源CO2の年間排出削減量(tCO2/年）×耐用年数（年））

- **○GHG排出削減に関わる補助金額の費用対効果**

GHG削減コスト(円/t-CO2換算) ＝
補助金（円）÷（GHGの年間排出削減量(tCO2換算/年）×耐用年数（年））

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
5. 排出削減総量及び補助金の見込み額、費用対効果 ②ショッピングモール

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- 太陽光発電：996.6t-CO2/年
- 高効率チラー：691.4t-CO2/年
- 以下は、太陽光発電の排出削減量の算出資料。

事業名	大型ショッピングモールへの大規模太陽光発電と高効率チラーの導入											
実施サイト	住所	Sangkat Kmounh and Sangkat Phnom Penh Thmey, Khan Sen Sok, Phnom Penh										
	緯度		経度									
設置角	方位角	東：67°	（ 北：0°、東：90°、南：180°、西：270° ）									
	傾斜角	5%	（ 水平面に対するモジュールの設置角度）									
太陽電池モジュールの容量（公称最大出力W）＝		270	（JIS C8918の条件における）									
設置モジュール枚数＝	3,840	枚										
システムの太陽電池容量＝	1,036.8	（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
各月の1日平均日射量(実施サイトにおける値：kWh/㎡・日)		5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
各月の1日平均有効日射量(方位角、設置角における補正値：kWh/㎡・日)		5.25	5.19	5.61	5.03	5.72	5.66	5.77	5.64	4.95	4.64	4.47	4.86
温度補正係数（損失が無い場合=1.0）		0.875	0.867	0.861	0.86	0.862	0.868	0.869	0.871	0.876	0.877	0.88	0.877
影による損失係数（無い場合は、1.0）		1	1	1	1	1	1	1	1	1	1	1	1
パワコンデショナー変換効率（定格負荷時電力効率）		0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981	0.981
その他損失(無い場合:1.0)（モジュール汚れ、送電ロス、経年劣化など）（経年劣化は使用期間の中間年での数値とする）		0.919	0.919	0.919	0.919	0.919	0.919	0.919	0.919	0.919	0.919	0.919	0.919
1日推定発電電力量（kWh/日）		4,295	4,202	4,515	4,046	4,611	4,595	4,690	4,591	4,053	3,805	3,677	3,982
工場等の稼働日における平均1日消費電力量（kWh/日）		**71,335**	**73,650**	**79,962**	**85,282**	**85,429**	**86,237**	**85,666**	**81,424**	**81,245**	**81,035**	**82,834**	**76,235**
工場等の稼働日における平均余剰電力量（kWh/日）		0	0	0	0	0	0	0	0	0	0	0	0
非稼働日で発電量がほぼ全量余剰電力となる日数		0	0	0	0	0	0	0	0	0	0	0	0
実有効日数		31	28	31	30	31	30	31	31	30	31	30	31
月間推定余剰電力量(kWh/月)		0	0	0	0	0	0	0	0	0	0	0	0
月間推定有効発電電力量（kWh/月）		133,150	117,670	139,953	121,382	142,936	137,846	145,396	142,311	121,593	117,961	110,304	123,454
年間推定有効総発電量	1,553,956	kWh/年											

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
5. 排出削減総量及び補助金の見込み額、費用対効果 ③セメント工場

NTT DATA

●セメント工場への廃熱回収発電システムの導入事業を通じた低炭素化の推進について、事業が実現した場合の想定事業のCO2 排出削減効果を記載する。

- ６MW規模の発電で、自工場での電力消費の削減(買電の削減) を想定。

○エネルギー起源CO2排出削減量

排出削減総量(t-CO2)＝ 375,000 (=25,000 × 15)
エネルギー起源CO2の年間排出削減量(tCO2/年)×耐用年数(年)

○エネルギー起源CO2排出削減に関わる補助金額の費用対効果

CO2削減コスト(円/t-CO2)＝2,933 (=1,100,000,000 ÷ 375,000)
補助金（円）÷（エネルギー起源CO2の年間排出削減量(tCO2/年)×耐用年数（年））

○GHG排出削減に関わる補助金額の費用対効果

GHG削減コスト(円/t-CO2換算)＝2,933 (=1,100,000,000 ÷ 375,000)
補助金（円）÷（GHGの年間排出削減量(tCO2換算/年)×耐用年数（年））

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
6.　調査上の課題等 ①大型病院

NTT DATA

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.	該当する現地病院の抽出・働きかけ	ＪＣＭ事業実施の候補となる大型病院を抽出する。(5月)	北九州市 プノンペン都 NTTデータ	現地病院	北九州市とプノンペン都の連携を活かし、該当病院を紹介いただく。
2.	現地病院への訪問・ヒアリング	紹介いただいた現地病院への訪問し、導入可能な技術を検討する。(6月)	NTTデータ 北九州市	現地病院	空調の規模、太陽光発電パネル設置面積等を確認し、導入技術の検討を行う。
3.	要求仕様に基づく技術検討の実施	現地病院の要求仕様を満たしたうえで、CO2排出削減に資する省エネ/低炭素型な機器を選定する。(8月)	NTTデータ	国内ベンダー等	現地企業の要求仕様をもとに、仕様を満たす機器を各ベンダーに確認する。
4.	設備導入にかかる経済性検討	設備導入による発電・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。(10月)	NTTデータ	国内ベンダー等	ベンダーから得た見積もり及び、性能をもとに、投資回収期間等の経済性評価を行う。
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。(11月)	NTTデータ	国内ベンダー等	ベンダーから得た性能と、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。(12月)	NTTデータ (北九州市)	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を抽出し、働きかけを行う。 北九州市のチャンネルも活用する。
7.	JCM事業実施に向けた意思決定	調査結果を元に、現地病院のJCM事業実施の意思を確認する。(12月)	NTTデータ 北九州市	現地病院	JCM制度、検討結果の説明を行い、JCM事業実施に向けた意思決定をサポートする。
8.	国立病院の契約方式の確認	国立病院の契約方式が入札なのか随意契約なのか調査する。(12月)	NTTデータ 北九州市	現地病院	現地病院に直接ヒアリングし、契約方式を確認する。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
6.　調査上の課題等 ②ショッピングモール

NTT DATA

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.	現地ショッピングモールのJCM案件への参画意識調査	ＪＣＭ事業実施の候補となる企業に連絡を取り、JCM案件形成の可能性を調査する。(4月)	NTTデータ 北九州市	ショッピングモール	イオンモールに連絡を取り、JCM制度の説明を行い、JCM事業参画への意思を確認する。
2.	要求仕様に基づく技術検討の実施	現地モールの要求仕様を確認し、CO2排出削減に資する省エネ/低炭素型な機器を選定する。(4月)	NTTデータ	イオン 国内ベンダー等	現地モールの要求仕様をもとに、仕様を満たす機器を各ベンダーに確認する。
3.	設備導入にかかる経済性検討	設備導入による発電・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。(4月・5月)	NTTデータ	国内ベンダー等	ベンダーから得た見積もり及び、性能をもとに、投資回収期間等の経済性評価を行う。
4.	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。(4月・5月)	NTTデータ	国内ベンダー等	ベンダーから得た性能と、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。
5.	平成28年度JCM設備補助公募への提出の意思決定	イオンモール、及び、イオンモールカンボジアに、平成28年度公募提出の意思を確認する。(5月)	NTTデータ	イオン	JCM制度、検討結果の説明を行い、JCM事業実施に向けた意思決定を確認する。公募提出に際しては、各種サポートを行う。
6.	案件関係者のJCM制度の理解向上	案件関係者を対象として、JCM設備補助事業の理解向上や役務確認等を行う。(12月)	NTTデータ	イオン 国内ベンダー等	イオンモール本社、現地ショッピングモール1号店、2号店建設予定地等を訪問し、JCM制度の説明を行う。
7.	ショッピングモール等、他施設への横展開の可能性調査	技術や事業モデルが横展開可能な現地企業を発掘する。(12月)	北九州市 プノンペン都 NTTデータ	現地企業	北九州市とプノンペン都の連携を活かし、横展開可能な現地企業を発掘する。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
6.　調査上の課題等 ③セメント工場

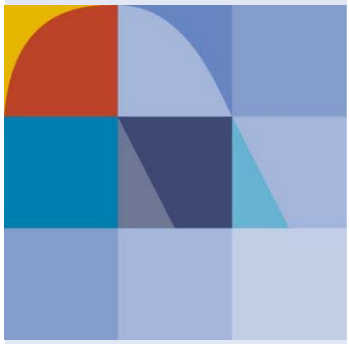
NTT DATA

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.	現地企業の抽出・働きかけ	ＪＣＭ事業実施の候補となる企業を抽出する。(7月)	北九州市 プノンペン都 NTTデータ	現地企業	北九州市とプノンペン都の連携を活かし、該当企業を発掘、紹介いただく。
2.	紹介された民間企業へのヒアリング	JCM制度を説明し、案件可能性、現地企業の関心有無をヒアリングする。(9月)	北九州市 プノンペン都 NTTデータ	現地企業	紹介いただいた現地企業に連絡をとり、JCM制度を説明する。案件の形成が可能か、また現地企業がJCM案件に関心があるかを確認する。
3.	関心のある現地法人にする直接協議	関心のある現地法人に対しては、直接協議の上、案件の可能性を検討する。(12月)	NTTデータ	現地企業	1) セメント工場設備の規模や、廃熱の条件等をヒアリングし、廃熱回収発電の規模等の検討を行う。 2) 資金の調達方法を確認し、資金面での障害がないか検討する。
4.	代表事業者の抽出・働きかけ	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。(12月)	NTTデータ (北九州市)	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を抽出し、働きかけを行う。 北九州市のチャンネルも活用する。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
6.　調査実施スケジュール

NTT DATA

活動項目	2016年 5月	6月	7月	8月	9月	10月	11月	12月	2017年 1月	2月	3月
1. 大型病院を対象とした省エネ対策等を通じた低炭素化の推進	大型病院との直接協議	技術検討			経済性検討	CO2排出削減量評価		事業に関する意思決定			
2. ショッピングモール等の施設を対象とした省エネ対策等を通じた低炭素化の推進	・民間企業との直接協議 ・事業に関する意思決定 ・技術検討 ・経済性検討 ・CO2排出削減量評価	・案件関係者へのJCM理解の向上 ・横展開の可能性調査									
3.セメント工場への廃熱回収発電システムの導入	プノンペン都の該当部局との直接協議		紹介された民間企業との直接協議			関心のある民間企業との直接協議					
○　現地調査	☆		☆			☆			☆		
○　国内会議（2回程度）					☆			☆			
○　現地ワークショップ（2回程度）	☆								☆		
○　報告書の作成						☆（中間ドラフト）				☆（最終ドラフト） ☆（最終報告書）	



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FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (April-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in April

- [Common] We prepared necessary documents for " workshop in Phnom Penh" and "first field survey" which are scheduled on coming May,.
- [Activity 2 (Shopping mall)] We conducted the following activities.
  - It contacted AEON Mall and confirmed their intention to participate in the JCM project. (Contract Number 2-2①)
  - As a result of consultation with AEON Mall, they decided to focus on "photovoltaic power generation" and "high efficiency chiller". We began technical study with equipment vendors. (Contract Number 2-2②)
  - It started economic consideration based on the materials we got. (Contract Number 2-2③)
  - We started studying the calculation of CO2 reduction effect and MRB methodology. (Contract Number 2-2④)

(2) Major activities in May

- [Common] We plan to conduct " workshop in Phnom Penh" and "first field survey."
- [Activity 1 (Large hospital)]
  - Potential hospital is to be introduced (Contract Number 2-1①)
  - To visit the local hospital and conduct hearings. (Contract Number 2-1②)
- [Activity 2 (Shopping mall)]
  - to work out the details of introduction of Technology (Contract Number 2-2②)
  - To continue economic consideration. (Contract Number 2-2③)
  - Continue to consider CO2 reduction effect calculation and MRB methodology. (Contract Number 2-2④)
  - Final confirmation of intention of submission to AEON Mall's "Financing Programme for JCM public offering in FY 2016" (Contract Number 2-2⑤)
- [Activity 3 (cement plants)] To request finding potential relevant company (Contract Number 2-3①)

(3) Schedule and Progress

・Progress as of the end of April is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆ (final draft)	☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (May-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in May

- [Common] We conducted " workshop in Phnom Penh" and "first field survey." (Contract Number2-4 & 2-5④)
- [Common] We conducted kick-off meeting with MoEJ(Contract Number2-5②)
- [Activity 1 (Large hospital)]
  - Kalmet National Hospital and Khmer-Soviet Friendship Hospital was introduced (Contract Number2-1①)
  - Hearting to Hospital was conducted.(Contract Number2-1②)
- [Activity 2 (Shopping mall)]
  - Deeply technical study was done.(Contract Number2-2②)
  - Economy study was conducted.(Contract Number2-2③)
  - study for calculation of CO2 emission reduction.(Contract Number2-2④)
  - As result of these studies, AEON MALL confirmed to submit application to official announcement of JCM subsidy project. (Contract Number2-2⑤)
  - We Visit AEONMALL Japan and Cambodia (Contract Number2-2⑥)
- [Activity 3 (cement plants)] We requested to Phnom Penh Capital City to introduce potential cement company. (Contract Number2-3①)

(2) Major activities in June

- [Common] Preparation for 2nd visit.
- [Activity 1 (Large hospital)] Based on hearing with hospital, technical study to be started. (Contract Number2-1③)
- [Activity 2 (Shopping mall)] Potential companies for horizontal expansion to be searched. (Contract Number2-2⑦)
- [Activity 3 (cement plants)] Potential companies of cement plant to be searched (Contract Number2-3①)

(3) Schedule and Progress

・Progress as of the end of May is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆	(final draft) ☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (June-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in June

- [Common] Preparation for 2nd visit was continued.
- [Activity 1 (Large hospital)] Based on hearing with hospital, technical study was started. (Contract Number2-1③)
- [Activity 2 (Shopping mall)] Potential companies for horizontal expansion were searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] Potential companies of cement plant were searched (Contract Number2-3①)

(2) Major activities in July

- [Common] We plan to have 2nd visit to Phnom Penh. (Contract Number2-4)
- [Activity 1 (Large hospital)] Technical study to be continued. (Contract Number2-1②)
- [Activity 2 (Shopping mall)] Potential companies for horizontal expansion are to be continuously searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] Potential companies of cement plant are to be continuously searched(Contract Number2-3①)

(3) Schedule and Progress

・ Progress as of the end of Jule is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆	(final draft) ☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (July-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in July

- [Activity 1 (Large hospital)] Study of PV panels for rooftop of Khmer-Soviet Friendship Hospital was started. (Contract Number2-1③④)
- [Activity 2 (Shopping mall)] Potential companies for horizontal expansion were continuously searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] Potential companies of cement plant were continuously searched (Contract Number2-3①)
- [Activity 3 (cement plants)] We tried to contact SCCC Group which is Cement Company in Thailand. (Contract Number2-3①)
- [Common] 2nd visit is postponed to Sep-2016. (Contract Number2-4)

(2) Major activities in Aug

- [Common] Progress meeting with MOEJ is planned on 9-Aug(Contract Number2-5②)
- [Common] We will contact JETOR to find potential companies (Contract Number2-2⑦ / 2-3①)
- [Activity 1 (Large hospital)] Study of PV panels for rooftop of Khmer-Soviet Friendship Hospital is to be continued. (Contract Number2-1③④)
- [Activity 3 (cement plants)] Potential companies of cement plant are to be continuously searched (Contract Number2-3①)

(3) Schedule and Progress

・ Progress as of the end of July is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆	(final draft) ☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (August-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in Aug

- [Common] Progress meeting with MOEJ was held on 9-Aug (Contract Number2-5②)
- [Common] Preparation for next visit to be started (Contract Number2-4)
- [Common] We contacted JETOR to find potential companies (Contract Number2-2⑦ / 2-3①)
- [Activity 1 (Large hospital)] Study of PV panels for rooftop of Khmer-Soviet Friendship Hospital was continued. (Contract Number2-1③④)
- [Activity 2 (Shopping mall)] Potential companies were continuously searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] We tried to contact SCCC Group which is Cement Company in Thailand. (Contract Number2-3①)

(2) Major activities in Sep

- [Common] 2nd Seminar to be held on 25-Sep to 30-Sep (Contract Number2-5②)
- [Activity 1 (Large hospital)] Result of PV panels study of Khmer-Soviet Friendship Hospital to be reported. (Contract Number2-1③④)
- [Activity 3 (cement plants)] Potential companies of cement plant are to be continuously searched (Contract Number2-3①)
- [Common] Potential companies are to be continuously searched (Contract Number2-2⑦ / 2-3①)

(3) Schedule and Progress

・ Progress as of the end of Aug is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆	(final draft) ☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (September-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in Sep

- [Common] 2nd Seminar were held on 25-Sep to 30-Sep。(Contract Number2-4)
- [Activity 1 (Large hospital)] Result of PV panels study of Khmer-Soviet Friendship Hospital was reported. (Contract Number2-1②③④⑤)
- [Activity 1 (Large hospital)] As result of hearing, we understand that Khmer-Soviet Friendship Hospital needs official bid. (Contract Number2-1⑧)
- [Activity 1 (Large hospital)] We visited Sunrise Japan Hospital (Contract Number2-1②)
- [Activity 2 (Shopping mall)] We visited PPSEZ and required them to introduce potential companies are to be continuously searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] As result of survey, we realized that potential cement plant are exist in Kampot (Contract Number2-3①)
- [Common] We contacted local bank to consider financial collaboration. (Contract Number2-1③、2-2③、2-3③)

(2) Major activities in Aug

- [Common] Study with local bank to be started.(Contract Number2-1③、2-2③、2-3③)
- [Activity 2 (Shopping mall)] Potential companies are to be continuously searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] We will try to contact Potential cement plant in Kampot (Contract Number2-3①)

(3) Schedule and Progress

・ Progress as of the end of Aug is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆ (final draft)	☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (October-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in Oct

- [Common] Preparation for Next Visit to Phnom Penh (Contract Number2-2⑦ / 2-3①)
- [Activity 1 (Large hospital)] As result of Hearing, Khmer-Soviet Friendship Hospital informed that initial cost paid by themselves is difficult (Contract Number2-1④⑦)
- [Activity 2 (Shopping mall)] Midori Techno Park and Sumi (Cambodia) Wiring Systems were introduced. (Contract Number2-2⑦)
- [Activity 3 (cement plants)] We found out that Potential companies of cement plant are exist in Kamot area. (Contract Number2-3①)
- [Common] We attended to JCM City to City Seminar in Kitakyushu (Contract Number2-5③⑤)
- [Common] Reporting are on-going. (Contract Number2-6)

(2) Major activities in Nov

- [Common] Preparation for next meeting(Contract Number2-2⑦ / 2-3①)
- [Common] Discussion with local bank to be started (Contract Number2-1③、2-2③、2-3③)
- [Activity 2 (Shopping mall)] Potential companies for horizontal expansion are to be continuously searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] Potential companies of cement plant in Kampot be contacted (Contract Number2-3①)

(3) Schedule and Progress

・ Progress as of the end of Oct is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆ (final draft)	☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (November-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in Nov

- [Common] Preparation for next meeting(Contract Number2-2⑦ / 2-3①)
- [Activity 1 (Large hospital)] Further study with local bank is conducted (Contract Number2-1④⑦)
- [Activity 2 (Shopping mall)] Appointment to Midori Techno Park and Sumi (Cambodia) Wiring Systems was done (Contract Number2-2⑦)
- [Activity 2 (Shopping mall)] As potential company, we started to contact with Beer Factory (Contract Number2-2⑦)
- [Activity 3 (cement plants)] We contacted Chip Mong Insee Cement for next meeting (Contract Number2-3①)
- [Common] 報告書ドラフトの作成中。(Contract Number2-6)

(2) Major activities in Dec

- [Common] 3rd visit is planned on 8-Dec to 16-Dec (Contract Number2-4 / 2-5④)
- [Common] We plan to have a progress reporting meeting to MOEJ on 20-Dec (Contract Number2-5②)
- [Common] Economic study with local bank to be continued (Contract Number2-1③、2-2③、2-3③)
- [Activity 2 (Shopping mall)] Potential companies for horizontal expansion are to be continuously searched (Contract Number2-2⑦)
- [Activity 3 (cement plants)] Hearing to Cement Plant is to be conducted (Contract Number2-3①)
- [Common] Drafting final report。(Contract Number2-6)

(3) Schedule and Progress

- Progress as of the end of Nov is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆ (final draft)	☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (December-2016)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in Dec

- [Common] 3rd visit was held on 8-Dec to 16-Dec (Contract Number 2-4 / 2-5④)
- [Common] We held a progress reporting meeting to MOEJ on 20-Dec (Contract Number 2-5②)
- [Activity 1 (Large hospital)] We visited sunrise japan hospital and had further discussion. (Contract Number 2-1②③④⑦)
- [Activity 2 (Shopping mall)] We visited Midori Techno Park and Sumi (Cambodia) Wiring Systems.(Contract Number 2-2⑦)
- [Activity 3 (cement plants)] We visited Chip Mong Insee Cement and exchanged opinions (Contract Number 2-3③)

(2) Major activities in Jan

- [Common] We will participate JCM city to city seminar on 23-Jan (Contract Number 2-5⑤)
- [Common] Preparation for next visit. (Contract Number 2-4 / 2-5④)
- [Common] Drafting final report(Contract Number 2-6)

(3) Schedule and Progress

・ Progress as of the end of Dec is shown in below

Activity item	2016 May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	2017 Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆ (final draft)	☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (January-2017)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in Jan

- [Common] 4th visit was held on 16-Jan to 17-Jan (Contract Number2-4 / 2-5④)
- [Activity 1 (Large hospital)] Further discussion with Sunrise Japan Hospital was conducted. (Contract Number2-1②③④⑦)
- [Activity 3 (cement plants)] We visited construction site of Chip Mong Insee Cement. We discussed study for PV panels (Contract Number2-3③)
- [Common] We participated JCM city to city seminar on 23-Jan (Contract Number2-5⑤)

(2) Major activities in Feb

- [Common] 5th visit will be held on 12-Feb to 16-Feb (Contract Number2-4 / 2-5④)
- [Activity 1 (Large hospital)] Reporting the result of study for Sunrise Japan Hospital (Contract Number2-1②③④⑦)
- [Activity 3 (cement plants)] Reporting the result of study for Chip Mong Insee Cement (Contract Number2-3③)
- [Common] Drafting final report (Contract Number2-6)

(3) Schedule and Progress

・ Progress as of the end of Jan is shown in below

Activity item	2016									2017	
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals		technical examination			economic consideration		calculation of CO2 reduction effect	decision-making for business		
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆ (final draft)	☆ (final report)	

FY2016 JCM City-to-City Collaboration Project Between Kitakyushu City and Phnom Penh Capital City Monthly progress report (Febrary-2017)

NTT Data Institute of Management Consulting, Inc.,

(1) Major activities in Feb

- [Common] 5th visit was be held on 12-Feb to 16-Feb (Contract Number2-4 / 2-5④)
- [Activity 1 (Large hospital)] Reporting the result of study for Sunrise Japan Hospital (Contract Number2-1②③④⑦)
- [Activity 2 (Large Shopping Mall)] Reporting the result for AEONMALL Cambodia. We confirmed that the construction site is on progress. (Contract Number⑤⑥⑦)
- [Activity 3 (cement plants)] Reporting the result of study for Chip Mong Insee Cement (Contract Number2-3③)
- [Common] Reporting Meeting to MOEJ was held on 27-Feb (Contract Number 2-5 ②)
- [Common] Drafting final report (Contract Number2-6)

(2) Major activities in Mar

- [Common] Submission of final report (Contract Number2-6)
- [Common] Audit for Payments.

(1) Schedule and Progress

・ Progress as of the end of Feb is shown in below

Activity item	2016								2017		
	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. promotion of low carbon through energy conservation countermeasures for large hospitals	Direct talk with large hospitals	technical examination			economic consideration	calculation of CO2 reduction effect		decision-making for business			
2. promotion of low carbon emissions through measures such as energy saving measures for facilities such as shopping malls	・improvement of the stakeholders understanding of JCM project ・possibility survey of the lateral deployment ・direct consultation with private companies ・decision-making for business ・technical examination ・economic consideration ・calculation of CO2 reduction effect										
3.introduction of waste heat recovery power generation system to cement factory	direct talk with relevant departments of Phnom Penh		direct consultation with private companies introduced			direct consultation with private companies interested in the introduction ☆					
○ field survey	☆		☆						☆		
○ national conference (about twice)					☆			☆			
○ on-site workshop (about twice)	☆								☆		
○ report writing						☆ (mid-term draft)			☆	(final draft) ☆ (final report)	

環境省　国際協力室
御中

平成28年度JCM都市間連携事業
（北九州市ープノンペン都連携事業）
最終報告会用資料

2017年2月27日
株式会社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

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平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
INDEX

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平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
0. 事業の背景 (キックオフ時と同じ資料)

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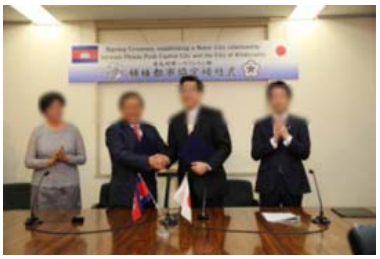

- ２０１６年３月２９日に、北九州市とプノンペン都の姉妹都市が締結された。
- カンボジア国気候変動戦略計画(2014-2023)やそれに基づく省別行動計画(2015-2018)を実現するため、「プノンペン都気候変動適応行動計画策定」を日建設計シビルが担当する。
- NTTデータ経営研究所が担当する本事業では、エネルギー分野でのJCMスキームを活用したパイロットプロジェクトの案件形成調査を行う。以下の３つが、主な活動内容である。

活動項目	活動内容
活動1：大型病院を対象とした省エネ対策等を通じた低炭素化の推進	**大型病院への高効率型の導入、インバータ機能付き空調の導入、太陽光パネル・太陽熱温水システムの設置**
活動2：ショッピングモール等の施設を対象とした省エネ対策等を通じた低炭素化の推進	**ショッピングモール等への高効率型冷蔵ショーケースやチラーの導入、太陽光パネルの設置**
活動3：セメント工場への排熱回収発電システムの導入	**セメント工場における排熱回収発電システムの導入**

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
1. 第１回現地調査（5/8～5/13）

NTT DATA

【訪問先】

① プノンペン都国際連携課
② プノンペン都都市開発局
③ プノンペン都計画投資局
④ 日本大使館
⑤ 水道公社
⑥ 鉱業・エネルギー省
⑦ 公共事業・運輸省
⑧ **イオンモールカンボジア**
⑨ 新菱冷熱工業
⑩ **イオンモール2号店建設地**
⑪ **カルメット国立病院**
⑫ **クメール-ソビエト友好病院**
⑬ **全体セミナー**
⑭ 水資源・気象局
⑮ JICA

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
2. 第２回現地調査（9/25～9/30）

NTT DATA

【訪問先】

① プノンペン都国際連携課
② プノンペン都都市開発局
③ プノンペン都計画投資局
④ **全体セミナー**
⑤ **クメール-ソビエト友好病院**
⑥ プノンペン経済特区
⑦ 鉱業・エネルギー省（都）
⑧ JETRO
⑨ **サンライズジャパン病院**
⑩ 鉱業・エネルギー省（本省）
⑪ 工業・手工芸省（本省）
⑫ **サタパナ銀行**
⑬ JICA

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
3. 第３回現地調査（12/8～12/17）

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【訪問先】

① サタパナ銀行
② **Chip Mong Insee Cement**
③ プノンペン都国際連携課
④ プノンペン都計画投資局
⑤ Kingdom Breweries
⑥ **水道公社**
⑦ プノンペン経済特区
⑧ **Sumi (Cambodia) Wiring Systems**
⑨ サンライズジャパン病院
⑩ ミドリテクノパークカンボジア
⑪ **全体セミナー**
⑫ 環境省気候変動局
⑬ **環境省環境保護総局**
⑭ 排棄物管理局
⑮ 鉱業・エネルギー省（本省）
⑯ 工業・手工芸省（本省）

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
4. 第4回現地調査（1/17～1/18）/ 第5回現地調査（2/13～2/16）

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【第4回現地調査 訪問先】

① サタパナ銀行
② サンライズジャパン病院
③ **Chip Mong Insee Cement**

【第5回現地調査 訪問先】

① プノンペン都国際連携課
② 在カンボジア日本大使館
③ サンライズジャパン病院・アクレダ銀行
④ **全体セミナー**
⑤ イオンモール2号店建設地
⑥ Chip Mong Insee Cement

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
5. 活動1：大型病院 (Khmer Soviet Friendship Hospital: 想定)

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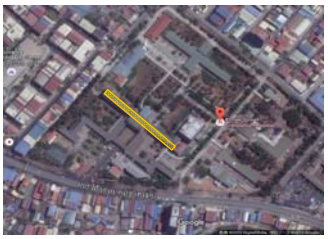
事業の概要(想定)

想定されるプロジェクト(Khmer Soviet Friendship Hospital)

■エネルギー消費量の大きな施設に数えられる「Khmer Soviet Friendship Hospital」を対象と想定して、JCM補助事業の実現可能性を調査中。
■病院の屋根スペース（約1,800m^2）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：
■年間発電量：およそ250,000 kWh/year
■年間電気代削減額：およそ47,500 USD
■年間CO2排出削減量： およそ160 tCO2/年

＊本結果は、あくまで想定である。
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：300,000 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、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。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
6. 活動1：大型病院 (Sunrise Japan Hospital：想定)

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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70 tCO2/年

＊本結果は、あくまで想定である。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
■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。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
7. 活動2：ショッピングモール (イオンモールプノンペン2号店：採択案件)

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事業の概要

■イオンモールカンボジアが建設を計画するイオンモールプノンペン2号店 PPC（仮称、2018年夏オープン予定）において、「太陽光発電」および「高効率チラー」の導入する。
■再生可能エネルギーの導入（太陽光発電）と省エネ（高効率チラー）を通じて、グリッド電力を生成する段階での化石燃料の燃焼から生じるCO2排出を削減する。

期待される効果

■ 太陽光発電システム： CO2排出削減量：948.7[tCO2/year]　　高効率チラー：CO2削減量：615.6 [tCO2/year]

資金調達方法

■ 想定初期投資額：太陽光発電システム： およそ2.9億円　高効率チラー：およそ2.3億円
■ JCM設備補助の活用：太陽光発電システム：補助率40%、高効率チラー：補助率50%

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
8. 活動3：セメント工場 (排熱回収発電: 想定)

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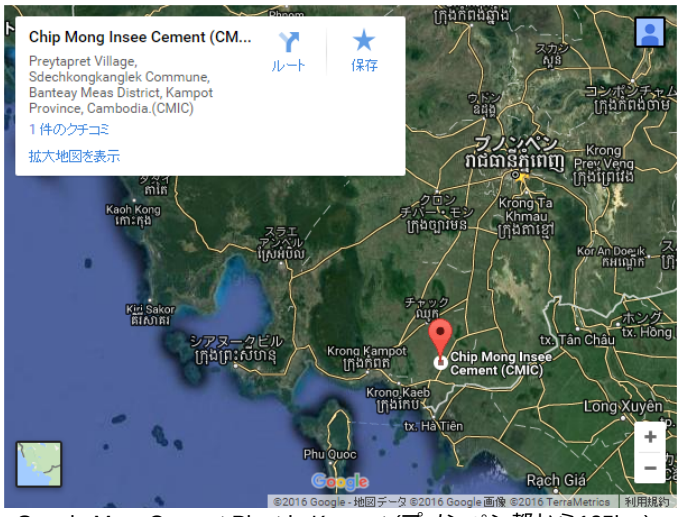
事業の概要(想定) 想定されるプロジェクト(CHIP MONG INSEE CEMENT)

■CO2排出削減効果の大きいセメント工場における排熱回収発電システムの導入を想定して、JCM補助事業の実現可能性を調査中。
■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4四半期に生産開始予定。
■2018年中頃に排熱回収発電システムの入札開始予定。
■2020年初～中旬に排熱回収発電システムの試運転開始を想定。



Google Map: Cement Plant in Kampot (プノンペン都から125km)

期待される効果(想定)
■約8MW の規模の排熱回収発電システムを想定
■CO2排出削減量：30,000 [tCO2/year]

資金調達方法(想定)
■設備導入を行う事業者の自己資金で調達。
■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する。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
9. 活動3：セメント工場 (太陽光発電システム: 想定)

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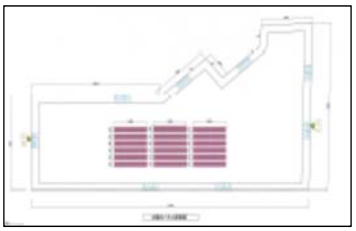
事業の概要(想定) 想定されるプロジェクト(CHIP MONG INSEE CEMENT)

■会社概要は、前ページ参照。
■セメント工場のいくつかの建物の屋根スペースに太陽光パネルの設置することを想定。
■アーチ型の屋根への軽量パネルの設置や、貯水池でのフローティングタイプの太陽光パネルも検討中。

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 5.5 MW
■年間発電量：およそ 7,500,000 kWh/year
■年間電気代削減額：およそ 937,500 USD
■年間CO2排出削減量： およそ 4,800 tCO2/年

＊本結果は、あくまで想定である。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：14,000,000 USD
■イニシャルコストの最大30%をJCM設備補助事業で調達することを想定する。
■ESCOやリース事業による調達も検討

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
10. ESCO事業・リース事業の検討

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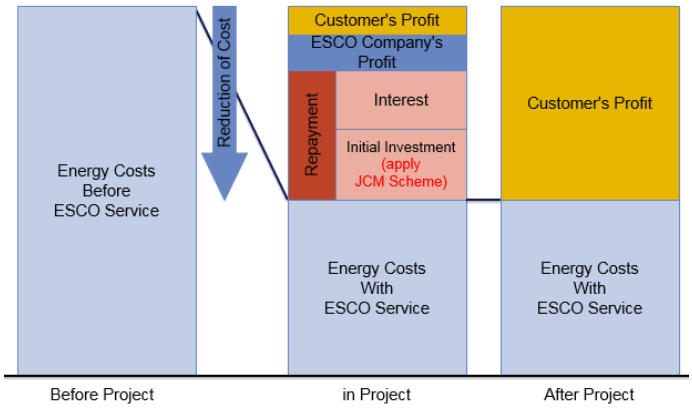
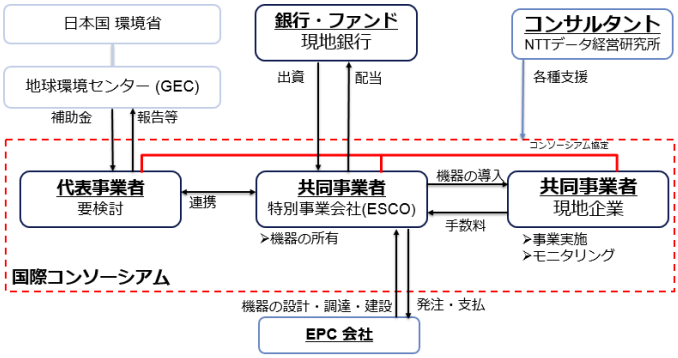
- 初期投資負担の課題を解決するため、アクレダ銀行・サタパナ銀行とESCO事業の検討を開始した。
  - 省エネ機器や再エネ機器により削減した電気代から、初期投資費用を返済していく仕組みである。
  - 実施体制の検討を左図に示す。
  - 電気代の高いカンボジアでは、省エネ、再エネによる電気代削減の効果は高いため、事業のポテンシャルは高い。
  - 一方で、金利が非常に高いカンボジアでは、現地での調達コストが高いため、月々の返済額が高くなる、もしくは、契約期間が長くなる懸念がある。
  - 日本国内からの資金調達などの検討も含め、ESCO事業者、現地企業、双方にメリットのある形で仕組みづくりができるかが来年度の検討項目である。



ESCO事業の検討



実施体制の検討

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
11. その他、横展開の可能性のある施設の検討

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- 事業の横展開として、下記へ訪問し案件化を検討。

【Sumi (Cambodia) Wiring Systems】
- プノンペン経済特区にあるワイヤーハーネス製造工場。
- 敷地面積およそ1400m^2 (200m x 70m)。
- 主な電力消費は空調、ワイヤー切断圧着機。
- 月額電気代は25000ドル～33000ドル。

Sumi (Cambodia) Wiring Systems

【ミドリテクノパークカンボジア】
- プノンペン経済特区にある車両シフト部の製造工場。
- 新設工場3000m^{2}を検討中。2017末完成予定。
- 新設工場には、成形機械10数台を導入予定。
- 屋根に太陽光発電システムを導入するか検討中。

水道公社の太陽光発電システム

【水道公社】
- 既設浄水場に2ヵ所に太陽光発電システムの導入か検討しているが、初期投資の費用負担が困難であるとのこと。
- そのうち、ニーロ浄水場では最大で4MW規模を想定。
- ESCO事業を適応し案件化可能か要検討。

ビール工場のイメージ

【ビール工場】
- Kingdom Breweriesに訪問したが、小規模のため案件化は難しい。また、法定耐用年数のモニタリングも困難。
- Khmer Brewery(Cambodiaビールを製造)も今後検討。

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
12. H29年度JCMプノンペン ①排熱回収発電事業

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【概要】

■セメント工場のおいてCO2排出削減効果の大きい排熱回収発電システムの導入を想定し、JCM補助事業の実現可能性を調査する。
■場所：カンボジア国カンポット州（プノンペンから125Km）
■現在、工場建設中のChip Mong Group (CMG)：60% 、Siam City Cement Company (SCCC)：40% の合弁会社である「CHIP MONG INSEE CEMENT」を対象に、排熱回収発電システムを検討。
■2017年12月頃からセメントの生産開始予定。

Google Map: Cement Plant in Kampot
(プノンペン都から125km)

【排熱回収発電システム】

■焼成工程で発生する排熱を回収し、約8MW規模の発電。
■CO2排出削減量：　約 30,000 tCO2/年
■事業者が自己資金で初期投資額を負担し、その最大50%をJCM設備補助事業で調達。
■2018年中頃に入札開始が見込まれ、2020年初～中旬に試運転開始を予定。


現在建設中のChip Mong Insee Cement

平成28年度JCM都市間連携事業（北九州市ープノンペン都連携事業）
13. H29年度JCMプノンペン ②太陽光発電事業

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【概要】

■セメント工場や病院等エネルギー消費の大規模な施設を対象に太陽光発電システムや省エネ機器を導入し、JCM補助事業の実現可能性を調査する。

【クメール-ソビエト友好病院】

■想定年間発電量：　約250,000 kWh/year
■想定年間CO2排出削減量：　約160 tCO2/年

【サンライズジャパン病院】

■想定年間発電量：　約110,000 kWh/year
■想定年間CO2排出削減量：　約70 tCO2/年

【Chip Mong Insee Cement】

■想定年間発電量：　約7,500,000 kWh/year
■想定年間CO2排出削減量：　約4,800 tCO2/年

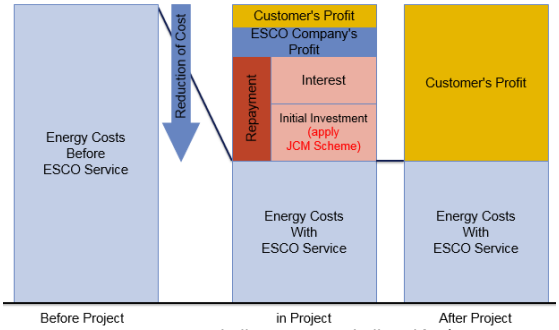
【ESCO事業・リース事業の検討】

■想定している施設は、自己資金による初期投資負担が困難である。そのため、現地銀行と協業し、ESCO事業やリース事業の検討を行う。
■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。


クメール-ソビエト友好病院


サンライズジャパン病院


Chip Mong Insee Cement



ESCO事業・リース事業の検討

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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)

May 2016
NTT Data Institute of Management Consulting, Inc.
Secio & Eco Strategic Consulting Unit

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1. Overview of Kitakyushu- Phnom Penh Capital City Cooperation Project

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)

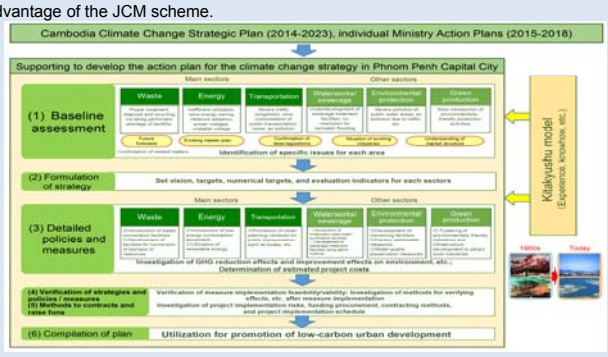
City of Kitakyushu ⟷ **Planned conclusion of sister-city agreement (March 2016)** ⟷ Phnom Penh Capital City

supporting project to develop the action plan for the climate change strategy in Phnom Penh Capital City

<Nikken Sekkei Civil Engineering, City of Kitakyushu>
Phnom Penh Metropolitan Authority (Waste Management Bureau, Planning and Investment Bureau, Urban Development Bureau), Phnom Penh Water Supply Authority
Kingdom of Cambodia
(Ministry of the Environment, Ministry of Mines and Energy, Ministry of Planning, Ministry of Public Works and Transport, Ministry of Industry and Handicrafts)

In order to implement the Cambodia Climate Change Strategy Action Plan (2014-2023) and individual Ministry Action Plans (2015-2018) based on it, development of the action plan for the climate change strategy in Phnom Penh Capital City will be supported.

The subjects of this plan will be 6 fields: Waste management, energy, transportation, waterworks/sewerage/rainwater drainage, environmental protection, and green manufacturing. Pilot projects for each field will be incorporated and the effectiveness of the plan will be ensured. The pilot projects for energy and waste management will take advantage of the JCM scheme.



Pilot projects promotion

Energy sector

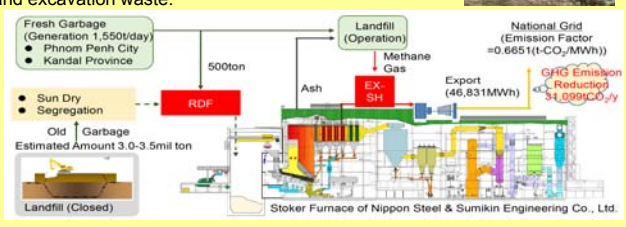
<NTT Data Institute of Management Consulting, City of Kitakyushu>

Activity item	Activity details
Activity 1: Promotion of conversion to low-carbon type through energy-saving measures at large hospitals	Introduction of high-efficiency chillers, introduction of air conditioners equipped with inverter functions, and installation of solar panels and solar hot-water systems at large-scale hospitals.
Activity 2: Promotion of conversion to low-carbon type through energy-saving measures at shopping malls	Introduction of high-efficiency refrigerated showcases and chillers and installation of solar panels at shopping malls, etc.
Activity 3: Introduction of waste heat recovery power generation system for cement plant	Introduction of waste heat recovery power generation for cement plant

Waste sector

<EX Research Institute, NTT Data Institute of Management Consulting, City of Kitakyushu>

Building of cooperative relationship with CINTRI which have an exclusive contract for collection/ transportation to perform waste power generation using municipal waste and excavation waste.



2. Survey for Kitakyushu-Phnom Penh Capital City Cooperation Project

【Applicant】NTT Data Institute of Management Consulting, Inc.
【Co-Applicant】City of Kitakyushu

City of Kitakyushu ⇔ Phnom Penh Capital City

- The entire project oversees based on the inter-city cooperation
- Coordination, discussions and approach with Government organizations

NTT Data Institute of Management Consulting, Inc.

- Survey for 3 activates (direct consultation, technical studies, economic evaluation, CO2 emissions reduction evaluation, etc.)
- Coordination with related organizations aim to commercialization
- Preparation for application of equipment subsidy, if necessary.
- Setting, preparation, participation, management, etc. for conferences

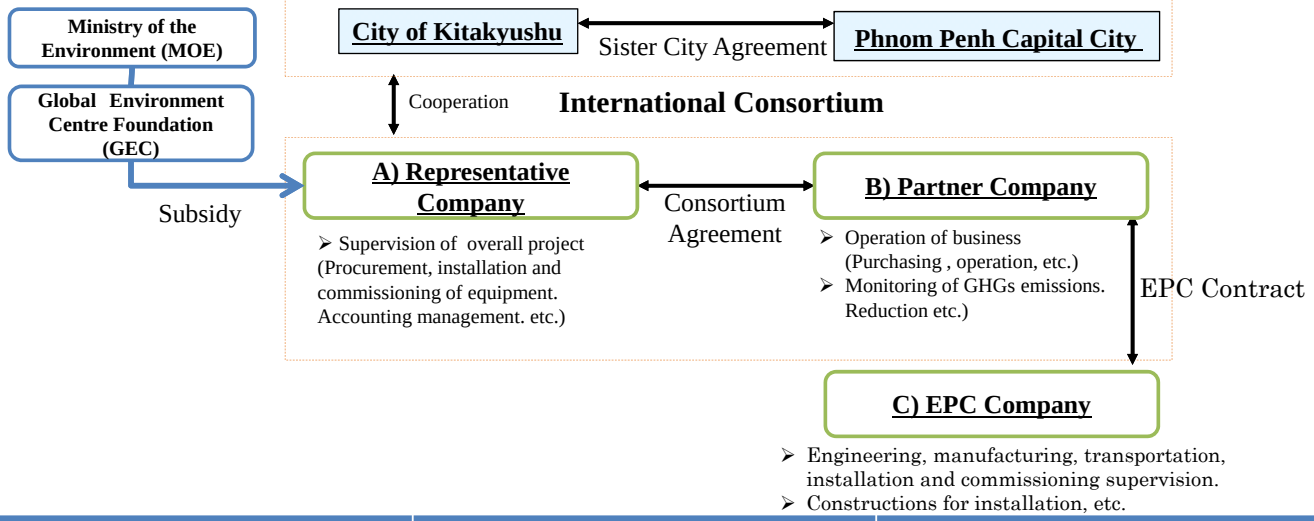
◆ Cooperation (mainly technical), as needed

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
➢ Introduction of solar panel power generation, solar thermal water-heater system, etc. for large hospital	➢ Introduction of high-efficiency refrigeration showcase, solar panel power generation, etc. for shopping mall.	➢ Introduction of waste heat recovery power generation for cement plant

- Chiller Manufacturers
- Solar Panel Manufacturer
- WHR Manufacturer

3. Organization at Implementation Phase

The following shows organization when the three proposed activities (tentative plan) are implemented as JCM project.



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
【Organization Plan】 A) NTT Data Institute of Management Consulting, Inc B) Calmette National Hospital, Khmer-Soviet Friendship Hospital C) Japanese chiller manufacturers , Japanese solar panel manufacturer	【Organization Plan】 A) Aeon Retail B) Aeon Mall Phnom Penh C) Japanese chiller manufacturers, Japanese solar panel manufacturer , Japanese refrigerator showcase manufacture	【Organization Plan】 A) NTT Data Institute of Management Consulting, Inc B) Under investigation C) WHR Manufacture

Kitakyushu- Phnom Penh Capital City Cooperation Project
4-1. [Activity 1] Energy-Saving Facilities for Large Hospital

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○[Activity 1] If high efficiency chiller system and solar power generation system are introduced in Calmette National Hospital and Khmer-Soviet Friendship Hospital, it greatly contribute to reduction of CO2 emissions since they are energy-intensive facilities in Phnom Penh Capital City.

Kitakyushu- Phnom Penh Capital City Cooperation Project
4-2. [Activity 2] Energy-Saving Facilities for Shopoping Mall

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○[Activity 2] Solar power system and high efficiency chiller system will be installed in Aeon Mall Phnom Penh 2nd shop. We are planning to submit proposal of JCM application to GEC in 2016.

NTTDIOC are supporting technical study, economic study, CO2 emission reduction evaluation, etc.

Kitakyushu- Phnom Penh Capital City Cooperation Project
4-3. [Activity 3] Waste heat recovery power generation system for cement plant

○[Activity 3] Recently, cement plant in Phnom Penh Capital City are increasing. However, most of them do not have waste heat recovery power generation system.

Therefore, we aim to introduction of the waste heat recovery power generation system in large cement factory in order to reduce CO2 emissions based on JCM scheme.

Kitakyushu- Phnom Penh Capital City Cooperation Project
5. Our Experience

○Technologies

[Activity 1] Large hospital ⇒ [Solar Power Generation] [High Efficiency Chiller]
[Activity 2] Shopping Mall ⇒ [Solar Power Generation] [High Efficiency Chiller]
[Activity 3] Cement Plant ⇒ [Waste Heat Recovery Power Generation System]

○Point

[Solar Power Generation] and [High Efficiency Chiller]: Both technologies have many JCM experiences in past. Hence, it is not difficult to establish MRV methodology.

[Waste Heat Recovery Power Generation System]: Power generation using waste heat from cement plant can reduce CO2 due to power from national grid.

○Our Experiences

Technologies	Year	Country	Summary
Solar Power Generation	Apr-2015 to Sep-2016	Malaysia	Solar panels are installed on the roof of the new building in Kuala Lumpur, to achieve emissions reductions of CO2.
Solar Power Generation	Feb-2015 to Sep-2017	Vietnam	Solar panels are installed on the roof of a new large shopping mall in Ho Chi Minh suburbs, to achieve a reduction of CO2 emissions
High Efficiency Chiller	Oct-2015 to Oct-2016	Indonesia	High efficiency chiller system is installed on an existing large shopping mall in Surabaya, to achieve emissions reductions of CO2.
Waste Heat Recovery Power Generation System	Nov-2013 to Mar-2015	Indonesia	Waste heat by cement burning process are converted into electric energy by the waste heat recovery power generation system.

Kitakyushu- Phnom Penh Capital City Cooperation Project
6. Survey Points

[Activity 1] Large Hospital

- ✓ Detail Study with Calmette National Hospital and Khmer-Soviet Friendship Hospital
- ✓ Technical study, economic study and CO2 emission reduction evaluation based on detail study
- ✓ Decision-making of the project based on studies above

[Activity 2] Shopping Mall

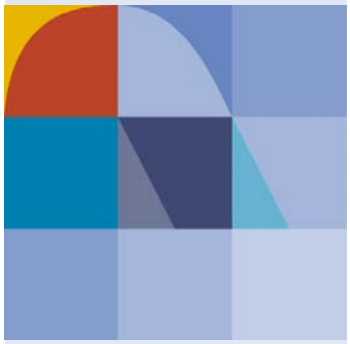
- ✓ Detail Study with Aeon Mall
- ✓ Technical study, economic study and CO2 emission reduction evaluation
- ✓ Support for JCM application in 2016

[Activity 3] Cement Plant

- ✓ Study with Related Governments in Phnom Penh Capital City
- ✓ Study with introduced companies
- ✓ Detail Study with companies who have interest
- ✓ Technical study, economic study and CO2 emission reduction evaluation based on detail study
- ✓ Decision-making of the project based on studies above

Kitakyushu- Phnom Penh Capital City Cooperation Project
7. Survey Schedule

Actions	2016								2017		
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
[Activity 1] Large hospital	Detail study	Technical study	Economic study	CO2 evaluation	reduction	Decision making of the project		Support for JCM			
[Activity 2] Shopping Mall	Support for JCM application - Detail study - Technical study - Economic Study - CO2 reduction evaluation - Decision making of the project				Support for JCM						
[Activity 3] Cement Plant	Study with Related Governments	Study with introduced companies	Detail Study with companies who have interest	Technical study	Economic study	CO2 reduction evaluation	Decision making of the project		Support for JCM		
○ Survey at Phenom Penh	☆		☆				☆		☆		
○ Conference in Japan					☆			☆			
○ Workshop at Phenom Penh	☆								☆		
○ Report						☆Draft				☆Report	



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Introduction about JCM(Joint Crediting Mechanism)

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

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1-1 What is JCM(Joint Crediting Mechanism) ?

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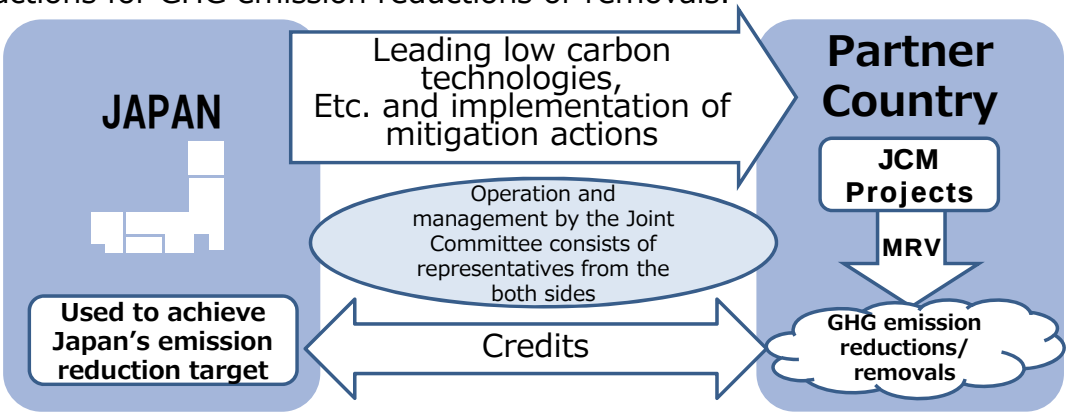
Purpose

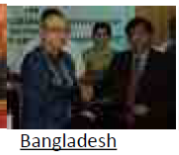
- Facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries.
- Appropriately evaluating contributions from Japan to GHG emission reductions 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.



1-2 JCM Partner Countries

➢ Japan has held consultations for the JCM with developing countries since 2011 and has established the JCM with Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Viet Nam, Lao PDR, Indonesia, Costa Rica, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar and Thailand.

Mongolia
Jan. 8, 2013
（Ulaanbaatar）



Bangladesh
Mar. 19, 2013
(Dhaka)

Ethiopia
May 27, 2013
(Addis Ababa)

Kenya
Jun. 12,2013
(Nairobi)

Maldives
Jun. 29, 2013
(Okinawa)

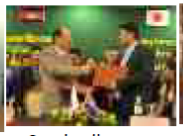
Viet Nam
Jul. 2, 2013
(Hanoi)

Lao PDR
Aug. 7, 2013
(Vientiane)

Indonesia
Aug. 26, 2013
(Jakarta)

Costa Rica
Dec. 9, 2013
(Tokyo)

Palau
Jan. 13, 2014
(Ngerulmud)



Cambodia
Apr. 11, 2014
(Phnom Penh)

Mexico
Jul. 25, 2014
(Mexico City)

Saudi Arabia
May 13, 2015

Chile
May 26, 2015
(Santiago)

Myanmar
Sep. 16, 2015
(Nay Pyi Taw)

Thailand
Nov. 19, 2015
(Tokyo)

PHILIPPINE is newly add as Partner Country on 12-Jan-2017

1-3 JCM Subsidy Project

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**)

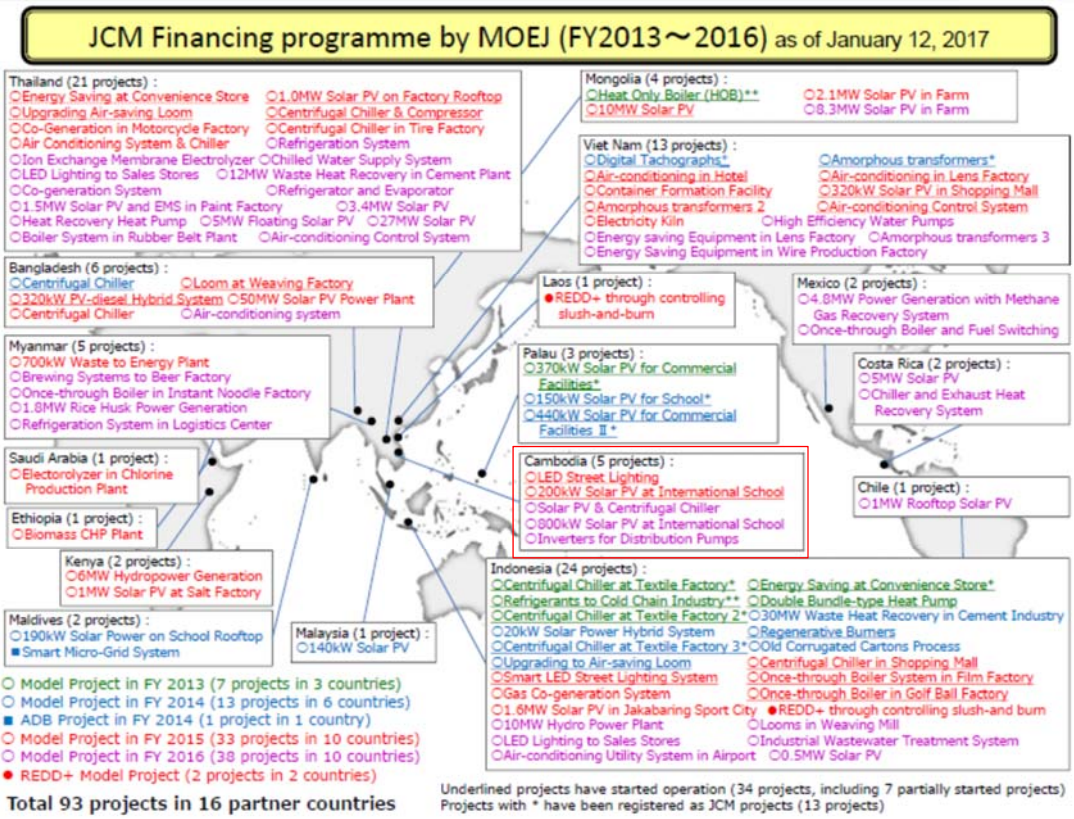
Conduct MRV and expected to deliver at least half of JCM credits issued

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

International consortiums
(which include Japanese entities)

◆ Scope of the financing: facilities, equipment, vehicles, etc. which reduce CO2 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.

1-4 JCM Financing Program by MOEJ (FY2013-2016)



Source：JCM Home Page

2-1 FY2016 Feasibility Studies for City to City Collaboration Project by MOEJ

Country	Area/City	Project Name	Project Description
Thailand	Rayong	Project to realize low carbonization model projects in Ecological Industrial Town in Rayong Prefecture and expand JCM (Kitakyushu-Rayong Cooperation Project)	Under the cooperation between DIW, IRPC & IEAT and City of Kitakyushu, Japan, this project aims to realize saving energy, introduction of renewable energy and introduction of electricity generation system with high total energy efficiency to reduce GHG emissions highly.
Vietnam	Hai Phong City	Project to accelerate low carbonization in Hai Phong City (Energy Field) (Kitakyushu-Hai Phong Cooperation Project)	In order to accelerate the implementation of Hai Phong's Low Carbonization Projects under the framework of the cooperative agreement between the City of Kitakyushu, Japan, and City of Hai Phong, Viet Nam, this projects aims to conduct low-carbonization of factories mainly in the field of energy and establishment of new funding mechanism to introduce low-carbon vehicle in an isolated island.
Malaysia	Iskandar Development Area	Project to accelerate low carbonization model projects in Iskandar Development Area for Expansion of JCM (Kitakyushu-IRDA Cooperation Project)	Under the cooperation between IRDA and City of Kitakyushu, Japan, this project aims to conduct low-carbonization activity in factories to acquire an understanding of the merit of JCM and realize a high GHG emissions reduction in accordance with “Low Carbon Society Blueprint” which IRDA is now implementing.
Cambodia	Phnom Penh Capital City	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 between Phnom Penh Capital City and Kitakyushu City, this project aims to realize saving energy such as introduction of energy efficient chiller, introduction of renewable energy such as solar power to reduce GHG emissions highly.

2-2 Activity 1 : Introduction of promotion of shift to low-carbon society through energy-saving measures, etc. targeting large hospitals (Under Survey)

NTT DATA

Project overview (assumed)

Assumed project (Khmer Soviet Friendship Hospital)

- With the Khmer-Soviet Friendship Hospital, which would be counted among facilities with large energy consumptions, as the assumed target, the feasibility of a JCM subsidized project is being investigated.
- Installation of solar panels on the hospital roof space (approx. 1,800m^2) is assumed.

Expected effects (assumed)

Based on rough estimation, the following effects are expected:

- Yearly Power Generation: approximately 250,000 kWh/year
- Yearly Electricity Cost Reduction: approximately 47,500 USD
- Yearly CO_2 Emission Reduction: approximately 160 tCO_2/year

*Note that these figure are based on rough estimation. Detail design with PV panel manufacturer and EPC company are needed for actual project.

Funding procurement methods (assumed)

- Based on rough estimation, initial cost is approximately 300,000 USD.
- It is assumed that around 30 ~ 40% of the initial cost is subsidized by JCM equipment subsidy project.
- As results of hearing with hospital, financing by themselves may be difficult.
- As one of the solution of initial cost, we started discussion with local bank using ESCO or lease scheme.
- After power generation is started, monthly lease fee which is commensurate with cost reduction by power generation will be paid by hospital to the bank

2-3 Activity 2 : Introduction of solar large power generation and high efficiency chiller for large shopping mall (Actual Project in FY2016)

NTT DATA

Project Outline

~ AEON mall Cambodia No.2 ~

- Introduction of solar power generation and high efficiency chiller for AEON mall No.2 PPC(Tentative name, It will open in the summer of 2018) which AEON Cambodia is planning to construct.
- Reduction of CO_2 emissions which is produced from the combustion of the fossil fuel when the grid electricity is generated by introducing renewable energy (solar power generation) and energy saving device (high efficiency chiller).

Expected Effects

Solar Power： CO2 Reduction：948.7[tCO2/year] High Efficiency Chiller： CO2 Reduction ：615.6 [tCO2/year]

Ratio of Subsidy by JCM

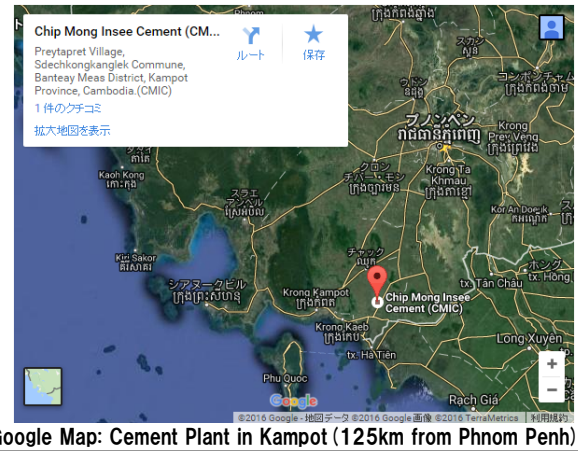
Application of JCM scheme：Solar Power System ;Subsidy rate 40% High Efficiency Chiller System; Subsidy rate 50%

2-4 Activity 3 : Introduction of waste heat recovery power generation system for cement plant (Under Survey)

Assumed project (CHIP MONG INSEE CEMENT CORPORATION)

Project overview (assumed)

- 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 equipment subsidy project.

3-1 JCM project - 4 things must be considered

◆ To apply JCM scheme to get subsidy, 4 things below must be determined.

(1) Implementation system of business

- The determination of the members of the international consortium.
- Especially, the selection of the liability only large representative operators.
- Consideration of the benefit exclusion.

(2) Establishment of MRV technique

- Study of quantification method of CO2 emission reductions
- the cost-effectiveness of CO2 emissions are becoming increasingly important

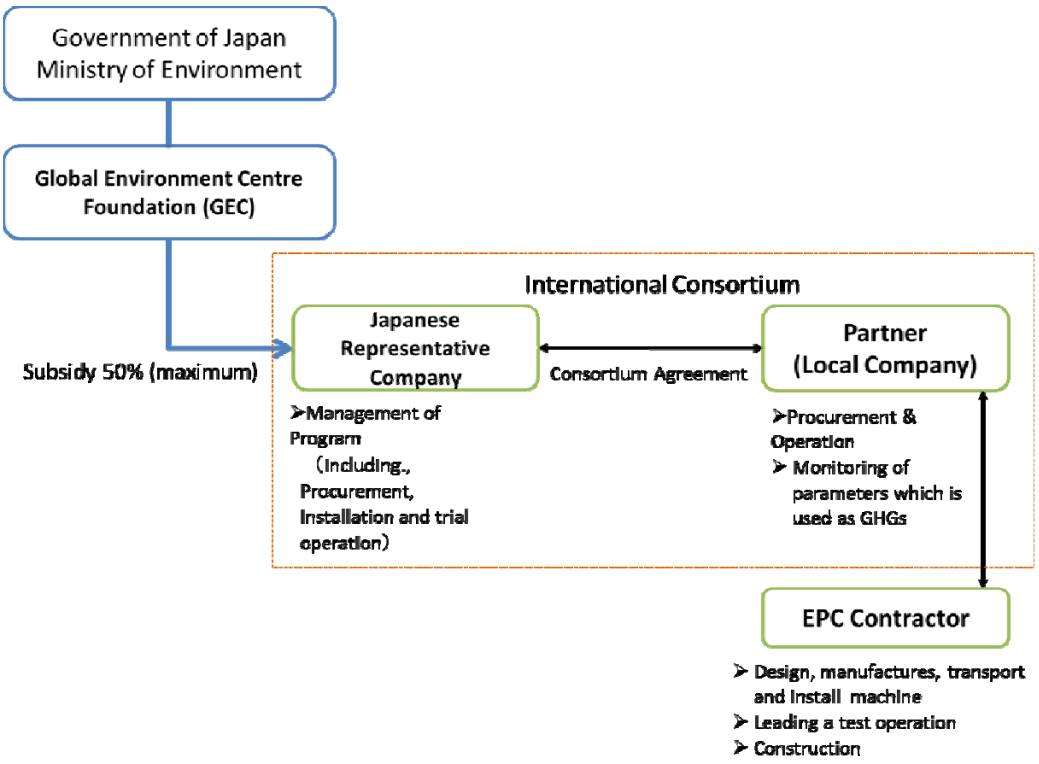
(3) Details of equipment to be introduced in subsidy

- Determination of the specifications and price of at the expected target equipment
- Evaluation of the validity of the specifications and price of the target equipment that is assumed
- Competitiveness of assumed to have the target equipment

(4) Evaluation of business potential

- Evaluation of IRR
- Validity of subsidy necessary

3-2 JCM Subsidy Project International Consortium Structure



3-3 JCM Subsidy Detail of Cost-effectiveness and Payback Period

Points of Attention Regarding Application for JCM Subsidy

- **Subsidy rate changes depending on the contents of the project and country.**

Adoption number of similar technology in the country to implement the project	0 (first case)	From 1 to 3	Over 4
Subsidy late	Maximum 50 %	Maximum 40%	Maximum 30%

- **There are 2 Check points to get subsidy**

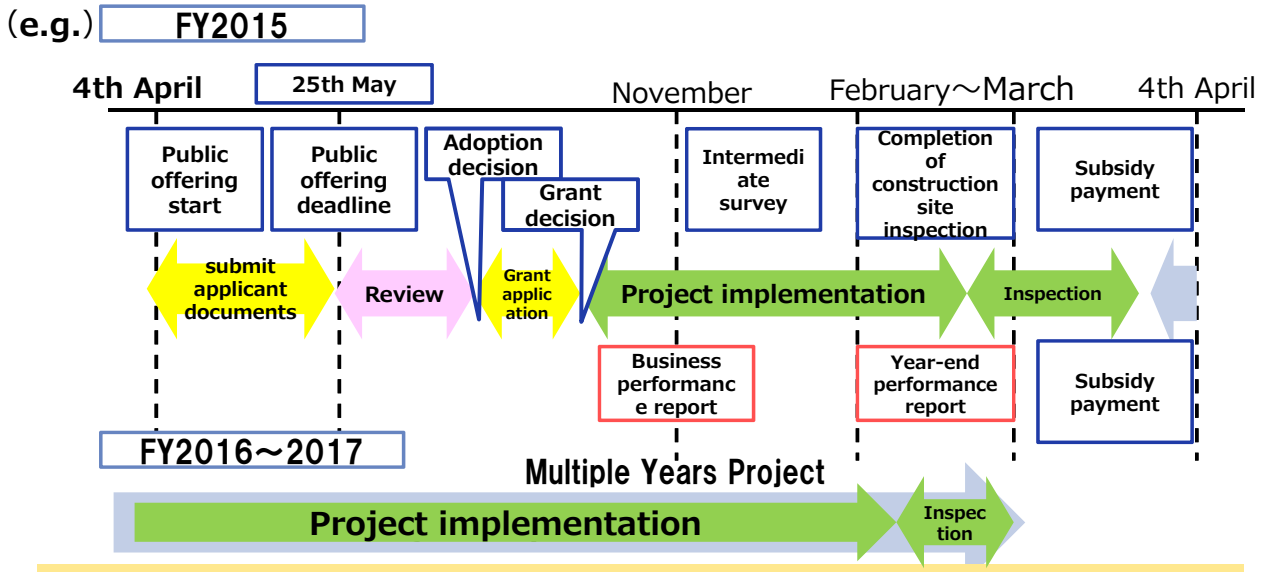
1. Cost-effectiveness for subsidy vs amount of reduced CO2

【New Criteria from FY2017】
Regardless of the amount of subsidy,
Cost effectiveness should be less than **4000JPY/t-CO2 (approx. 35USD/t-CO2)**

2. Payback period

➢ **Payback period should be longer than three years.**

3-4 JCM Subsidy Project
Schedule of Application to Project Implementation



- 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

Public offering start approx. Beginning of April and finished Mid-of May for FY2017.

4-1 JCM Subsidy Project
Adopted Practice (practice in Factory ①)

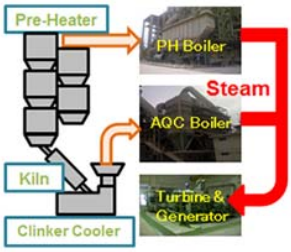
MODEL Power Generation by Waste-heat Recovery in Cement Industry

Project Owner: (Japan): JFE Engineering Corporation, (Indonesia) PT Semen Indonesia (Persero) Tbk

Outline of GHG Mitigation Activity

The proposed project is planned to introduce a waste heat recovery (WHR) boiler steam turbine generator system at an existing cement production plant (PT Semen Indonesia, Tuban Plant) located in Tuban, East Java, Indonesia. The WHR system utilizes waste heat currently emitted from the cement factory without utilization. WHR boilers generate steam using the waste heat exhausted from the cement plant, and the steam is fed to the steam turbine generator to generate electricity.


セメンインドネシア社トゥバン工場



Source:JCM Home Page

4-2 JCM Subsidy Project Adopted Practice (practice in Factory ②)

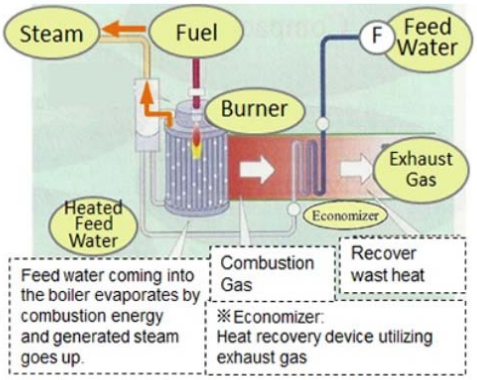
NTT DATA

MODEL Introduction of High-efficiency Once-through Boiler System in Film Factory

PP(Japan): Mitsubishi Plastics Inc. / PP(Indonesia): PT. MC Pet Film Indonesia

Outline of GHG Mitigation Activity

The factory has been using a water tube boiler (oil type) for plastic film production. In this project, a high efficiency one-through boiler (gas type) is introduced for energy saving.
This one-through boiler with PI control better manages the combustion and feed waster supply, which contribute to increased boiler efficiency and stable steam supply. For instance, it can achieve maximum boiler efficiency of 98% (95-97% under practical condition), whereas the efficiency of conventional fire tube boiler and water tube boiler is around 88%. Also, built-in inverters can reduce electricity consumptions.



Expected GHG Emission Reductions

363 tCO_2/ year

- Emission reductions is calculated by estimating the boiler efficiency of 88% for conventional boilers and 96% for project boilers

Source:JCM Home Page

4-3 JCM Subsidy Project Adopted Practice (practice in Factory ③)

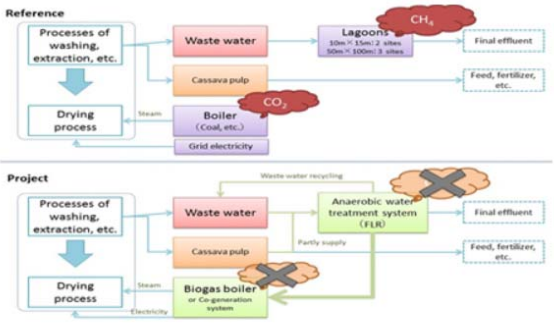
NTT DATA

FS Biogas recovery and utilization in tapioca starch factory

FS Entity : Pacific Consultants. Co.,Ltd.

Outline of GHG Mitigation Activity

The project aims to reduce GHG emissions by introducing a biogas boiler and an anaerobic water treatment system. Biogas collected from which is used to replace the whole amount of coal consumption in the tapioca starch factory. By avoiding CO2 emissions from coal combustion and CH4 emissions from open lagoons, GHG emission reductions of 22,824tCO2e/year will be achieved.



Expected GHG Reductions

22,824 tCO_2/year

- Reference emissions : 22,824 tCO_2/year
  Substitution of Coal usage: 3,087 tCO_2/year
  Methane emission avoidance: 19,737 tCO_2/year
- Project emissions : 0 tCO_2/year
- Emission reductions : 22,824 tCO_2/year

Sites of JCM Study

Source:JCM Home Page

4-4 JCM Subsidy Project adopted practice (practice in commercial facility ②)

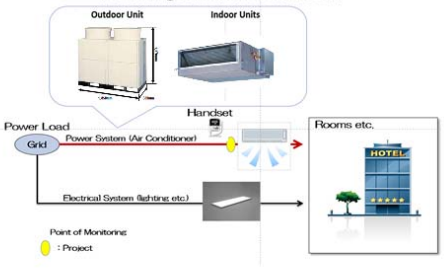
MODEL Introduction of High Efficiency Air-conditioning in Hotel

PP(Japan): NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.
PP(Vietnam): Peace Real Estate Investment Company Limited

Outline of GHG Mitigation Activity

While non-inverter air conditioner with poor energy efficiency is popular in hotels in Vietnam, this project is intended to achieve the energy saving as a whole with the introduction of high efficiency air-conditioning system, which is introduced to the new Novotel Suites in Hanoi (total floor area of about 29,000㎡, 17 floors above ground, two floors underground, 200 rooms), and achieves GHG emission reductions from reducing power consumption with introduction of high efficiency air-conditioning.
(Equipment performance : COP 4.53, 73.0kW x 1set, COP4.09, 90kW x 12set, COP4.05, 95.0kW x 2set, COP3.29, 109kW x 1set, COP3.27. 125kW x 1set)

<Introducing of Inverter Air Conditioner>



Expected GHG Emission Reductions

826 tCO_2/ year

Calculated based on the electricity consumptions of non-inverter air conditioner and project air-conditioner as well as grid emission factor in Vietnam (3,412tCO_2/year - 2,586tCO_2/year = 826tCO_2/year).

Sites of JCM Model Project

Novotel Suites

Source:JCM Home Page

4-5 JCM Subsidy Project adopted practice (practice in commercial facility ②)

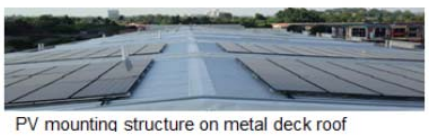
MODEL PV power generation system for the office building

PP from Japan : NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc / PP from host Country: KEN TTDI SDN BHD

Outline of GHG Mitigation Activity

The PV panels installed on the top of building roof in Kuala Lumpur, Malaysia will generate electricity power and contribute to CO2 reduction.
The solar cell is made of a thin monocrystalline silicon wafer surrounded by ultra-thin amorphous silicon layers. This product offers the industry's leading performance and value; 19.4% conversion ratio. The electricity amount generated on solar panel will be monitored and managed in the data management server.

an example of Installation work of PV



PV mounting structure on metal deck roof

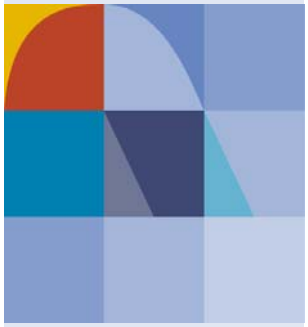
Expected GHG Emission Reductions

179 tCO_2/year

- (RE_p – PE_p) = (The generated electricity of solar power × Emission factor(EF)) - 0 RE_p : Reference CO_2 emissions period $_p$ ($tCO_2/_p$) PE_p : Project CO_2 emissions period $_p$ ($tCO_2/_p$) EF : CO emission factor for Malaysia region = 0.000741(tCO_2/kWh)

Sites of JCM Model Project

Source:JCM Home Page



NTT DATA

Global IT Innovator

Dear Sunrise Japan Hospital Dear
ACLEDA Bank

Study of Sunrise Japan Hospital and ESCO / Lease Business using JCM (Joint Crediting Mechanism) Scheme

17-Jan-2017
NTT Data Institute of Management Consulting, Inc.
Secio & Eco Strategic Consulting Unit

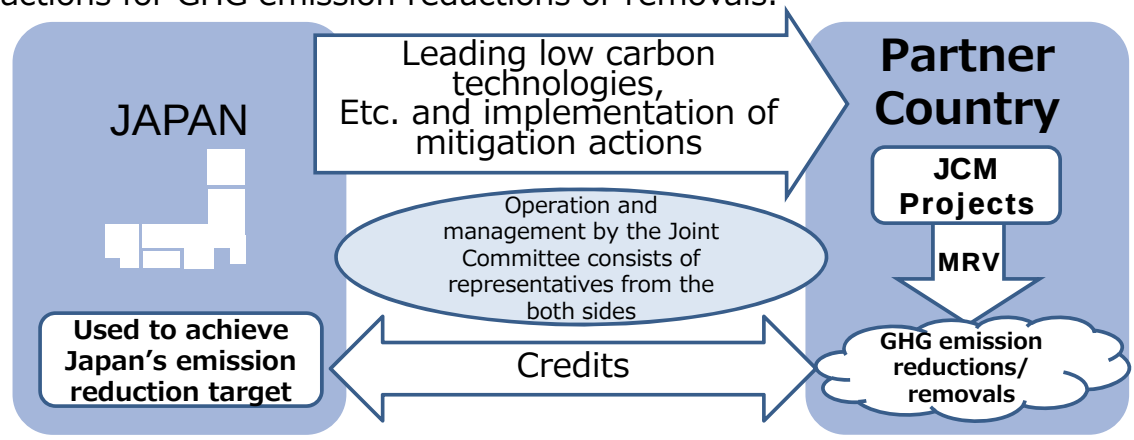
1 Explanation for JCM(Joint Crediting Mechanism)

1-1 What is JCM(Joint Crediting Mechanism) ?

NTT DATA

Purpose

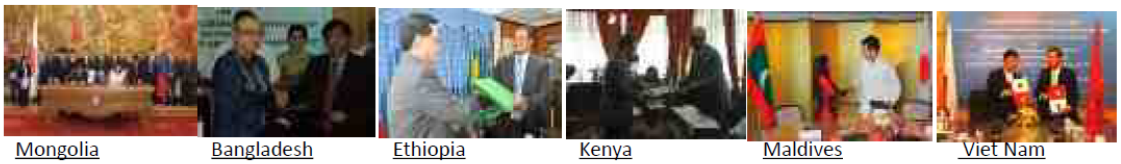
- Facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries.
- Appropriately evaluating contributions from Japan to GHG emission reductions 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.



1-2 JCM Partner Countries

NTT DATA

- Japan has held consultations for the JCM with developing countries since 2011 and has established the JCM with Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Viet Nam, Lao PDR, Indonesia, Costa Rica, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar and Thailand.



Mongolia
Jan. 8, 2013
（Ulaanbaatar）

Bangladesh
Mar. 19, 2013
(Dhaka)

Ethiopia
May 27, 2013
(Addis Ababa)

Kenya
Jun. 12,2013
(Nairobi)

Maldives
Jun. 29, 2013
(Okinawa)

Viet Nam
Jul. 2, 2013
(Hanoi)

Lao PDR
Aug. 7, 2013
(Vientiane)

Indonesia
Aug. 26, 2013
(Jakarta)

Costa Rica
Dec. 9, 2013
(Tokyo)

Palau
Jan. 13, 2014
(Ngerulmud)

Cambodia
Apr. 11, 2014
(Phnom Penh)

Mexico
Jul. 25, 2014
(Mexico City)

Saudi Arabia
May 13, 2015

Chile
May 26, 2015
(Santiago)

Myanmar
Sep. 16, 2015
(Nay Pyi Taw)

Thailand
Nov. 19, 2015
(Tokyo)

PHILIPPINE is newly add as Partner Country on 12-Jan-2017

1-3 JCM Subsidy Project

The draft budget for project starting from FY 2017 is 6.0 billion JPY (approx. USD 52 million) in total by FY2019

※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

International consortiums (which include Japanese entities)

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

- Scope of the financing: facilities, equipment, vehicles, etc. which reduce CO2 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.

1-4 JCM Financing Program by MOEJ (FY2013-2016)

JCM Financing programme by MOEJ (FY2013～2016) as of January 12, 2017

Thailand (21 projects) :
- ○Energy Saving at Convenience Store
- ○Upgrading Air-saving Loom
- ○Co-Generation in Motorcycle Factory
- ○Air Conditioning System & Chiller
- ○Ion Exchange Membrane Electrolyzer
- ○LED Lighting to Sales Stores
- ○Co-generation System
- ○1.5MW Solar PV and EMS in Paint Factory
- ○Heat Recovery Heat Pump
- ○Boiler System in Rubber Belt Plant
- ○1.0MW Solar PV on Factory Rooftop
- ○Centrifugal Chiller & Compressor
- ○Centrifugal Chiller in Tire Factory
- ○Refrigeration System
- ○Chilled Water Supply System
- ○12MW Waste Heat Recovery in Cement Plant
- ○Refrigerator and Evaporator
- ○3.4MW Solar PV
- ○5MW Floating Solar PV
- ○27MW Solar PV
- ○Air-conditioning Control System

Bangladesh (6 projects) :
- ○Centrifugal Chiller
- ○320kW PV-diesel Hybrid System
- ○Centrifugal Chiller
- ○Loom at Weaving Factory
- ○50MW Solar PV Power Plant
- ○Air-conditioning system

Myanmar (5 projects) :
- ○700kW Waste to Energy Plant
- ○Brewing Systems to Beer Factory
- ○Once-through Boiler in Instant Noodle Factory
- ○1.8MW Rice Husk Power Generation
- ○Refrigeration System in Logistics Center

Saudi Arabia (1 project) :
- ○Electorolyzer in Chlorine Production Plant

Ethiopia (1 project) :
- ○Biomass CHP Plant

Kenya (2 projects) :
- ○6MW Hydropower Generation
- ○1MW Solar PV at Salt Factory

Maldives (2 projects) :
- ○190kW Solar Power on School Rooftop
- ■Smart Micro-Grid System

Malaysia (1 project) :
- ○140kW Solar PV

Mongolia (4 projects) :
- ○Heat Only Boiler (HOB)**
- ○10MW Solar PV
- ○2.1MW Solar PV in Farm
- ○8.3MW Solar PV in Farm

Viet Nam (13 projects) :
- ○Digital Tachographs*
- ○Air-conditioning in Hotel
- ○Container Formation Facility
- ○Amorphous transformers 2
- ○Electricity Kiln
- ○Energy saving Equipment in Lens Factory
- ○Energy Saving Equipment in Wire Production Factory
- ○Amorphous transformers*
- ○Air-conditioning in Lens Factory
- ○320kW Solar PV in Shopping Mall
- ○Air-conditioning Control System
- ○High Efficiency Water Pumps
- ○Amorphous transformers 3

Laos (1 project) :
- ●REDD+ through controlling slush-and-burn

Palau (3 projects) :
- ○370kW Solar PV for Commercial Facilities*
- ○150kW Solar PV for School*
- ○440kW Solar PV for Commercial Facilities Ⅱ*

Cambodia (5 projects) :
- ○LED Street Lighting
- ○200kW Solar PV at International School
- ○Solar PV & Centrifugal Chiller
- ○800kW Solar PV at International School
- ○Inverters for Distribution Pumps

Indonesia (24 projects) :
- ○Centrifugal Chiller at Textile Factory*
- ○Refrigerants to Cold Chain Industry**
- ○Centrifugal Chiller at Textile Factory 2*
- ○20kW Solar Power Hybrid System
- ○Centrifugal Chiller at Textile Factory 3*
- ○Upgrading to Air-saving Loom
- ○Smart LED Street Lighting System
- ○Gas Co-generation System
- ○1.6MW Solar PV in Jakabaring Sport City
- ○10MW Hydro Power Plant
- ○LED Lighting to Sales Stores
- ○Air-conditioning Utility System in Airport
- ○Energy Saving at Convenience Store*
- ○Double Bundle-type Heat Pump
- ○30MW Waste Heat Recovery in Cement Industry
- ○Regenerative Burners
- ○Old Corrugated Cartons Process
- ○Centrifugal Chiller in Shopping Mall
- ○Once-through Boiler System in Film Factory
- ○Once-through Boiler in Golf Ball Factory
- ●REDD+ through controlling slush-and-burn
- ○Looms in Weaving Mill
- ○Industrial Wastewater Treatment System
- ○0.5MW Solar PV

Mexico (2 projects) :
- ○4.8MW Power Generation with Methane Gas Recovery System
- ○Once-through Boiler and Fuel Switching

Costa Rica (2 projects) :
- ○5MW Solar PV
- ○Chiller and Exhaust Heat Recovery System

Chile (1 project) :
- ○1MW Rooftop Solar PV

○ Model Project in FY 2013 (7 projects in 3 countries)
○ Model Project in FY 2014 (13 projects in 6 countries)
■ ADB Project in FY 2014 (1 project in 1 country)
○ Model Project in FY 2015 (33 projects in 10 countries)
○ Model Project in FY 2016 (38 projects in 10 countries)
● REDD+ Model Project (2 projects in 2 countries)

Total 93 projects in 16 partner countries

Underlined projects have started operation (34 projects, including 7 partially started projects)
Projects with * have been registered as JCM projects (13 projects)

Source：JCM Home Page

2 Feasibility Study in Cambodia

2-1 FY2016 Feasibility Studies for City to City Collaboration Project by MOEJ

Country	Area/City	Project Name	Project Description
Thailand	Rayong	Project to realize low carbonization model projects in Ecological Industrial Town in Rayong Prefecture and expand JCM (Kitakyushu-Rayong Cooperation Project)	Under the cooperation between DIW, IRPC & IEAT and City of Kitakyushu, Japan, this project aims to realize saving energy, introduction of renewable energy and introduction of electricity generation system with high total energy efficiency to reduce GHG emissions highly.
Vietnam	Hai Phong City	Project to accelerate low carbonization in Hai Phong City (Energy Field) (Kitakyushu-Hai Phong Cooperation Project)	In order to accelerate the implementation of Hai Phong's Low Carbonization Projects under the framework of the cooperative agreement between the City of Kitakyushu, Japan, and City of Hai Phong, Viet Nam, this projects aims to conduct low-carbonization of factories mainly in the field of energy and establishment of new funding mechanism to introduce low-carbon vehicle in an isolated island.
Malaysia	Iskandar Development Area	Project to accelerate low carbonization model projects in Iskandar Development Area for Expansion of JCM (Kitakyushu-IRDA Cooperation Project)	Under the cooperation between IRDA and City of Kitakyushu, Japan, this project aims to conduct low-carbonization activity in factories to acquire an understanding of the merit of JCM and realize a high GHG emissions reduction in accordance with “Low Carbon Society Blueprint” which IRDA is now implementing.
Cambodia	Phnom Penh Capital City	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 between Phnom Penh Capital City and Kitakyushu City, this project aims to realize saving energy such as introduction of energy efficient chiller, introduction of renewable energy such as solar power to reduce GHG emissions highly.

2-2 Activity 1 : Introduction of promotion of shift to low-carbon society through energy-saving measures, etc. targeting large hospitals (Under Survey)

Project overview (assumed)

Assumed project (Sunrise Japan Hospital)

- Joint venture hospital by JGC, Innovation Network Corporation of Japan (INCJ), Kitahara Hospital Group.
- The hospital is one of the Growth strategy of the Japanese government's "hospital export." It was opened on 20th September 2016.
- Installation of solar panels on the hospital roof space and parking space are assumed.

Expected effects (assumed)

Based on rough estimation, the following effects are expected:

- Scale of PV panels: approximately 80kW
- Yearly Power Generation: approximately 110,000 kWh/year
- Yearly Electricity Cost Reduction: approximately 20,000 USD
- Yearly CO_2 Emission Reduction: approximately 70 tCO_2/year

*Note that these figure are based on rough estimation. Detail design with PV panel manufacturer and EPC company are needed for actual project.

Funding procurement methods (assumed)

- Based on rough estimation, initial cost is approximately 200,000 USD.
- It is assumed that around 30% of the initial cost is subsidized by JCM equipment subsidy project.
- Financing by themselves at this stage is difficult, since they are opened recently.
- As one of the solution of initial cost, we started discussion with local bank using ESCO or lease scheme.
- After power generation is started, monthly lease fee which is commensurate with cost reduction by power generation will be paid by hospital to the bank

2-3 Activity 1 : Introduction of promotion of shift to low-carbon society through energy-saving measures, etc. targeting large hospitals (Under Survey)

Project overview (assumed)

Assumed project (Khmer Soviet Friendship Hospital)

- With the Khmer-Soviet Friendship Hospital, which would be counted among facilities with large energy consumptions, as the assumed target, the feasibility of a JCM subsidized project is being investigated.
- Installation of solar panels on the hospital roof space (approx. 1,800m^2) is assumed.

Expected effects (assumed)

Based on rough estimation, the following effects are expected:

- Yearly Power Generation: approximately 250,000 kWh/year
- Yearly Electricity Cost Reduction: approximately 47,500 USD
- Yearly CO_2 Emission Reduction: approximately 160 tCO_2/year

*Note that these figure are based on rough estimation. Detail design with PV panel manufacturer and EPC company are needed for actual project.

Funding procurement methods (assumed)

- Based on rough estimation, initial cost is approximately 300,000 USD.
- It is assumed that around 30% of the initial cost is subsidized by JCM equipment subsidy project.
- As results of hearing with hospital, financing by themselves may be difficult.
- As one of the solution of initial cost, we started discussion with local bank using ESCO or lease scheme.
- After power generation is started, monthly lease fee which is commensurate with cost reduction by power generation will be paid by hospital to the bank

2-4 Activity 2 : Introduction of solar large power generation and high efficiency chiller for large shopping mall (Actual Project in FY2016)

Project Outline ~ AEON mall Cambodia No.2 ~

- Introduction of solar power generation and high efficiency chiller for AEON mall No.2 PPC(Tentative name, It will open in the summer of 2018) which AEON Cambodia is planning to construct.
- Reduction of CO_2 emissions which is produced from the combustion of the fossil fuel when the grid electricity is generated by introducing renewable energy (solar power generation) and energy saving device (high efficiency chiller).

Expected Effects

Solar Power： CO2 Reduction：948.7[tCO2/year] High Efficiency Chiller： CO2 Reduction ：615.6 [tCO2/year]

Ratio of Subsidy by JCM

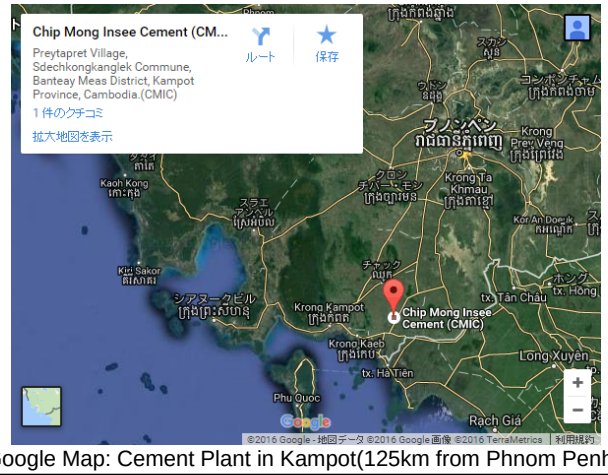
initial cost: Solar Power System: approximately 2,500,000 USD / Chiller System: approximately 2,000,000 USD
Application of JCM scheme：Solar Power System ;Subsidy rate 40% / Chiller System; Subsidy rate 50%

2-5 Activity 3 : Introduction of waste heat recovery power generation system for cement plant (Under Survey)

Assumed project (CHIP MONG INSEE CEMENT CORPORATION)

Project overview (assumed)

- 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)

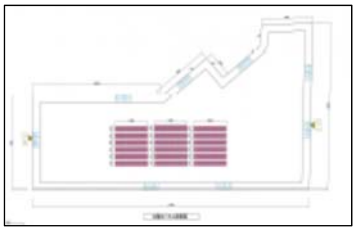
- Initial cost of equipment would be financed by the cement company.
- It is assumed that 50% of the initial cost, as maximum, is subsidized by JCM equipment subsidy project.

2-6 Activity 3 : Introduction of waste heat recovery power generation system for cement plant (Under Survey)

Assumed project (CHIP MONG INSEE CEMENT CORPORATION)

Project overview (assumed)

- Company profile are shown in previous slide.
- Installation of solar panels on roof of a few buildings are assumed.
- We are also studying less-weight panels on rounded-shape roof and floating-type panels on pond.



Expected effects (assumed)

Based on rough estimation, the following effects are expected:

- Scale of PV panels: approximately 5.5MW
- Yearly Power Generation: approximately 7,500,000 kWh/year
- Yearly Electricity Cost Reduction: approximately 1,400,000 USD
- Yearly CO_2 Emission Reduction: approximately 4,800 tCO_2/year

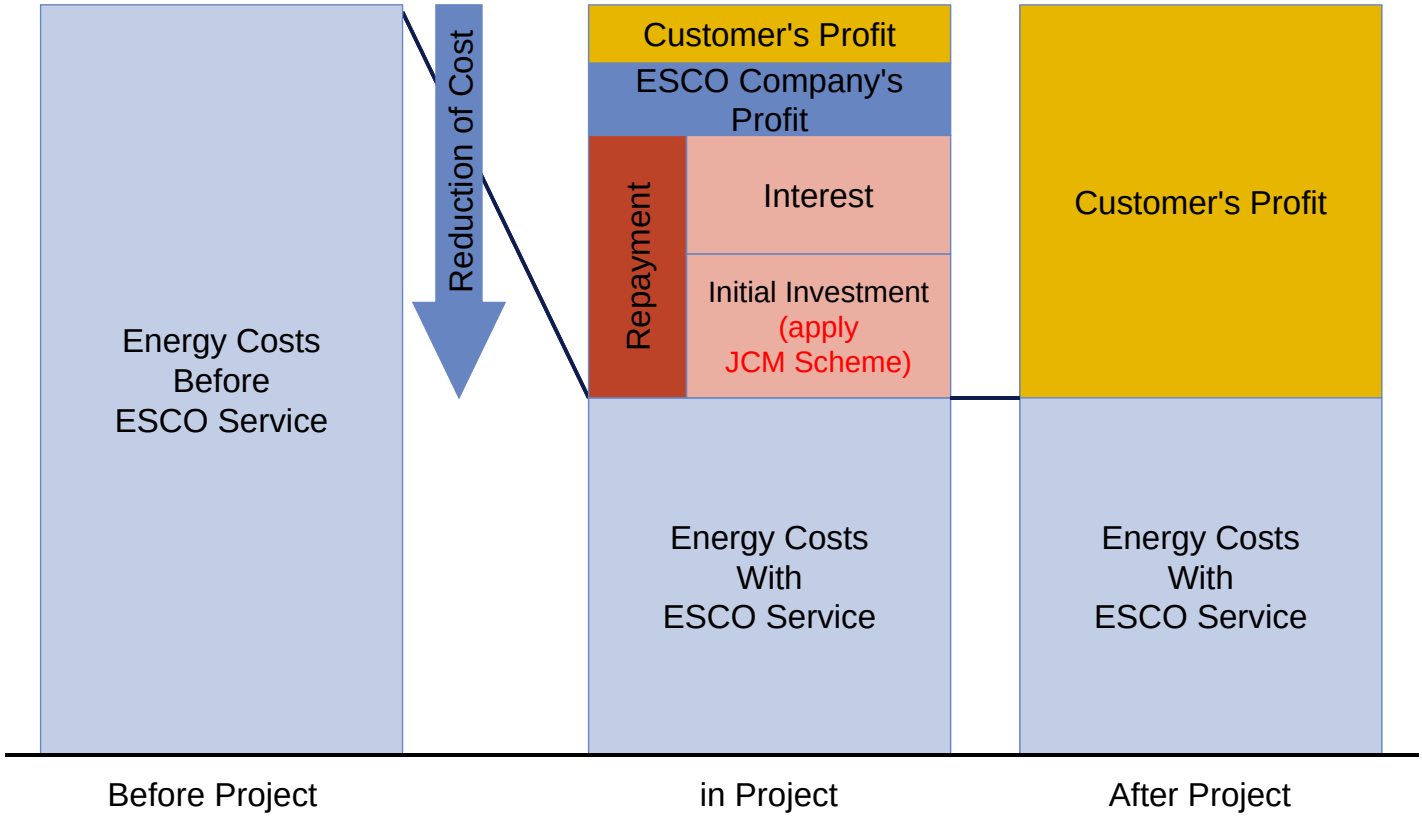
*Note that these figure are based on rough estimation. Detail design with PV panel manufacturer and EPC company are needed for actual project.

Funding procurement methods (assumed)

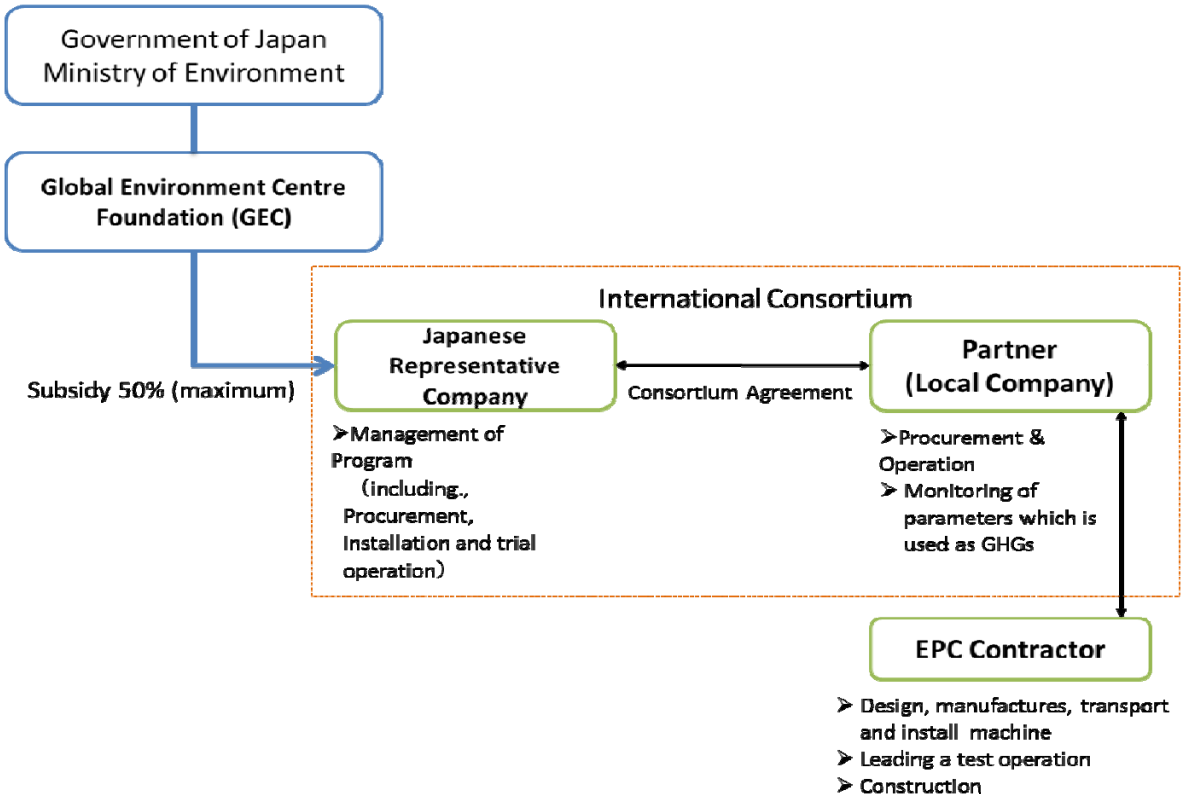
- Based on rough estimation, initial cost is approximately 14,000,000 USD.
- It is assumed that 30% of the initial cost, as maximum, is subsidized by JCM equipment subsidy project.
- As alternative option, ESCO or lease scheme are also considered.

3 ESCO (Energy Service Company) Scheme

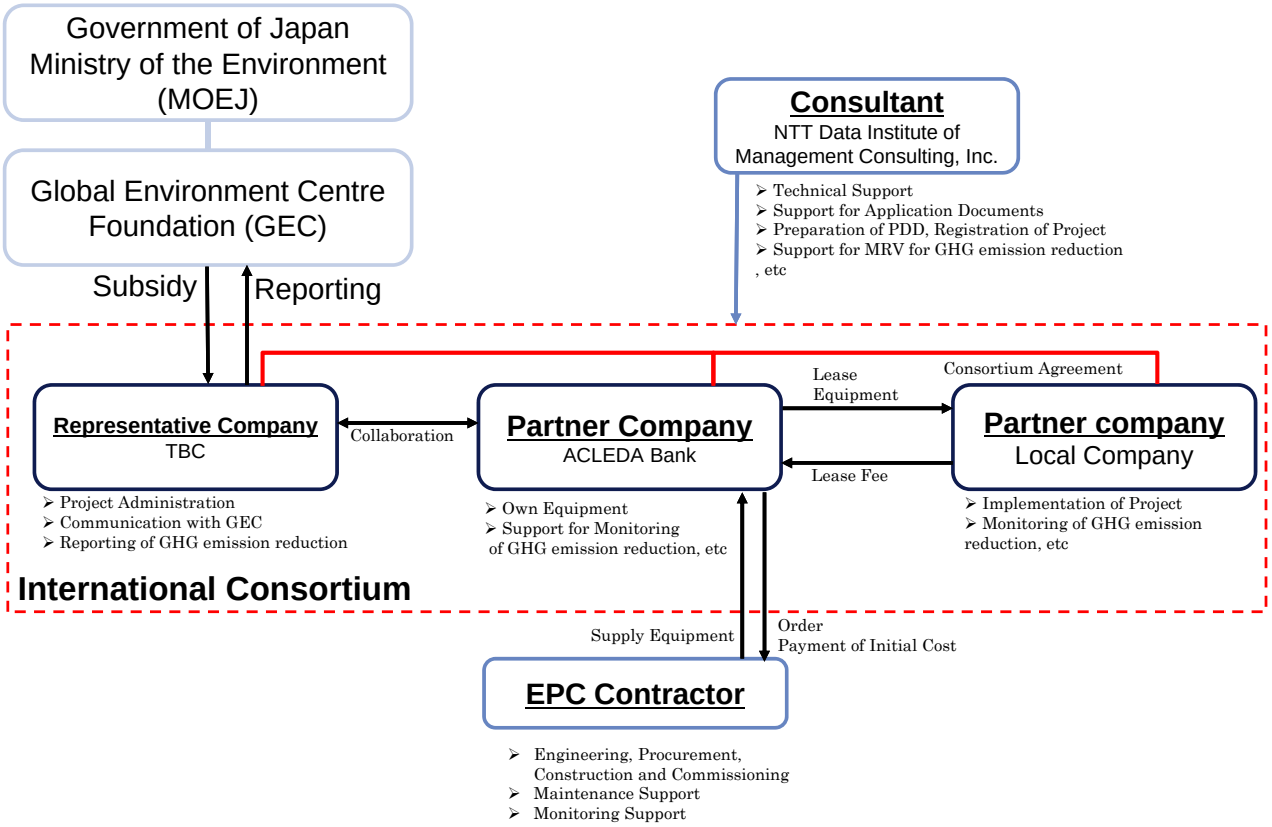
3-1 ESCO (Energy Service Company)



3-2 General Organization



3-3 Image of Organization (Tentative)



4 Feasibility Study for Sunrise Japan Hospital

4-1 Summary of Estimation

Project overview (assumed)

Assumed project (Sunrise Japan Hospital)

- Joint venture hospital by JGC, Innovation Network Corporation of Japan (INCJ), Kitahara Hospital Group.
- The hospital is one of the Growth strategy of the Japanese government's "hospital export." It was opened on 20th September 2016.
- Installation of solar panels on the hospital roof space and parking space are assumed.

Expected effects (assumed)

Based on rough estimation, the following effects are expected:

- Scale of PV panels: approximately 80kW
- Yearly Power Generation: approximately 110,000 kWh/year
- Yearly Electricity Cost Reduction: approximately 20,000 USD
- Yearly CO_2 Emission Reduction: approximately 70 tCO_2/year

*Note that these figure are based on rough estimation. Detail design with PV panel manufacturer and EPC company are needed for actual project.

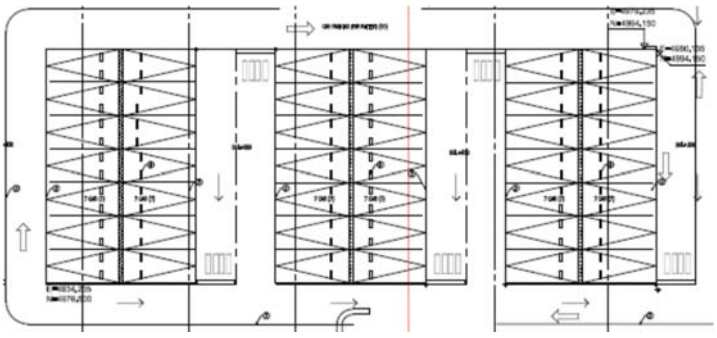
Funding procurement methods (assumed)

- Based on rough estimation, initial cost is approximately 200,000 USD.
- It is assumed that around 30% of the initial cost is subsidized by JCM equipment subsidy project.
- Financing by themselves at this stage is difficult, since they are opened recently.
- As one of the solution of initial cost, we started discussion with local bank using ESCO or lease scheme.
- After power generation is started, monthly lease fee which is commensurate with cost reduction by power generation will be paid by hospital to the bank

4-2 Available Roof Space and Parking Area of Sunrise Japan Hospital

- Roof Space:

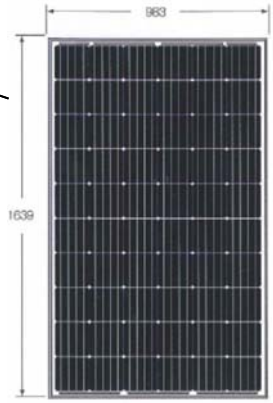
- Parking Area:



4-3 Light Weight PV Module and Frame

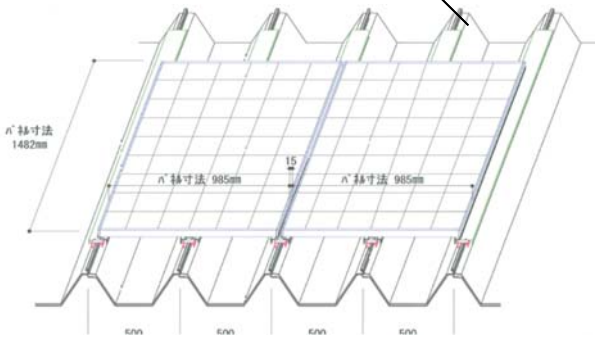
[Light Weight PV Module: NER660M275A(4)-LS]

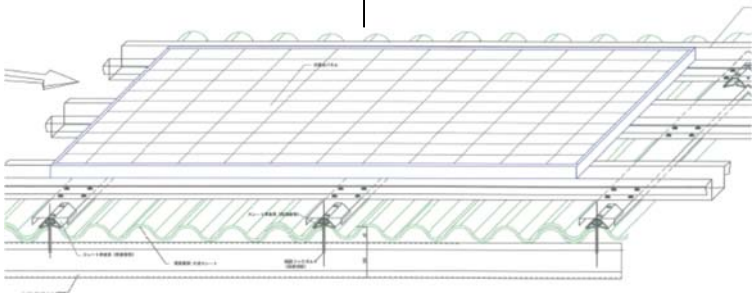
- Manufactured by Next Energy
- Almost half weight: 10.5kg per panel
- Size: W983 x H1639 x D35 (mm)
- Pmax: 275W Module Efficiency: 16.9%



[Light Weight Frame]: Patented Technology

- Light Type: 8 kg per $1m^2$
- (Conventional type: 20kg perm^2)
- Either for “Folded Plate Roof” or for “Corrugated Slate Roof”

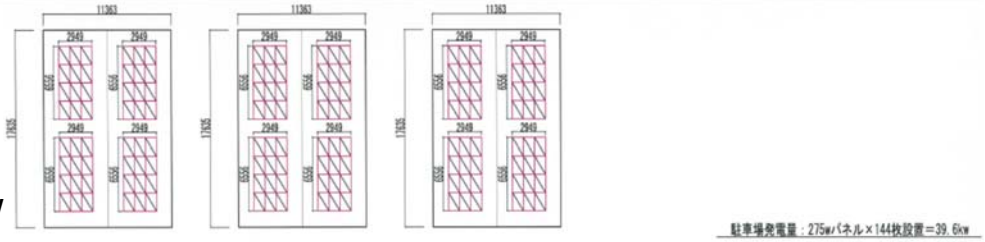




4-4 Estimation of PV Panel Scale

Total: 81.4kW

(275W x 296pcs)

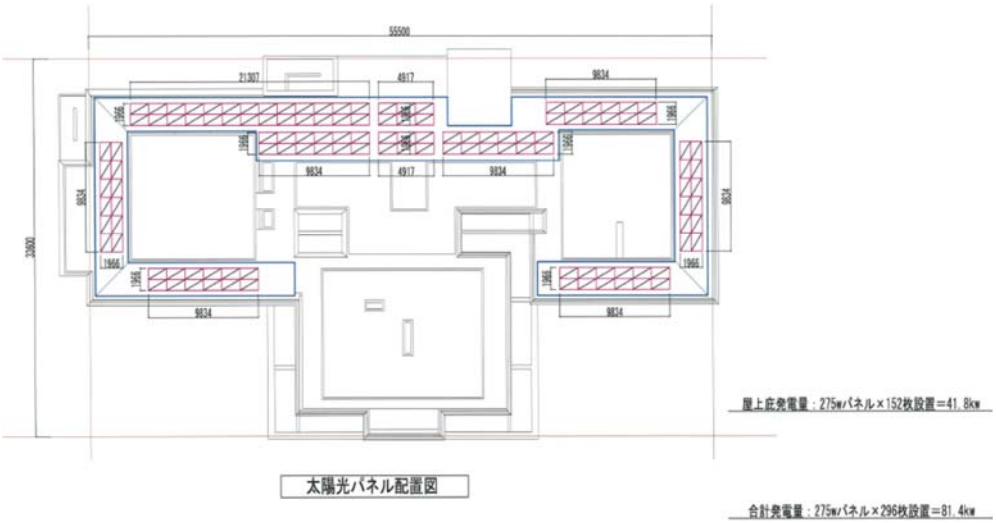


- Parking Area: 39.6kW

(275W x 144pcs)

- Roof Space: 41.8kW

(275W x 152pcs)



4-5 Estimation of Power Generation per Year

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- Approx.110,000 kWh/Year (Refer to calculation sheet)

	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月
各月の1日平均日射量(実施サイトにおける値:kWh/㎡・日)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
各月の1日平均有効日射量(方位角、設置角における補正値:kWh/㎡・日)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
温度補正係数(損失が無い場合=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
影による損失係数(無い場合は、1.0)	1	1	1	1	1	1	1	1	1	1	1	1
パワコンディショナー変換効率(定格負荷時電力効率)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
その他損失(無い場合:1.0)(モジュール汚れ、送電ロス、経年劣化など)(経年劣化は使用期間の中間年での数値とする)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
1日推定発電電力量(kWh/日)	298.58788	297.23332	322.38567	290.48176	330.75208	327.17622	332.7972	325.3604	284.334	265.30816	254.94001	276.6493
工場等の稼働日における平均1日消費電力量(kWh/日)	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
工場等の稼働日における平均余剰電力量(kWh/日)	0	0	0	0	0	0	0	0	0	0	0	0
非稼働日で発電量がほぼ全量余剰電力となる日数												
実有効日数	31	28	31	30	31	30	31	31	30	31	30	31
月間推定余剰電力量(kWh/月)	0	0	0	0	0	0	0	0	0	0	0	0
月間推定有効発電電力量(kWh/月)	9256.2244	8322.533	9993.9558	8714.4528	10253.315	9815.2865	10316.713	10086.172	8530.02	8224.553	7648.2003	8576.1282
年間推定有効総発電量	109737.55	kWh/年										

4-6 Rough Estimation of Initial Cost and Cost Reduction

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[Initial Cost]

- **Initial Cost is approximately 200,000 [USD]**
  - **81.4 [kW] x 2,500 [USD/kW](assumption of cost per capacity)**

部材		工事	
名称	価格／kW	名称	価格／kW
パネル	¥99,000	架台取付(パネル共)	¥68,000
パワーコンディショナ	¥13,000	電気工事	¥45,000
キュービクル	¥16,000	電気付帯	¥13,000
接続箱	¥4,000	監視装置取付	¥1,500
集電箱	¥4,000	安全対策	¥8,000
ケーブル	¥1,500	諸経費	¥6,200
監視装置	¥4,000		
合計	¥141,500	合計	¥141,700

部材＋工事	¥283,200 ／kW

[Cost Reduction by Power Generation]

- **Cost Reduction by Power Generation is approximately 20,900 [USD/year].**
  - **110,000 [kWh/Year] x 0.19 [USD/kWh] (electricity price)**

4-7 Criteria for Cost-Effectiveness and Payback Period

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Points of Attention Regarding Application for JCM Subsidy

- **Subsidy rate changes depending on the contents of the project and country.**

Adoption number of similar technology in the country to implement the project	0 (first case)	From 1 to 3	Over 4
Subsidy late	Maximum 50 %	Maximum 40%	Maximum 30%

- **There are 2 Check points to get subsidy**

1. Cost-effectiveness for subsidy vs amount of reduced CO2

【New Criteria from FY2017】
Regardless of the amount of subsidy,
Cost effectiveness should be less than
4000JPY/t-CO2 (approx. 35USD/t-CO2)

2. Payback period

- **Payback period should be longer than three years.**

4-8 JCM Subsidy Project Schedule of Application to Project Implementation

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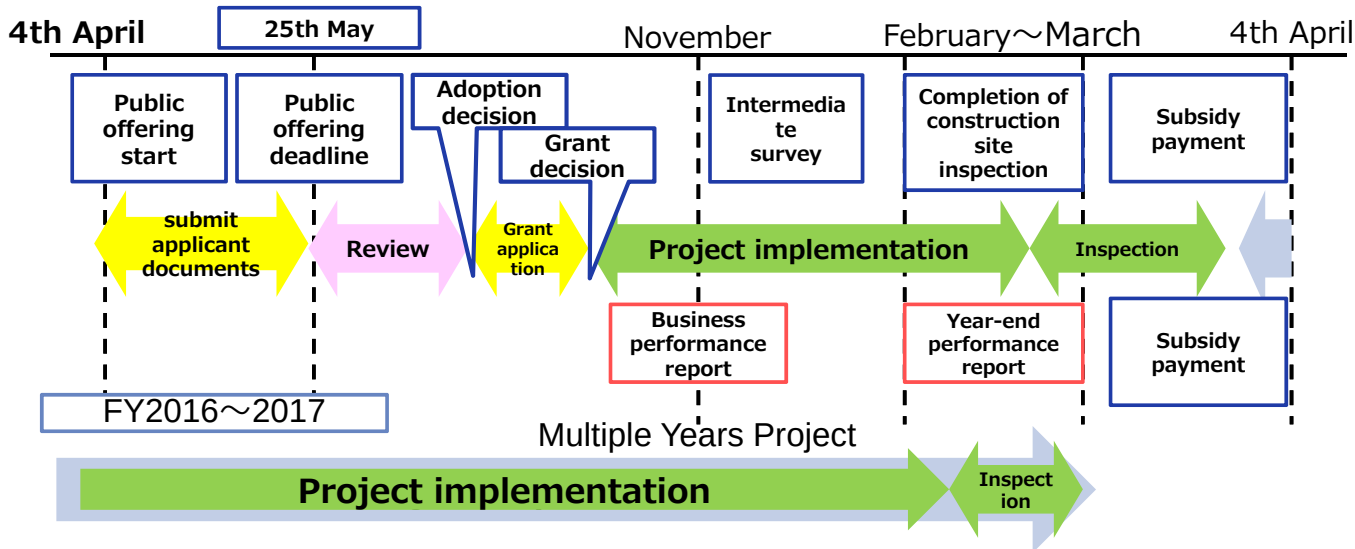
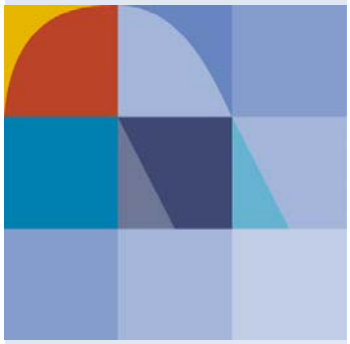
(e.g.) FY2015



- **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**

Public offering is started Beginning of April and finished Mid-of May for FY2017.



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Global IT Innovator

Dear Chip Mong Insee Cement

Feasibility Study for PV Panel Installation for Chip Mong Insee Cement

16-Feb-2017
NTT Data Institute of Management Consulting, Inc.
Secio & Eco Strategic Consulting Unit

NTT DATA

1. Summary

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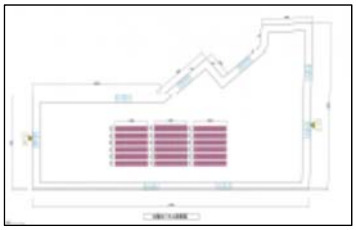
Assumed project (CHIP MONG INSEE CEMENT CORPORATION)

Project overview (assumed)

- Installation of solar panels on roof of a few buildings are assumed.
- We are also studying light-weight panels on arch-shape roof and floating-type panels on pond.



Expected effects (assumed)

Based on rough estimation, the following effects are expected:
- Scale of PV panels: approximately 5.5MW
- Yearly Power Generation: approximately 7,500,000 kWh/year
- Yearly Electricity Cost Reduction: approximately 937,500 USD
- Yearly CO_2 Emission Reduction: approximately 4,800 tCO_2/year

*Note that these figures are based on estimation. Detail design with PV panel manufacturer and EPC company are needed for actual project.

Funding procurement methods (assumed)

- Based on rough estimation, initial cost is approximately 14,000,000 USD.
- It is assumed that 19% of the initial cost is subsidized by JCM equipment subsidy project, based on JCM Criteria of cost effectiveness.
- As alternative option, ESCO or lease scheme are also considered.

2. Estimated PV Panel Capacity for each Building

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➢ Estimated PV panel capacity for each building are as follows:

No.	Building	kW	Remark
No.1	Clay storage hall	580.80	Based on half of sunlight gaps are covered by PV. If all sunlight gaps are covered: 792.0 kW If all sunlight gaps are NOT covered: 378.4 kW
No.2	Coal storage hall	1,062.60	Based on half of sunlight gaps are covered by PV. If all sunlight gaps are covered: 1593.9 kW If all sunlight gaps are NOT covered: 581.9 kW
No.3	Premixed mat. storage hall	2,020.70	Based on half of sunlight gaps are covered by PV. If all sunlight gaps are covered: 3049.2 kW If all sunlight gaps are NOT covered: 1149.5 kW
No.4	Gypsum storage hall	184.80	
No.5	Part And Refractory Brick Warehouse	223.85	
No.6	Maintenance workshop building	220.00	
No.7	Central Control Room (CCR)	-	not offered since the capacity is small: 31.9 kW
No.8	Canteen	-	not offered since the capacity is small: 72.6 kW
No.9	Administrative Building	-	not offered since the capacity is small: 57.2 kW
No.10	Cement Silo	-	not recommended due to limited area and high level.
No.11	Baggaged Cement Palletizing	798.60	
No.12	Water Pond	500.50	Further study may be needed.
TOTAL		**5,591.85**	**kW**

3. ① Clay Storage Hall

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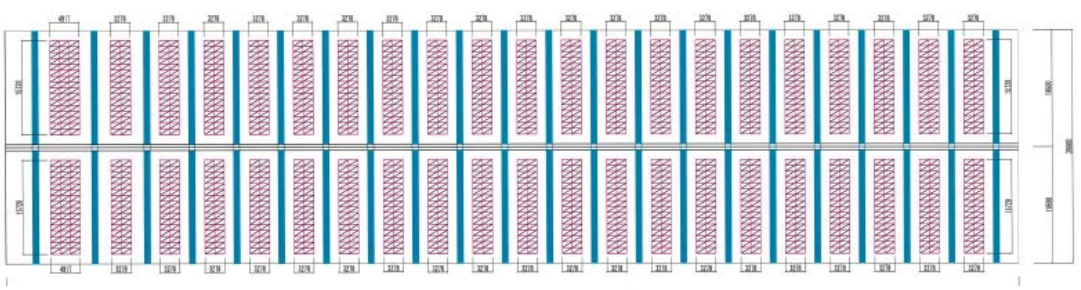
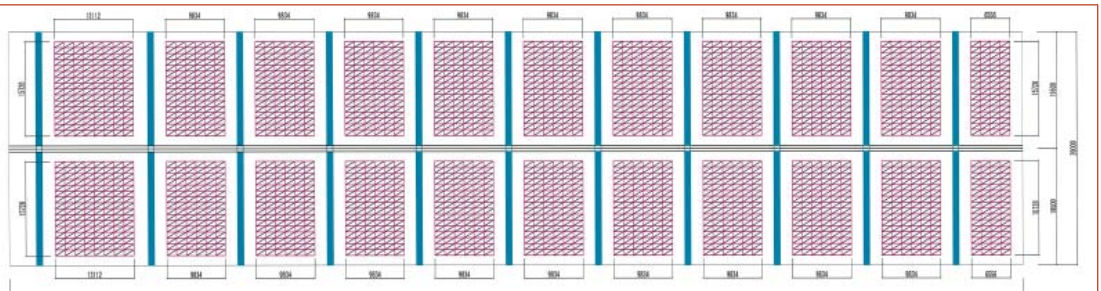
1

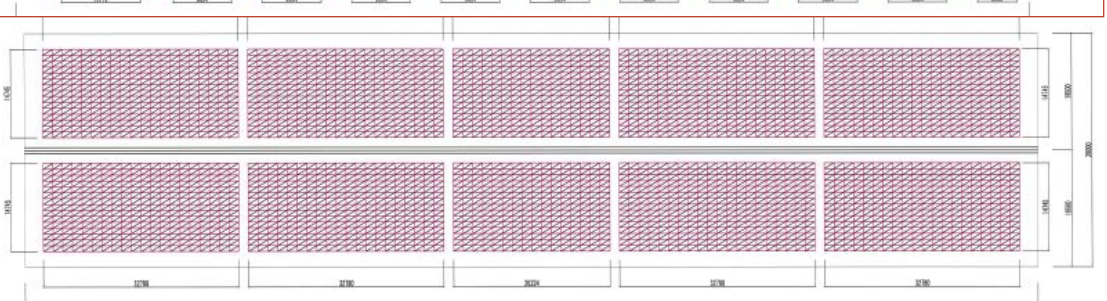
NO sunlight gaps are covered:
378.4 kW
(Not Recommended)



➢Half of sunlight gaps are covered:
<u>580.80 kW</u>
(Recommended)



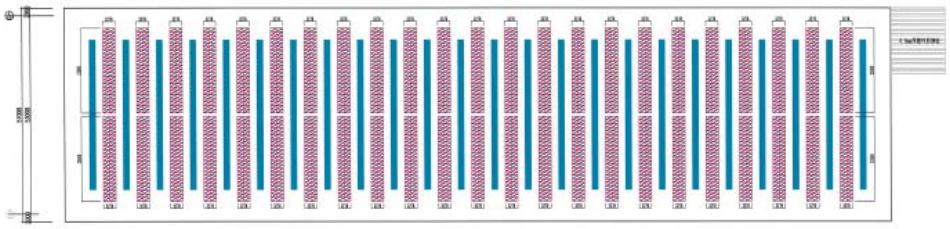
All sunlight gaps are covered:
792 kW
(Not Recommended)



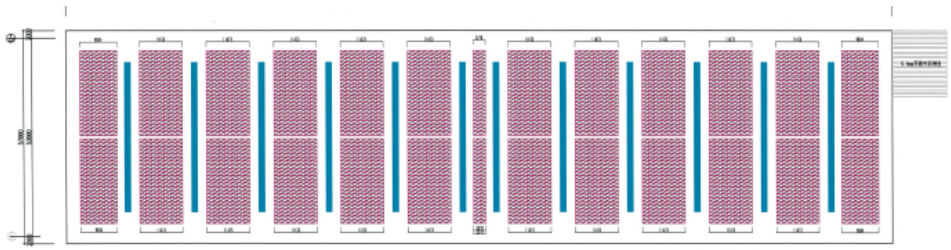
4. ② Coal Storage Hall

2

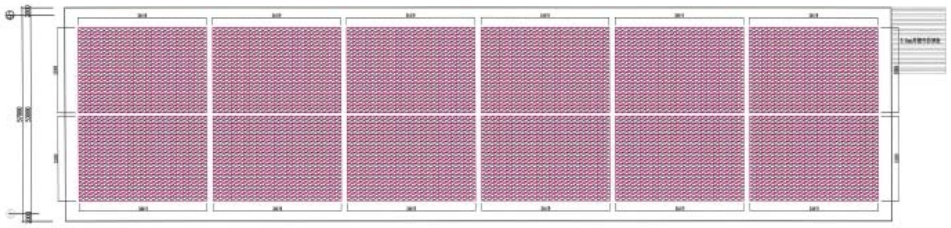
NO sunlight gaps are covered:
581.9 kW
(Not Recommended)



➢Half of sunlight gaps are covered:
1062.60 kW
(Recommended)



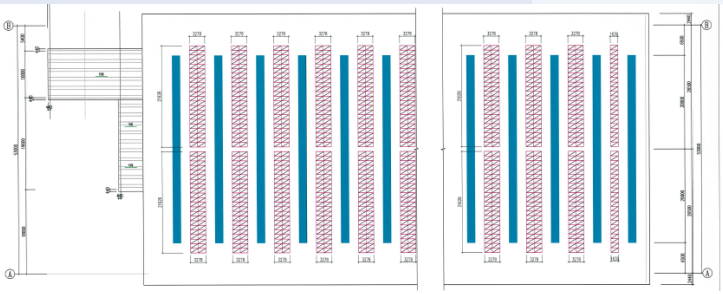
All sunlight gaps are covered:
1593.9 kW
(Not Recommended)



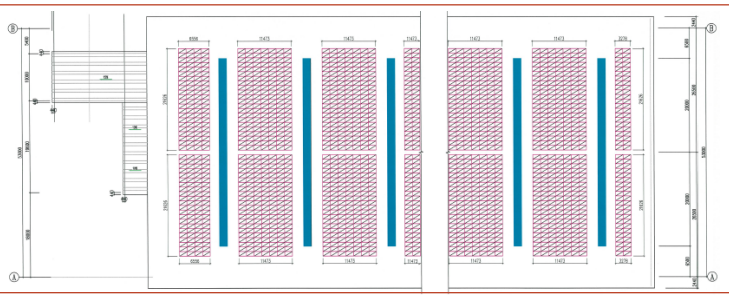
5. ③ Premixed mat. storage hall

3

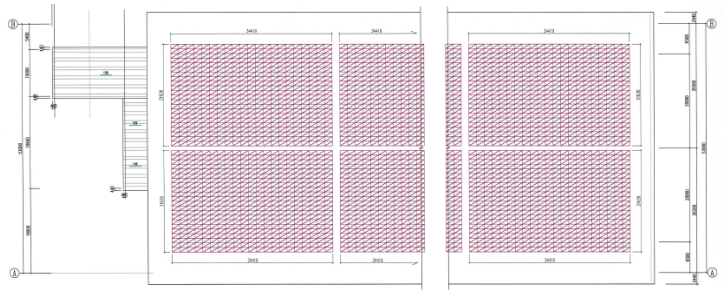
NO sunlight gaps are covered:
1149.5 kW
(Not Recommended)



➢Half of sunlight gaps are covered:
2020.7 kW
(Recommended)

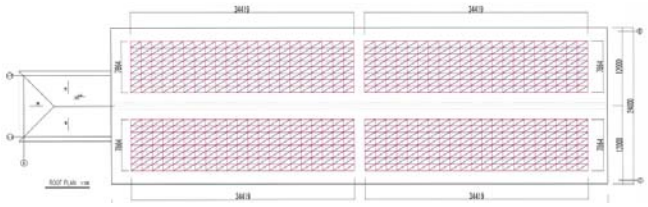


All sunlight gaps are covered:
3049.2 kW
(Not Recommended)

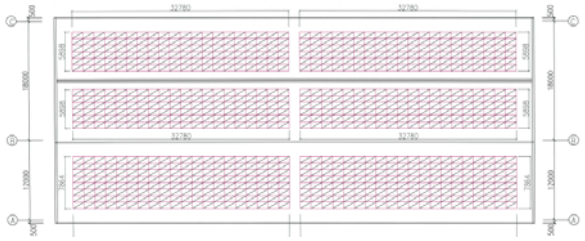


6. PV Panels for Other Building

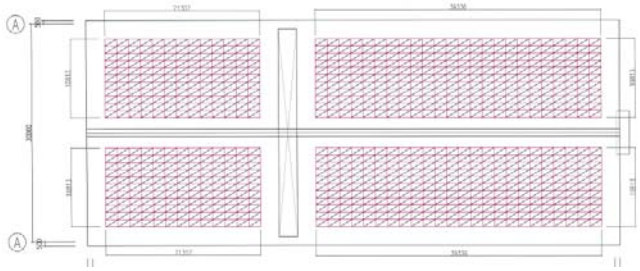
4 Gypsum storage hall: 184.80 kW



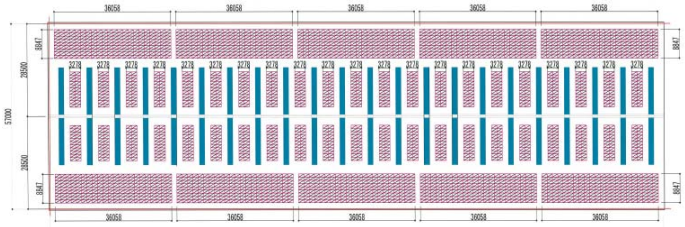
6 Maintenance workshop building: 220.00 kW



5 Part And Refractory Brick Warehouse: 223.85 kW



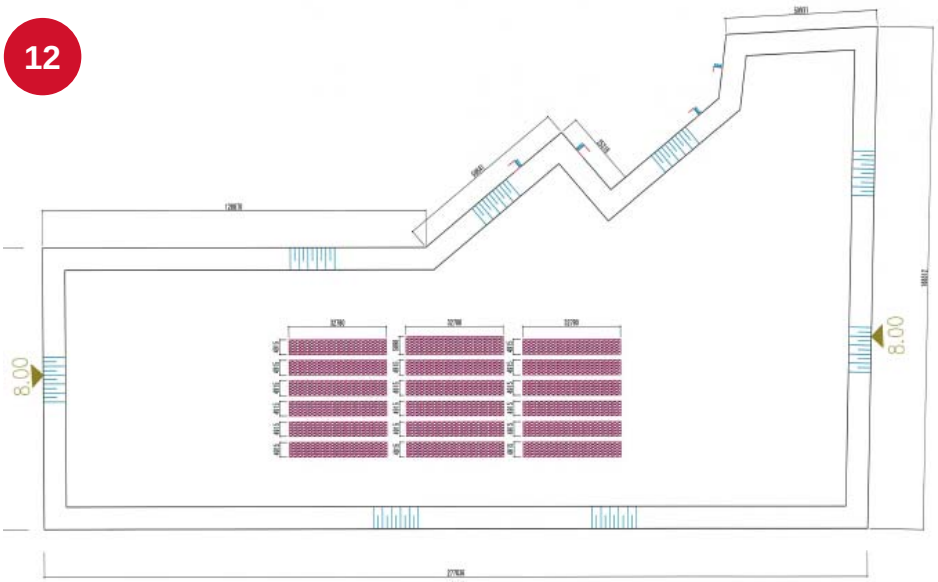
11 Baggaged Cement Palletizing: 798.60 kW



- PV panels for **No.7, 8, 9 are not offered** since they are relatively small size and it is not cost effective.
- PV panels for **No10: Cement Silo is not recommended** due to limited area.

7. ⑫ Water Pond

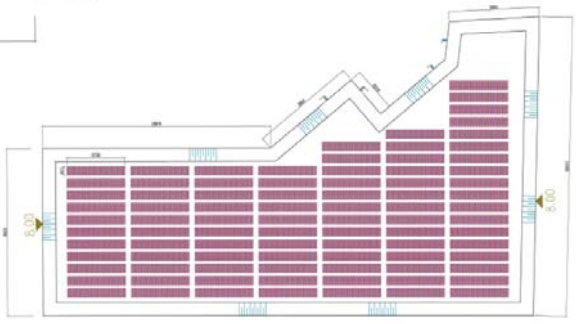
12



- Floating-type PV panels for water pond: **Apporox. 500.50 kW**
- Further study may be needed based on water level changes in dry and rain seasons.

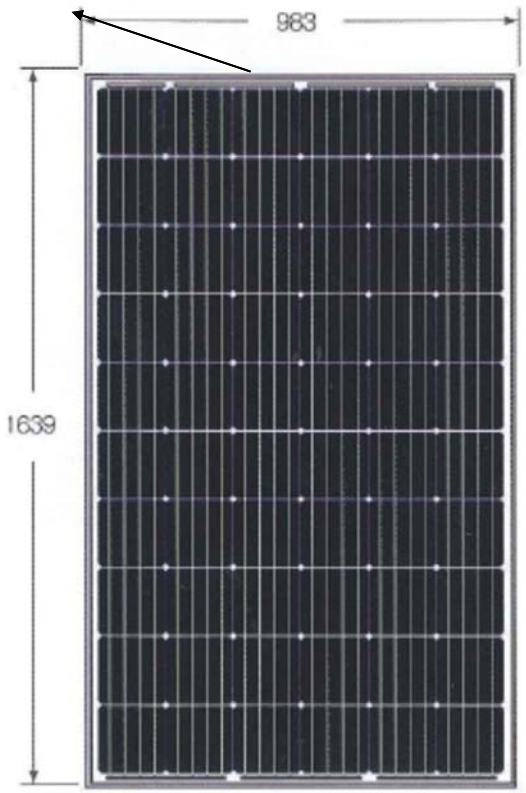
→ (only for reference)

Note that 2447.5 kW is expected if all of pond area are utilized. However, this is NOT feasible considering water level change.



8. Light Weight PV Module

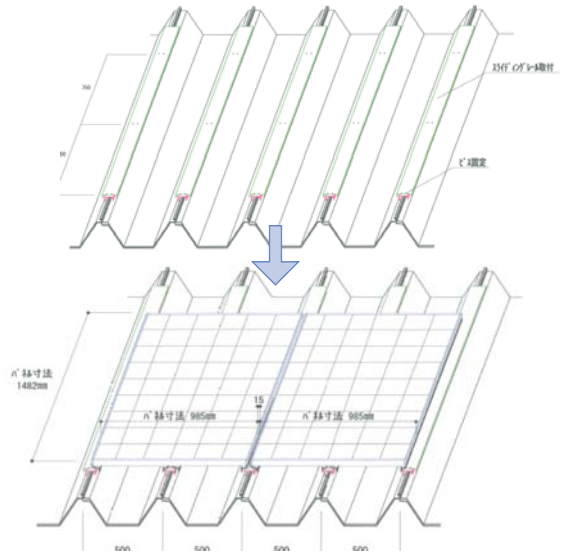
- Based on technical evaluation such as strength calculation of structure, consultation by first-class qualified architect, **arch-shaped structure have NOT enough strength for conventional PV panels.**
- Therefore, **light weight PV module** and **light weight installation method are mandatory.**
  (Other competitors may offer conventional PV panels, which is not suitable for the current structure.)
- Light Weight PV Module is manufactured by **Next Energy**.
- Model Number: **NER660M275A(4)-LS**
- It is Almost half weight: **10.5kg per panel**
- Size: **W983 x H1639 x D35 (mm)**



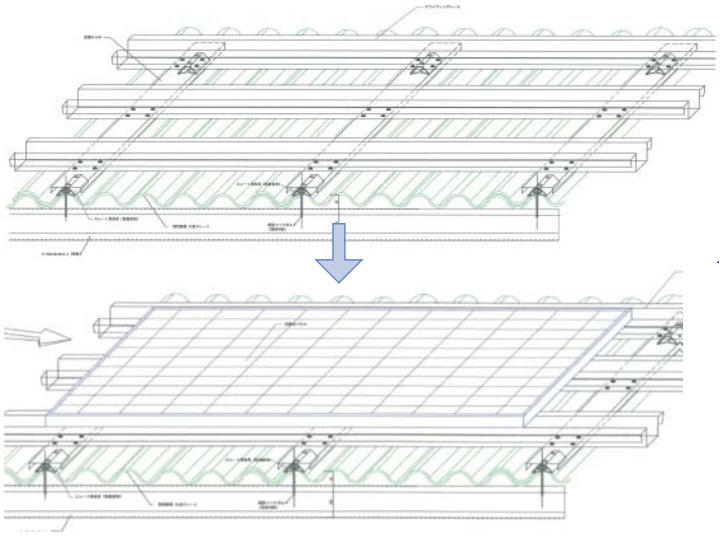
9. Light Weight Installation Method

- As explained in previous slide, light weight installation method is mandatory required due to structure strength.
- PV panels are mounted on roof directly, using special supports.
- This is patented technology by Japanese Construction Company.
- Light Type: 8 kg per 1m^2 (Conventional type: 20kg perm^2)

[For Folded Plate Roof]



[For Corrugated Slate Roof]



10 Rough Estimation of Initial Cost

NTT DATA

- Initial cost is approximately **14,000,000 [USD]** (1.6 billion [JPY])
  (5,591 [kW] x approx. 2,500 [USD/kW] (283,200 [JPY/kW]))

Equipment		
Name		Price/kW
パネル	PV Module	¥99,000
パワーコンディショナ	Power Conditioner	¥13,000
キュービクル	Cubicle	¥16,000
接続箱	Junction Box	¥4,000
集電箱	Terminal Box	¥4,000
ケーブル	Cable	¥1,500
監視装置	Monitoring Equipment	¥4,000
合計	Subtotal	¥141,500

Construction		
Name		Price/kW
架台取付(パネル共)	Installation Panels	¥68,000
電気工事	Electrical Construction	¥45,000
電気付帯	Electrical Auxiliary Cons	¥13,000
監視装置取付	Installation of Monitorin	¥1,500
安全対策	Safety	¥8,000
諸経費	Other Expense	¥6,200
合計	Subtotal	¥141,700

Equipment + Construction	¥283,200 /kW

- The cost above including **special coating which makes the panels clean in 20 years** (maintenance free).
- The equipment cost are based on FOB.
- JCM subsidy is applicable ONLY for equipment and construction contributing to CO2 emission reduction and there monitoring system. For example, PV module, Power Conditioner and Monitoring equipment.

11 Rough Estimation of Running Cost

NTT DATA

[Estimation of Annual Maintenance Costs]

- Basically, no maintenance is required for PV panels.
- As license fee of monitoring equipment, approximately **1,000 ~ 2,000 [USD/Year]** (120,000 ~ 240,000 [JPY/Year]) is required.

[Estimation of Main Parts Replacement Costs]

- Based on manufacturer's recommendation, approximately **34,000 [USD]** (4,000,000 [JPY]) is required as main parts replacement in 20 years.
  - At 5 years: approximately 8,500 [USD] (1,000,000 [JPY])
  - At 10 years: approximately 17,000 [USD] (2,000,000 [JPY])
  - At 15 years: approximately 8,500 [USD] (1,000,000 [JPY])

[Costs Over 20 Years Period]

- We recommend to keep operating of PV panels with main parts replacement as necessary. Although efficiency goes a little bit down after 20 years, no problem for operation.

12 Estimation of Power Generation per Year

NTT DATA

- Approximately 7,500,000 kWh/Year.

	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月
各月の1日平均日射量(実施サイトにおける値:kWh/㎡・日)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
各月の1日平均有効日射量(方位角、設置角における補正値:kWh/㎡・日)	5.18	5.16	5.59	5.04	5.74	5.68	5.77	5.65	4.93	4.60	4.42	4.80
温度補正係数(損失が無い場合=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
影による損失係数(無い場合は、1.0)	1	1	1	1	1	1	1	1	1	1	1	1
パワコンディショナー変換効率(定格負荷時電力効率)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
その他損失(無い場合:1.0) (モジュール汚れ、送電ロス、経年劣化など) (経年劣化は使用期間の中間年での数値とする)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
1日推定発電電力量(kWh/日)	20511.777	20418.724	22146.589	19954.919	22721.32713	22475.68	22861.819	22350.94	19532.593	18225.595	17513.345	19004.685
工場等の稼働日における平均1日消費電力量(kWh/日)	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000
工場等の稼働日における平均余剰電力量(kWh/日)	0	0	0	0	0	0	0	0	0	0	0	0
非稼働日で発電量がほぼ全量余剰電力となる日数												
実有効日数	31	28	31	30	31	30	31	31	30	31	30	31
月間推定余剰電力量(kWh/月)	0	0	0	0	0	0	0	0	0	0	0	0
月間推定有効発電電力量(kWh/月)	635,865	571,724	686,544	598,648	704,361	674,270	708,716	692,879	585,978	564,993	525,400	589,145
年間推定有効総発電量	7,538,525 kWh/年											

13 Rough Estimation of Annual Cost Reduction and CO2 Emission Reduction

NTT DATA

[Estimation of Annual Cost Reduction]

- Annual cost reduction is **937,500 [USD].**
  (7,500,000 [kWh/Year] x 0.125 [USD] (electricity price)
  = 937,500 [USD])

[Estimation of Annual CO2 Emission Reduction]

- Annual CO2 emission reduction is approximately **4,800 [tCO2/Year].**
  (7,500,000 [kWh/Year] x
  0.641 [kg-CO2/kWh] (Grid CO2 Mission Factor in KH) / 1000
  = 4,807.5 [ton-CO2/Year])

[JCM Subsidy Amount based on Criteria of Cost Effectiveness]

- Rough estimation of JCM Subsidy amount is approx. **2,700,000 [USD]** (approx. **19% of Initial Cost**) based on criteria of cost effectiveness.
  (4,800 [tCO2/year] x 17 [Years] x 33 [USD/tCO2] =2,692,800 [USD])

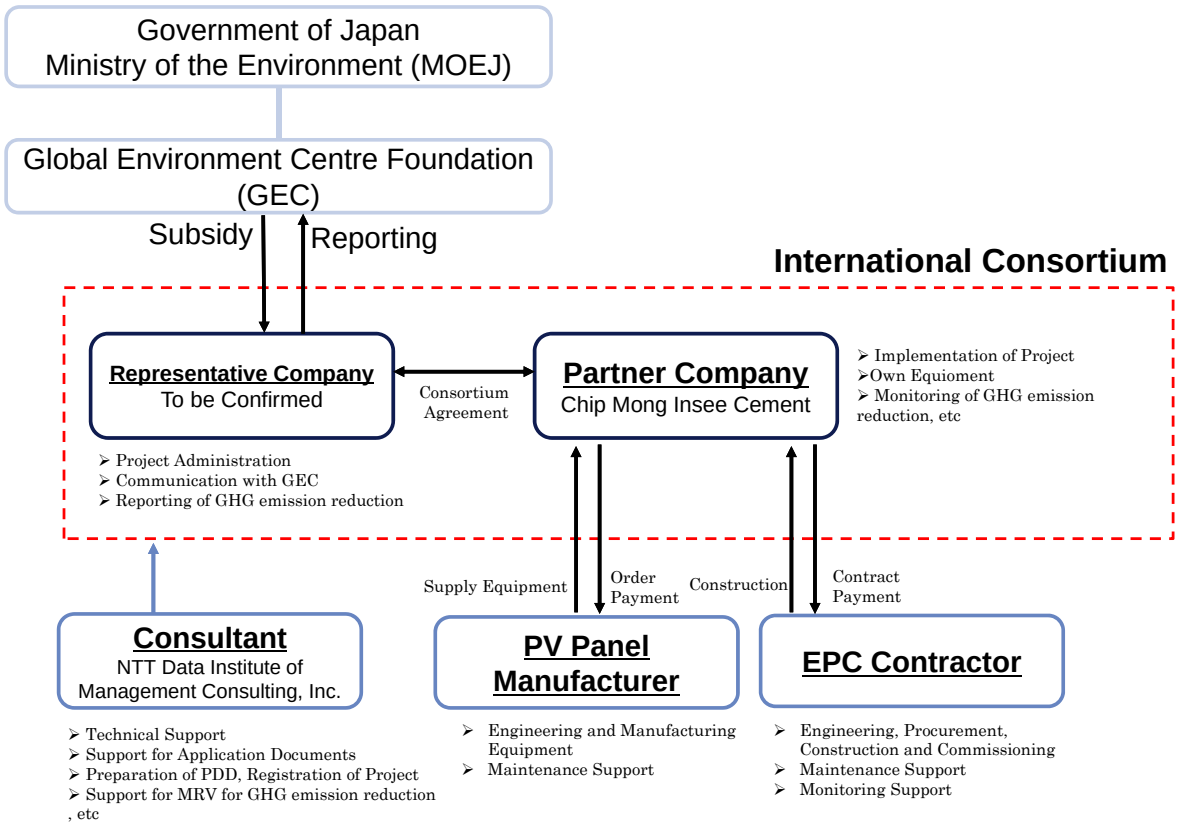
【New Criteria from FY2017】
Cost effectiveness should be less than **4000JPY/tCO2 (approx. 33USD/tCO2)**

14 Rough Estimation of Payback Period and IRR

- Payback period and IRR are as follows:
  - Payback Period without subsidy is approximately **15 [Years]**
  - Payback Period with subsidy is approximately **13.1 [Years]**
  - IRR without subsidy is approximately **1.4 [%]**
  - IRR with subsidy is approximately **4.1 [%]**
- They are based on rough cost estimation at this stage.

投資回収年数（補助金なし） Payback Period without Subsidy	15.0 years
投資回収年数（補助金あり） Payback Period with Subsidy	13.1 years
内部収益率（補助金なし） IRR without Subsidy	1.4%
内部収益率（補助金あり） IRR with Subsidy	4.1%

15 Image of Organization (Tentative)

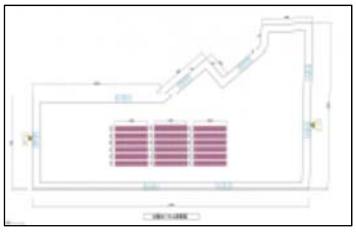


16. Summary (same slide at the beginning)

Assumed project (CHIP MONG INSEE CEMENT CORPORATION)

Project overview (assumed)

- Installation of solar panels on roof of a few buildings are assumed.
- We are also studying light-weight panels on arch-shape roof and floating-type panels on pond.



Expected effects (assumed)

Based on rough estimation, the following effects are expected:

- Scale of PV panels: approximately 5.5MW
- Yearly Power Generation: approximately 7,500,000 kWh/year
- Yearly Electricity Cost Reduction: approximately 937,500 USD
- Yearly CO_2 Emission Reduction: approximately 4,800 tCO_2/year

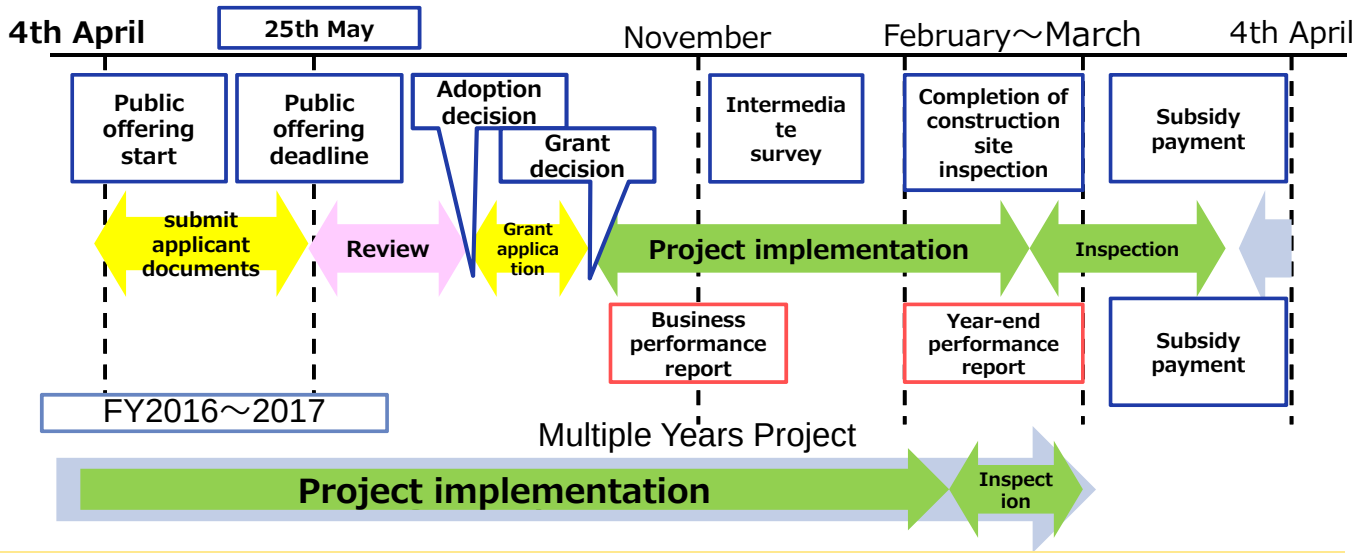
*Note that these figures are based on estimation. Detail design with PV panel manufacturer and EPC company are needed for actual project.

Funding procurement methods (assumed)

- Based on rough estimation, initial cost is approximately 14,000,000 USD.
- It is assumed that 19% of the initial cost is subsidized by JCM equipment subsidy project, based on JCM Criteria of cost effectiveness.
- As alternative option, ESCO or lease scheme are also considered.

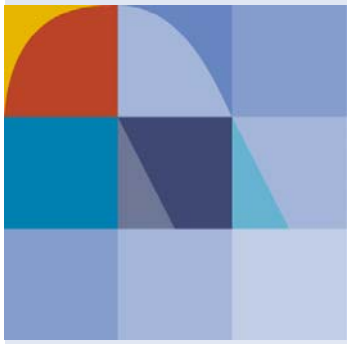
Ref) JCM Subsidy Project Schedule of Application to Project Implementation

(e.g.) FY2015



- **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**

Public offering is started Beginning of April and finished Mid-of May for FY2017.



NTT DATA

Global IT Innovator

Example of the case to establish a project through city-to-city collaboration

October 20th, 2016
NTT Data Institute of Management Consulting, Inc.,
Socio & Eco Strategic Consulting Unit
Partner, Motoshi Muraoka

Index

1. Introduction of our company

NTT DATA

Corporate outline

Name	NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.
Date of Establishment	April 12, 1991
Shareholder	NTT DATA Corporation 100%
Capital	¥450 million
Head Office	10th floor, JA Kyosai Building, 7-9, Hirakawa-cho 2-chome, Chiyoda-ku, Tokyo 102-0093, Japan Tel +81-3-3221-7011 (main number) Fax +81-3-3221-7022
Office Toyosu	25th floor, Toyosu Center Building, 3-3, Toyosu 3-chome, Koto-ku, Tokyo 135-6025, Japan Tel +81-3-3221-7011 (main number) Fax +81-3-3534-3880
Office Singapore Branch	20 Pasir Panjang Road, #11-28 Mapletree Business City, Singapore 117439
URL	http://www.keieiken.co.jp/english/

The environmental and energy sectors continue to be the scene of dynamic developments exemplified by the revision of energy policy, approaches to global warming, and recycling of dwindling resources. They also hold much promise for industrial activity. We promote client approaches through activities including support for smart community development, assistance with export of infrastructural elements, and creation of new business by private-sector consortiums.

- Development of environmental business and environmental management
- Social and environmental communication
- Building of recycling-oriented social systems
- Measures to mitigate global warming
- New energy and energy conservation
- Systems for assurance of safety/security and management of chemical substances
- Smart communities
- Infrastructural export

2. Experience of JCM related Projects(1/2)

NTT DATA

◆Industrial Sector

Outline of Activity	Purpose	Phase
Installation of Co-generation System into the Factory and Industrial Estate (Indonesia, Vietnam)	Reduce CO2 Emission & Energy Cost	Study
Installation of Economizer for the Existing Boiler in Factory (Malaysia)	Reduce CO2 Emission & Energy Cost	Study
Installation of Exhaust Heat Recovery & Electricity Generation System into the Existing Cement Factory (Vietnam and Thailand)	Reduce CO2 Emission & Energy Cost	Study, Implementation
Replacement or Installation of Saving Energy Type of Electrical Furnace into Casting Companies (Vietnam)	Reduce CO2 Emission & Energy Cost	Implementation
Installation of Electricity Generation System using Rice Husk (Indonesia)	Reduce CO2 Emission & Energy Cost	Study
Installation of Solar Electricity Generation System on the Roof of the Existing Cold Storage Warehouse (Malaysia)	Reduce CO2 Emission & Energy Cost	Study
Replacement of Existing Lighting System into LED Lighting System (Indonesia)	Reduce CO2 Emission & Energy Cost	Implementation
Changing Fuel Type from Oil to Natural Gas in a Factory (Malaysia)	Reduce CO2 Emission & Energy Cost	Study
Installation of Mini-hydro Electricity Generation System in Isolated Area (Kenya and Ethiopia)	Reduce CO2 Emission & Energy Cost	Implementation
Installation of Mega Solar Electricity Generation System (Costa Rica)	Reduce CO2 Emission & Energy Security Increase	Implementation
Installation of Landfill Gas Recovery & Electricity Generation System (Mexico)	Reduce CO2 Emission & Energy Cost	Implementation

2. Experience of JCM related Projects(2/2)

NTT DATA

◆Commercial Sector

Outline of Activity	Purpose	Phase
Replacement or Installation of Saving Energy Type of Chiller or Air-conditioning System into Hotel, Commercial Building and Shopping Mall (Indonesia, Vietnam, Cambodia, Costa Rica)	Reduce CO2 Emission & Energy Cost	Implementation
Installation of Mini Co-generation System into Hotel (Indonesia)	Reduce CO2 Emission & Energy Cost	Study
Replacement of Refrigerated Show Case into Saving Energy Type (Vietnam)	Reduce CO2 Emission & Energy Cost	Study
Replacement of Air-conditioning System, Lighting System and Refrigerated Show Case of Convenience Store into Saving Energy Type (Vietnam, Thailand)	Reduce CO2 Emission & Energy Cost	Implementation
Installation of Solar Electricity Generation System on the Roof of the New Building (Malaysia, Thailand), Hospital (Cambodia) and Shopping Mall (Vietnam)	Reduce CO2 Emission & Energy Cost	Implementation, Study
Introduction of EV Bus & Solar Electricity Generation System with Funding Mechanism in an Isolated Island (Vietnam)	Keep Environment and Reduce CO2 Emission	Study
Installation of Solar System & Saving Energy Equipments into the Existing School, Building and Hotel, using Environmental Fund & ESCO + Leasing System (Costa Rica)	Reduce CO2 Emission & Energy Cost	Study

3. Typical Step to realize JCM Project through city-to-city collaboration

NTT DATA

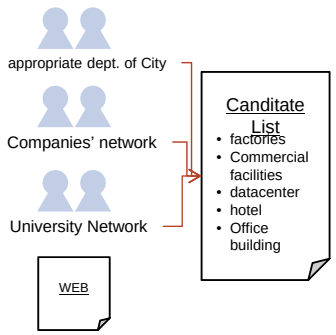
Support through City-to-City Collaboration

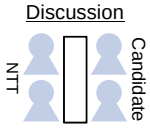
1st Fiscal Year | 2nd Fiscal Year ～

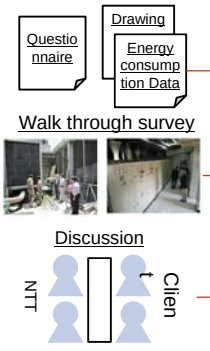
Selection of Candidate Site	Discussion	Diagnosis	Proposal & Discussion	JCM Project

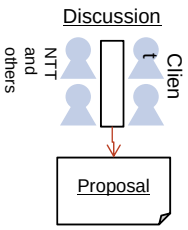
Activity

- Selection of facility through Interview with appropriate dept. of City, Explanatory meeting to companies, WEB Research
- Explanation of JCM Scheme and Agreement for research for JCM
- Energy diagnosis (including collection of existing energy data)
- Based o Data, Saving energy idea will be proposed under JCM scheme.
- Discussion with manufacturers, based on Energy diagnosis
- Proposal to Owners
- Organization of Implementation structure
- Submit the JCM Subsidy Program
- Start the Project









Output

- Selection of Candidate factory, commercial facility, datacenter, hotel and office building
- Understanding of JCM Scheme
- Start the discussion on introducing saving energy technologies or renewable energy technologies
- Cellection of existing energy data and preparation of energy diagnosis result if energy diagnosis implemented
- Propose necessary saving energy idea and find out the proper related manufacturer or engineering company

1. Replacement of Chiller at Shopping Mall in Indonesia

◆Outline of the project is as below.

Target	Shopping Mall A
Outline	• Large Shopping Mall by Indonesian Company at Surabaya city • Under construction of 2 new buildings (50 F)
Completion	1986 (expanded 91,96,01)
Floor Space	125,000m^2
Floor Number	6 F(Above), 1 F(Below)
Appearance	

Implementation Structure

International Consortium

Representative NTT Facilities — partner PT. Pakuwon Jati Tbk

PDD/MRV Methodology — NTT Data Institute od Management Consulting Inc.,

Construction — Local Company

Project Outline

- Replacement of Chiller & Cooling Tower
- CO2Emission Reduction（925　tCO2/year）

（Reference）Process of Chiller Replacement

◆Process of the project is as below.

	Selection of Candidate Site	Discussion	Diagnosis	Proposal & Discussion	JCM Project
Activity	• Based on Kitakyushu-Surabaya Collaboration, we found out the company through interview to Surabaya City	• Explanation of JCM Scheme and proposed the research for energy saving	• Energy Diagnosis (Cellection of the existing Energy data) • Based on the Energy Diagnosis result, proposed saving energy action using JCM Scheme	• Contacted with manufacturer based on diagnosis result • Manufacturer prepared proposal • Proposal was submitted to Owner • Prepared implementation structure	• Applied for JCM subsidy program • Starting Project

Point

- Owner of Mall have an interest in saving energy.
- Replacement to efficient system is economical when using JCM scheme.
- Owner company which is Indonesian company, have already prepared financial
- Owner company accepted monitoring & reporting of CO2 emission reduction for legal durable years in Japan　and so on

- Sometimes, financial documents were hard to be submitted.
- Buildings which passed several ten years have the possibility to be reconstructed and have the possibility not to match the legal durable years rule.

2. Introduction of Efficient Electric Furnace into foundries in Vietnam

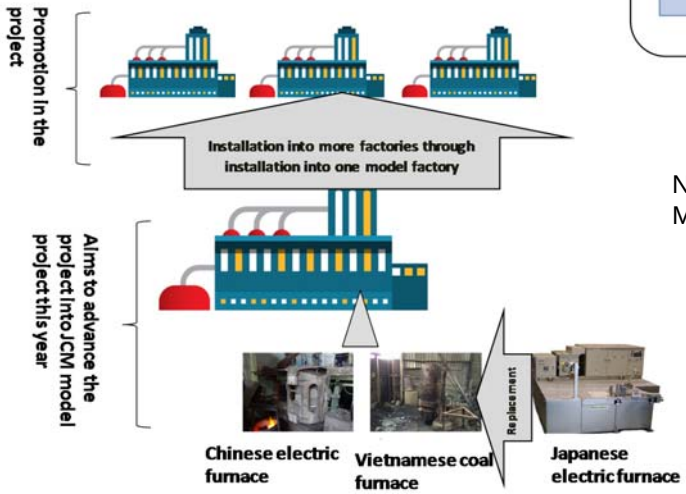
◆Outline of the project is as below.

Target

Foundries A & B

- 2 factories in Vietnam
- Introduction of efficient Japanese Electric Furnace in place of Chinese one, although initial cost is high by JCM scheme

Outline



Implementation Structure

International Consortium

Representative	Partner
NTT Data IOMC	2 Local Foundries

PDD/MRV Methodology: NTT Data Institute od Management Consulting Inc.,

EPC: Japanese manufacturer

Project Outline

- New Introduction of efficient electrical furnace
- CO2 emission reduction effect（around 600tCO2/year and around 1,800tCO2/year）

（Reference）Process of introduction of electrical furnace

◆Process of the project is as below.

	Selection of Candidate Site	Discussion	Diagnosis	Proposal & Discussion	JCM Project
Activity	• Found out candidate site through the network of Kitakyushu Univ. (Project was implemented Kitakyushu-Haiphong Collaboration)	• Explanation of JCM Scheme and proposed the research for energy saving	• Collection of existing energy data and simulated economics & CO2 reduction effect	• Discussion with Japanese manufacturers and found out the partner • Prepared proposal under JCM scheme • Proposal & discussion with owner of factories • Prepared implementation structure • Negotiation with owners	• Applied for JCM subsidy program

Point

- High reliability in Japanese Equipment and high interest in economics
- Efficient Japanese equipment is economical under JCM scheme and so on

- In some cases, several type of financial documents exist.
- It is very difficult to evaluate creditworthiness of local companies in some cases.
- Severe cost negotiation (in other project, manufacturer was changed after the acceptance for JCM scheme)
- Currency exchange risk emerged.

3. Introduction of Waste Heat Recovery & Electricity Generation System Furnace into Cement Factory in Vietnam

◆Outline of the project is as below.

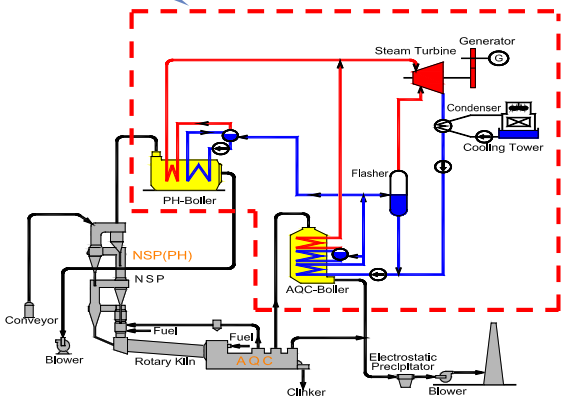
Target

Cement Factory without waste heat recovery

Outline

- Existing cement factory
- Introduction of waste heat recovery & electricity generation system, using JCM scheme
- Large CO2 emission reduction

Introduction System



Implementation Structure

International Consortium

Representative NTT Data IOMC	Partner Cement Company
PDD/MRV Methodology	EPC
NTT Data Institute od Management Consulting Inc.,	Japanese manufacturer

Project Outline

- New Introduction of waste heat recovery & electricity generation system
- CO2 emission reduction effect（around 17,600tCO2/year）

（Reference） Process of introduction of waste heat recovery & electricity generation system

◆Process of the project is as below.

	Selection of Candidate Site	Discussion	Diagnosis	Proposal & Discussion	JCM Project
Activity	• Found out candidate through city-to-city collaboration workshop. (Project was implemented Kitakyushu-Haiphong Collaboration)	• Explanation of JCM Scheme and proposed the research for waste heat recovery & electricity generation • Selection of engineering company	• Collection of existing data and simulated economics & CO2 reduction effect • Site detailed survey	• Discussion with Japanese manufacturers and found out the partner • Prepared proposal under JCM scheme • Proposal & discussion with owner of factory • Prepared implementation structure • Negotiation on price	• Applied for JCM subsidy program

Point

- High reliability in Japanese Equipment and high interest in economics
- Efficient Japanese equipment is economical under JCM scheme and so on

- There will be several business model such as simple EPC with maintenance service agreement and BOT with the establishment of SPC
- There will be several candidate technologies such as steam ranking cycle and binary cycle, which should be decided based on various analysis.
- In some cases, public organization has to follow open tendering process.

1. Point & Challenges to Realize Projects

(1) Local partner

- It is hard to evaluate creditworthiness of local companies in some cases
- Sometimes, unclearness of financial documents happens

→ Japanese companies in partner country tend to be well prepared

(2) Representative company

- Responsibility of representative company is high (Administration of subsidy, reporting of CO2 reduction for Japanese legal durable years etc)
- Considering the economics of CO2 emission reduction, new tools such as bundling & introduction of program type for commercial sector

(3) Application of Japanese legal durable years

- It seems important to consider the condition of the equipment to be used in partner countries when applying Japanese legal durable years (some equipment degrades fast.)

(4) Economics

- Local partner has to prepare all of initial investment first. Sometimes, preparing all of initial cost will be a burden.
- Sometimes, currency exchange risk will be a headache for the project.

(5) Schedule

- JCM subsidy program schedule does not meet the private company's investment schedule in some cases.

NTT DATA

変える力を、ともに生み出す。

FY 2016 JCM City-to-City Collaboration Projects between Kitakyushu City and Phnom Penh Capital City Material for Activities Introduction

January 23rd, 2017

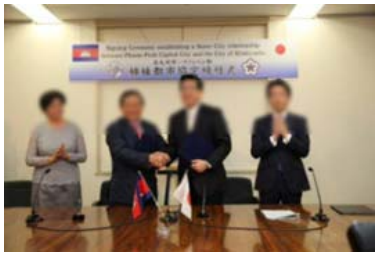
NTT Data Institute of Management Consulting, Inc.,
Socio & Eco Strategic Consulting Unit

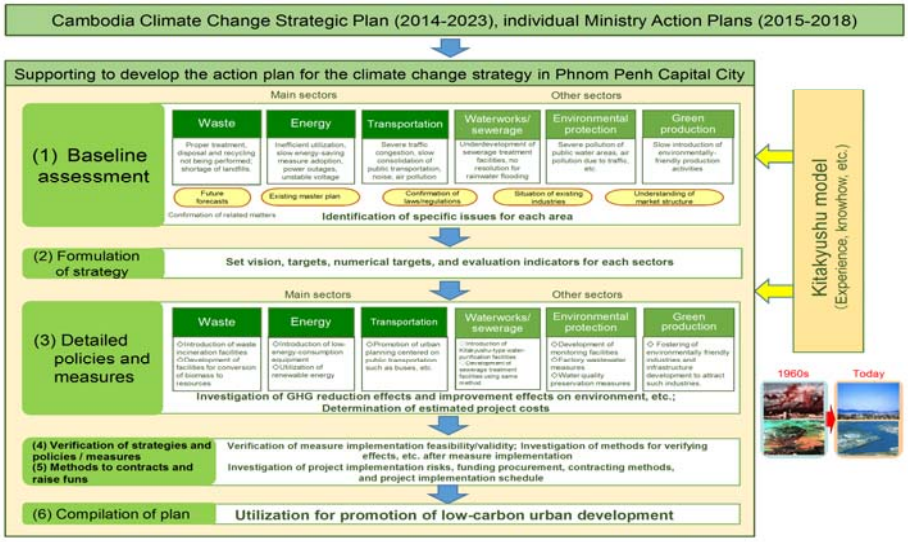
NTT DATA

1. Background and Purpose

NTT DATA

- Sister-city agreement between City of Kitakyushu and Phnom Penh Capital City was signed on 29-Mar-2016
- In order to implement the “Cambodia Climate Change Strategy Action Plan (2014-2023)” and “individual Ministry Action Plans (2015-2018)”, development of “the action plan for the climate change strategy” is supported by Nikken Sekkei Civil Engineering.
- NTT Data Institute of Management Consulting, Inc. survey feasibility a few JCM projects. These projects are handled as pilot projects in energy sector of the action plan for the climate change strategy.”





2. Organization for Feasibility Study

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City of Kitakyushu ⇔ Phnom Penh Capital City

- The entire project oversees based on the inter-city cooperation
- Coordination, discussions and approach with Government organizations

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- Survey for 3 activates (direct consultation, technical studies, economic evaluation, CO2 emissions reduction evaluation, etc.)
- Coordination with related organizations aim to commercialization
- Preparation for application of equipment subsidy, if necessary.
- Setting, preparation, participation, management, etc. for conferences

◆ Cooperation (mainly technical), as needed

- Chiller Manufacturers
- Solar Panel Manufacturer
- WHR System Manufacturer

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
➢ Introduction of solar panel power generation, solar thermal water-heater system, etc. for large hospital	➢ Introduction of high-efficiency refrigeration showcase, solar panel power generation, etc. for shopping mall.	➢ Introduction of waste heat recovery power generation for cement plant

3. Activities and Projects of Feasibility Study

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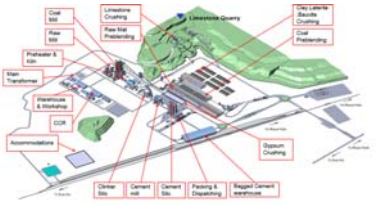
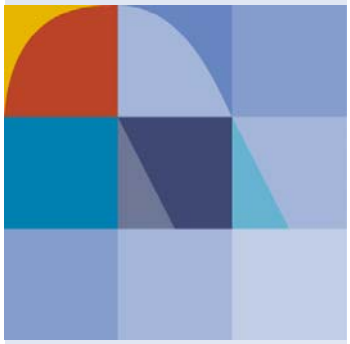
Activities and projects for feasibility study are as follows:

Activities	Low-carbon business by energy-saving facilities for large hospital	Low-carbon business by energy-saving facilities for shopping mall, etc.	Introduction of waste heat recovery power generation system for cement plant
Project Target	Large Hospitals in Phnom Penh	Large Shopping Mall in Phnom Penh	Cement Plant in Cambodia
Equipment	Solar Power Generation System	Solar Power Generation System High Efficiency Chiller	Waste Heat Recovery Power Generation System Solar Power Generation System
Image of Project			



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