

Study for Developing JCM Projects under City-to-City Collaboration between Yokohama City and Batam City Feb., 2016 Institute for Global Environmental Strategies (IGES)

A. Energy Saving System at Hang Nadim Airport

1. Project Background

Hang Nadim Airport is one of Indonesia's prime airport which located 17 km east of Batam city. It is operated 24 hours to serve 39,797 aircraft movements to carry about 4.77 million passengers in 2014. The total area of airport complex about 1,762 Ha includes 165,840 m² of terminal building.

The airport authority has plan to improve the facilities and operation of Hang Nadim airport to be an eco-airport in the future. To achieve the goal, several efforts has been planned include revitalization of terminal building and building energy management system. The energy saving is one of the priority program because of its high operational cost of electricity consumption about 2 Billion Rupiah per month (Interview on April 2015).

The city-to-city cooperation between Yokohama and Batam proposed a feasibility study to introduce building energy management system which was developed by Yokohama based company, iFORCOM Co, Ltd. iFORCOM company developed ECO-PRO version 1 in 2004 to visualize electric consumption and CO₂ reduction in order to reduce energy consumption many buildings in Japan. The company has experience in more than 2000 facilities in Japan and several places in ASEAN. In Indonesia, the company already implement their system in several locations and also open the Indonesia Representative Office in 2015.

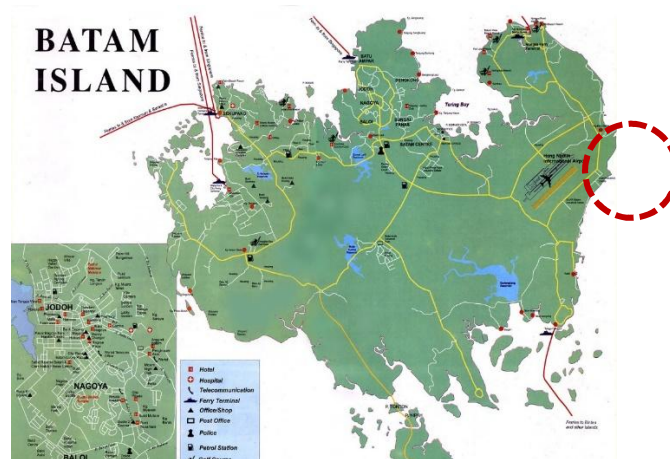
2. Objective of the FS

The objective of feasibility study on energy saving at Hang Nadim Airport are as follows:

- Introduce new system for building energy management system in terminal building to reduce electricity cost
- By introducing new system, the airport authority implement energy saving program to achieve their goal to be an Eco-Airport.
- The study will identify the potential CO₂ reduction from several facilities in terminal building. The study also will develop methodology of GHG emission reduction and project design document (PDD) which can be implemented and expanded in other facilities such as ferry terminal building, hospital, shopping mall and hotel in Batam and Indonesia.
- Introduction of new system will also reduce CO₂ emission from the airport as contribution to reduce global GHG Emissions.

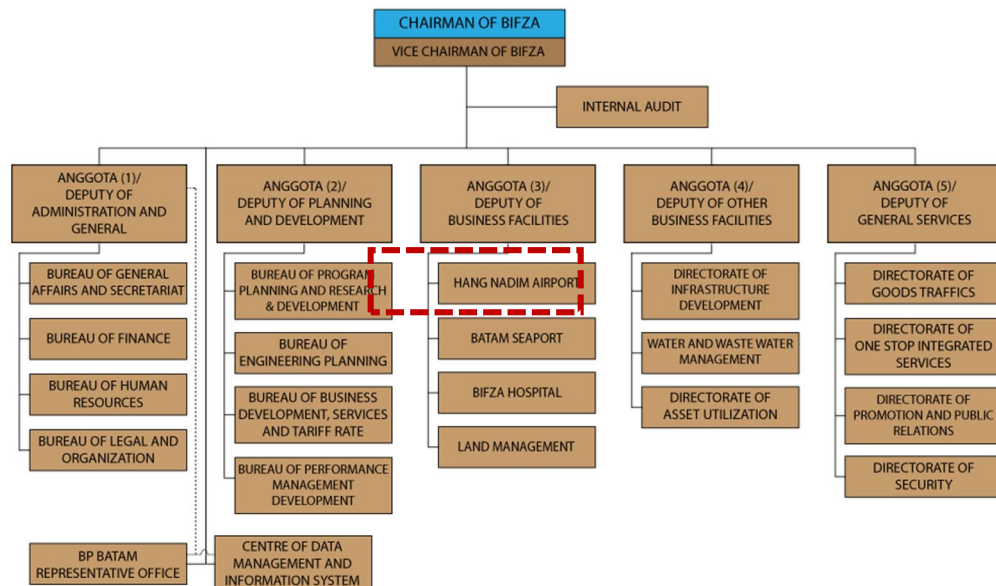
3. Project Description

- a. Project Location: Hang Nadim International Airport Batam-Indonesia



b. Indonesian Partner

The partner of this study are Hang Nadim Airport Authority and Badan Pengusahaan (BP) Batam (BIFZA). The birth of Law Number 44 of 2007 established Batam, Bintan and Karimun as an area of free trade area and free port (Free Trade Zone) which will encourage more economic growth and through the Government Regulation no 46 of 2007 imply BIFZA will move into the Body of Batam.



In accordance with:
 - Regulation of BIFZA Chairman No 5 Year 2015 on the Organizational Structure and Working Procedure Unit under the Member/Deputy in BIFZA Environment.
 - Decree of BIFZA Chairman No 23 Year 2015 dated May 5, 2015.
 - Warrant of BIFZA Chairman No 40/KA/5/2015 dated May 5, 2015

Figure: Organizational Structure of BP Batam and Hang Nadim Airport



Figure: Organization of Hang Nadim Airport

The Indonesian partner is in charge of the following issues:

- Provide information and cooperation during survey and FS Study
- Taking necessary approval and authorizations for implementation of project

c. Description of Technology

Business to build the best energy-saving promotion platform in response to user needs, we have track records to introduce more than 2000 facilities in Japan, then have developed in the office building, factory and mall in Indonesia.

Specifically, by utilizing the following, it is possible to construct verified optimum energy saving promotion platform at airports.

- Know-how of the rule of "Energy efficiency improvement due to human operation (AC, OA equipment, etc.)"
- Design know-how of the incentive scheme based on behavioral science in order to comply with it
- Know-how to apply the "automatic control by utilizing information technology (active automatic control of AC)."

d. Project Detail



Figure: Building Energy Management System

Step by Step Implementation of New System in Hang Nadim Airport includes several steps as follows:

- Operational improvement on electricity usage of airport facilities
- Inverter control of the chiller pump
- Installation of the monitoring system

4. The Results of study

I. Energy Saving at Hang Nadim Airport

2. Reference emission

Conservative calculation of “Energy saving ratio (λ)” from track record of similar energy saving project.

$$RE_p = EC_{PJ,p} \times 1 / (1 - \lambda_{EMS}) \times EF_{elec}$$

RE_p :Reference emissions during the period p [tCO₂/p]

$EC_{PJ,p}$:Amount of electricity consumption of the project air-conditioning system during the period p [MWh/p]

λ_{EMS} :Energy-saving ratio by EMS [-]

EF_{elec} :CO₂ emission factor for consumed electricity [tCO₂/MWh]

3. Monitoring methods

Automatic data logging (electricity consumption) and transmitting to iFORCOM Co, Ltd

I. Energy Saving at Hang Nadim Airport

4. Quantification of GHG emissions and their reductions

Year	Estimated Reference emissions (tCO _{2e})	Estimated Emissions (tCO _{2e})	Project	Estimated Emission Reductions (tCO _{2e})
2017	10,095	9,090		1,005
2017-30	141,330	127,260		14,070

5. MRV methods (Eligibility criteria)

Criterion 1	The project energy-efficient air-conditioning system is newly installed or installed to replace existing air-conditionings equipment and centrifugal chiller at a building.
Criterion 2	The compressor motor of the centrifugal chiller applied in the project air-conditioning system has automatic control technology of motor speed of the inverter-driven compressor and evaporation temperature of the centrifugal chiller which is controlled by EMS defined in the section B. In cases where the project replaces existing air-conditionings equipment and centrifugal chiller, the existing centrifugal chiller is non-inverter-type products without EMS.
Criterion 3	Periodical check at least once a month is planned. And the project system is continually monitored by the manufacturer on the internet.

6. Capacity building plan: Training programme for operation

7. Others (Next step): signing LOI

5. Conclusion and Next Steps

Based on our calculation result, the CO₂ reduction is about 1,095 tCO₂/year which was obtained by reduction of electricity consumption 1,197,634 kWh/year or equal to 10% of electricity consumption by Hang Nadim Airport Batam. The return of investment of Project is about 3 years (without subsidy) and 1.5 year with JCM subsidy.

The next steps for implementation projects as follows: (a) Sign a letter of intention for introduced solution between iFORCOM and Indonesian Partner (Hang Nadim Airport and BIFZA); (b) Detail site investigation and implementation details for developing proposal for subsidy; (c) Submit the proposal for application of subsidy to Ministry of the Environment Japan.

B. High-efficiency of Industrial Wastewater Treatment System at PT Desa Air Cargo

1. Project Background

PT Desa Air Cargo is an Environmental Service Provider in Batam Island. In 1995, the company started to transport Industrial Hazardous Waste materials from Batam to final disposal in PPLI-Jakarta Indonesia. The company together with BIFZA built the hazardous waste temporary transfer facilities in 1997. Then, the company built their own treatment facilities step by step since year 2000. Through the installation of treatment facilities, the company could treat about 60% of total waste received from the industries in Batam. The treatment facilities include: (a) Electro coagulant (EFT) system for liquid waste; (b) Distillation unit for treatment of solvent based liquid waste and (c) various treatment facilities for solid waste recycle, reduce and reuse (3R) system.

The EFT system has several problems such as: (a) high electricity consumption for electro coagulant and maintenance cost for replacement of electric plate; (b) clogging at filter press; (c) sometimes the effluent exceed the standard of effluent discharge. Therefore, the company seek various alternative to improve their treatment facilities mainly for two main important issues: (a) reduce operational cost and (b) improve water quality to be discharge in the river body.

The city-to-city cooperation between Yokohama and Batam proposed a feasibility study to introduce high-efficiency of wastewater treatment facilities which was developed by Yokohama based company, AMCON Co, Ltd. AMCON company developed VOLUTE dewatering system which reduce electricity consumption of regular filter press system. The company also has experience in dealing with various wastewater treatment facilities in Japan. The VOLUTE system has been widely installed all over the world especially for food industries. The company also has experience to install their system in several factories in Indonesia.

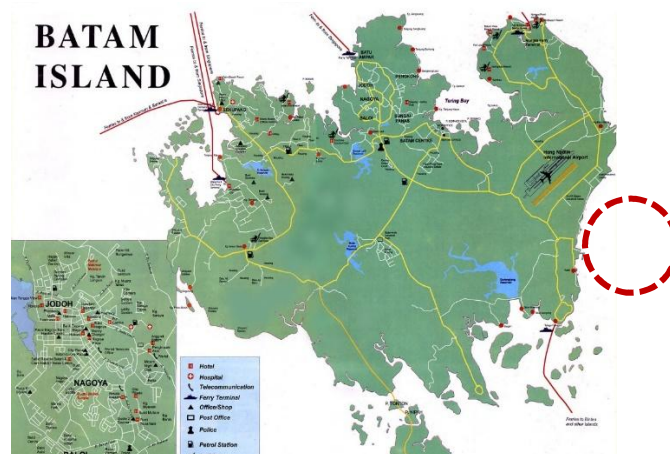
2. Objective of the FS

The objective of feasibility study on high-efficiency of industrial wastewater treatment facilities are as follows:

- Introduce new dewatering system to reduce electricity cost of the existing treatment unit in PT Desa Air Cargo Batam
- The study also introduce total solution system to improve existing treatment facilities owned and operated by PT Desa Air Cargo Batam
- By introducing new system, the company can reduce operational cost and improve water quality which will be discharged in the river body.
- The study will identify the potential CO₂ reduction from two options. The study also will develop methodology of GHG emission reduction and project design document (PDD) which can be implemented and expanded in other facilities such as industrial complex facilities in Batam. Batam Island has 26 industrial complex.
- Introduction of new system will also reduce CO₂ emission from the industry as contribution to reduce global GHG Emissions.

3. Project Description

a. Project Location: PT Desa Air Cargo Batam



b. Indonesian Partner

The partner of this study is PT Desa Air Cargo Batam, an Environmental Service Provider which was established in Batam since 1995. PT Desa Air Cargo Batam is seeking a better treatment facilities which may increase the wastewater treatment efficiency which may: (a) Increase the total number of waste treated in Batam from the existing 60%; (b) reduce operational cost; (c) improve the quality of effluent of water discharge to the river body.

The Indonesian partner is in charge of the following issues:

- Provide information and cooperation during survey and FS Study
- Taking necessary approval and authorizations for implementation of project

c. Description of Technology

Volute dewatering press is the so-called Multi-Disk-Plate Screw Press with unique “Volute” technology developed by AMCON, enabling stable SLUDGE dewatering with less operational cost. As of today, installation amounts to more than 2600 units in 62 countries worldwide, covering both municipal and industrial sector.

The volute dewatering system has several advantages such as:

- Clog-free system
- Suitable for oily sludge
- Easy operation
- Low-concentration of sludge
- Energy saving and water saving

d. Project Detail

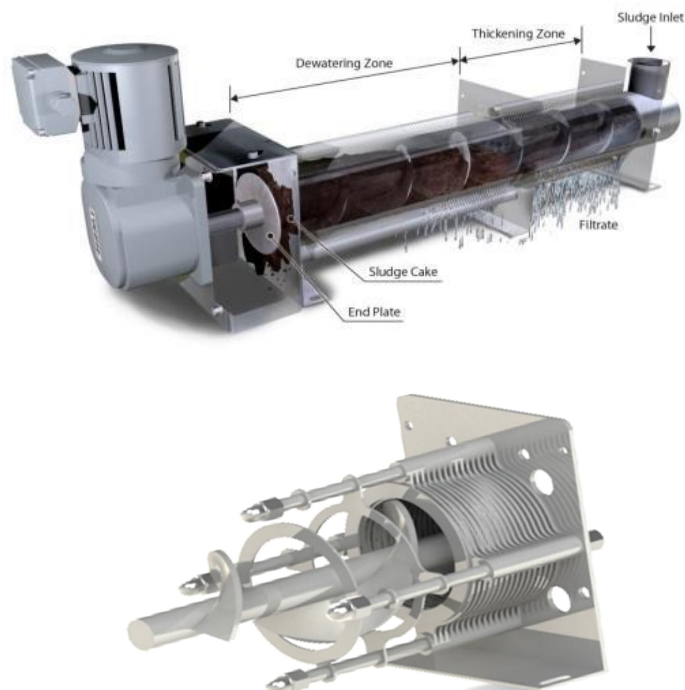


Figure: Volute dewatering system and Moving Filtration Body

In this study, we proposed two idea:

- Replacement of Belt Press with Volute Dewatering System
- Total Improvement of wastewater treatment system: (a) Replacement of electro coagulant system with microbubble unit and (b) combine with replacement of belt press system with volute dewatering system

4. The Results of study

II. High-efficiency Industrial Waste Water Treatment

2. Reference emission

High-efficiency model of conventional wastewater treatment plant.

$$REp = ECPI \times EFelec \times 1/(1-\lambda)$$

REp :Reference emissions during the period p [tCO₂/p]

ECPI,p :Amount of electricity consumption of the project plant during the period p [MWh/p]

λ :Energy-saving ratio [-]

EFelec :CO₂ emission factor for consumed electricity [tCO₂/MWh]

3. Monitoring methods

Electricity consumption to be monitored by Indonesian partner

II. High-efficiency Industrial Waste Water Treatment

4. Quantification of GHG emissions and their reductions

Year	Estimated Reference emissions (tCO _{2e})	Estimated Project Emissions (tCO _{2e})	Estimated Emission Reductions (tCO _{2e})
2017	42	2	40
2017-30	588	28	560

5. MRV methods (Eligibility criteria)

Criterion 1	The project energy-efficient wastewater treatment plant is newly installed or installed to replace existing equipment.
Criterion 2	The project plant consists of micro-bubble wastewater treatment unit and high-efficiency dewatering unit for sludge treatment.
Criterion 3	Periodical check at least once a month is planned. And the project system is continually monitored.

6. Capacity building: Training for operation of the project plant

7. Others (SD):Microbubble (control quality of discharging water)

Volute (easy operation and maintenance)

5. Conclusion and Next Steps

Based on our calculation result, the CO₂ reduction is about 40 tCO₂/year which was obtained by reduction of electricity consumption 44,693 kWh/year.

The next steps for implementation projects as follows: (a) Sign a letter of intention for introduced solution between AMCOM and PT Desa Air Cargo Batam.

C. Solar PV System at PT Desa Air Cargo Batam

1. Project Background

PT Desa Air Cargo is an Environmental Service Provider in Batam Island. In 1995, the company started to transport Industrial Hazardous Waste materials from Batam to final disposal in PPLI-Jakarta Indonesia. The company together with BIFZA built the hazardous waste temporary transfer facilities in 1997. Then, the company built their own treatment facilities step by step since year 2000. Through the installation of treatment facilities, the company could treat about 60% of total waste received from the industries in Batam. The treatment facilities include: (a) Electro coagulant (EFT) system for liquid waste; (b) Distillation unit for treatment of solvent based liquid waste and (c) various treatment facilities for solid waste recycle, reduce and reuse (3R) system.

The 3R system has create several opportunities for development of renewable energy system in the company and industrial complex in Batam. Therefore, the company seek various alternative to improve their 3R system facilities mainly for two main important issues: (a) reduce operational cost to send the materials for final treatment in Java Island and (b) increase the portion of waste which can be treated in Batam.

The city-to-city cooperation between Yokohama and Batam proposed a feasibility study to introduce renewable energy system which was developed by Yokohama based company, Finetech Co, Ltd. Finetech developed and managed Smart Green Park which combined solar energy, wind energy, biomass energy and hydro power generation system in a single park. The company also has experience to develop solar panel system in Fukushima area and other ASEAN region.

2. Objective of the FS

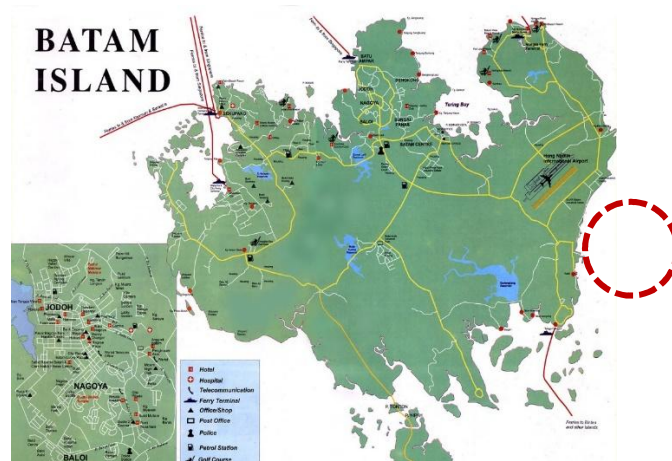
The objective of feasibility study on developing renewable energy system in PT Desa Air Cargo are as follows:

- Introduce solar PV system which can generate electricity for internal use by PT Desa Air Cargo and sell to other facilities nearby the company.
- The study also analyse future possibility on developing renewable energy from Biomass and integrated energy system in PT Desa Air Cargo in the future
- By introducing new system, the company can produce their own energy system and provide energy to the neighbourhood.
- The study will identify the potential CO₂ reduction from two options. The study also will develop methodology of GHG emission reduction and project design document (PDD) which can be implemented and expanded in remote area in Batam islands. The local city government has idea to implement independent solar energy system in remote islands.
- Introduction of new system will also reduce CO₂ emission from the industry as contribution to reduce global GHG Emissions.

3. Project Description

4. Project Location

- a. PT Desa Air Cargo Batam



b. Indonesian Partner

The partner of this study is PT Desa Air Cargo Batam, an Environmental Service Provider which was established in Batam since 1995. PT Desa Air Cargo Batam is seeking a treatment facilities for renewable energy which may: (a) Increase the total number of waste treated in Batam from the existing 60%; (b) reduce operational cost to send the waste to Java Island; and (c) improve the 3R facilities in PT Desa Air Cargo Batam.

The Indonesian partner is in charge of the following issues:

- Provide information and cooperation during survey and FS Study
- Taking necessary approval and authorizations for implementation of project

c. Description of Technology

Renewable energy project at PT Desa Air Cargo consists of following ideas:

- First step: Roof-top PV System with demand control implementation project
- Waste-to-energy (edible-oil refinery) combined with PV System with advanced demand control implementation project
- Add-on Biomass (waste)-based power generator

d. Project Detail of Roof-top PV system with demand control

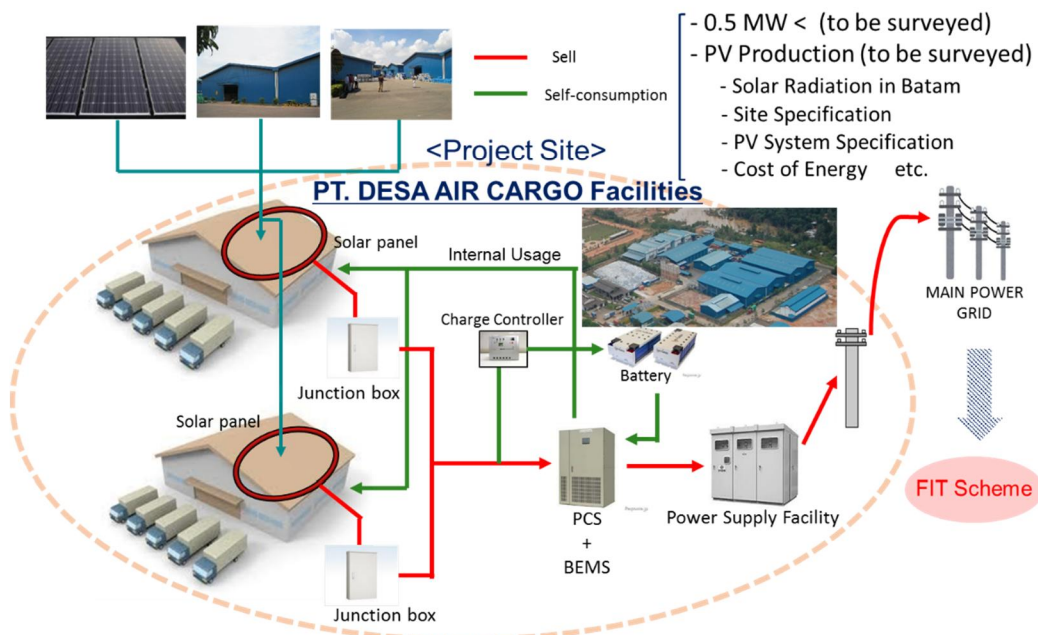


Figure 6 Roof-top Solar PV System with demand control at PT Desa Air Cargo

5. The Results of study

III. Renewable Energy at Industrial Area

2. Reference emission

$$RE_p = \sum_i EG_{i,p} \times EF_{RE}$$

RE_p : Reference emissions during the period p [tCO₂/p]

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

EF_{RE} : The reference CO₂ emission factor of the captive generator electricity) [tCO₂/MWh]

3. Monitoring methods

Electricity consumption to be monitored by Indonesian partner

III. Renewable Energy at Industrial Area

4. Quantification of GHG emissions and their reductions

Year	Estimated Reference emissions (tCO _{2e})	Estimated Project Emissions (tCO _{2e})	Estimated Emission Reductions (tCO _{2e})
2017	1,400	0	1,400
2017-30	19,600	0	19,600

5. MRV methods (Eligibility criteria)

Criterion 1	The project installs solar PV system(s).
Criterion 2	The solar PV system is connected to the internal power grid of the project site and/or to the grid for displacing grid electricity and/or captive generator electricity at the project site.
Criterion 3	The PV modules have obtained a certification of design qualifications (IEC 61215, IEC 61646 or IEC 62108) and safety qualification (IEC 61730-1 and IEC 61730-2).
Criterion 4	The equipment to monitor output power of the solar PV system and irradiance is installed at the project site.

6. Capacity building plan: Training for operation of the project plant

7. Others (Next step): Further discussion on final quotation of the project cost

6. Conclusion and Next Steps

Based on our calculation result, the CO₂ reduction is about 1,400 tCO₂/year. The roof-top solar PV system may produce electricity 1,564,246 kWh/year per site.

The next steps for implementation projects as follows: (a) Sign a letter of intention for installation of Roof-top solar PV system between Finetech and PT Desa Air Cargo; (b) Detail site investigation and developing project proposal for subsidy; (c) Submit the proposal for application of subsidy to Ministry of the Environment Japan.