FY2014 “Large-scale JCM Development Programme for Low Carbon Society in Asia”

Hai Phong Green Growth Action Plan Development in Association with Kitakyushu City

Final Report

March 2015

City of Kitakyushu
Institute for Global Environmental Strategies
Nikken Sekkei Civil Engineering Ltd.
NTT Data Institute of Management Consulting Inc.
Nishihara Corporation
Amita Corporation
Amita Institute for Sustainable Economies Co., Ltd.

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Summary

Background & Objective

This programme, which targets sectors with large GHG emissions in the City of Hai Phong in Viet Nam, aims to identify projects that can reduce emissions with assistance from Japan (in particular, CO_2 emissions from energy sources), and acquire JCM credits through the implementation of the programme. The results were used to help develop systems for local monitoring and quantification of emissions. The systems and policies necessary to expand these outcomes to the entire area are also being considered, and their adoption is being lobbied through consultations with related organizations and governmental authorities.

The low-carbon technologies of private companies, environmental management capacity and systems of local governments, and institutional analysis by research institutes and universities, as well as coordination among stakeholders was advanced with the long intercity cooperative relationship shared by cities of Kitakyushu and Hai Phong (conclusion of friendship agreement in 2009 and sister city cooperation in 2014) forming the basis for the implementation of this programme.

Overview of the City of Hai Phong

The City of Hai Phong has a population of 1.9 million people and is the third largest city in Viet Nam. Hai Phong is located about 100 km from the capital city of Hanoi on the coast, and is the largest marine distribution base in northern Viet Nam, with a concentration of large-scale industrial complexes. The city is connected to the capital of Hanoi by national route 5, and a new freeway will be opening in 2015. The Port of Hai Phong, which is the largest container port in northern Viet Nam, is able to accommodate 40,000 DWT (deadweight tonnage), and the Lack Huyen deep-sea port of 1,200 ha, which is currently under construction offshore, will be able to allow 2 large 100,000 DWT ships to berth at the same time. The City of Hai Phong is aiming to become an environmentally-friendly Green Port City as the largest port distribution complex in northern Viet Nam.

Hai Phong's economy is growing about 7.5% annually, and GDP per person has reached USD 2,500 (2013). There are 11 industrial parks in the city, and more than 50 Japanese firms have entered the market in Hai Phong. The city is expected to make further inroads from the perspective of the importance of smooth economic growth and as a distribution base.

Viet Nam National Strategy on Climate Change (2011)

The National Strategy on Climate Change (2139/QD-TTg) was enacted in 2011 in Viet Nam. The strategy has four priority objectives: development of renewable energies; industrial production and energy savings in construction and the transportation sector; efficiency in the agricultural sector; and treatment of waste and energy use. The direction of these proposed projects are in agreement with the strategy's objectives.

Viet Nam Green Growth Strategy (2012)

The Government of Viet Nam developed and concluded the country's Green Growth Strategy in 2012 in order to promote the reduction of GHG emissions and maintain economic development. This strategy includes targets to reduce GHG emissions by 20% in 2020 (10% for overseas cooperation), 30% by 2030 (same as 2020), and 1.5% to 2% by 2050 annually (as compared to levels in 2010). In order to achieve these targets, the strategy identifies 17 policies, which include the effective use of energy, review of fuel composition, development of renewable energy resources, review of industrial sector plans and promotion of environmentally-friendly production methods, adoption and expansion of cleaner production, sustainable urbanization, financing, human resources development, and international cooperation, among others.

The Ministry of Planning and Investment, which has jurisdiction over this strategy, is currently developing an overall plan for the national level to achieve the targets set out in the Green Growth Strategy. The plan will be applied to the local level as well (provincial cities and cities under the direct authority of the central government). The City of Hai Phong will play a leading role in the development of this plan, and is seeking technical cooperation from the City of Kitakyushu, with which it has a friendship city cooperation agreement. In response to this request, Kitakyushu established a sister city agreement with Hai Phong in 2014, and is actively promoting cooperation, utilizing the Kitakyushu Model as a support tool, which is a compilation of the policies and know-how garnered by Kitakyushu during its process of overcoming pollution to its current status as an environmental city.

Project Implementation Details

This project was implemented with the objective of providing support for the development of a low-carbon city plan for Hai Phong, and selecting CO_2 emission reduction projects (JCM project development) related to the energy, transport, and waste sectors, as well as conservation of Cat Ba Island.

Creation of plan for the development of a low-carbon city

Although Hai Phong is aiming to become a Green Port City as the largest port distribution

base in northern Viet Nam, it was discovered through preliminary surveys that the city faces many problems in different sectors, including waste, water and sewage, rainwater supply, transportation, energy, environmental protection, and protection of biodiversity. This project provided support for the development of the Green Growth Action Plan (and creation of a plan for the development a low-carbon city), into which solutions to these problems have been woven.

Energy sector

The Law on Economical and Efficient Use of Energy was enacted in 2010 in Viet Nam, which requires the development of an energy use plan every five years and a report on energy accounting every three years by major energy consuming businesses (that use over 1,000 tons/year of fuel), as well as the development of energy plans and reports on energy accounting by businesses with buildings with a total floor area of over 2,500 m^2. There are 47 major energy consuming businesses in Hai Phong (2012) that consume 40% of all the energy in the entire city.

Electric power and energy consumption in Viet Nam continue to increase each year, and prices are also rising. This trend is reflected in the increasing interest of local businesses in energy savings.

Within the energy sector of this plan, the project looked at business development in three areas: introduction of cleaner production in plants that have high energy consumption (high energy consumers), energy savings in large-scale businesses, and installation of LED lighting on roads.

Iron foundries, food processing plants, paper mills, and cement plants, which are big consumers of energy, were the targets for the introduction of cleaner production. The project examined the potential for energy savings, high-efficiency electric furnaces and the introduction of distributed power supply, reduced use of raw materials, and adjustment of the treatment of waste gas through local assessments of factories and collection of related data.

The plan also examined the potential to introduce energy savings (air conditioning, thermoelectric supply equipment, lighting systems, building energy management systems (BEMS)) and distributed power supply in large-scale businesses through local assessments and collection of data on energy consumption. Targets for the introduction of water conservation equipment and conversion of energy sources of boilers (form coal to natural gas) included office buildings, commercial facilities, and hospitals.

Development of packages with photovoltaic power generation and operation and management of infrastructure using IT were also considered for the installation of LED lighting for roads.

Waste sector

The waste sector targeted four areas: promotion of recycling of metals, plastics, and paper and composting of organic waste through the promotion of the separation of general waste; power generation from incineration of waste residue after separation; production of raw materials for cement from industrial waste, such as hazardous wastes; and the proper treatment of electric/electronic waste (e-waste), including fluorocarbons. The project conducted a survey on the current state of waste generation and treatment flow for each area, and examined business models and necessary legal systems to support proper treatment, the potential to reduce CO_2 emissions, and MRV methodologies.

The project carried out a survey on the design of the final disposal site and collection/transportation system in the JICA project for the waste sector in Hai Phong, and conducted interview surveys to establish a Hai Phong project team in order to implement the project.

Conservation of Cat Ba Island (Creation of resource recycling model)

Cat Ba Island is a reserve of 26,000 ha (17,000 ha of land and 9,000 ha of sea) in the largest group of islands in Ha Long Bay, and is a treasure house for biodiversity, where 4,000 species of animals and plants live. The island has a population of about 30,000 people, and each year, more than 1 million tourists visit the island, making it one of Viet Nam's most prominent tourist areas. However, Cat Ba Island is facing problems with the treatment of wastewater and waste, which is increasing in recent years due to large-scale tourism development, as well as the protection of the island's valuable ecosystem. This project looked at measures to address these issues and developed proposals for eco-development and the creation of a resource recycling model for the island.

Main activities included consideration of energy-saving measures for tourist facilities, such as hotels; use of renewable energies; introduction of water-saving equipment; proposals for eco-tours using electric vehicles and electric bicycles; development of biogas from waste, organic waste, night soil, and sludge generated on the island, and their effective use through the processing of solid fuel; and financial mechanisms, such as an island tax to financially support these activities.

Overall summary

The City of Kitakyushu and the Institute for Global Environmental Strategies (IGES) were responsible for integrating the surveys on the above three sectors, and creating a report on the progress of the project for stakeholders in Hai Phong. To explain the details of the project to stakeholders in Hai Phong, a total of four meetings were organized, including an Inception Workshop in May, progress report meeting in July, interim report in November, and a seminar to report the outcomes of the project in January.

Together with the meetings in July and November, a workshop was also organized to discuss the request by Hai Phong to Kitakyushu regarding the development of Hai Phong's Green Growth Plan, and Kitakyushu's responses. The outcomes of the project were planned to be incorporated into the Green Growth Plan.

Implementation System

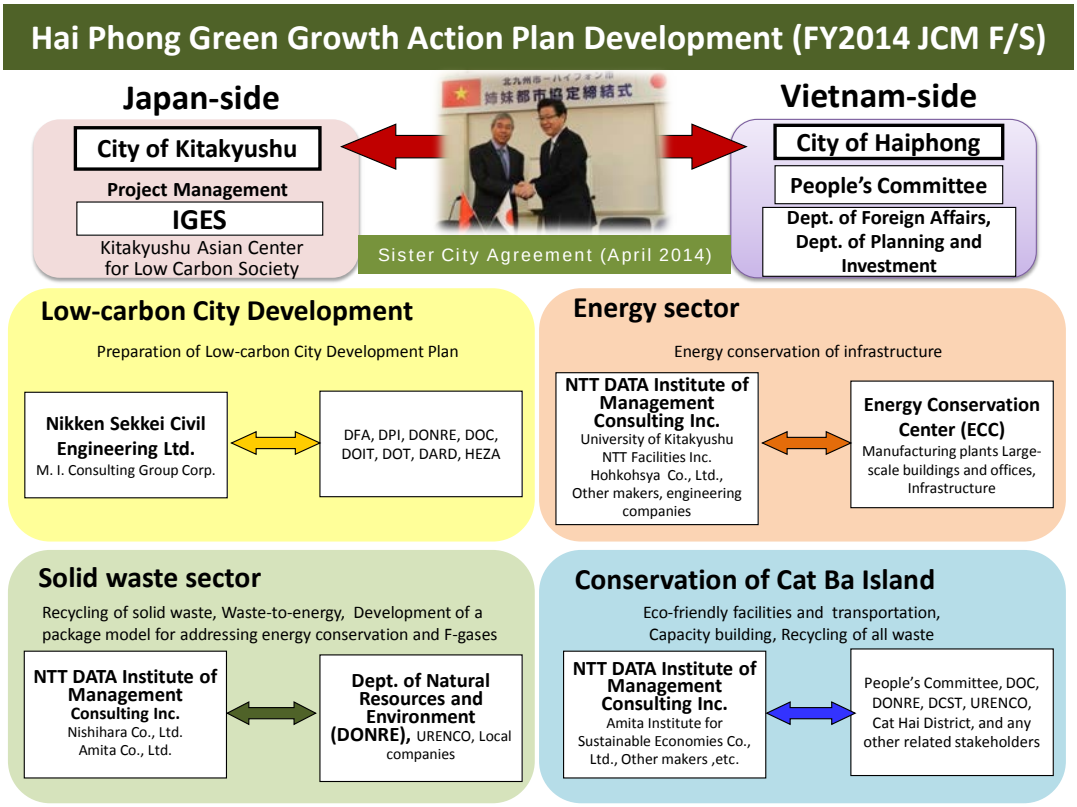
As shown in the implementation system figure below, IGES and the Kitakyushu Asian Center for Low Carbon Society are responsible for the overall coordination of the project and coordination with Hai Phong. Counterparts in Hai Phong, mainly the Department of Foreign Affairs and the Department of Planning and Investment, submitted reports on appropriate progress to the central government authorities and related Japanese departments (embassy, JICA, etc.) to seek cooperation.

Nikken Sekkei Civil Engineering Co. is in charge of the development of a low-carbon city plan. This company has a local office in Hanoi, and a good track record of achievements, including the development of urban planning and master plans in Viet Nam. In Hai Phong as well, Nikken Sekkei has a proven record in the development a master plan for the construction of the Dinh Vu-Cat Hai Economic Zone until 2025, detailed urban planning for the areas surrounding the Lach Tray river, and as the winner of an urban design competition for the south bank of the Cam river (highest award).

NTT Data Institute of Management Consulting is responsible for the energy sector. NTT Data is in charge of the energy sector as well for the development of large-scale JCM project feasibility studies in the city of Surabaya, Indonesia, in cooperation with Kitakyushu and IGES, and has a number of related achievements. For cleaner production in factories, the project has called for the cooperation of The University of Kitakyushu. NTT Facilities is responsible for assessments on energy savings, and Hohkohsya Co. and other manufacturers and engineering firms are offering cooperation for the installation of LED lighting on roads.

NTT Data Institute of Management Consulting was also responsible for coordination in the waste sector. NTT Data carried out a project on the recycling of e-waste (2012, Ministry of Economy, Trade and Industry) in cooperation with Nippon Magnetic Dressing Co., and implemented a joint project on intermediate treatment of recyclable waste in Surabaya, Indonesia (2012, Ministry of Foreign Affairs; 2013, JICA) with Nishihara Corporation. Both companies also took part in this project in other sectors. Hitachi Zosen Corporation extended their cooperation for the project by examining the generation of power from the incineration of waste residue from intermediate treatment facilities. Amita Corporation was responsible for studying the production of raw materials for cement from industrial waste (hazardous waste).

NTT Data Institute of Management Consulting and Amita Institute for Sustainable Economies were responsible for studies on the conservation of Cat Ba Island (creation of a resource recycling model). NTT Data examined the introduction of renewable energies in tourist facilities on the island, water conservation and use of rainwater, expanded use of electric vehicles and bicycles, and financial mechanisms, such as an island tax. Amita Institute examined the production of biogas from waste, night soil and sludge generated at hotels and by residences on the island, and policies for the effective use of solid fuels. Amita Institute for Sustainable Economies has a proven track record in participation in the development and demonstration of local recycling plans using biogas facilities for organic waste and biomass resources as models for the reconstruction of disaster areas in the town of Minami Sanriku in Miyagi prefecture (2012, Ministry of the Environment), as well as a preliminary survey on the creation of resource recycling systems in the Republic of Palau (2013-2014, Ministry of the Environment).



Work Flow

This project was implemented through the below process.

Stakeholders in all sectors took part in the first and final domestic meetings held in Kitakyushu, as well as related meetings organized in Haiphong. At these meetings, workshops on the development of a Green Growth Action Plan in Hai Phong were organized, at which the blueprint for the project was submitted, progress of the plan could be confirmed by all

stakeholders, and participants could discuss the cooperative projects that were expected of Kitakyushu. At the interim report meeting in October, Kitakyushu submitted the details of potential support projects, and discussions were held on how to promote these activities in the future.

From 8 to 30 September 2014, there was a NAMA/MRV (development of low-carbon city plan) training session held at JICA Kyushu in Kitakyushu, in which two staff from Hai Phong and one member of the Vietnamese national government took part. The IGES Kitakyushu Urban Centre supervised this training session, with the objective of expanding similar activities to other cities with detailed reference to the low-carbon policies in Kitakyushu.

In July and October, a meeting on JCM was organized in Yokohama, in which stakeholders from Hai Phong participated. Both Hai Phong and Kitakyushu also took part in the 6th High Level Seminar on Environmentally Sustainable Cities held in Johor Bahru in Malaysia in February.

Implementation Flow

Apr 2014	Adoption of programme, exchange of contracts
13 May (Tue) 26 May	**1st Domestic Stakeholders Meeting (in Kitakyushu)** **Inception Meeting (@City of Hai Phong)**
June	
22 Jul (Tue) 23-24 Jul 28 Jul (Mon)	Workshop on JCM (at Pacifico Yokohama) ● Participation of two staff from Hai Phong ISAP 2014 (at Pacifico Yokohama) ● Participation of Hai Phong in workshop on JCM **Progress report meeting (in Hai Phong)**
August	
8-30 Sep	**JICA Training on NAMA/MRV (development of low-carbon city plan) (in Kitakyushu)** ● Participation of two staff from Hai Phong and one member of the Vietnamese national government
3 Oct 20 (Mon) 28-29	**2nd Domestic Stakeholders Meeting (in Kitakyushu)** **Interim report meeting (in Hai Phong)** Workshop and seminar on JCM (at Pacifico Yokohama) ● Participation of cities implementing JCM projects, including Hai Phong
Dec	
Jan 2015 16 (Fri) 19 (Mon)	JCM report meeting (at Ministry of the Environment) **Workshop on report of outcomes of project (in Hai Phong)**
9-10 Feb	6th High Level Seminar on Environmentally Sustainable Cities ● Participation of Hai Phong and Kitakyushu
6 Mar (Fri)	**Submission of final report**

Results of Survey

Potential CO_2 Emission Reductions & Cost Effectiveness from Reductions

All potential CO_2 emission reductions and their cost effectiveness are listed in the following table.

Kết quả nghiên cứu tính khả thi dự án JCM: Tiềm năng giảm thiểu CO_2

【】giảm thiểu khí CO2 được tính bao gồm cả giảm thải khí CH4　　* Giả định dự án hỗ trợ 50% vốn đầu tư ban đầu　　USD1 = JPY100

Lĩnh vực		Nội dung	Lượng giảm phát thải [t-CO2/năm]	Vốn đầu tư [USD]	Chi phí giảm thải [USD/t-CO2/năm]	Chi phí giảm thải nếu có hỗ trợ* [USD/t-CO2]【EUL】
Năng lượng	Nhà máy bia A【tạm dừng】	Cải thiện máy nén lạnh	35	130,000	3,700	
	Nhà máy đúc (áp dụng lò điện)	**Thay thế lò điện của Trung Quốc**	**400**	**500,000**	**1,200**	**42【15 năm】**
		Thay thế lò đốt than	**1,000**		**500**	**17【15 năm】**
	Khách sạn A【tạm dừng】	Cải thiện điều hòa không khí	75	270,000	3,600	
	Trung tâm thương mại A	Cải thiện điều hòa không khí	300	280,000	900	31【15 năm】
		Cải thiện tủ lạnh	140	220,000	1,600	52【15 năm】
	Bệnh viện A【tạm dừng】	Cải thiện điều hòa không khí	35	220,000	6,300	
	Đèn đường	Đèn LED【không bao gồm các đầu cực】	600	4.0m	6,700	220【15 năm】
	Nhà máy xi măng	Máy phát điện từ nhiệt thải	Đang ng/ cứu	Đang ng/ cứu	Đang ng/ cứu	
Chất thải rắn	Tái chế, ủ làm phân compost	Xử lý 40tấn/ngày	【1,400】	750,000	【500】	【28】【9 năm】
	Nhà máy chuyển chất thải thành năng lượng	Năng lực 600tấn/ngày, 9,000kW	- 48,000 【46,000】	74triệu	— 【1,600】	— 【54】【15 năm】
	Xử lý khí freon	Năng lực 3kg/giờ (6tấn/năm)	14,000	350,000 (không gồm phí thu gom)	25	1.4【9 năm】
	Tái chế chất thải công nghiệp	Tái sử dụng dầu thải 2,000t/năm Nguyên liệu cho sx xi măng 24,000t/năm	1,200	3.0triệu	2,500	140【9 năm】
Đảo Cát Bà	Cải thiện hiệu quả sử dụng năng lượng	20 xe buýt điện	700	6.3triệu	9,000	900【5năm】
		Tấm pin năng lượng mặt trời: 200kW	100	200,000	2,000	110【9 năm】
		Tiết kiệm năng lượng ở k sạn(A/C, tủ lạnh)	45	120,000	2,600	89【15 năm】
		Đèn đường (313 vị trí)	100	60,000	600	20【15 năm】
		Nhà máy sản xuất nước đá	35	Đang ng/ cứu	Đang ng/ cứu	
	Hệ thống tuần hoàn nguồn tài nguyên 【Nghiên cứu khả thi khi áp dụng thuế thăm quan đảo cho du khách 】	Cơ sở tạo khí Biogas: 5.6 tấn/ngày	16 【2,600】	1.0triệu	62triệu 【380】	210 【13】【15năm】
		Viên nhiên liệu rắn từ rác: 0.8tấn/ngày	50 【370】	900,000	1.8triệu 【2,400】	100 【130】【9năm】
Vận tải	Xe buýt công cộng	2 xe buýt điện, thẻ điện tử, trạm nạp điện	Đang ng/ cứu	600,000	Đang ng/ cứu	

* Service life (depreciation period) was set as follows, using the depreciation period from the National Tax Administration Agency.

- Energy-savings equipment of buildings: 15 years (buildings and accompanying facilities, electrical equipment and air conditioning, heating systems, ventilation or boiler equipment, other)
- Separation, recycling and composting facilities, facilities for the production of raw materials for cement from business waste, projects on the production of solid fuel: 9 years (equipment for other manufacturing industries)
- Power generation from incineration and biogas production projects: 15 years (equipment for gas industry, equipment for supply, other equipment)
- EV shuttle bus: 5 years (vehicles and transport vehicles, transportation business, large passenger vehicles)
- Photovoltaic power generation: 9 years (equipment used by mechanical equipment manufacturers for transport)

The potential for the development of three projects in the energy sector is high: installation of electric furnaces in iron foundries, energy savings in commercial establishments, and installation of LED lighting on roads. In particular, the installation of electric furnaces in iron foundries will bring about a number of benefits if installing high efficiency induction furnaces manufactured in Japan (When converting from Chinese-manufactured electric furnaces, emission reductions of 400 t-CO_2/year per capita can be expected, and when converting from coal furnaces, this figure is 1,000 t-CO_2/year.) Reduction of unit price for JPY 50 million of initial investment will be JPY 50,000 to 120,000/t-CO_2/year (JPY 1,700 to 4,200/t-CO_2 with

expected depreciation period of 15 years and 50% subsidy).

The component on energy savings in commercial facilities (updating chillers and refrigerated display cases) also has high potential for JCM project feasibility, with a reduction unit price per one ton of CO_2 at about JPY 100,000/year (about JPY 3,000 to 5,000 with depreciation period of 15 years and 50% subsidy). A similar unit price is seen for LED lighting on roads at a high price of JPY 670,000/year, however, this price also includes poles. Substantial reductions can only be expected for the prices for lights and bulk administration. Detailed discussions must be carried out with stakeholders in the future. There is also potential develop JCM projects for waste heat recovery and power generation projects that use the technologies of Japanese companies in cement plants in the city, which are currently in progress.

Additionally, JCM project feasibility was examined for breweries, hotels, and hospitals, however, the costs related to CO_2 emissions for initial investment was calculated at over JPY 300,000/year, and it was determined that the potential for project development was low.

Four areas were studied in the waste sector: separation and composting facilities, incineration power generation, destruction of fluorocarbons, and production of raw materials for cement from business waste. The studies determined separation/composting facilities and incineration power generation had potential to be developed as JCM projects when considered from the perspective of the control of the generation of methane gas, with cost effectiveness estimated at JPY 50,000/t-CO_2/year (JPY 2,800/t-CO_2 with depreciation period of 15 years and 50% subsidy) and JPY 160,000/t-CO_2/year (JPY 5,300/t-CO_2 with depreciation period of 15 years and 50% subsidy), respectively. However, if this is purely limited to the reduction of CO_2 emissions from petroleum sources, there is no potential for project development. With regard to incineration power generation, the results of the study found that waste had a high water content and lower calorific value (LCV) at 400 to 700 kcal/kb, and it would be necessary to combine this with preprocessing of the waste in order to reach the calorific value of about 1,500 kcal/kg needed for incineration power generation.

With regard to the destruction of fluorocarbons, the cost benefits for CO_2 emission reductions for initial investment in the destruction are high (about JPY 2,500/t-CO_2/year). However, it would be necessary to enforce laws and improve compliance to guarantee systems and mechanisms to collect fluorocarbons from air-conditioners used in households and in businesses that are being disposed (thousands of units each year). A long-term implementation system would be required.

With regard to the production of raw materials for cement from business waste, cost effectiveness is slightly high at JPY 250,000/t-CO_2/year (JPY 14,000/t-CO_2 with a depreciation

period of 9 years and 50% subsidy). However, it is possible to increase the amount of emissions that can be reduced by closely examining the current incineration treatment systems for waste oil and waste plastic, which form the baseline of the project. This may indicate additional possibilities for lowering the unit price. From interviews with local companies, the demand for proper treatment of hazardous waste and provision of effective services has been determined to be high with a focus on Japanese firms. However, cement companies are accepting and treating hazardous waste, although there is no business model available in which they receive processing fees (several companies are putting this into effect, however, the amount of waste used per one ton of cement produced is about 60 kg (as compared to 480 kg in Japan)). It is necessary to approach related governmental agencies with regard to the potential to develop this into a project because the Ministry of Construction, under which jurisdiction for this falls, is not promoting this idea.

On Cat Ba Island, a study was carried out on the development of low-carbon facilities, such as hotels (introduction of solar power and EV, energy savings, LED lighting on roads, etc.) and the creation of a resource recycling system for the production of biogas from hazardous waste and production of solid fuel from solid waste. For the development of low-carbon facilities, cost effectiveness for energy savings in hotels and from roadside lighting was high at around JPY 60,000/t-CO_2/year (JPY 2,000/t-CO_2 with a depreciation period of 15 years and 50% subsidy). Cost effectiveness for solar power and energy savings in hotels was relatively expensive at JPY 200,000 to 260,000/t-CO_2/year (about JPY 10,000/t-CO_2 with a depreciation period and 50% subsidy) and for the introduction of EV buses at JPY 900,000/t-CO_2/year (JPY 90,000/t-CO_2 with a depreciation period of 5 years and 50% subsidy).

The potential for project development for the creation of a resource recycling system opens up when considering the control of the generation of methane gas (less than JPY 210,000/t-CO_2/year). However, from the perspective of CO_2 emission reductions from petroleum sources, its application is difficult. This study proposed the imposition of a new tax on entry to the island (JPY 20-22/person) for tourists, which total more than one million people a year, to be used as the costs of improving facilities. If an island tax could be levied, initial investment could be recovered in about five years, and it would be possible to reduce CO_2 emissions and create a resource recycling model for the island.

In addition to the above, the project proposed the improvement of convenience for public transport with the introduction of electric buses and use of IC cards as a way to reduce CO_2 emissions from the transport sector in the city, and as one policy to support the development of the Green Growth Action Plan for the entire city.

Implementation Plan towards JCM Project Feasibility

An implementation plan of projects towards JCM project feasibility are listed in the following table.

Implementation Plan of JCM Projects in Hai Phong

USD1 = JPY100

Area		Contents	Capital Cost [USD]	FY2015	FY2016	FY2017	FY2018	Expected subsidy
Energy	Improving energy efficiency*	Casting factories	500,000	P/S	**EPC**	**O&M, MRV**		MOEJ
		Commercial building	500,000	Detailed F/S	P/S	**EPC**	**O&M, MRV**	
		Street lights: LED	4.0m					
		Cement factories: waste heat	t.b.c.					
Solid Waste	Waste recycling, composting	Rural model: 40t/day Urban model: 200t/day	750,000	Detailed F/S	Rural model	Urban model implementation		MOEJ
	Waste-to-energy plant	600t/day processing capacity, 9,000kW	74m	Detailed F/S	P/S	EIA, **EPC**	**O&M (FY2020)**	JICA Loan & MOEJ
	Destroying freon gases	3kg/hr (6t/yr) capacity	350,000	Detailed F/S	P/S	**O&M, MRV**		MOEJ
	Industrial waste recycling	Liquid alternative fuels 2,000t/yr Cement raw materials 24,000t/yr	3.0m	Detailed F/S	P/S	**EPC**	**O&M, MRV**	MOEJ
Cat Ba Island**	Improving energy efficiency*	Electric buses, PV, hotels, street lights, ice cube factories	500,000	Detailed F/S	P/S	**EPC**	**O&M, MRV**	MOEJ
	Resource circulation system	Biogas generation: 5.6t/day	1.0m	Detailed F/S	P/S	**EPC**	**O&M, MRV**	MOEJ
		Refuse derive fuel: 0.8t/day	900,000					
Transport	Public buses	2 electric buses, IC card, charging station	600,000	Detailed F/S	P/S	**O&M, MRV**		MOEJ, JICA

* Considering additional 30% subsidy for investment in energy efficient equipment from Ministry of Industry and Trade, Viet Nam
** Proposing to introduce an island entrance tax to fund the proposed projects
F/S: Feasibility study P/S: Project formulation study EPC: Engineering, procurement and construction O&M: Operation and maintenance
MRV: Measuring, reporting and verification EIA : Environment impact assessment MOEJ: Ministry of the Environment, Japan

Looking at this figure, it can be seen that the earliest project that could be implemented is the installation of electric furnaces in iron foundries. Next fiscal year, a project survey (P/S) will be implemented and a plan will be developed with select companies within the fiscal year. Further detailed feasibility studies (F/S) for JCM project development of other projects will be necessary next fiscal year. After these studies are concluded, JCM project feasibility studies can be implemented the following fiscal year, and plans can be put into effects from the year after that. The expected project implementation budget for many of the projects will use assistance for CO_2 emission reduction technology from the Ministry of the Environment. Incineration power generation, which is a large-scale project, will use both the assistance scheme for CO_2 emission reduction technology of the Ministry of the Environment and the JICA overseas private sector investment scheme.

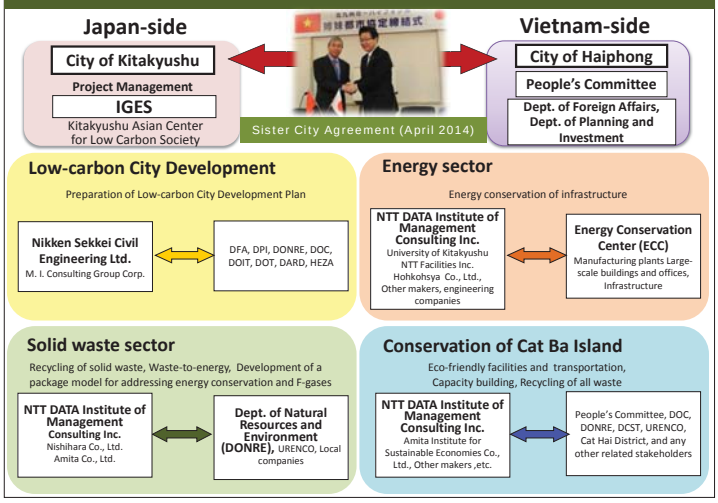
Hai Phong Green Growth Action Plan Development in Association with Kitakyushu City

（FY2014 Feasibility Study for JCM Large-Scale Project Development, Ministry of the Environment, Japan）

19 January 2015

IGES Kitakyushu Urban Centre

Hai Phong Green Growth Action Plan Development (FY2014 JCM F/S)



FY2014 Results of JCM F/S in Hai Phong：CO2 Emissions Reduction Potential

【 】CO2 emissions reduction including avoidance of methane gas emissions　* Assuming 50% subsidy for capital investment　USD1 = JPY100

Area		Contents	Emissions Reduction [t-CO2/yr]	Capital Cost [USD]	Emissions Reduction Cost [USD/t-CO2/yr]	Emissions Reduction Cost with Subsidy* [USD/t-CO2]【EIA】
Energy	Beer factory A【suspended】	Improving refrigeration compressors	35	130,000	3,700	
	Casting factory (adopting electric furnace)	**Replacing Chinese electric furnaces**	**400**	**500,000**	**1,200**	**42【15 yrs】**
		Replacing coal-fired furnaces	**1,000**		**500**	**17【15 yrs】**
	Hotel A【suspended】	Improving chillers	75	270,000	3,600	
	Commercial building A	Improving chillers	300	280,000	900	31【15 yrs】
		Improving freezers	140	220,000	1,600	52【15 yrs】
	Hospital A【suspended】	Improving air conditioners	35	220,000	6,300	
	Street light	LED【poles not excluded yet】	600	4.0m	6,700	220【15 yrs】
	Cement factory	Power generation by waste heat	t.b.c.	t.b.c.	t.b.c.	
Solid Waste	Waste recycling, composting	40t/day processing capacity	【1,400】	750,000	【500】	【28】【9 yrs】
	Waste-to-energy plant	600t/day capacity, 9,000kW	- 48,000 【46,000】	74m	— 【1,600】	— 【54】【15 yrs】
	Destroying freon gases	3kg/hr (6t/yr) capacity	14,000	350,000 (not incl. collection cost)	25	1.4【9 yrs】
	Industrial waste Recycling	Liquid alternative fuels 2,000t/年 Cement raw materials 24,000t/年	1,200	3.0m	2,500	140【9 yrs】
Cat Ba Island	Improving energy efficiency	20 electric buses	700	6.3m	9,000	900【5 yrs】
		Photovoltaic panels: 200kW	100	200,000	2,000	110【9 yrs】
		Energy saving of hotels (A/C, fridge)	45	120,000	2,600	89【15 yrs】
		Street lights (313 units)	100	60,000	600	20【15 yrs】
		Ice cube factory	35	t.b.c.	t.b.c.	
	Resource circulation system 【Proposing island entrance tax for USD0.2/person】	Biogas generation: 5.6t/day	16 【2,600】	1.0m	62,000 【380】	210 【13】【15yrs】
		Refuse derived fuel: 0.8t/day	50 【370】	900,000	18,000 【2,400】	100 【130】【9yrs】
Transport	Public buses	2 electric buses, IC cards, charging station	t.b.c.	600,000	t.b.c.	

Implementation Plan of JCM Projects in Hai Phong

USD1 = JPY100

Area		Contents	Capital Cost [USD]	FY2015	FY2016	FY2017	FY2018	Expected subsidy
Energy	Improving energy efficiency*	Casting factories	500,000	P/S	EPC	O&M, MRV		MOEJ
		Commercial building	500,000	Detailed F/S	P/S	EPC	O&M, MRV	
		Street lights: LED	4.0m					
		Cement factories: waste heat	t.b.c.					
Solid Waste	Waste recycling, composting	Rural model: 40t/day Urban model: 200t/day	750,000	Detailed F/S	Rural model	Urban model implementation		MOEJ
	Waste-to-energy plant	600t/day processing capacity, 9,000kW	74m	Detailed F/S	P/S	EIA, EPC	O&M (FY2020)	JICA Loan & MOEJ
	Destroying freon gases	3kg/hr (6t/yr) capacity	350,000	Detailed F/S	P/S	O&M, MRV		MOEJ
	Industrial waste recycling	Liquid alternative fuels 2,000t/yr Cement raw materials 24,000t/yr	3.0m	Detailed F/S	P/S	EPC	O&M, MRV	MOEJ
Cat Ba Island**	Improving energy efficiency*	Electric buses, PV, hotels, street lights, ice cube factories	500,000	Detailed F/S	P/S	EPC	O&M, MRV	MOEJ
	Resource circulation system	Biogas generation: 5.6t/day	1.0m	Detailed F/S	P/S	EPC	O&M, MRV	MOEJ
		Refuse derive fuel: 0.8t/day	900,000					
Transport	Public buses	2 electric buses, IC card, charging station	600,000	Detailed F/S	P/S	O&M, MRV		MOEJ, JICA

* Considering additional 30% subsidy for investment in energy efficient equipment from Ministry of Industry and Trade, Viet Nam
** Proposing to introduce an island entrance tax to fund the proposed projects
F/S: Feasibility study　P/S: Project formulation study　EPC: Engineering, procurement and construction　O&M: Operation and maintenance
MRV: Measuring, reporting and verification　EIA：Environment impact assessment　MOEJ: Ministry of the Environment, Japan

Green Growth Action Plan Support Project in Hai Phong City in Collaboration with Kitakyushu City "Energy Sector"

January, 2015
NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.
Socio & Eco Strategic Consulting Unit

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Project Outline

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- ◆Energy saving diagnosis and feasibility assessment of distributed power system introduction were conducted at about five sites targeting factories and offices for the purposes of JCM project finding, feasibility assessment in terms of project profitability and potential assessment of GHG reduction.
- ◆Potential of energy saving and GHG reduction for the infrastructure was also assessed such as for road lighting system.
- ◆Measures to utilize the Hai Phong environmental conservation fund were discussed.

	①Factory	②Offices	③Infrastructure
Theme	Introduction of Cleaner Production including promotion of energy saving	Promotion of energy saving and carbon reduction for large offices with co-benefit effects	Energy saving for infrastructure with future possibility of its efficient management in scope
Target	Large factories, Parts-supply industries (casting, metal processing, etc.), Industrial estate	Hospitals, Hotels, Commercial facilities, etc.	Roads, Bridges, etc.

Survey Items

① Site selection
② Diagnosis of current situation
③ Examination of measures
④ Proposal of measures and discussion
⑤ GHG reduction potential assessment and development of MRV methodology
⑥ Discussion on the measures to utilize the Hai Phong environmental conservation fund
⑦ Feasibility assessment
⑧ Preparation for the application for JCM projects

Project Flow

NTT DATA

Original Plan → Result

Survey Items	2014 Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	2015 Jan	Feb
①Site selection											
②Diagnosis of current situation											
③Examination of measures											
④Proposal and discussion											
⑤GHG reduction potential assessment, MRV methodology development											
⑥Discussion of fund utilization measrues											
⑦Feasibility assessment											
⑧Preparation for application for JCM project											
Report writing											
Draft development											
Follow-up survey and finalization											

Planning for JCM Projects

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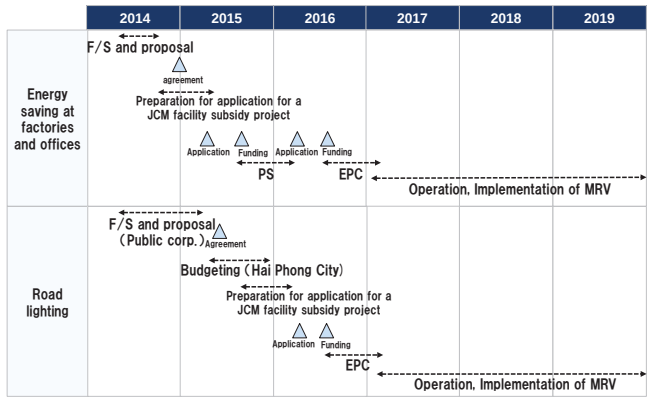
At least one candidate project should proceed to PS in 2016 and Start a JCM project in 2017 at an early case.



Beer Factory A (Factory)

NTT DATA

Progress

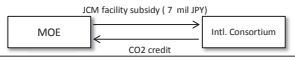
- 7/3) Project introduction (NTT)
- 7/31) Energy saving diagnosis (NTT, NTT-GP)
- Discussion with vendors and cost estimation

Technology

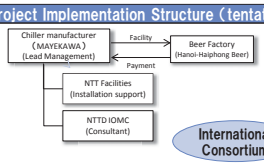
High efficiency chiller

Project Scheme

International consortium utilizing JCM facility subsidy



Project Implementation Structure (tentative)



Future Public Project and the Scale

- FY2015:F/S continues (including project finding)
- FY2017:MOE JCM facility subsidy project

	FY 2015	FY 2016	FY 2017
Initial Cost	13 mil JPY	-	-
Maintenance Cost	-	pending	pending
CO2 reduction (Energy origin)	-	35 tCO2	35 tCO2

Request for Hai Phong City

- Project site introduction
- Supervision of local companies at the time of JCM project
- Connection to Vietnam government support menu

Power Generation by Heat Recovery at Cement Factory (Factory)

NTT DATA

Progress

- April) Discussion and site investigation (NTT)
- Currently under construction of power generation facilities by heat recovery
- Energy saving diagnosis report obtained. (NTT, NTT-GP)
- Discussion with Japanese cement companies

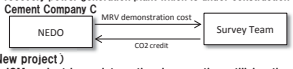
Technology

Power Generation Facility by Heat Recovery

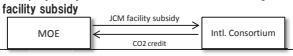
Source : Kawasaki Heavy Industries

Project Scheme

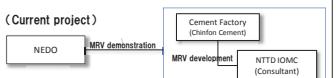
(Current project)
- JCM project by MRV demonstration program for the heat recovery power generation plant which is under construction at Cement Company C



(New project)
- JCM project by an international consortium utilizing the facility subsidy



Project Implementation Structure (tentative)



Future Public Project and the Scale

- FY2015:MRV demonstration (current project)
- FY2016:F/S for project finding (new project)
- FY2017-:MOE JCM facility subsidy project

	FY 2015	FY 2016	FY 2017
Initial cost	2000 mil JPY	-	-
Maintenance cost	-	pending	pending
CO2 reduction (Energy origin)	-	To be estimated	To be estimated

Request for Hai Phong City

- Introduction of cement factories which has interest in heat recovery power generation
- Supervision of local companies at the time of JCM project
- Connection to Vietnam government support menu

Energy Saving Project at Commercial Facilities (Offices)

NTT DATA

Progress

- 4/24) Project introduction (NTT)
- 7/2) Energy saving diagnosis (NTT, NTT-GP)
- Discussion with vendors
- 7/31) Discussion on project procedure
- August) Onsite survey on refrigeration show case by a candidate vendor company

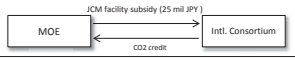
Technology

Air-cooled high efficiency chiller and refrigeration show case

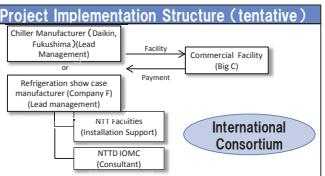
Source : Daikin, Fukushima Industries

Project Scheme

International consortium utilizing JCM facility subsidy



Project Implementation Structure (tentative)



Future Public Project and the Scale

- FY2015:F/S continues (including project finding)
- FY2015:MOE JCM facility subsidy project

	FY2015	FY2016	FY2017~
Initial cost	50 mil JPY (Chiller + Show case)	-	-
Maintenance cost	-	pending	pending
CO2 reduction (energy origin)	-	400 tCO2 (Chiller + Show case)	400 tCO2 (Chiller + Show case)

Request for Hai Phong City

- Project site introduction
- Supervision of local companies at the time of JCM project
- Connection to Vietnam government support menu

Public Lighting Corporation A (Infrastructure)

NTT DATA

Progress

- 5/27) Project introduction (NTT)
- 7/2) Discussion of project procedure (NTT, NTT-GP)
- July) Site selection (Public Lighting Corporation A)
- Discussion continues for the order system for a public project

Technology

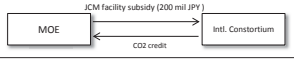
Road lighting (LED), Solar panel, Surveillance system

Source : MLIT

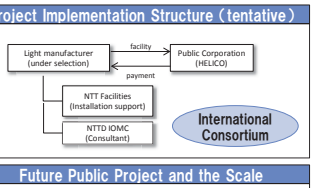
※The public corporation installs and operates the road lighting system in Hai Phong. It is interested in energy saving and introduction of renewable energy.

Project Scheme

International consortium utilizing JCM facility subsidy



Project Implementation Structure (tentative)



Future Public Project and the Scale

- FY2015:F/S continues (negotiation with the local partners, establishment of project implementation structure)
- FY2015-:MOE JCM facility subsidy project

	FY2016	FY2017	FY2018~
Initial cost	400 mil JPY (LED+poles)	-	-
Maintenance cost	-	pending	Pending
CO2 reduction (Energy origin)	-	600 tCO2	600 tCO2

Request for Hai Phong City

- (In case of tender) Support for the documentation
- Supervision of local companies at the time of JCM project
- Connection to Vietnam government support menu

NTT DATA

変える力を、ともに生み出す。

Support Project for Developing Green Growth Plan in Hai Phong City in Collaboration with Kitakyushu City Study Report (Waste Sector)

February 2015

NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, INC.
Socio & Eco Strategic Consulting Unit

NTT DATA

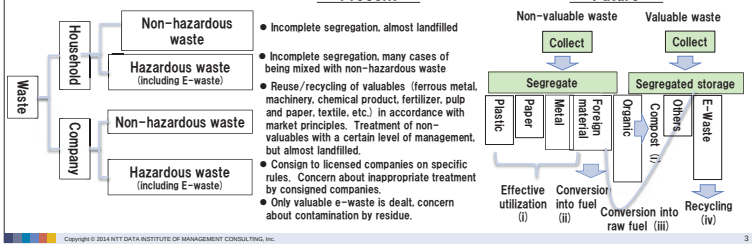
Contents

1. Project Summary (Waste Sector)

◆In Vietnam, the level of waste treatment and recycling is gradually rising with improving legal systems, while there are problems such as landfilled hazardous waste mixed with non-hazardous waste. This project aims to introduce an advanced whole waste treatment system, which achieves both lowering of carbon and recycling of resources, by realizing a more appropriate treatment and recycling system along with an already established system, which reuses and recycles valuables in accordance with market principles.

◆NTT Data Institute of Management Consulting, Inc. will work focusing on (ii) and (iv) of the following (i) - (iv), and cooperating with companies which conduct the study on (i) and (iii).

- Complete segregation of solid waste and effective utilization of valuables such as metal, plastic and paper (i)
- Composting of food waste (organic) (i)
- Conversion of residual foreign materials into fuel (Waste to Energy) (ii)
- Conversion of industrial solid waste including hazardous waste into raw fuel (iii)
- Reuse/recycling/appropriate treatment of E-waste, considering CFCs (iv)



2. Situation of Treatment and Recycling of Target Waste (1) General Waste (Related to Waste Power Generation)

1) Generated amount

- According to the report of policy of solid waste management in Hai Phong City and power recovery potentials from solid waste, a current per capita generating index in the city is approximately 0.7 kg/person/day (Nguyen Hoai Duc, 2014). The generated amount in the whole city, which is calculated by multiplying per capita generating index by population (1,925,200), is approximately 1,347.7 tons/day (waste tons/day). The per capita generating index is expected to increase to 1.3 kg/person/day in urban areas and approximately 1.2 kg/person/day in rural areas in the future, and daily generated household waste is estimated to increase to approximately 3,045 tons/day by 2025.

2) Situation of collection and transportation/intermediate treatment/final disposal

- Regarding collection and transportation, intermediate treatment and final disposal, Hai Phong Urban Environment One Member Limited Company (URENCO Hai Phong) is responsible for general waste generated in urban areas, and collect and dispose approximately 900 tons of waste daily. Two hundred tons of 900 tons is treated as composting raw materials at composting facility in Trang, and the rest of 700 tons is landfilled at final landfill site.

3) Application of FIT to waste power generation in Vietnam

- Regarding application of FIT to waste power generation in Vietnam, the Decision of Prime Minister (No.: 31/2014/QD-TTg: on support mechanism for the development of power generation projects using solid waste (s) in Vietnam (Refer to * below)) was declared in May, 2015, and a tariff was set at 2,114 VND/kWh (10.05 UScent/kWh) for power generation directly from burning solid waste

  * For power generation using combustion gas collected from landfills: 1,532 VND/kWh (7.28 Uscent/kWh)

- The Decision of Prime Minister above is effective from Jun 20, 2014. Operating bodies (investors) are allowed to start construction only if they meet Article 72 of the Law on Construction (Conditions for commencement of construction) and have relevant documents (investment certificate, written approval for electricity buying of a buyer, connection agreement with distributing unit or power transmitting unit, etc.)

2. Situation of Treatment and Recycling of Target Waste (1) General Waste (Related to Waste Power Generation)

4) Waste characteristics analysis

- With URENCO's cooperation, we conducted a waste characteristics analysis on two types of waste (one sample of household waste and one sample of market waste). Market waste was analyzed by using waste which was taken from four wards.
- The proportion of food waste is very high, which accounts for approximately 90% of the whole market waste (wet weight), and almost 80% of the whole household waste (wet weight).
- The low calorific value of market waste is 406.3 kcal/kg, and that of household waste is 697.9 kcal/kg. As mentioned on the previous page, this is because of a large proportion of moisture and food waste.

* While 1,500 kcal/kg of low calorific value is necessary for waste power generation, low calorific value of natural limit, is supposed to be 800 kcal/kg.

Item	Market waste	Household waste
Moisture (%ww)	75.9	65.4
Ash (%ww)	6.8	13.1
VS (Volatile Solid) (%ww)	17.3	21.5
HCV (High Calorific Value) (kcal/kg)	816.1	1,051.0
LCV (Low Calorific Value) (kcal/kg)	406.3	697.9

2. Situation of Treatment and Recycling of Target Waste (2) CFCs

1) Recoverable CFCs from home air conditioner (estimation)

- As of 2014, the number of home air conditioners introduced in Hai Phong City is estimated to be 100,759. The number of home air conditioners disposed in 2014 is estimated to be 7,392. Recoverable CFC is 7,613.5 kg/year, which is likely to increase year by year with a rise in adoption rate of air conditioners (Refer to a table below).

2) Recoverable CFCs from industrial air conditioner (estimation)

- As of 2014, the number of adopted air conditioners is estimated to be 7,965. Total CFC is estimated to be 79,652 kg (by refrigerant, 75,669 kg of R22 and 3,983 kg of R410).

Table Recoverable CFCs from Home Air Conditioners (estimation)

FY	Number of wasted air conditioners	Breakdown of the number		Breakdown of CFC amount		Total CFC amount (kg)	Breakdown by refrigerant	
		1-1.5 horsepower	more than 2 horsepower	1-1.5 horsepower	more than 2 horsepower		R22	R410
2014	7,392	6,653	739	6,653	960.9	7,613.5	5,329.5	2,284.1
2015	7,228	6,505	723	6,505	939.6	7,444.8	5,211.4	2,233.4
2016	7,820	7,038	782	7,038	1,016.6	8,054.5	5,638.1	2,416.3
2017	8,376	7,539	838	7,539	1,088.9	8,627.5	6,039.2	2,588.2
2018	8,874	7,986	887	7,986	1,153.6	9,139.8	6,397.8	2,741.9
2019	9,101	8,190	910	8,190	1,183.1	9,373.5	6,561.5	2,812.1
2020	9,477	8,530	948	8,530	1,232.1	9,761.6	6,833.1	2,928.5
2021	9,809	8,828	981	8,828	1,275.1	10,102.9	7,072.0	3,030.9
2022	10,041	9,037	1,004	9,037	1,305.4	10,342.6	7,239.8	3,102.8
2023	10,279	9,251	1,028	9,251	1,336.2	10,586.9	7,410.9	3,176.1
2024	10,406	9,366	1,041	9,366	1,352.8	10,718.6	7,503.0	3,215.6
2025	10,063	9,057	1,006	9,057	1,308.2	10,365.1	7,255.6	3,109.5
2026	10,169	9,152	1,017	9,152	1,321.9	10,473.8	7,331.7	3,142.1
2027	10,443	9,398	1,044	9,398	1,357.6	10,756.0	7,529.2	3,226.8
2028	9,888	8,899	989	8,899	1,285.5	10,185.0	7,129.5	3,055.5
2029	10,320	9,288	1,032	9,288	1,341.6	10,629.8	7,440.8	3,188.9
2030	10,795	9,715	1,079	9,715	1,403.3	11,118.5	7,783.0	3,335.6

2. Situation of Treatment and Recycling of Target Waste (3) E-waste

1) Situation of treatment of E-waste in Vietnam (estimation)

- In Vietnam, electrical and electronic waste (hereinafter called E-waste) is not particularly managed. Collection and treatment of E-waste is left to markets.

2) Generated amount of E-waste in Hai Phong City (estimation)

- We have estimated the change of generated amount of six kinds of E-waste (TV, PC, telephone (including fixed-line phone and mobile phone), washing machine, refrigerator, air conditioner) through 2030 in Hai Phong City.

  The generated amount of E-waste from PC and telephone is likely to double by 2030.

Table Generated Amount of E-waste through 2030 in Hai Phong City

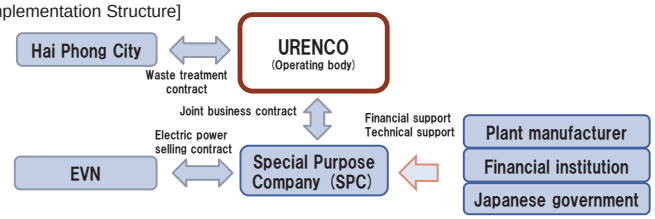
FY	Item (number of unit)					
	TV	PC	Telephone	Refrigerator	Air conditioner	Washing machine
2014	20,957	9,149	58,461	19,313	7,392	10,806
2020	20,714	12,191	66,071	17,538	8,613	8,233
2030	22,431	19,670	125,383	24,143	9,810	10,129

3. Project Implementation Structure

Supposing that...

- Waste power generation project is conducted by setting a SPC of URENCO and Japanese companies (plant manufacturer, etc) (Refer to the chart below).
- Installation site is Trang Cat (multiple treatment facility), in which URENCO is operating a composting plant (capacity: 200 tons/day), and a scale of operation is 600 tons/day.
- Regarding CFCs treatment project, MONRE and DONRE establish systems to oblige collection and depletion of CFC, or to provide incentives for collection and depletion of CFC. Then CFC is recovered by local maintenance companies of air conditioner, and depleted by local private treatment operators of industrial waste as an operating body.

[Implementation Structure]



4. CO2 Reduction Effect

(1) Waste Power Generation

- CO2 reduction effect is calculated to be 45,929 t-CO2/year by adding up greenhouse gas emission from energy/non-energy resources and greenhouse gas reduction (Refer to the table below).

Item	Increase or decrease in greenhouse gas (t-CO2/year)
(i) Greenhouse gas emission from waste incineration of fossil fuel origin	80,220
(ii) Greenhouse gas emission included in exhaust incineration gas	2,791
(iii) Greenhouse gas emission from auxiliary fuel	281
(iv) Greenhouse gas reduction effect by waste power generation	▲35,043
(v) Leakage	0
Avoided amount of methane by avoiding landfilling	▲94,178
Total	▲45,929

(2) CFCs

- If it is possible to recover HFC (R410A, R32), that could be included in credit because both R410A and R32 are in the framework of the Kyoto Protocol as substances with GWP of relatively 2090 and 675. However, R-22 of HCFC is mainly used for spreading-type products as refrigerant at present, and products using HFC are expensive. Therefore, it is likely to take long to start recovering R410A and R32 mainly. Especially, R32 has just been launched since FY2014, so it will be possibly recovered after around 2030 at the earliest because the life span of air conditioner is between 10 and 15 years in Vietnam.

5. Cost-Effectiveness

(1) Waste power generation

1) Cost-effectiveness on implementation cost (Introduction cost of facility)

Cost-effectiveness on implementation cost (Introduction cost for facility) is approximately USD 1,360 ((i) / (ii)).

Breakdown	Amount
(i) Initial cost	USD 62.5 million
(ii) Annual reduction of CO2 emission	45,929 t-CO2/year

2) Cost-effectiveness on the whole project (for 20 years)

With adding avoided amount of methane by avoiding landfilling to reduction of CO2, the total cost-effectiveness (cost required for CO2 reduction of one ton) of the whole project is approximately USD147.

Breakdown	Amount
Initial cost	USD 62.5 million
Maintenance cost (for 20 years)	USD 72.92 million
Total	USD 135.42 million
Reduction of CO2 emission	918,580 t-CO2/20 years

5. Cost-Effectiveness

(2) CFCs

The table below shows a recoverable amount of CFC for 10 years from 2014 (i), and the values multiplied (i) by GWP. Project cost is estimated to be 63 million yen. As a result of dividing this project cost by total GWP for 10 years between 2014 and 2024, the cost which is required to reduce 1 ton of CO2 is 362.5 yen.

Table Recoverable CFC amount for 10 years from 2014

FY	Depleted amount by refrigerant (t)		GWP by refrigerant		Total
	R22	R410A	R22 (1700)	R410A (1730)	
2014	6	2	9,887	4,312	14,199
2015	5	2	8,786	3,832	12,617
2016	6	2	9,505	4,145	13,650
2017	6	3	10,181	4,440	14,622
2018	6	3	10,786	4,704	15,490
2019	7	3	11,062	4,824	15,886
2020	7	3	11,520	5,024	16,544
2021	7	3	11,922	5,200	17,122
2022	7	3	12,205	5,323	17,528
2023	7	3	12,494	5,449	17,942
2024	7	3	12,649	5,517	18,166
Total	71	31	120,996	52,770	173,766

Table Project Cost

Breakdown	Amount
Initial cost	35 million yen
Maintenance cost (10 years)	28 million yen
Total	63 million yen

* Installation cost at the time of introduction and a cost for recovering CFC are not included.

6. Project Schedule

- In the results of this time's waste characteristics analysis, low calorific values are less than required value for waste power generation. Only two samples (one sample of household waste and one sample of market waste) were used for the waste characteristics analysis this time. Therefore, it is necessary to analyze in detail more samples in more various sampling period. The table below shows a schedule based on the above.
- The detailed F/S is supposed to take a year. Through the following EIA, basic/detailed design, and facilities improvement (In case of incineration facility with the level of 600 tons/day, it takes around two years), operation is supposed to start.
- Regarding a treatment operation of CFCs, it needs long time for the project, because the mechanism of CFC recovery is required, and also it is necessary to enforce a law and develop a compliance structure for that mechanism.

Table Project Schedule (Waste Power Generation)

FY	Implementation Contents
2015	detailed F/S
2016	P/S
2017	EIA, Basic/detailed design
2018	Construction work
2019	Construction work
2020	Final completion/Operation

NTT DATA
Global IT Innovator

Project to Support the Development of the Green Growth Action Plan in the City of Hai Phong through Cooperation with the City of Kitakyushu Final Report (Waste Sector: Project on Composting of Organic Waste)

January 2015

Nishihara Corporation & NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.

BEETLE 株式会社西原商事 NTT DATA

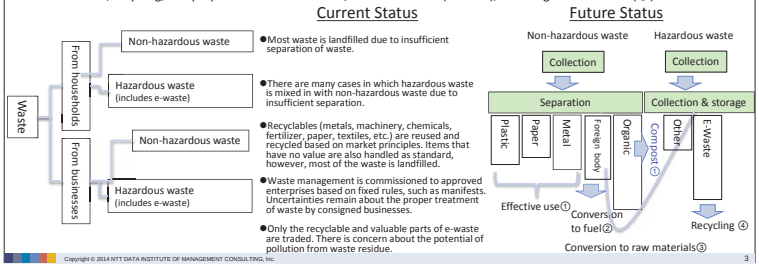
Table of Contents

1. Project Overview (Waste Sector)

◆In Viet Nam, legal systems continue to be developed and standards for waste treatment and recycling are gradually being improved. However, Viet Nam is facing various problems, such as the mixing and disposal of hazardous waste with non-hazardous waste. Systems and mechanisms for the reuse and recycling of recyclable materials that conform to market principles are already in place, and the country is aiming to create improved systems for the proper treatment and recycling of waste, as well as introduce an advanced treatment system for all waste to be compatible with the development of a low-carbon city and resource recycling.

◆Of the following items in ① to ④, Nishihara Corporation and NTT Data Institute of Management Consulting carried out studies on the implementation of ①.

- Complete separation of solid waste and effective reuse of recyclables, such as metals, plastic, and paper (①).
- Composting of kitchen waste (organic) (①).
- Conversion of waste residue to fuel (Waste-to-Energy) (②).
- Conversion of solid waste from industries, including hazardous waste, to raw materials and fuel (③).
- Reuse, recycling, and proper treatment of electric/electronic waste (e-waste), including fluorocarbons (④).



2. Current State of Treatment & Recycling of Target Waste

1) Amount of waste generated

- According to a report on solid waste management and potential to collect waste in Hai Phong, the current waste discharge rate per capita in the city is approximately 0.7 kg/person per day (Nguyen Hoai Duc, 2014). When multiplying the population (1.9252 million) by the discharge rate, the amount of waste generated in the entire city is about 1,347.7 tons/day (waste tons/day). Future forecasts indicate that the discharge rate will increase to 1.3 kg/person per day in the city area, and about 1.2 kg/person per day in the region. Lifestyle-related waste that is discharged every day is forecast to reach approximately 3,054 tons/day by 2025.

2) State of collection & transport, intermediate treatment, and final disposal

- Hai Phong Urban Environment Company (URENCO) is responsible for the collection and transport, intermediate treatment, and final disposal of general waste that is generated in the urban area. Each day, approximately 900 tons of waste is collected and treated. Of that 900 tons, 200 tons are converted into raw materials for compost at the Trang Cat composting facility. The remaining 700 tons are sent to the final landfill site.

3) Composting facilities

- The Trang Cat composting facility was constructed by URENCO at a total cost of JPY 2.1 billion using ODA from Korea. Lifestyle waste from households and waste from markets are transported to facilities on separate trucks. However, waste is mixed together in waste pits (Production of compost from market waste is not enforced.) Waste conveyed to pits undergoes the process of fermentation after paper, metals, and soil are separated at separation facilities (trommel, magnetic separators, hand-sorting conveyers).
- The period of primary fermentation is 20 days; secondary fermentation is one month. During the period of primary fermentation, lime and bacteria is added and compost is cutback using shovel loaders. Compost is aerated for 24 hours in primary fermenters. Aeration stops when the compost reaches a certain temperature. The produced compost is currently being used as a soil covering for the landfill site because product quality standards for compost have not been reached.
- Operating costs of the compost center are subsidized by the City of Hai Phong (VMD 200,000/ton).

4) Quality standards for organic compost produced using urban waste in Viet Nam

- Regulations on quality standards for compost that are specified in "Số: 36/2010/TT-BNNPTNT" and regulations on the production and sale of organic compost from urban waste that are laid out in "CV512Phancompost" have been revised in "So41/2014/TT-BNNPTNT," which was announced in November 2014. (New regulations have been applied since December 29, 2014).

2. Current State of Treatment & Recycling of Target Waste

5) Analysis of waste quality

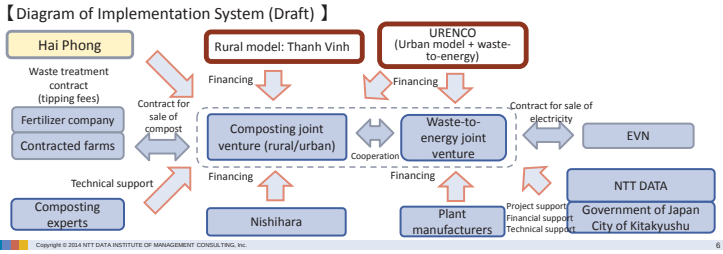
- Waste quality analysis of samples was carried out in cooperation with URENCO for two types of waste: waste generated from households and waste generated from markets. Analysis of waste from markets was carried out based on the collection of waste from four different areas.
- The composition ratio of kitchen waste was very high, with market waste at 85% (wet base) and household waste at approximately 75% (wet base).

No.	Waste composition	Physical composition (wet base) (%)		Physical composition (dry base) (%)	
		Market waste	Household waste	Market waste	Household waste
1	Food waste (can be composted)	85.9	74.1	61.5	49.0
2	Food waste (cannot be composted)	4.9	4.3	14.6	8.9
3	Disposable diapers	2.1	0.9	2.8	0.5
4	Paper	2.0	3.7	4.0	5.3
5	Plastic	2.4	5.0	7.9	9.3
6	Textiles	0.4	2.2	1.4	3.0
7	Vegetation	0.5	1.0	1.2	1.1
8	Rubber and leather	0.1	0.2	0.4	0.3
9	Metal	0.1	0.1	0.4	0.3
10	Glass	0.5	0.9	2.2	2.4
11	Ceramics and stone	0.3	0.1	1.1	0.4
12	Charcoal and ash	0.8	7.2	2.5	18.7
13	Hazardous waste	-	0.2	-	0.6
14	Other	-	0.1	-	0.2

3. Project Implementation System (Draft)

- An urban model and a rural model can be developed for the composting of organic waste.
- In the urban model, URENCO and Nishihara Corporation will establish a specialized SPC for composting, and implement activities from the start of the production process to the final sale of compost. This model will use equipment already in use at the Trang Cat composting plant that is operated by URENCO (treatment capacity: 200 tons/day).
- The urban model will establish a waste-to-energy business (treatment capacity: 600 tons/day) using collected waste and waste residue generated at the Trang Cat composting plant, in order to further reduce CO_2 emissions and the amount of waste sent to landfill.
- In the rural model, Thanh Vinh Co. and Nishihara Corporation will establish a specialized SPC for composting. The treatment capacity of the SPC is expected to be 40 tons/day. (※Thanh Vinh Co. has submitted a plan to the Vietnamese Ministry of Construction for treatment of solid waste (treatment capacity: about 10 tons/day) through a private sector model in the Kiến Thụy area. The facility and equipment are expected to be installed by Thanh Vinh Co.)
- NTT Data Institute of Management Consulting will provide support for the development of the project, including various types of surveys. The project will also be promoted with the support of the Government of Japan, City of Kitakyushu, and composting experts.

【Diagram of Implementation System (Draft)】



4. Effects from the Reduction of CO_2 Emissions

- The rural model (treatment capacity: 40 tons/day) estimates that about 60% (24 tons/day) of the 40 tons of waste/day will be used as raw materials for the production of compost. Trial calculations for CO_2 emission reductions were performed.
- The amount of emissions reduced in this project is calculated in "Reference emissions - Project emissions". Reference emissions are calculated at 2,650 t- CO_2/year.
- Data (such as the amount of electricity used in the composting process) is needed to determine the amount of project emissions during this process. However, the practical use of the compost center in its current state has not been elaborated, and it is unclear how much electricity is used and how much energy is consumed.
- In this case, figures for greenhouse gas (GHG) emissions generated during the composting process, as indicated by existing studies and surveys, are used as project emissions. The specific figure used is the generation of GHG emissions through composting (0.14 t CO_2/ton (waste)), as referenced in a Ministry of Economy, Trade, and Industry (METI) project development study on private sector infrastructure for an integrated waste-to-energy project in the city of Malang and surrounding areas in East Java, Indonesia, which was carried out in FY 2011.
- Calculations using the above values resulted in a figure of 1,226 t- CO_2/year, which was used as the reference value for project emissions. The CO_2 emission reduction effects from the project are below. ※All are GHG emission reduction effects from non-energy sources (avoidance of methane emissions).

Rural model: 2,650 ton-CO_2/day − 1,226 ton-CO_2/year = **1,424 ton-CO_2/year**

- The production scale of the urban model (treatment capacity: 200 tons/day) is five times that of the rural model. Therefore, the amount of CO_2 emissions reduced are expected to be nearly five times as much. Additional CO_2 emission reductions are expected through connections with waste-to-energy projects (below).

Urban model: 1,424×5 (composting projects) +45,929 (waste-to-energy projects)=**53,049 ton-CO_2/year**

※However, energy consumption from aeration (project emissions) must be reviewed in the future.

5. Cost Benefits

【Rural Model】

(1) Requirements

Requirements, floor plan, and layout (draft) for the rural model are below.

Item	Requirements	Notes
Separation line treatment capacity	40 tons/day	Composting production line to be connected.
Building site	Kiến Thụy district (rural area)	Land owned by Thanh Vinh Co.
Waste treatment costs	Expected to be covered by transportation costs collected from households and partial government subsidies.	
Disposal costs for waste residue	VND 160/kg	Costs for disposal at neighboring Do Son disposal site.
Compost sales price	VND 600/kg	Does not include transportation costs.

Recycling center floor plan

Recycling center layout

5. Cost Benefits

(2) Cost benefits

Initial costs for the introduction of the facility/equipment mentioned in the requirements listed in (1) are expected to be JPY 75 million. Because CO_2 emission reductions are calculated at 1,424 t- CO_2/year, the results of the equation, 【PJ overall costs ÷ CO_2 emissions related to energy use】, are approximately JPY 52,670/CO_2 (※ CO_2 reductions from control of methane fermentation only).

At this time, it is anticipated that the project will use churning methods (open-type, straight-line composting equipment). However, cost effectiveness can be improved by considering cost reductions through the introduction of a piling method for composting (ventilated, non-ventilated type) to respond to actual conditions.

5. Cost Benefits

【Urban Model】

(1) Requirements

Requirements for the urban model are specified below.

① Composting facility

At this time, no initial costs are anticipated because URENCO will utilize the composting facility and equipment that has already been installed and is in use (200 tons/day). (※Necessity to upgrade the facility/equipment must be reviewed in the future).

② Waste-to-energy facility

The requirements for the waste-to-energy facility are listed below.

Item	Requirements	Remarks/Note
Project period	20 years	
Treatment capacity	600 tons/year	Single sequence
Operation hours (annual)	7,200 hours/year	
Turbine steam conditions	400℃, 4MPa	
Potential amount of electricity for sale	9,000 kW	Amount of electricity generated – Amount of electricity in the facility
Unit price of electricity for sale	JPY 11.7/kWh	USD 0.1005/kWh (USD 1 = JPY 117)
Building site	On the site of the current CP facility site	
Collection and transportation costs	Collection and transportation fees are not included since the project will use existing resources (personnel, equipment, etc.) at the current CP facility.	
Waste incineration and residue treatment costs	Treatment costs are not included since incineration ash and fly ash that has already been treated can be conveyed to the existing final disposal site.	

5. Cost Benefits

(2) Cost benefits

The composting facility will operate 300 days annually (treat 60,000 tons/year). Treatment costs per one ton of compost are calculated at JPY 1,120. Based on these calculations, the cost benefit for the entire project (20-year period) will be approximately JPY 16,200/CO_2 (CO_2 emissions reductions related to energy use + CO_2 emission reductions from control of methane fermentation).

(※Additional detailed studies should be considered for repair costs under the O&M costs for the composting facility.)

Breakdown		Cost	Notes
① Initial costs		JPY 7.3125 billion	USD 62.5 million (USD 1 = JPY 117)
② Running costs (20 years)	Composting facility	JPY 1.344 billion	VND 200,000/t (VND 1 = JPY0.0056, operates 300 days/year
	Waste-to-energy facility	JPY 8.5316 billion	USD 72.92 million
③ Total		JPY 17.1881 billion	①+②
④ CO_2 emissions reduction		1,060,980 t-CO_2/20 years	

6. Project Development Schedule

	2014	2015	2016	Post 2017
Rural model	• Prepare for open call and applications (Ministry of the Environment Project on the Overseas Business Development of Material-Cycle Industries in Japan (survey on the foundation of a business environment), MOEJ JCM detailed F/S, other) • Compile report	• Produce compost (※sample production, quality testing) at separation/composting production facility (10 t/day) to be established by Thai Vinh Co. and prepare for acquisition of certification. • Detailed study on business plan of producing 40 t/day of compost (including facility/equipment details, discussions on contract details with compost vendors, examination of joint management contents, etc.) • Discussions and related studies to gain cooperation of farms that use compost (in cooperation with rural bureaus).	• Support for the acquisition of certification for composting (product quality tests, scatter tests) ※Process of acquiring certification may take about one year. • Preparation for the establishment of joint venture (40 t/day) • Preliminary design of facility • Decision on contract details related to market	• Business development
Urban model + Waste-to-energy	• Prepare for open call and applications (Ministry of the Environment Project on the Overseas Business Development of Material-Cycle Industries in Japan (survey on the foundation of a business environment), MOEJ JCM detailed F/S, other) • Compile report	• Survey on waste discharge sources, such as waste residue from markets, food production plants, restaurants, and composting facilities (amount of waste discharged, composition, treatment charges, etc.); examination of separation and collection methods. • Production of compost using high-quality organic waste (sample production, product quality testing); preparation for acquisition of certification. • Preparation for the establishment of joint venture, consultations on contract details with contacts for sales of compost and electricity. • Discussions and related studies to gain cooperation of farms that use compost (in cooperation with rural bureaus).	【Composting project】 • Support for the acquisition of certification for composting (product quality tests, scatter tests) ※Process of acquiring certification may take about one year. • Preparation for the establishment of joint venture • Preliminary design of facility (※If changes or improvements are necessary • Decision on contract details related to market. 【Waste-to-energy project】 •Preparation for establishment of joint venture •Decision on financing methods	【Composting project】 2017: Est. of joint venture Business development 【Waste-to-energy project】 2017: Est. of joint venture EIA, basic/detailed design 2018～2019: Construction of facility 2020: Completion and start of operations

7. Requests to the City of Hai Phong

(1) Requests to City of Hai Phong

① Consideration of waste-to-energy project
Think proactively about waste-to-energy projects that can contribute to the reduction of waste sent to landfill and CO_2 emissions.

② Consideration of tipping fees related to composting and waste-to-energy projects
Think about the payment of tipping fees to SPC, when establishing SPC and implementing composting and waste-to-energy projects, since operation costs for URENCO's composting facility are partially subsidized at this time.

③ Provision of composting demonstration field (commercial farms, test sites)
Provision of composting demonstration field in order to understand the fertilizer effects of the produced compost and to use/store compost (=farmers can be confident of the quality and effects of the compost and use it on their own farms).

④ Provision of locations to use compost (parks, forests, etc.) and sales support
Work out a plan to provide locations where compost can be used, and offer sales support so that the produced compost can be shipped in a stable and reliable manner.

⑤ Development of policies to promote the use of compost (includes incentives)
Consider policies to promote the use of compost (organic fertilizer) from the perspective of price, usability, and immediate effect, since farms continue to use chemical fertilizers even as soil fertility is declining due to the use of such fertilizers.

⑥ Technical guidance for farmers on the use of compost by the Department of Agriculture and Rural Development (DARD)
Consider offering technical guidance through the Department of Agriculture and Rural Development for the use of compost since farmers may not have sufficient knowledge in this area.

(2) Requests to URENCO

① Periodic analysis of waste quality
Consider the implementation of periodic analysis of waste quality because the results of waste quality analysis are essential as fundamental information for the development of plans on proper treatment and recycling of waste (=effective and efficient plans cannot be developed without waste quality analysis).

② Procuring detailed data on composting facilities
Provide assistance and cooperation in procuring various data on composting facilities (operating costs, input to the line and generation of waste residue, different kinds of numerical data on composting (e.g., temperature in fermenters, water content, pH, aeration operating conditions, etc.) when carrying out detailed examination of composting projects and waste-to-energy projects.

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Project to Support the Large-Scale Formation of Joint Crediting Mechanism Programs to Realize Low Carbon Societies in Asia from Fiscal 2014

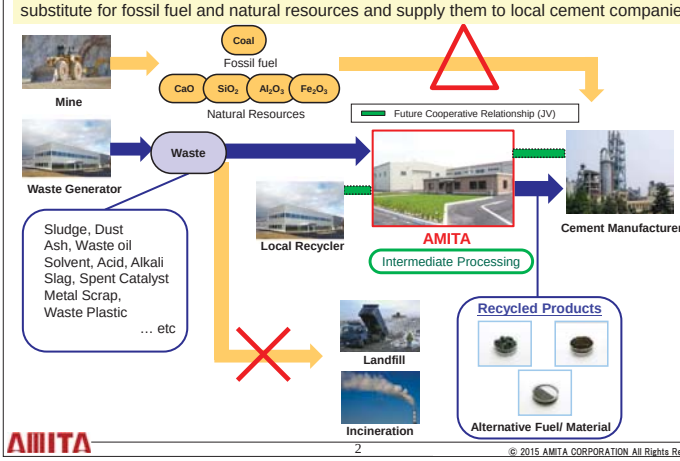
Project to Support Formulation of the Green Growth Program for Haiphong City in Cooperation with Kitakyushu City

Study of Conversion of Industrial Wastes into Raw Materials or Fuels to Contribute to Realization of Low-Carbon Society

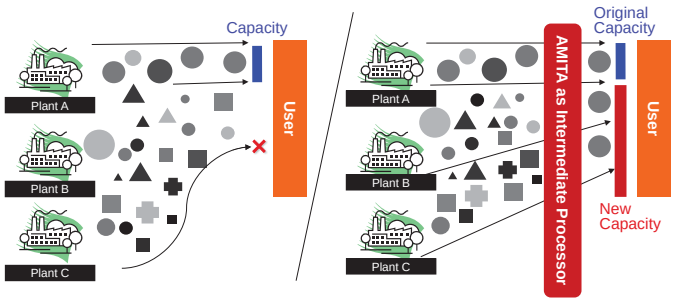
AMITA CORPORATION

Project Outline – Utilization of wastes as alternative material and fuel –

Recycling industrial wastes (incl. hazardous wastes) into alternative fuel and materials substitute for fossil fuel and natural resources and supply them to local cement companies.



AMITA's Role in the Project



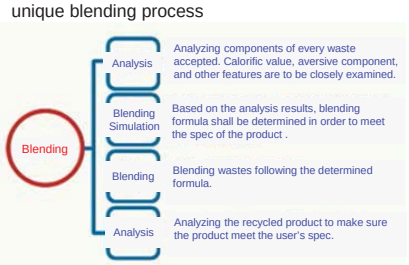
"Intermediate processing," makes it possible to recycle many and variety of wastes that are simply landfilled and incinerated into alternative resources.

"Intermediate processing" means any process which involves transformation of form, component, and any features of waste (e.g. dehydration, drying, incineration, separation, neutralization, crushing, resolution, smelting, blending)

Recycling Knowhow

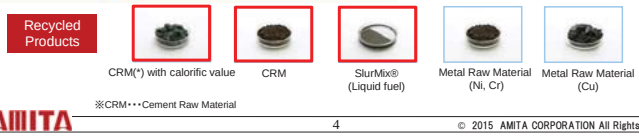
Achieving 100% recycle of waste by "Blending" knowhow

Components and the timing of supply is hard to predict for wastes. However, AMITA recycles 100% of those wastes into stable alternative fuel and material with unique blending process



- Non-ferrous metal
- Mining
- Metal Products
- Construction
- Machinery
- Pulp/paper
- Rubber products
- Steel
- Service
- Food
- Chemical
- Electricity/Gas
- Oil/coal
- Textile

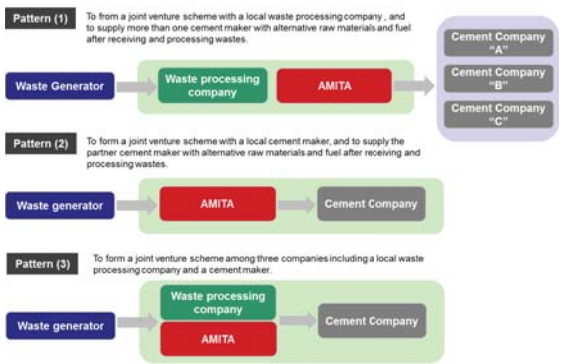
Accepting more than 4,000 kinds of wastes from the industries above, blending them, and producing recycled products below



※CRM・・・Cement Raw Material

Project Implementation Plan

Project will be implemented by any of these plans below;



Some wastes treatment companies have shown their interests in cooperative relationship in this project, and it was confirmed that several cement companies, mainly foreign financed, have intention to utilize alternative material and fuel.

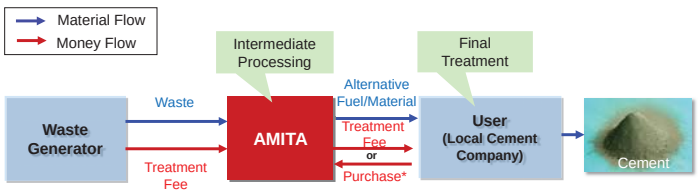
Project Scale

◇Project cost is to be examined further. Project may be implemented in smaller scale than below.

◇Capacity below is estimated on the assumption that the wastes are collected from Haiphong, Hai Duong, and Hanoi.

	Project Cost	Capacity
SlurMix®(Liquid Fuel) Plant	Approx. 300,000,000 JPY	Approx. 2,000t/year
CRM Plat		Approx. 24,000t/year

Business Model

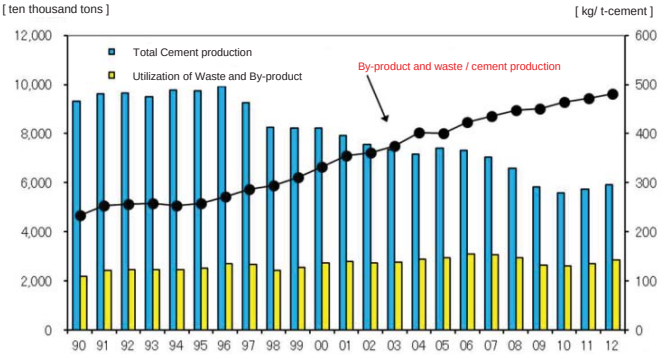


◇Waste generators outsource treatment of the waste to AMITA, paying treatment fee
↓
◇Recycled material (alternative fuel/material) is shipped to, and treatment fee is paid to cement companies (regarded as outsourcing of treatment of waste)*

*In case that alternative fuel has high calorific value, cement companies may have to purchase it as a substitute for coal.

Waste Utilization by Cement Industry in Japan (1)

Cement industry plays a key role in recycle of industrial waste in Japan



- More than **28 million tons** out of total 400 million tons of industrial wastes were utilized in cement production (2012)
- **481kg** of industrial wastes are used to produce 1 ton of cement (2012)

Ref. Japan Cement Association

Waste Utilization by Cement Industry in Japan (2)

Use of Industrial Wastes and By-products in Cement Industry

[thousand tons]

Wastes/ By-products	Main purpose of Use	2006年度	2007年度	2008年度	2009年度	2010年度	2011年度	2012年度
Blast furnace slag	Material, Mixing Material	9,711	9,304	8,734	7,647	7,408	8,082	8485
Fly ash	Material, Mixing Material	6,995	7,256	7,149	6,789	6,631	6,703	6870
Sludge	Material	2,965	3,175	3,038	2,621	2,627	2,673	2987
Gypsum (By-product)	Material (Admixture)	2,787	2,636	2,461	2,090	2,037	2,158	2286
Soil from construction	Material	2,589	2,643	2,779	2,194	1,934	1,946	2011
Cinders (excl. Fly ash), Dust	Material, Heat Energy	982	1,173	1,225	1,124	1,307	1,394	1505
Slag (Non-ferrous)	Material	1,098	1,028	863	817	682	675	724
Wood chip	Material, Heat Energy	372	319	405	505	574	586	633
Casting sand	Material	650	610	559	429	517	526	492
Waste plastic	Heat Energy	365	408	427	440	418	438	432
Steel Slag	Material	633	549	480	348	400	446	410
Waste Oil	Heat Energy	225	200	220	192	275	264	273
Waste Clay	Material, Heat Energy	213	200	225	204	238	246	253
Recycled Oil	Heat Energy	249	279	188	204	195	192	189
Waste Tire	Material, Heat Energy	163	148	128	103	89	73	71
Meat & Bone meal	Material, Heat Energy	74	71	59	65	68	64	65
Clum	Material, Heat Energy	203	155	0	0	0	0	0
Other	-	615	565	527	518	595	606	835
TOTAL	-	30,890	30,720	29,467	26,291	25,995	27,073	28523
Amount of utilized waste per 1 ton of cement (kg/t)		423	436	448	451	465	471	481

Waste Utilization by Cement Industry in Japan (3)

◇ Treatment fee paid to cement companies is one of the important revenue stream for them.

◇ Utilization of waste is being regarded as a part of main business of cement companies. (Establishment of supply chain)

◇Cement companies in Japan has been putting their efforts in technological development aiming to utilize much amount and more variety of wastes (Some of them are promoted and achieved because of government's official request). Cement companies control acceptance of wastes at their discretion based on the policy that the final product shall meet the specification.

E.g. Contribution of Cement Industry
Cement industry utilized approx. 28.5 million tons of wastes and byproducts in 2012, and as a result, the life duration of landfill site has increased to 8 year longer. Increase in the amount of the waste utilized in cement industry gives huge contribution to reduction of environmental burden.

Result of Feasibility Study - Current Status -

◇Waste treatment
・Wastes are generally landfilled or incinerated. There is a possibility to enhance recycle more of those wastes.
・Transparency in final treatment process of hazardous wastes is questionable. Hazardous wastes are landfilled with municipal wastes and that may harm environment of surrounding area. Appropriate and transparent treatment of wastes are required.

◇Waste utilization at cement companies
・Waste utilization of wastes as alternative wastes and materials is limited. (Only two companies in the whole country)⇔waste utilization ratio in one ton of cement is 1/8 of that of Japan)
・It is unfamiliar that cement companies get treatment fee on accepting wastes. ⇔ healthy recycle market is to be established.

◇Feasibility of the project
・Product simulation based on analysis result of 18 waste samples proves that those wastes can be utilized as alternative fuel/material and the products meet the technological guideline QCVN41:2011/BTNMT.
・Treatment fee for hazardous waste in general is set in the range that can be judged as feasible. Additional market research on waste generation amount and types of wastes is required. (Interview on 34 manufacturers have been implemented).
・Active involvement of cement companies in the project is essential.

Effect of the Project (1)

◇Transparent treatment of wastes
…Treatment flow is apparent
(Waste generator⇒AMITA⇒Cement company)

Illegal dumping
Treatment that gives environmental burden

Appropriate wastes aiming resource circulation

◇Promotion of appropriate treatment
…100% recycle, No residue generation
Treatment process aiming to achieve resource circulation

Landfill

Utilization as Fuel/material

◇Life extension of final disposal site
…Less wastes are to be landfilled

◇Improvement in recycle rate
…Higher recycle rate is achieved

◇New revenue stream for cement companies
…Giving incentives for cement companies. Appropriate treatment fee will be set based on market mechanism

Promoting Green Growth
Reducing Environmental Burden
Environmental/Resource Control
Promotion of 3R
Establishment of
Healthy Recycle Market

➡ Creation of environmental industry and employment(Establishing Kita-kyushu Model)

Effect of the Project (2)

◇Reduction of Green House Gas Emission

Green house gas emission will be reduced as below when the recycled product is used as a substitute for coal in cement production.

Production amount and substituted amount of coal

SlurMix® :2,000t/year	⇒	Substitute 1,031t/year of coal
CRM:24,000t/year	⇒	Substitute 6,646t/year of coal

Reduction of Green House Gas Emission

(A)	Baseline Emission Amount (In case the project is not implemented)	18,493t-CO2/year
(B)	Project Emission Amount (In case the project is implemented)	17,324t-CO2/year
(A)-(B)	Reduction Amount of Green House Gas Emission (Baseline Emission Amount−Project Emission Amount)	**1,169t-CO2/year**

Issues to be Solved (Suggestion)

◇Waste Utilization Policy and its Promotion
Waste utilization scheme at cement industry is not so common in Vietnam. Effect and impact lead by waste utilization and the scheme itself requires more understanding and that has to be supported by waste utilization policy and its promotion.

Sharing Japan's Experience

◇Visualization of Co-Processing Scheme
Visualizing the waste utilization scheme by implementing pilot project with cooperation with local cement companies and support from Haiphong City.

E.g. Case in Malaysia
Malaysia Department of Environment has announced a policy to promote waste utilization in cement production and Co-processing Guideline prepared by Malaysia Cement Association will be implemented shortly. Malaysian cement companies are involved in the process of developing the guideline in order to make it reasonable and feasible.

Project Schedule

◇Government Support Scheme
○Ministry of Environment:
Project to Support the Large-Scale Formation of Joint Crediting Mechanism Programs to Realize Low Carbon Societies in Asia
(Other possible government scheme)
・Ministry of Economy, Trade and Industry:
Project to Support Overseas Expansion of Infrastructure System (Feasibility Study on Overseas Expansion of Recycling Business)
・Ministry of Environment :
Project to Enhance Overseas Expansion of Japan's Resource Circulation Industry

◇Project Schedule

2015
・Feasibility study(Market research, Related law, etc)
・Choosing business partner
・Consensus with related government
・Financing scheme

2016
・JV Agreement with business partner
・Application for related license

2017
・Construction of plant
・Starting business

Green Growth Action Plan Support Project in Hai Phong City in collaboration with Kitakyushu City

Pilot Project: Low-Carbon Project in Cat Ba Island, Hai Phong City

Final Meeting

January, 2015

NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.

Socio & Eco Strategic Consulting Unit

NTT DATA

Contents of Cat Ba Island Conservation

NTT DATA

- **Objective**
  - ◆Conduct the feasibility study and assessment of CO2 emission reduction potential based on the economic aspect of the project using JCM for low-carbon project focusing on the tourism sector as main actor in Cat Ba Island
- **Overview**
  - ◆Focus on the introduction of energy efficiency, renewable energy, and saving water as the methodology for low carbon project
  - ◆Conducted field surveys at 24 sites and examined the measures for low carbon project
    ⇒ Survey objects：7 hotels, 3 tourism transportation services, tourism farm, 3 ice manufactures, 2 fish source factories, public facility management and urban service corporation (road lighting), Fish farm, shrimp aquaculture company, water supply authority, large-scale resort development, hospital, national park, and speed boat management company
  - ◆Examine and propose funding mechanism for environmental conservation project in Cat Ba Island
- **Project Candidates**
  - ◆ Select 3 projects as candidates and examine demonstration projects based on the aspects of the feasibility and CO2 emission reduction

① Solar power generation and EV bus projects at tourism farm, zoo, and botanical garden
② Energy saving of hotels
③ Apply LED to road lighting

Schedule (Result base)

NTT DATA

Items	April	May	June	July	August	September	October	November	December	January	February
(1) Meeting	local kickoff	Domestic ①, local inception		Local progress report			Domestic ②, local midterm report			Local result report	
(2) Field survey	1st	2nd		3,4th			5,6th			7,8th	
(3) Select candidate sites											
(4) Survey and assess each facility and site											
(5) Eamine measures											
(6) Proposal and discussion based on the result											
(7) Assess CO2 reduction potential and establish MRV methodology											
(8) Aseess feasibility and commercialization											
(9) Make a report											

Continuing to discuss with local project counterparts.

Tentative Plan for Project Implementation

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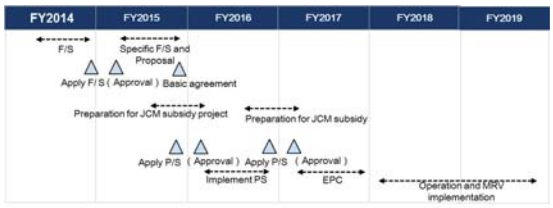
We would like to conduct PS in 2016 for one of the projects examining in this financial year and run it as JCM project in 2017



① Solar Power Generation and EV Bus Projects at Tourist Farm, Zoo, and Botanical Garden

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- **Project Outline**
  - ◆ Quoc Hung Co., Ltd (QH), which is a tourism and transportation company in Cat Ba Island, has been developing 16 hectares site for tourist farm, zoo, and botanical garden. They plan to open in 2017. QH has been planning to introduce Japanese solar power generation, including the examination of solar sharing, to provide electricity for restaurants, hotels, shops, and offices in the farm. They also plan to use the solar power generation to charge EV bus.
  - ◆ Currently, there is no fixed-route bus in Cat Ba Island. However, when the bridge between mainland Hai Phong City and Cat Hai District completes in 2017, the number of tourists coming to Cat Ba Island would increase. Therefore, QH has been planning to start EV bus service in 2017. QH will introduce EV microbus provided by the company in Kitakyushu City. The EV microbus consists of Japanese electric bus kit and ultralight Chinese vehicle. QH plans to establish and provide zero CO2 emission tourism and transportation services in the island through solar power generation and EV charge systems.



① Solar Power Generation and EV Bus Projects at Tourist Farm, Zoo, and Botanical Garden

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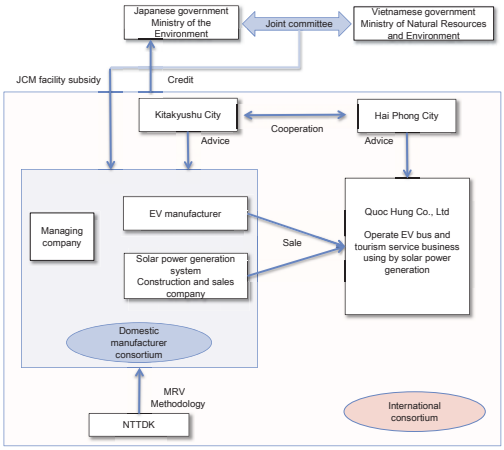

①Solar Power Generation and EV Bus Projects at Tourist Farm, Zoo, and Botanical Garden

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- **Tentative Project Scale**

  Solar power generation system
  Generation capacity: 200kW
  Initial cost: 10 million yen (after JCM facility subsidy)
  CO2 reduction amount: 100 t-CO2/year
  Cost-effectiveness: 100,000 yen/t-CO2/year

  EV bus
  Introduced unit: 20 units as trial
  Initial cost: 31.5 million yen (after JCM facility subsidy)
  CO2 reduction amount: 700 t-CO2/year
  Cost-effectiveness: 450,000 yen/t-CO2/year

- **Proposed utilization plan of the Japanese government public offering menu for commercialization**
  FY2015: Specific F/S
  FY2016 later: Ministry of the Environment JCM facility subsidy project

- **Requests to Hai Phong City to consider**
  ➢ Use Vietnam Energy Efficiency Program (VNEEP) to cover 30% of the initial cost
  ➢Examine the introduction of island entrance tax for environmental conservation in Cat Ba Island

EV microbus specification
(References: Kitakyushu City, Company S)

② Energy Efficiency of Hotels

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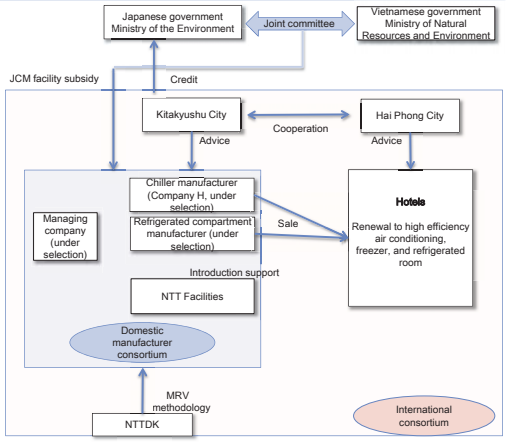
- **Project Outline**
  - ◆Focus on Cat Ba Island Resort and Spa Hotel with the maximum number of rooms in Cat Ba Island, and renewal to high efficiency air conditioning system and energy saving freezer and refrigerated room



Project Organizational Structure

② Energy Efficiency of Hotels

- **Tentative Project Scale**
  Initial cost: 6 million yen (after JCM facility subsidy)
  CO2 reduction amount: 45 t-CO2/year
  Cost-effectiveness: 130,000 yen/t-CO2/year

- **Proposed utilization plan of the Japanese government public offering menu for commercialization**
  FY2014: Assess feasibility
  FY2015: JCM P/S
  FY2015 later: Ministry of the Environment JCM facility subsidy project

- **Requests to Hai Phong City to consider**
  ➢Use Vietnam Energy Efficiency Program (VNEEP)to cover 30% of the initial cost
  ➢Examine the introduction of island entrance tax for environmental conservation in Cat Ba Island


Hotel panoramic view


HITACHI air conditioning outdoor unit

③ Apply LED to Road Lighting

- **Project Outline**
  ◆ Public facility management and urban service corporation operates and manages the road lighting in Cat Ba Island. There are 313 lightings in the island and the public corporation considers replacing all sodium lamps with LED for energy saving of road lighting.

- **Tentative Project Scale**
  Initial cost: 3 million yen (after JCM facility subsidy)
  CO2 reduction amount: 100 t-CO2/year
  Cost-effectiveness: 30,000 yen/t-CO2/year

- **Proposed utilization plan of the Japanese government public offering menu for commercialization**
  FY2015: Specific F/S
  FY2016 later: Ministry of the Environment JCM facility subsidy project

- **Requests to Hai Phong City to consider**
  ➢Use Vietnam Energy Efficiency Program (VNEEP)to cover 30% of the initial cost
  ➢Examine the introduction of island entrance tax for environmental conservation in Cat Ba Island


Road lighting


Park lighting

④ Proposed Funding Mechanism for Environmental Conservation Projects in Cat Ba Island

- **Current Funding Mechanism**
  ◆ Currently, tourists visiting Cat Ba Island pay Cat Ba National Park tourist fee and Cat Ba Bay tourism commission at each entrance. It has been used as fund for environmental conservation activities, such as salaries for cleaning staffs and educational activities in Cat Ba Island.

  ◆ Annual revenue from the commission based on 2013 result base is that the former is 3.8 billion VND and the latter is 1.5 billion VND.

  ◆ Each collected amount is Cat Ba Bay: 30,000 VND, National Park Forest : 15,000 VND or 35,000 VND, Sea : 30,000 VND.

  ◆ Annual revenue from the commission based on 2013 result base is that Cat Ba Bay tourism commission is 3.8 billion VND and Cat Ba National Park tourist fee is 1.5 billion VND.

  ◆ Currently, Hai Phong City examines to increase the commissions due to lack of the collected amount.

④ Proposed Funding Mechanism for Environmental Conservation Projects in Cat Ba Island

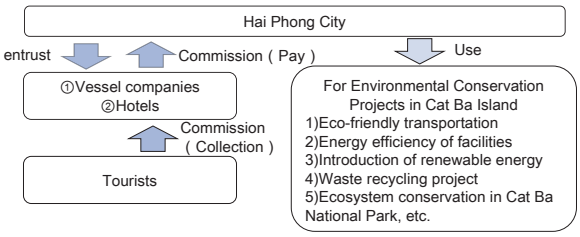
- **Proposed New Funding Mechanism**
  ◆ Propose the introduction of "environmental conservation commission" to Hai Phong City because it needs more fund to implement low carbon and environmental conservation projects in the island. #① and ② are the examples as collection method.
  ➢ ①Add environmental conservation commission on tourist passage ticket of speed boats and ferries, and vessel companies pay the collection to Hai Phong City.
  ➢ ②Add environmental conservation commission on hotel charges, and hotels pay the collection to Hai Phong City (or determine the collected amount based on the number of rooms in hotels)

  ◆ **Features of ① and ②**
  ➢ ① Routes visiting the island is only by sea using speed boats or ferries. The commission will be collected from tourists including day trip; therefore, collection target number can be ensured. This lets collected amount per person maintain low. Shipping company is run by two most influential hotel companies in Cat Ba Island. Thus, it is relatively high effectiveness of the fee collection.
  ➢ ② it is easy to distinguish tourists from residents and workers because the commission targets hotel guests.

  ◆ It is possible to extend the range of uses of the commission. Obtain the agreement from fee collectors and tourists through giving understandable and sufficient explanation.

  ◆ It is necessary to have further discussion with Hai Phong City about the selection of above schemes, the price of collected amount, and target project.

④ Proposed Funding Mechanism for Environmental Conservation Projects in Cat Ba Island



NTT DATA
Global IT Innovator

Project to Build a Comprehensive Resource Recycling System for Waste in Haiphong City & Cat Ba Island

Report

March 2, 2015

AMITA

AMITA Institute for Sustainable Economies Co., Ltd. (AISE)

Project Aim

- Aim

  The aim of the project is to reduce GHG and conserve the environment through comprehensive recycling of waste generated on Cat Ba Island and by reducing the amount of waste disposed in landfills. In addition, the project also aims to contribute to the building of a sustainable socio-economic system on the island by promoting eco-tourism and environmentally sustainable farming and fishing industries, etc.
- Technologies and systems to be surveyed and studied for commercialization purposes
  - (1) Bio-gasification of organic and other waste with a high water content
  - (2) Solid fuel processing of flammable waste with a low water content
  - (3) Cement raw material processing of flammable waste that cannot be used for the above
  - (4) Waste sorting and collection system, incentive design


Bio-gas


Solid fuel


Cement

Outline of Survey & Study

- Status survey
  - Waste collection and disposal status
  - Waste recycling status
  - Sewage treatment status
  - Agricultural situation (users of bio-gas and liquid fertilizers)
  - Potential users of solid fuel
  - Status survey of cement factory
  - Survey of commercial waste composition
  - Survey of household waste composition and volume
  - Survey of residents' level of awareness (interviews)
- Estimation of Project Scale
  - Business plan and business scheme
  - Bio-gasification project
  - Solid fuel processing project
- Methodology to measure GHG emissions, monitoring system, emission reduction possibility
- Secondary (co-benefits) effects
- Measures required to promote commercialization (issues, requests, etc.)
- Future plans

Outline of Survey & Study





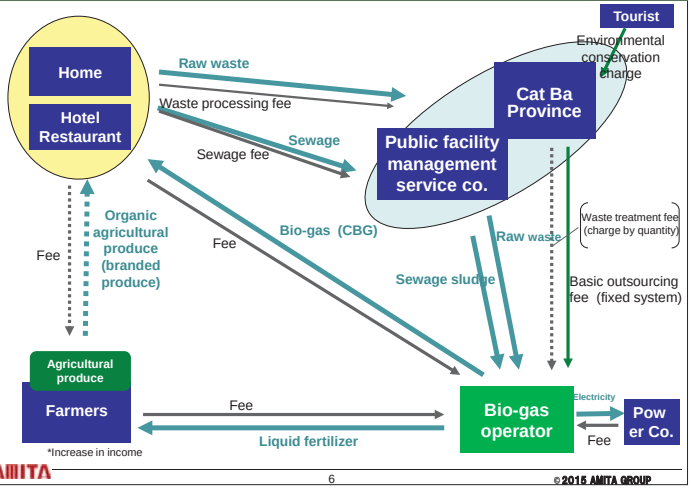




1. Project Outline – Overall Concept -

Conserve the rich natural environment and promote the tourism industry with the blessings offered by the environment

1. Project Outline – Bio-gas Project – Proposed Flow of Goods and Funds

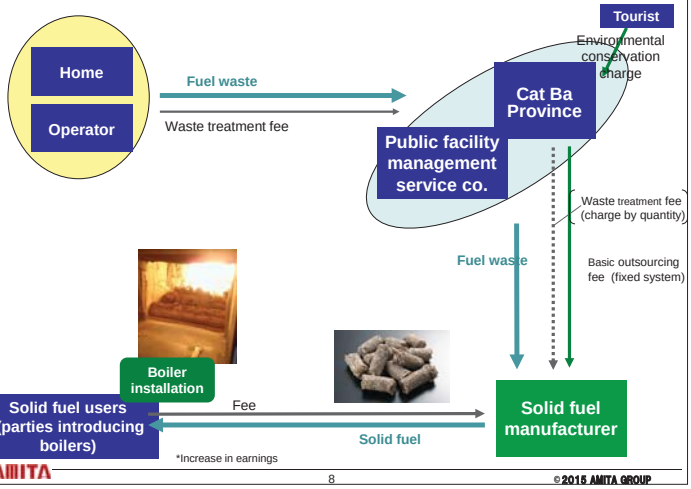


1. Project Outline Bio-gas Project - Project Plan-

	Power Generation Pattern	CBG Pattern
Amount of waste recycled	5.6t/day (approx. 2,000t/year) (raw waste; 2.4t/day, sewage sludge:3.2t /day)	Same as on the left
Amount of bio-gas generated	approx. 225 m3/day (82,000m3/year)	Same as on the left
Amount of power generated	400-500 kWh/day (150,000-180,000kWh/year)	—
CBG production volume	—	110-120 kg/day (40-44t/year)
Initial cost	90 – 100 mil yen (max 50% JCM subsidy)	110 – 120 mil yen (max 50% JCM subsidy)
Running cost *Figures within parentheses exclude depreciation cost	16 – 18 mil yen/year (11 – 13 mil yen/year)	18 – 20 mil yen/year (12 – 14 mil yen/year)
Investment recovery	5 years *In the case of JCM 50% subsidy	Same as on the left *In the case of JCM 50% subsidy
Basic outsourcing fee with environmental conservation fee*1 as a source of funds (fixed)	Approx. 19 – 21 mil yen/year (20 – 22 yen/person)	approx. 19 – 21 mil yen/year (20 – 22 yen/person)
Electricity sales price	10 yen/kWh	—
CBG sales price	—	110 yen/kg
GHG reduction	2,000-3,000t-CO2/year (energy origin:10 - 20t-CO2/year)	

*1) Collection of waste treatment fee etc. as a source of funds is also possible

1. Project Outline Solid Fuel Project – Proposed Flow of Goods and Funds



1. Project Outline Solid Fuel Project - Project Plan -

Amount of waste recycled	0.8t/day (approx. 300t/year) - plastics, paper, fiber, plants, etc.
Amount of solid fuel generated	0.8t/day (approx. 300t/year)
Amount of power generated	6,500 - 7,500GJ/year
Initial cost (production of solid fuel)	55 – 60 mil yen (max 50% JCM subsidy)
Initial cost (use of solid fuel)	30 – 35 mil yen (max 50% JCM subsidy) *Borne by supplying party (some patterns require the user to bear the cost)
Running cost *Figures within parentheses exclude depreciation cost	15 – 16 mil yen/year (9 – 10 mil yen/year)
Investment recovery	5 years *In the case of JCM 50% subsidy
Basic outsourcing fee with environmental conservation fee*1 as a source of funds (fixed)	Approx. 14 - 15 mil yen/year (15 – 16 yen/person)
Solid fuel sales price	15,000 – 16,000 yen/t
GHG reduction	350 - 400t-CO2/year (energy origin: 40 - 60t-CO2/year)

*1) Collection of waste treatment fee etc. as a source of funds is also possible

2. Expected effects (including mutual benefits)

・Reduce land-fill waste

→Reduce landfill cost and extend the life of landfills = Reduce the risk involved in securing new landfills

→Contribute to conservation of the natural environment and registration as a world natural heritage site

・Create locally-produced energy

→Contribute towards energy self-sufficiency

・Create environmental business (bio-gas project, solid fuel processing project)

→Create regional employment and build up the local economy

・Improve value as an eco-island

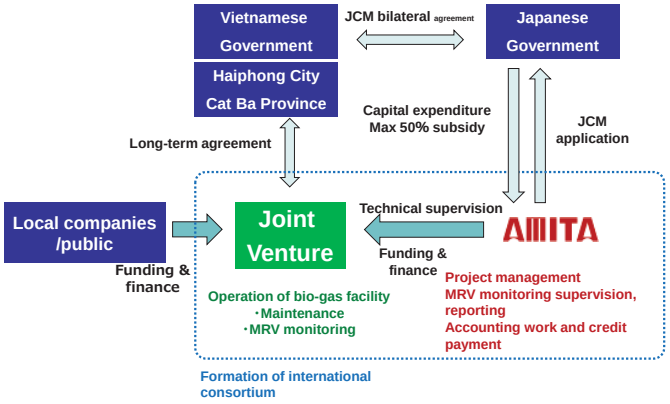
→Improve the branding power of the island and stimulate the tourism industry and economy

・Create low-cost, organic fertilizers

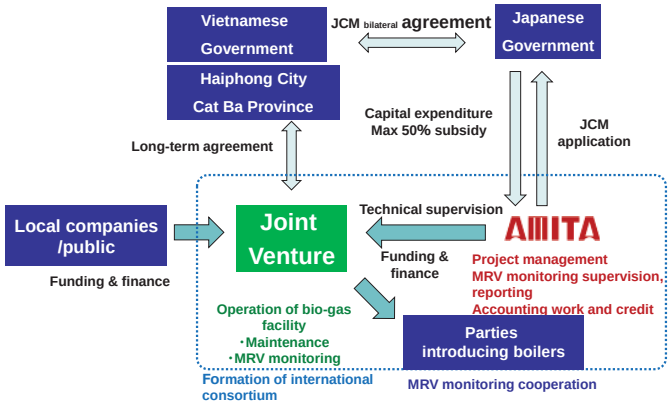
→Supply organic agricultural produce to hotels etc.

→Increase value-add of agricultural produce to increase the income of farmers

3. Project Implementation System (Proposed) Bio-gas Project



3. Project Implementation System (Proposed) Solid Fuel Project



4. Fundraising Methods (With Japanese Government Support) & Proposed Schedule

FY	Implementation Theme	Implementation Points	Funding Support Measures
FY2015	Detailed F/S (verification test, detailed business plan)	・Check environmental awareness as well as the quantity/quality of waste through sorting verification tests by residents and operators ・Detailed study of business plan, examine business feasibility ・Design of necessary system and policies etc. ・Check precise intent of Haiphong city (Cat Hai Province) (structure, funding, organization, etc.) and counterparts (structure, funding, etc.)	Ministry of Environment JCM (F/S) project etc.
FY2016	P/S (design, quotation, consensus building, fundraising)	・Design, quotation ・Conclude agreement with Haiphong city (Cat Hai Province) regarding decision-making, council decision, etc. ・Conclude contract with counterpart	Ministry of Environment JCM (P/S) project etc.
FY2017	EPC, operation (design, procurement, construction, operation)	・Confirmation of development subsidy ・Detailed design, procurement, construction ・Start of operations, MRV	Ministry of Environment JCM development project, JICA cooperation fund, Ministry of Foreign Affairs non-compensated project etc.

5. Issues and Measures to be Studied by Haiphong City

・Escalating waste treatment charges to be borne by the residents*1 ※Main aim is to incentivize sorting and recycling

・Prohibition of waste dumping and regular collection*2

・Secure project funding (6.2 -6.8 billion VND a year)

→The collection of an environment conservation charge has been proposed as one of the concrete measures to raise this money. Details are as described in the materials from NTT Data Institute of Management Consulting, Inc.

・Conclude a long-term (10 years or longer) public-private cooperation agreement with the lead project implementation body (Japan-Vietnam joint venture)

*1 … A system that charges a low processing fee for properly sorted waste and a high fee for all other waste.

*2 … A system in which waste collection vehicles come at a fixed time and place and waste is taken out at certain time periods only.

Conclusion

❑The "Comprehensive Resource Recycling System for Waste" proposed by AISE has been discussed with the people's committees of Haiphong city and Cat Hai Province over several meetings.

❑As a result, the people's committees of Haiphong city and Cat Hai Province maintain a very positive outlook on the introduction of a "Comprehensive Resource Recycling System for Waste" and wish to continue with the study and survey to realize such a system. Regarding the issues highlighted in the preceding section, e.g. the systemization of an environmental conservation charge to secure the necessary funding, these are already being planned and promoted and a decision is due to be reached in several months' time. They have also opined that a new waste sorting system can be implemented without any problems. As for the potential business partners, several local companies have expressed their interest in participating in the projects.

❑Based on the above, AISE intends to continue the study and survey to realize a "Comprehensive Resource Recycling System for Waste" together with Haiphong city, Cat Hai Province, and other relevant parties, so as to achieved both economic development and the conservation of a beautiful environment on Cat Ba Island.

Survey Name: JCM Large-scale Feasibility Studies on Low-carbon Society Plan in Asia 2014
Hai Phong City Green Green Growth Plan Support Project in collaboration with Kitakyushu City (Host country: Viet Nam)

Nikken Sekki Civil Engineering Ltd.

1. Survey Organization: Kitakyushu City
Institute for Global Environmental Strategies
Nikken Sekkei Civil Engineering Ltd.

2. Host country: Hai Phong City, Viet Nam (Contact: Department of Foreign Affairs)

3. Targeted Field: Support for low-carbon city development plan

4. Outline of the Project

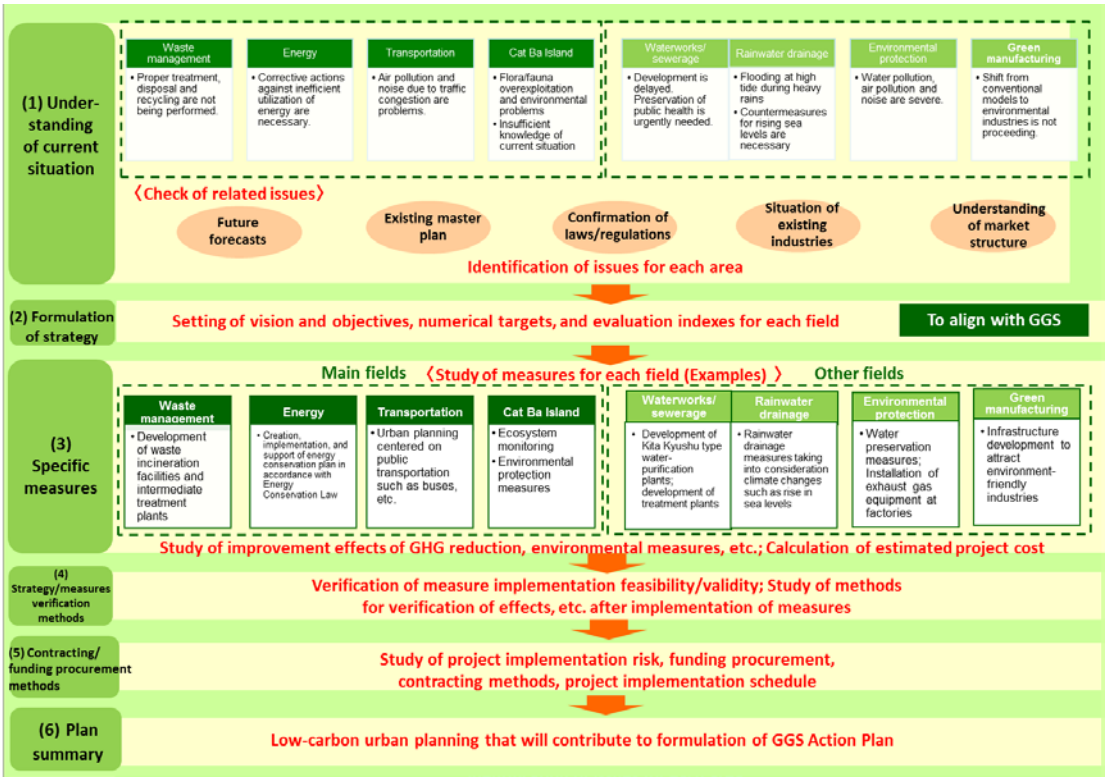
Hai Phong is the third largest city in Viet Nam with a population of approx. 1.9 million, and has developed into the largest military port in Viet Nam and the largest trading port in the northern region. While Hai Phong plays an important role in its social and economic contribution to the northern region including capital Ha Noi, it also is experiencing various environmental problems such as waste disposal, air pollution, water contamination of the public water area, as well as traffic jams, etc. Consequently, city development which can build a society and economy in consideration of environment is needed.

To make this a reality, the "Green Growth Promotion Plan" was established as a practical implementation plan to promote the "Action Plan for Green Growth Strategy in Hai Phong city" approved by Hai Phong City People's Committee.

In this plan, focus is directed to seven fields, namely waste, energy, transportation, Cat Ba Island, water and sewerage/rain water discharge, environmental conservation, and green production. Pilot projects were considered and suggested in order to promote specific approaches.

5. Operation Implementation Flow

Operations were carried out according to the following chart.



6. Outline of the Green Growth Promotion Plan

6-1. Current condition and tasks

In planning the Green Growth Promotion Plan, response to the following challenges is needed.

1) General Reasoning
- While large-scale city infrastructure development, such as the port and harbor, airport, and highway have been implemented, development of the daily living infrastructure such as waste management, sewage, main public roads has been slow, environmental pollution has increased and public health has deteriorated. In order to work towards the improvement of the quality of life of the residents, maintenance of the daily living infrastructure is an urgent task.
- There are currently many companies from overseas which have expressed concern over the poor development of support industries (regional enterprises) in Viet Nam. Creating and improving regional enterprises in Hai Phong, by collaborating and cooperating with foreign corporations and strengthening the competitive capacity of manufacturing industries, which will lead to the independent development of Hai Phong city itself, is important.
- Controlling the amount of greenhouse gas emissions, as well as water and energy demands, which continue to increase due to continuing rapid economic development and population expansion, is needed. Moreover, Hai Phong city is located in a coastal low-lying area which is easily affected by rising sea levels, so response to climate change is also needed.
- As observed by the example of Kitakyushu city, which overcame severe pollution and promoted green growth, improvement in the environment while continuing to encourage economical development is possible, and sustainable development that harmonizes the economy and environment can be expected.

2) Administration
- To solve various municipal issues, horizontal coordination by related departments and agencies is needed. However, this has not necessarily taken place.
- For Hai Phong city to achieve green growth, a clear urban strategy and city management based on such coordination is important, but human resources, information, and capital for such has been insufficient.

3) Enterprises
- Company compliance awareness is not considered to be sufficient. In particular, small-size regional enterprises do not have room to carry out environmental measures such as drainage or gas emissions treatment, due to financial difficulties.
- Since the technical ability and production management capacity of the regional enterprises is inadequate, they are unable to fully respond to the needs of foreign companies when the foreign companies visit the factory complex, and as a result, lose business opportunities.

4) Residents
- The daily living environment of the residents has deteriorated and environmental pollution has continued. However, residents show low awareness that the waste and sewage they discharge is the cause. Improving the environmental awareness of residents is needed.
- Most residents use automobiles or gasoline motorcycles for transportation to travel to and from school and work. As a result, traffic jams often occur central urban areas, etc., and cause air pollution and noise.

6-2. Vision, Basic Policy, and Goals

Looking towards 2050, the following vision was set for the plan.

■ Vision (Looking to 2050)

As the gateway and production base of northern Viet Nam, aim for a Green Port City where sustainability of society, economy, and environment is ensured.

■ Basic Policy

The basic policy for each field to achieve the vision is set as follows.

Table 6.1 Basic Policy by field

Field	Basic Policy
Waste	Proper waste treatment and development of a resource circulation type society
Energy	Promotion of effective energy management and clean and distribution type energy
Transportation	Introduction of a low-carbon public transportation system and modal shift to mass transit
Cat Ba Island	Promotion of whole-island environment conservation and ecotourism
Water supply and sewerage, rain water discharge	Promotion of a safe and secure water supply and measures for sewerage and rain water discharge according to regional characteristics
Environmental conservation	Ensuring a high quality living environment and conservation of a rich natural environment
Green Production	Improvement in the production and the promotion of low carbon emissions by technical innovation

■ Numerical goals

The numerical goals set to achieve the above-described vision and basic policy are shown in Table 6.2.

Table 6.2. Numerical goals

	Items \ Target year		2011-2020	2030	2050
Entire country	Amount of GHG emissions reduction		Reduced 8-10% (compared to 2010)	Reduced 1.5-2.0% annually Reduced 20-30% (BaU)	Reduced 1.5-2.0% annually
	Energy consumption		Reduced 1.0-1.5% in a year (per unit GDP)	-	-
Hai Phong City	GHG	Amount of emissions	Approx.10,950×10^3 t-CO_2/year		
		Reduction amount	10% reduced (compared to 2010)	Reduced 25% (BaU)	Reduced 50% (BaU)
	Index value of the evaluation (indication)	Waste Recycle rate	City solid garbage: 85% or more Industrial waste: 85% or more	City solid garbage: 90% or more Industrial waste: 90% or more	City solid garbage: 95% or more Industrial waste: 95% or more
		Amount of energy consumption per GDP	Reduced 20% or more (compared to 2010)	Reduced 50% or more (compared to 2010)	Reduced 70% or more (compared to 2010)
		Public transportation utilization ratio	20%	30%	50%
		Achievement rate of the environmental quality standard for air	50% or more	90% or more	100%
		Achievement rate of environmental quality standard for surface water	50% or more	70% or more	90% or more
		Sewage treatment rate	Daily living system: 5% or more Industrial system: 10% or more	Daily living system: 40% or more Industrial system: 70% or more	Daily living system: 75% or more Industrial system: 100%
		Green area	Approx. 24,200ha	10% increase (compared to 2020)	20% increase (compared to 2020)
		Mountain forest measures Implementation rate	20% or more	70% or more	100%
		Green agriculture implementation rate	10% or more	40% or more	70%

6-3. Promotion System

For the promotion system of the plan, the system shall be constructed and established in consideration of the following items.

Table 6.3 Promotion System

Item	Description
1. Steady Promotion of the Plan	The Ministry of Planning and Investment, shall have each department provide a report on the implementation status of GGS and a plan based upon it, and supervise its progress, and then regularly report this information to People's Committee on a yearly basis. Receive feedback from the People's Committee and securely implement GGS and this plan based on such feedback.
2. Human resource training	The Ministry of Home Affairs shall carry out the training of human resources who can create the necessary social system and respond to the effective implementation of measures in each field, in cooperation with related departments, in order to achieve this GGS and the plan based on it.
3. Securing Financial Resources	The Ministry of Finance shall work with the central government to secure funds for expenses incurred to implement GGS and this plan based on it. At the same time, the Ministry of Planning and Investment shall actively utilize its know-how to gain capital from the private sector through frameworks such as PPP (Public Private Partnership).
4. Understanding the Latest Technological Trends and their Application	The Ministry of Science and Technology shall understand the latest technological trends so that each function can be improved. Furthermore, the Ministry shall provide applicable technologies and related information regarding various technologies supporting green growth to related agencies.
5.Cooperation with International Agencies	The Ministry of Foreign Affairs shall work with international agencies for needed cooperation and financial support, in order to carry out GGS and this plan based on it.
6.Information Transmission	The Ministry of Information and Communication shall seek to publicize the project and progress status to the private sector using the city website, TV, and newspaper, etc., in order to effectively carry out GGS and this plan based on it.

6-4. Specific Measures by Field

There are seven targeted fields, as shown in Fig. 6.1., of which waste, energy, traffic and Cat Ba Island are considered to be able to contribute to GHG reduction and are set as main fields. The remaining fields are classified as "other". Specific measures and a pilot project were suggested.

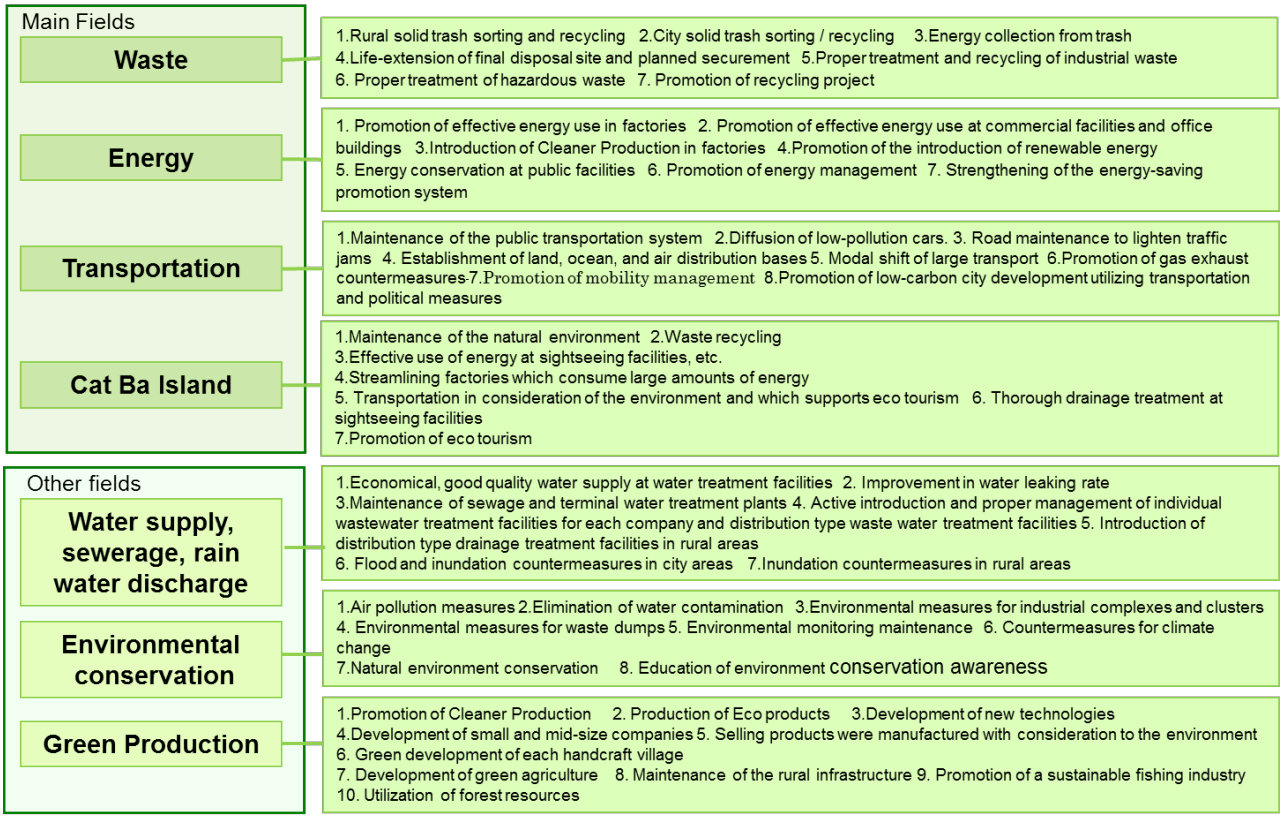


Fig.6.1. Configuration of Specific Measures (tentative) by Field

6-5. Outline of the Pilot Project by field

For the measures of each of the above described fields, project description, expected effect, project implementation system, fund procurement method, and schedule, etc., were considered. Within these, which items should be carried out in short-term and which items of higher urgency within the pilot project should be targeted, were considered. The outline of the consideration results is shown in Table 6.4 - 6.6.

Table 6.4. Outline of the Pilot Project by field (Part 1)

Field	Project name (Tentative name)	Description, etc.	Effect	System Fund Procurement
1)Waste	1) Sorting and composting project for daily living system garbage	- Establish compost manufacturing equipment targeting daily living system garbage approx. 40t/day in rural areas [Rural type model] - Renovate the existing compost manufacturing facility to target approx. 200t/day of garbage from urban areas [City type model]	[Rural type model] Approx. 1,420t-CO_2/ year reduction [City type model] Approx. 53,050t-CO_2/ year reduction	- SPC establishment is estimated for both models
	2) Project to change waste matter into cement raw fuel	- Industrial waste is mainly targeted, and an interim treatment factory (liquid fuel factory, cement raw fuel factory) which can be utilized for fuel and cement raw fuel supply, is established.	- Reduction in the amount of fossil fuels and natural resources used. - Approx.1,170 t-CO_2/ year reduction	- Establishment of a factory in the area is planned - Utilization of JCM's supplementary scheme
	3) E-waste	- Implementation of a collection experiment targeting cell phones is planned. - After considering the results from the above-described matters, consider how these operations should be carried out	- Proper waste treatment - Collection of precious metals and rare metals	- Collaboration with local hazardous waste treatment companies, etc.
2)Energy	1) Energy saving project at the factory	- Realization of energy conservation by introducing a high efficiency freezer - Comprehensive energy conservation measures by implementation of energy conservation diagnosis	- Running cost reduction - Approx.35 t-CO_2/ year reduction	- Formation of an international consortium - Utilization of JCM's supplementary scheme
	2) Exhaust heat recovery power generation project at cement factories	- Energy efficient utilization by introducing an exhaust heat recovery power generation facility (estimated scale: 10,000kW)	- Electricity cost reduction - Approx.19,000t-CO_2/ year reduction	- Same as above
	3) Energy conservation projects at commercial facilities, etc.	- Realization of energy conservation by introducing an air-cooling high-efficiency chiller and a high efficiency refrigerator showcase.	- Electricity cost reduction - Approx.400t-CO_2/ year reduction	- Same as above
	4) Project to change the road lights to LED lights	- Project to change the road lights to LED (1,000 locations) * Changing high-pressure sodium lamps (250W) to LED lights	- Electricity cost reduction - Approx.600t-CO_2/ year reduction	- Same as above
3) Transportation	1) Introduction of low-pollution type buses (EV bus)	- Aim for environmentally friendly public transportation system by introducing low-pollution type electric buses which use renewable energy sources such as solar generation, and improvement in operation management. - The local bus company will introduce an electric bus to the city route in 2015 and 2016.	- When 40 buses are introduced to the city route bus fleet, and 40 buses to the long-distance bus fleet by 2020, GHG is reduced by approx. 6,825 t-CO_2/year - Fuel cost reduction	- Formation of an international consortium - A part of the introduction costs for an EV bus is procured by the support of the Japanese government.

Table 6.5. Outline of the Pilot Project by field (Part 2)

Field	Project name (Tentative name)	Description, etc.	Effect	System Fund Procurement
3) Transportation	2) Promotion project to use public transportation	- As an improvement to the bus service, implementation of a timetable and on-time operations (targeting one city bus route and one private bus route) - Utilization of appropriate approaches in order to switch to other transportation modes, such as walking and public transportation, by "polite information provision" through the implementation of mobility management	- Ensuring and increasing bus demand - Sustainable development of public transportation projects by ensuring on-time bus operations - Contribute to lighter traffic jams and improvement in air and noise pollution near roads	- Formation of an international consortium - Utilize schemes supported by the Japanese government
4) Cat Ba Island	1) Project to construct a comprehensive resource circulation system	- Comprehensive recycling of wastes generated on the island - Develop a biogas system which uses organic waste, etc. with a higher moisture content (Waste volume: 5.6t/day) - Develop a solid fuel system which uses combustible waste with a lower moisture content (Waste volume: 0.8t/day) - Develop a cement raw fuel system for combustible waste which cannot be used in any of the above systems, etc.	- Reduction of landfill waste - Creation of locally generated energy Improvement of value as eco island - Creation of low-price organic fertilizer - Approx. 3,000 t-CO_2/ year reduction	- Establishment of a venture company with Japanese and local companies - Utilization of JCM's supplementary scheme
	2) Project to convert the entire Cat Ba Island to be a low-carbon island	2)-1 Solar power generation project at sightseeing plantations, zoos, botanical gardens and the EV route bus project Solar power generation (200kW), introducing 20 EV buses	- Solar power generation system Approx.100 t-CO_2/ year reduction - EV bus Approx. 700 t-CO_2/ year reduction	- Formation of an international consortium - Utilization of JCM's supplementary scheme
		2)-2 Energy conservation at hotels, etc. Introduction of high-efficiency air conditioning systems	- Approx. 45 t-CO_2/ year reduction	- Same as above
		2)-3 Change of the road lights to LED lights Change of sodium lamps in 313 locations on the island to LED lights	- Approx. 100 t-CO_2/ year reduction	- Same as above
5) Water supply and sewerage, rainwater discharge	1)U-BCF dispersion Project	- Introduction of U-BCF (Upward Biological Contact Filtration) designed for a water volume of 100,000m3/day at the An Duong water treatment plant	- Reduction of the amount of added flocculants - Ensuring good quality faucet water (reduction in the amount of generated trihalomethane)	- Utilization of JICA donated financial aid - Collaboration of Hai Phong Water Supply Company, and Kitakyushu city
	2) Introduction project of a sewage ledger system	- To reduce inundation damage, establish a "sewage ledger system" in order to maintain a healthy sewage drainage facility and to maximize its function	- Maintenance and management of sewage facilities and development of efficient financial management - Support for planned facility renewal, and the appropriate information provision to the residents is possible	- Establishment of the system within the currently implemented ODA project - Training of human resources is handled by Kitakyushu city
	3) Water drainage measures for handcraft villages	3)-1 Waste water measures for Tien Huong noodle manufacturing village Wastewater treatment facility which combines pretreatment of starch water discharge and septic tank use (treatment volume: Q=5m^3/day)	- Improvement in water quality pollution around the village - Ensuring good irrigation water	- Formation of an international consortium - JICA scheme Utilization
		3)-2 Support and measures for wastewater at My Dong casting village Mainly focus on facility management and operations, and provide technical support for effective treatment facility management and operations, including other facilities	- Same as above - Effective operation of existing facilities	- Hai Phong City carries out facility maintenance - Training of human resources, utilization of the JICA scheme

Table 6.6. Outline of the Pilot Project by field (Part 3)

Field	Project name (Tentative name)	Description, etc.	Effect	System Fund Procurement
6) Environmental conservation	1) Southwest canal regeneration project	- Water environment regeneration of the southwest canal, which is the most contaminated canal in Hai Phong City is carried out. - Among various measures, partial support for the maintenance of the pretreatment facility in the factory of the neighboring Vinh Niem small-scale industry cluster, and terminal water treatment facility, is provided.	- Reduction of CH_4 discharged from the canal - Recovery of a good life environment - Provision of places of relaxation and rest	- Formation of an international consortium, - Utilization of a support scheme by the Japanese government
	2) Air and noise monitoring system maintenance project	- Constant monitoring by establishing an air and noise automatic monitoring station (Maintenance of an automatic monitoring station in three locations and the parent station) - Response to accidents, etc., by the introduction of a mobile station	- Understanding the actual condition of air and noise pollution - Information provision to the residents - Rapid response by the mobile station in cases of unusual pollution generation	- Utilization of a support scheme by the Japanese government in order to introduce pilot equipment as well as human resource training
7) Green Production	1) Project to introduce high-efficiency electric furnaces to casting factories	- Targeting My Dong casting village, introduce high-efficiency electric furnaces made in Japan, carry out efforts to reduce CO_2 emissions, promote energy conservation, and improve production efficiency and quality (estimated 150t/month scale furnace)	- Electricity cost reduction - Production efficiency / quality improvement - Approx. 390t-CO_2/ year reduction (compared to electric furnaces made in China)	- Formation of an international consortium - Utilization of JCM's supplementary scheme
	2) Green agriculture promotion project	- Provision of a safe and secure rice supply and improvement in the income of the farmers by SRI distribution - Development of organic vegetable farming by coordinating with the conversion to compost project	- Provision of safe and secure crops - Reduction in the amount and cost of chemical fertilizer and agrochemicals, contributing to environmental conservation - Reduction of GHG emissions, etc., by SRI	- International consortium - Utilization of the JICA scheme

6-6. Reduction in the amount of GHG emissions by the pilot project diffusion (estimated)

Within the above described pilot project, reduction effects of the GHG emissions reduction project are organized below.

Table 6.7 Reduction in the amount of GHG emissions by pilot project diffusion (estimated)

Field	Project name (tentative)	Scale, etc. (estimated)	Amount of GHG emissions reduction (t-CO_2/year)
1. Waste	1) Sorting and composting project	Rural area: 40t/day City area: 600t/day	1,420 53,050
	2) Project to switch to liquid fuel	Capacity: Approx. 2,000t/year	1,170
	3) Project to change to cement raw fuel	Capacity: Approx. 24,000t/year	
2. Energy	1) Waste heat power generation at cement factories	Estimated output: 10,000kW	19,000
	2) Energy conservation project at commercial facilities, etc.	Chiller + show case replacement Approx. 10 locations	4,000
	3) Energy conservation project at factories	Introduction of high-efficiency freezers Approx. 20 locations	700
	4) Project to change the road lights to LED lights	LED 2,000 *1 PV＋LED 1,000 *2	1,200
3.Transportation	- Project to introduce EV buses	Introduction of 80 buses by 2020 Replacement effect by establishing new routes	6,800
4. Cat Ba Island	1) Waste recycling project (gas power generation, swtich to solid fuel, control of land-fill disposal related methane gas)	Amount of waste from switching to biogas: 5.6t/day Amount of waste from switching to solid fuel: Waste volume: 0.8t/day	3,000
	2) Solar power generation project at sightseeing plantations, zoos, botanical gardens and the EV route bus project	Solar power generation project × 5 locations EV bus × 20	500 700
	3) Energy conservation at hotels	Introduction of a high-efficiency air conditioning system × 5 locations	220
	4) Change of the road lights to LED lights	Change of sodium lamps in 313 locations on the island to LED lights	100
5. Green Production	1) Green agriculture (paddy rice) diffusion project	Target: 5,000ha	24,000
	2) Cleaner Production Introduction of high-efficiency electric furnaces to the casting factories	1.5t furnace per one company Production volume: 150t/month Estimation of introduction of 20 companies *electric furnace for 5 companies, coal furnace for 15 companies	17,000
		Total	132,860

*1 LED lights: abbreviation for Light-emitting diode, luminescence diode,

*2 PV: abbreviation for Photovoltaics, solar power generation

6-7.Verification methods of the strategy measures (Examples of implementation for sustainable improvement of the project)

To achieve the goal of the project, namely high cost effect, implementation of the following PDCA cycle, and working towards sustainable improvement, are important.

Item	Implementation item	Points to consider
Plan (Plan)	◇Specific planning of the project Amount, quality level, etc. of compost to secure. ◇Setting the evaluation indicators and monitoring method which can confirm progress ・Amount of trash to receive and the quality of the trash (raw garbage ratio, rate of valuables, etc.) ・Efficiency of facility operations ・Compost manufacturing volume, quality level, etc.	・Predict current risks, details from previous cases, and future prospect, etc. and reflect these in the plan ・The purpose of the plan is to determine problems, and establish improvement methods.
Do (execute)	・Implementation of the project ・Monitoring and recording of evaluation indicators	・Evaluation indicators must be recorded ・Evaluation indicators should be categorized as those which are directly related to the product and those that are conditions in manufacturing
Check (Evaluation)	・Confirmation of product quantity, quality level, other indicators (manufacturing conditions, etc.) ・Identify problems in product manufacturing ex)Some of the standards regarding quality level are not satisfied →Identification of the cause →Consideration of improvement measures	・Objective analysis of the problem by the evaluation indicators, etc., is needed.
Action (Handling)	・Specification of improvement measures ・Identification of points which can confirm the effectiveness of the improvement measures ・Reflection in the next planning	Objective analysis and accurate reflection in the next plan are important.

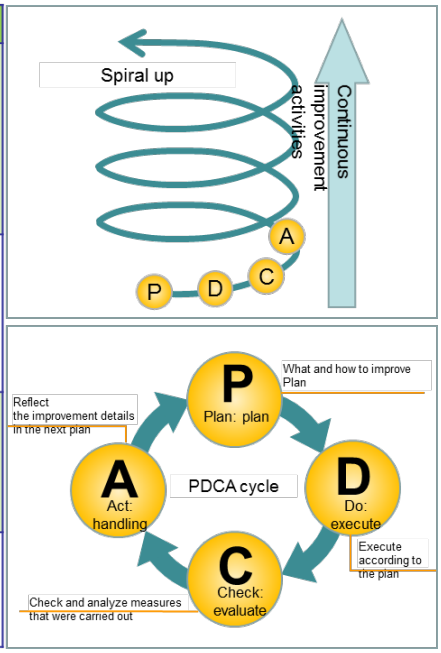


Fig. 6.2 Implementation items in each phase of PDCA, points to consider, and conceptual diagram

6-8 Order and Fund Procurement Methods

Regarding order and fund procurement methods of each project, an outline of the methods are listed below.

1) PPP (Public Private Partnership)
2) PFI (Private Finance Initiative)
3) Cat Ba Island Environmental Conservation Fee
4) Tourism Tax
5) Environmental Conservation Fund

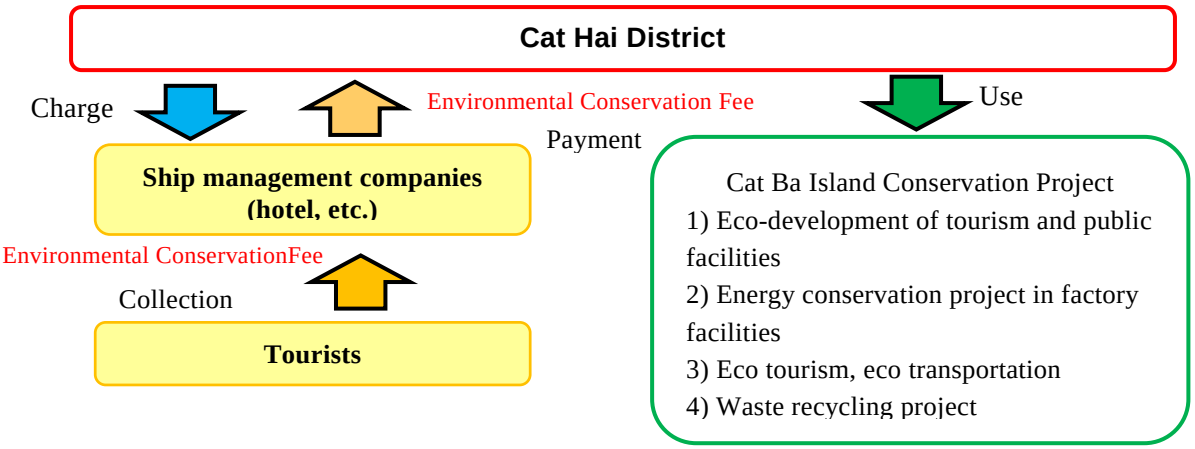


Fig. 6.3. Example of collection of Cat Ba Island Environmental Conservation Fee and its utilization

■ Conference status

◇General Conference (April 22, 2014), Hai Phong city

◇The 1st National Conference (May 13, 2014), Kitakyushu city (Kitakyushu Asian Center for Low-Carbon Society)

◇Inception Conference (May 26, 2014), Hai Phong city

◇The 2nd National Conference (October 03, 2014), Kitakyushu city (Kitakyushu Asian Center for Low-Carbon Society)

◇Interim Report Meeting, The 1st Workshop (July 28, 29, 2014), Hai Phong City

◇Interim Report Meeting, The 2nd Workshop (October 20, 2014), Hai Phong City

◇Final Achievement Report Meeting, (January 19, 2015), Hai Phong City

◇Inception Conference (May 26, 2014)

◇The 1st Workshop (July 28, 2014)

◇The 2nd Workshop (October 20, 2014)

◇Final Report Meeting (January 19, 2015)

FY 2014 Study on the Feasibility of JCM Large Scale Project for the Achievement of Low Carbone Society in Asia

"Support for the Establishment of Haiphong City Green Growth Plan in Cooperation with Kita-Kyushu City"

Report

NTT Data Institute of Management Consulting, Inc.

Contents

Chapter 1. Objective of Project and Implementation System

1.1 Project outline (Objective and target area)

In Vietnam, policies to restrict increasing energy demand and to contribute to the prevention of global warming, such as Law on Energy Efficiency and Conservation (2010) and National Strategy on Climate Change (2011), are being rolled out at present. However, all practical activities to achieve energy efficiency and the introduction of the distributed generation of power are not going well. In addition, in areas in Haiphong City where many coal power generation plants and cement plants are concentrated, air pollution is serious.

Through this project, we will roll out activities to provide models which contribute to the resolution of issues faced by Vietnam in Haiphong City, the third largest city of Vietnam with which Kita-Kyushu City has a sister-city relationship. Specifically, we will introduce JCM and implement energy efficiency diagnosis and distributed generation feasibility study at factories and large scale business establishments with large energy consumption. In this project, we will excavate projects contributing to the achievement of the target of Vietnam's laws, study the feasibility of the projects from economical point of view and assess CO2 emission reduction potential. The following is the theme and target area of this study.

Fig. 1. Study theme and target area

	(1) Factories	(2) Business establishments	(3) Infrastructure
Study theme	Introduction of cleaner production including the promotion of energy efficiency	Promotion of energy efficiency and low carbon technologies with co-benefit effect at large scale business establishments.	Promotion of energy efficiency of infrastructures with an eye on the effectiveness of future infrastructure management
Target area	Energy consumption-type factories (cement factories, etc.), supporting industries (casting, metal processing, etc.), industrial complexes.	Hospitals, hotels, commercial facilities, etc.	Roads, bridges, etc.

1.2 Technologies to be applied and related legal systems

(1) Technologies to be applied

Technologies to be studied this time have been selected based on the result of energy efficiency diagnosis implemented at factories and business establishments in Haiphong City. Technologies selected as candidate of this study are as follows.

Fig. 2. Technologies to be applied

Category	Facility	Technologies to be applied
Factories	Beer factory	High-efficiency refrigeration compressor
	Casting factory	High-efficiency induction furnace
Business establishment	Hotel	High-efficiency chiller
	Hospital	High-efficiency room air conditioner
	Commercial facility	High-efficiency refrigerated show case
Infrastructure	Road	LED street lightening

(2) Related legal systems

Vietnam government has established Law on Energy Efficiency and Conservation (Decree No. 50/2010/QH12) in 2010 as an energy efficiency-related law. This law specifies matters concerning financial support for the promotion of energy efficiency, reflection in prices, incentive policies, use of energy-efficient vehicles/equipment and energy labeling system.

In 2011, Detailed Regulations and Measures for Implementation of the Law on EE&C (Decree No. 21/2011/ND-CP) specifying detailed rules and regulations related with Law on Energy Efficiency and Conservation has been put into effect. This regulation specifies matters concerning the judging of facilities consuming large amount of energy, creation of lists of facilities consuming large amount of energy, system of energy management, energy diagnosis, energy efficiency plan and attaching of energy labels. Industrial manufactures, agricultural production sites, transportation facilities which annually consume energy of 1,000 tons or more in terms of petroleum quantity (relevant to 1,000 TOE) in a year; and estates, offices, buildings to be used as residents, educational facilities, medical facilities, leisure facilities, physical education facilities, sports facilities, hotels, supermarkets, restaurants and stores which consume energy of 500 tons or more in terms of petroleum quantity (relevant to 500 TOE) in a year.

Approval of the List of Facilities and Equipment Required to Comply with Regulations on Energy Labeling and Minimum Energy Performance Standards (Prime Ministerial Decree No. 51/2011/QD-TTg) specifying detailed rules on energy labeling has also come into effect in 2011. The following products are specified as products which must have energy labels.

Fig. 3. Products to which energy labels are to be attached

Category	Products to which energy labels are to be attached
Home appliances	Straight tube fluorescent lamp, compact fluorescent lamp, electromagnet for fluorescent, electronic ballast, air conditioner, refrigerator, home use washing machine, rice cooker, fan and TV.
Office and commercial equipment	Copy machine, PC monitor, printer and refrigerated show case, etc.
Industrial facilities	Distribution transformer and electric motor, etc.
Transportation means	Small vehicle

As a law concerning energy management, Energy Management - Education of Energy Consultants and Qualification (MOIT Circular No. 39 /2011/TT-BCT) was put into effect in 2011. This circular specifies matters regarding energy management qualification (qualification which will be provided by Ministry of Industry and Trade (MOIT) to those who passed energy management qualification exams) and qualification as energy consultants (qualification which will be provided by MOIT to those who passed energy consultant qualification exams).

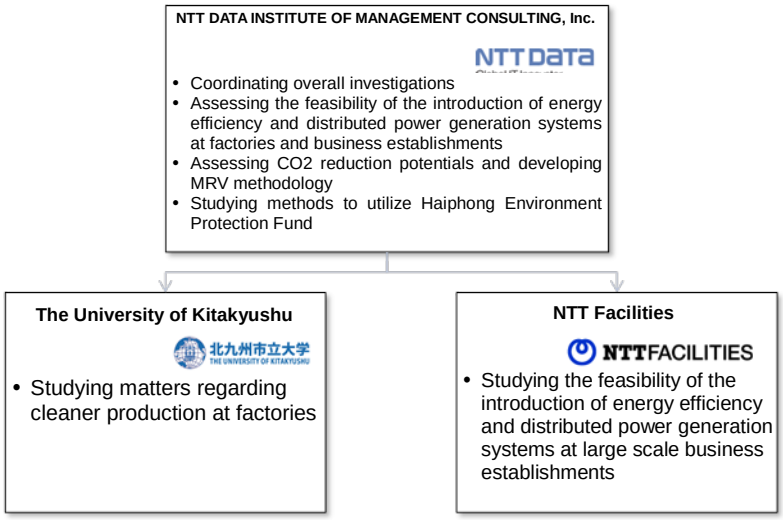
In 2012, Circular on Planning for Energy Efficiency, Reporting on the Implementation Results and the Implementation of Energy Diagnosis (MOIT Circular No. 09/2012/TT-BCT) came into operation. In this circular, matters concerning the establishment and report of annual plans for energy efficiency, implementation of energy diagnosis and responsibilities of related departments are defined.

Although subsidiary system for energy efficiency has not developed substantially yet, “National High Priority Programs for Energy Efficiency (subsidy rate: 30%, upper limit: 5 billion VND),” a subsidy system for energy efficiency, and “low interest financing (5.4% in relation to VND)” by development banks have been implemented.

1.3 Implementation system of project

Implementation system of this project is as follows.

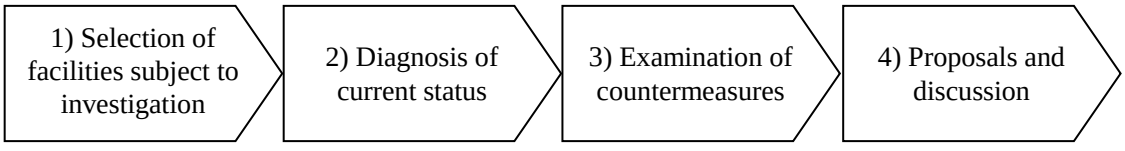
Fig. 4. Implementation system



1.4 Project procedure

Project procedure was comprised of the following four steps.

Fig. 5. Project procedure



Chapter 2 Investigation Result

2.1 Feasibility of greenhouse gas emission reduction (CO2 of energy origin in particular)

(1) Factories

In selecting factories subject to this investigation, we visited 10 companies in Haiphong City (4 steel makers, 2 food companies, 1 beverage company, 1 cement company, 1 shipbuilding company and 1 paper-making company) and explained the outline and the objective of this project. Out of the 10 companies, we performed an energy efficiency diagnosis for one factory which showed an interest in JCM projects and the introduction of Japanese-made facilities. Energy efficiency diagnosis for the cement factory we visited was deferred because they were constructing waste heat recovery facilities and showed a desire to concentrate on working toward the introduction of the facilities. Moreover, in January 2015, other cement factory showed an interest on the introduction of heat recovery facilities. We have been decided to visit the company to examine details in the future.

As regards supporting industries, investigations were carried out on the theme of energy efficiency at casting factories concentrated in Haiphong City.

Following is the outline of energy efficiency diagnoses performed at facilities.

(1)-1 Beer factory A

A beverage factory which was established in 1960 and produces beer mainly. Previously this company produced ice and water. The production of beer was started afterward and now it has become the main business of the company. It has two factories in Haiphong City. At one of the factories, we are rolling out a project to integrate functions into one site. This company is subject to the Law on EE&C. Energy efficiency diagnosis for this factory was performed by means of hearing and walk through investigations.

Fig.6. On-site investigation

Hearing	Inside the factory
	

As a result of these investigations, we considered that renewal of refrigeration compressors installed in the factory might become a target of JCM renewal project. The following refrigeration compressors are the candidate for the renewal. All of these refrigeration compressors have been used for 20 years since they were manufactured.

Fig. 7. Candidate refrigeration compressors for renewal

No.	Manufacturer	Year of manufacture	Motor output
1	Japanese refrigeration compressor manufacturer A	1988	45 kW
2	Japanese refrigeration compressor manufacturer A	1988	45 kW
3	Japanese refrigeration compressor manufacturer A	1988	45 kW
4	Japanese refrigeration compressor manufacturer A	1988	45 kW
5	Japanese refrigeration compressor manufacturer A	1987	55 kW
6	Japanese refrigeration compressor manufacturer A	1987	55 kW

We examined the recommendation of the renewal of those refrigeration compressors in cooperation with the Japanese refrigeration compressor manufacturer A, and as a result, following energy saving effect and greenhouse gas reduction are expected.

(1) Annual power consumption of existing facilities: 419,737 kWh

(2) Annual power consumption of new facilities: 354,750 kWh

Energy saving effect ((1) - (2)): 64,987 kWh

Estimated greenhouse gas reduction amount ([energy saving effect] x [grid emission factor in Vietnam]): 35.1t CO2

(1)-2 Casting factories

Haiphong City is the largest area in Vietnam where many casting factories are concentrated. In particular, My Dong district in the city is called the casting village and about 140 casting companies are located. Main products include pump parts, parts of sewing machine and products related with water supply and sewage systems. Most of the factories (120 factories) are using coal furnaces, and it was expected that changing these furnaces to electric ones may result in significant reduction of greenhouse gas emission. Twenty factories using electric furnaces have inefficient facilities made in China. It was also expected that, if these facilities are replaced with Japanese-made high-efficient facilities, that could reduce the emission of greenhouse gases greatly. Moreover, many factory relocation/expansion projects are underway. That can be regarded as a favorable opportunity for the renewal of facilities.

Fig. 8 Examples of melting furnaces introduced in factories in Haiphong City

Chinese-made electric furnace	Vietnam-made coal furnace
	

Source: Photo by the University of Kitakyushu

With the aim of grasping the current situation of energy consumption, we implemented questionnaire and hearing investigations for casting companies in Haiphong City. The result is as follows.

Fig. 9. Result of investigations on current situation of energy consumption

No.	Company name	Year of foundation	Capital	Employee	Production amount	Operation	Type of furnace	Scale	Number of units	Country of manufacture	Year of introduction	Consumption rate	Electricity charges Expense for cokes
1	A company	2001	1.8 BVND	120	270	Night	Electricity	1500kg	4/2	China	2008/2012	1.0kWh/kg	23,000 USD
2	B company	2000	1.8 BVND	100	120	day	Electricity	1500kg	2	China	2012	1.56kWh/kg	9,485 USD
3	C company	2007	3.0 BVND	115	300	day	Electricity	1500kg	2/2	China	2012/2013	1.0kWh/kg	25,000 USD
4	D company	1955	6.0 MUSD	250	30	Night	Electricity	500kg	2/2	China/Russia	2002	0.9kWh/kg	11,000 USD
5	E company	2000	2.0 BVND	60	110	day	Electricity	1000kg	2	China	2011	1.0kWh/kg	8,500 USD
6	F company	2006	1.9 BVND	50	140	day	Electricity	1500kg	2	China	2012	1.0kWh/kg	10,800 USD
7	G company	2005	4.8 BVND	55	150	day	Coke	1000mm	2	Vietnam	2011	0.3kg/kg	6,900 USD
8	H company	2004	1.9 BVND	60	140	day	Coke	1000mm	2	Vietnam	2012	0.25kg/kg	6,333 USD
9	I company	2003	2.6 BVND	40	100	day	Coke	950mm	2	Vietnam	2013	0.33kg/kg	6,200 USD
10	J company	2006	6.0 BUSD	60	120	day	Coke	1000mm	2	Vietnam	2013	0.33kg/kg	6,700 USD
11	K company	2005	1.8 BVND	30	100	day	Coke	1000mm	2	Vietnam	2014	0.3kg/kg	5,600 USD
12	L company	Unanswered	Unanswered	Unanswered	110	Unanswered	Coke	1000mm	Unanswered	Vietnam	2014	0.3kg/kg	6,000 USD
13	M company	2004	1.9 BUSD	50	110	day	Coke	1000mm	Unanswered	Vietnam	Unanswered	0.33kg/kg	6,800 USD
14	N company	2008	1.8 BVNB	30	80	day	Coke	900mm	2	Vietnam	2012	0.34kg/kg	5,200 USD
15	O company	2008	1.8 BVND	30	70	day	Coke	900mm	2	Vietnam	Unanswered	0.33kg/kg	4,400 USD

Source: Result of investigation by The University of Kitakyushu

On-site observations of the five companies (A, B, D, G and K companies) in the above table were performed by two Japanese induction furnace manufacturers from October 20 (Mon) through 21 (Tue), 2014.

Moreover, in order to sell Japanese technologies and JCM projects to more casting companies, a seminar with on-site related parties was held on October 21, 2014 at Haiphong City International Conference Hall.

In addition to that, since some casting companies in My Dong district did not participate in the seminar, we received a request to hold the seminar again and gave an extra seminar on October 23 (Thurs). The seminar was attended by 22 casting companies.

As a result of above mentioned activities, total of three companies have requested quotes from us. We will select equipment models and prepare quotes with the application of JCM equipment subsidiary system in mind.

The estimated greenhouse gas amount to be reduced if Japanese-made high-efficiency induction furnaces are introduced at factories with annual production amount of approx. 150t is 400t/year of CO2 in the event of a replacement for Chinese-made electric furnaces, and 1,000t/year of CO2 for coal furnaces.

A. Emission amount after the introduction of a Japanese-made high-efficiency induction furnace [(electric power consumption rate for melting) x (annual production amount) x (electricity emission factor)]:

584.1t/year of CO2

Fig. 10 Parameters used for the calculation

Parameter	Numerical value	Concept/Sources
Electric power consumption rate for melting	0.6 MWh/t	Index value for a Japanese-made electric furnace
Annual production amount	1,800t/year	150t/month × 12 months
Electricity emission factor	0.5408t/MWh of CO2	Grid electricity emission factor in 2010 in Vietnam (Vietnam Ministry of Natural Resources and Environment, December 2011)

B. Emission amount when a Chinese-made electric furnace is used [(electric power consumption rate for melting) x (annual production amount) x (electricity emission factor)]:

973.4t/year of CO2

Fig. 11 Parameters used for the calculation

Parameter	Numerical value	Concept/Sources
Electric power consumption rate for melting	1.0 kWh/t	Results of on-site hearing and questionnaire investigations
Annual production amount	1,800t/year	150t/month × 12 months
Electricity emission factor	0.5408t/MWh of CO2	Grid electricity emission factor in 2010 in Vietnam (Vietnam Ministry of Natural Resources and Environment, December 2011)

C. Emission amount when a coal furnace is used [(electric power consumption rate for melting) x (annual production amount) x (cokes emission factor)]:

1,630.8t/year of CO2

Fig. 12 Parameters used for the calculation

Parameter	Numerical value	Concept/Sources
Electric power consumption rate for melting	0.3 t/t	Results of on-site hearing and questionnaire investigations
Annual production amount	1,800t/year	150t/month × 12 months
Electricity emission factor	3.02t/t coke of CO2	CDM PDD ""Installation of a Natural gas based cokeless cupola furnace at a metal foundry in Ankleshwar, Gujarat, India "

Based on the above, the CO2 amount to be reduced in the event of a replacement of a Chinese-made electric furnace: 389.3t/year of CO2.

In the event of a replacement of a coal furnace (C. - A.): 1,046.7t/year of CO2

(2) Business establishments

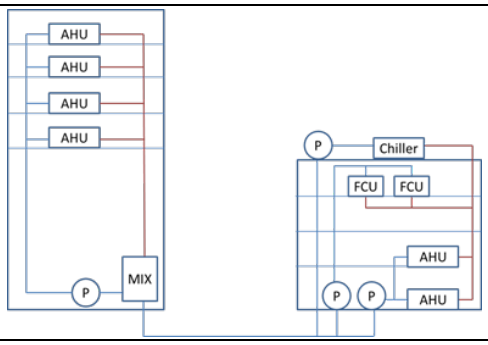
(2)-1 Hotel A

Hotel A is a foreign-owned hotel with total of 122 rooms and has started its business in 1998. It has an office building within the site. The hotel is not subject to the report specified by the Law on EE&C (500 TOE or more/year). Energy efficiency diagnosis for this hotel was performed by means of hearing and walk through investigations.

As a result of these investigations, it was revealed that existing air conditioning facilities were aging in general. In particular, we considered that existing chillers (cooling capacity: 494kW x 3 units) consuming huge amount of electricity might become a target of JCM project.

Fig. 13. 13 of air conditioning facilities

Candidate chiller for the replacement



Cool water pipes in Hotel A

With the cooperation of air conditioning facility manufacturer A, we estimated energy saving effect and the amount of greenhouse gases to be reduced. The result of the calculation is as follows.

(1) Annual power consumption of existing facilities: 1,283,121 kWh

(2) Annual power consumption of new facilities: 1,145,151 kWh

Energy saving effect ((1) - (2)): 137,970 kWh

Estimated greenhouse gas reduction amount ([energy saving effect] x [grid emission factor in Vietnam]): 74.6t of CO2

(2)-2 Commercial facility A

Large-scale commercial facility A in Haiphong City is a chain store of a French major commercial facility and started operation in 2006. It has an office building within the site. This facility is subject to the report specified by the Law on EE&C (500 TOE or more/year). Energy efficiency diagnosis for this commercial facility was performed by means of hearing and walk through investigations.

As a result of these investigations, we considered that existing chillers (cooling capacity: 1,116 kW × 1 unit) and refrigeration show cases (power consumption: 1.5 kW to 3.9kW, total of 26 units) might become a target of JCM project.

Fig. 14. Candidate facilities for renewal

Chiller

Refrigerated show cases

(Chiller)

With the cooperation of air conditioning facility manufacturer A, we estimated energy saving effect and the amount of greenhouse gases to be reduced. The result of the calculation is as follows.

(1) Annual power consumption of existing facilities: 1,822,839.2 kWh

(2) Annual power consumption of new facilities: 1,309,539.7 kWh

Energy saving effect ((1) - (2)): 513,299.5 kWh

Estimated greenhouse gas reduction amount ([energy saving effect] x [grid emission factor in Vietnam]): 277.6t of CO2

(Refrigerated show case)

With the cooperation of air conditioning facility manufacturer A, we estimated energy saving effect and the amount of greenhouse gases to be reduced. The result of the calculation is as follows.

(1) Annual power consumption of existing facilities: 558,686 kWh

(2) Annual power consumption of new facilities: 305,350 kWh

Energy saving effect ((1) - (2)): 253,336 kWh

Estimated greenhouse gas reduction amount ([energy saving effect] x [grid emission factor in Vietnam]): 137.0t of CO2

(2)-3. Hospital A

Hospital A in Haiphong City is positioned as the first grade municipal hospital, being a large-scale hospital having about 900 beds, 51 departments (38 medical care fields, 9 treatment support centers and 4 research centers) and 1,300 working staff. Energy efficiency diagnosis for this hospital was performed by means of hearing and walk through investigations.

As a result of these investigations, we considered that individual indoor room air conditioners (145 units) might become a target of JCM project.

Fig. 15. Candidate facilities for renewal

Indoor equipment

Outdoor equipment

We estimated energy saving effect and the amount of greenhouse gases to be reduced. The result of the calculation is as follows.

(1) Annual power consumption of existing facilities: 272,129 kWh

(2) Annual power consumption of new facilities: 223,643 kWh

Energy saving effect ((1) - (2)): 48,486 kWh

Estimated greenhouse gas reduction amount ([energy saving effect] x [grid emission factor in Vietnam]): 35.4t of CO2

(3) Infrastructure

The government-owned lightning company A engaging in the procurement and management of road lightening is examining the energy saving of road lightening with advice from Haiphong City Energy Conservation Center. The area attracting the most interest is the introduction of LED for road lightening and the utilization of recyclable energy. The number of road lightening under the management of the company is about 20 thousand. LED is adopted only for 1% of the total. They intend to increase the number gradually in the future.

They expressed their desire to replace 2000 high-pressure sodium lamps (250W) with LED lamps. Therefore, we estimated the energy saving effect and the amount of greenhouse gases to be reduced. The result of the calculation is as follows.

(1) Annual power consumption of existing facilities: 2,190,000 kWh

(2) Annual power consumption of new facilities: 1,576,800 kWh

Energy saving effect ((1) - (2)): 1,138,800 kWh

Estimated greenhouse gas reduction amount ([energy saving effect] x [grid emission factor in Vietnam]): 615.9t of CO2

2.2 Methodology of the measurement of emission amount of greenhouse gases and monitoring system

We studied the methodology of the measurement of emission amount of greenhouse gases and monitoring systems regarding (1) factories, (2) business establishments and (3) infrastructures. Specifically, as methodology of the emission amount of greenhouse gases, we studied 1) suitability requirements, 2) parameters which should be set before the project registration application, 3) setting and calculation of reference emission amount, 4) calculation of project emission amount and 5) setting of monitoring method for the following facilities: factories - beer factory A and casting factories; business establishments - hotel A, commercial facility A (air cooled chiller) and hospital A; and infrastructures. After that, we examined the monitoring systems.

2.3 Estimated project cost (including financial support scheme at the time of the start of projects) and cost effectiveness

(1) Factories

(1)-1 Beer factory A

For the beer factory A, we considered the introduction of four refrigeration compressors of 109.5kW refrigeration capacity and two refrigeration compressors of 180.8kW refrigeration capacity. The project cost is estimated to be about 13 million yen at present. The estimated simple payback period is about 16 years without the subsidy. If about seven million yen, corresponding to the half of

project cost, is granted as a subsidy of JCM equipment subsidiary program, the simple payback period is estimated to be about eight years. The table below shows the cost effectiveness of CO2 reduction.

Fig. 16. Cost effectiveness of subsidies for CO2 reduction (Beer factory A)

Item	Numerical value	Calculation formula
Cost effectiveness per year	199,175t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
Total cost effectiveness during project period (15 yeas)	13,278.3t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)

(1)-2 Casting factories

We studied the introduction of high-efficiency induction furnaces for casting factories. The project cost is estimated to be about 50 million yen per unit. The estimated simple payback period is about 7.6 years without the subsidy. If about 25 million yen, corresponding to the half of project cost, is granted as a subsidy of JCM equipment subsidiary program, the simple payback period is estimated to be about 3.8 years. The table below shows the cost effectiveness of CO2 reduction.

Fig. 17. Cost effectiveness of subsidies for CO2 reduction (Beer factory A)

	Item	Numerical value	Calculation formula
Cases for which coal furnaces are used as a reference	Cost effectiveness per year	23,883.8t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
	Total cost effectiveness during project period (15 yeas)	1,592.3t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)
Cases for which electric furnaces are used as a reference	Cost effectiveness per year	64,205.3t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
	Total cost effectiveness during project period (15 yeas)	4,280.4t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)

(2) Business establishments

(2)-1 Hotel A

Renewal of three chillers of 494kW refrigeration capacity was studied for Hotel A. The project cost is estimated to be about 27 million yen at present. The estimated simple payback period is about 20 years without the subsidy. If about 14 million yen, corresponding to the half of project cost, is granted as a subsidy of JCM equipment subsidiary program, the simple payback period is estimated to be about 10 years. The table below shows the cost effectiveness of CO2 reduction.

Fig. 18. Cost effectiveness of subsidies for CO2 reduction (Hotel A)

Item	Numerical value	Calculation formula
Cost effectiveness per year	187,631.9t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
Total cost effectiveness during project period (15 yeas)	12,508.8t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)

(2)-2 Commercial facility A

The renewal of chiller (refrigeration capacity: 1,116 kW × 1 unit) and refrigeration show cases (power consumption: 1.5 kW to 3.9kW x 26 units) was examined for the commercial facility A. The project cost is estimated to be about 28 million yen for the renewal of the chiller and about 22 million yen for the renewal of the refrigeration show cases at present. The estimated single payback period is about 4.2 years for the renewal of the chiller and about 8.0 years for the renewal of refrigeration show cases without the subsidy. If about 14 million yen is granted for the chiller as a subsidy of JCM equipment subsidiary program and about 11 million yen for the refrigeration show cases, the simple payback period is estimated to be about 2.1 years for the chillers and about 4.0 years for the refrigeration show case. The table below shows the cost effectiveness of CO2 reduction.

Fig. 19. Cost effectiveness of subsidies for CO2 reduction (Commercial facility A)

	Item	Numerical value	Calculation formula
Chiller	Cost effectiveness per year	80,289.6t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
	Total cost effectiveness during project period (15 yeas)	5,352.6t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)
Refrigeration show cases	Cost effectiveness per year	50,433.7t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
	Total cost effectiveness during project period (15 yeas)	3,362.2t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)

(2)-3. Hospital A

The renewal of individual indoor room air conditioners (145 units) was studied for the Hospital A. The project cost is estimated to be about 22 million yen at present. The estimated simple payback period is about 57.4 years without the subsidy. If about 11 million yen, corresponding to the half of project cost, is granted as a subsidy of JCM equipment subsidiary program, the simple payback period is estimated to be about 28.7 years. Under current situation, inexpensive electricity charges and low capacity utilization have significant influences on cost efficiency. The table below shows the cost effectiveness of CO2 reduction.

Fig. 14. Cost effectiveness of subsidies for CO2 reduction (Hotel A)

Item	Numerical value	Calculation formula
Cost effectiveness per year	419,507.4t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
Total cost effectiveness during project period (15 yeas)	27,967.2t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)

(3) Infrastructure

Replacing 2000 high-pressure sodium lamps (250W) with LED lamps is being studied for the government-owned lightening company A. The project cost is estimated to be about 400 million yen

at present. The estimated simple payback period is about 45.2 years without the subsidy. If about 200 million yen, corresponding to the half of project cost, is granted as a subsidy of JCM equipment subsidiary program, the simple payback period is estimated to be about 22.6 years. Not only LED bulbs but the installation cost of poles, etc. is also included in the estimated cost. Due to the large initial investment, the cost effectiveness of this project remains low. The table below shows the cost effectiveness of CO2 reduction.

Fig. 15. Cost effectiveness of subsidies for CO2 reduction (Hotel A)

Item	Numerical value	Calculation formula
Cost effectiveness per year	190,258.8t/yen of CO2	amount of subsidy ÷ annual CO2 reduction amount
Total cost effectiveness during project period (15 yeas)	12,683.9t/yen of CO2	amount of subsidy ÷ (annual CO2 reduction amount x 15)

Chapter 3 Implementation Plan for the Realization of Projects

3.1 Project scale and implementation system

(1) We studied the scale and implementation systems of projects intended for (1) factories, (2) business establishments and (3) infrastructures. Specifically, we organized the scale of projects and estimated financial support schemes regarding the following projects: projects for factories - beer factory A and casting factories; projects for business establishments - hotel A, commercial facility A and hospital A; and projects for infrastructures. The implementation systems of these projects were also studied in consideration of international consortium in mind, too.

3.2 Necessary measures for the promotion of project realization (challenges, requirements, etc.)

Cooperation to projects by Haiphong city government (instructions to local companies)

In implementing these equipment subsidiary projects, local companies are required to operate facilities adequately and give cooperation in performing monitoring under the responsibility of representatives of the companies. For the representatives, exerting compelling power to local companies to fulfill their responsibilities becomes a great burden. It is desirable that Haiphong city government provide instructions to local companies when necessary while making use of the framework of cooperation projects between Haiphong City and Kita-kyushu City.

In addition, since road lightening-related projects are public works, these projects will be put to competitive bidding in general. Close consultation is required because the competitive bidding may not conform to the schedule of JCM subsidiary projects or other constraints in some cases. We would like Haiphong city government to provide advice in the future too.

Support Project for Developing Green Growth Plan in Hai Phong City in Collaboration with Kitakyushu City

Study Report (Waste Sector/Study Report)

February 2015

NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, INC.

Contents

1. Legal Institutions and Project Environment of Target Country/City

1-1. Project-Related Environmental Load

1-1-1. Overall waste

According to Hai Phong City Department of Construction, the generated amount of waste in FY2013 is 2,000 tons in the whole city, 1,600 tons/year of which is from Hai Phong urban areas (8 districts) and 400 tons/year of which is from rural areas.

1-1-2. General waste

(1) Generated amount

According to the report of policy of solid waste management in Hai Phong City and power recovery potentials from solid waste, a current per capita generating index in the city is approximately 0.7 kg/person/day (Nguyen Hoai Duc, 2014). The generated amount in the whole city, which is calculated by multiplying per capita generating index by population (1,925,200), is approximately 1,347.7 tons/day (waste tons/day). The per capita generating index is expected to increase to 1.3 kg/person/day in urban areas and approximately 1.2 kg/person/day in rural areas in the future, and daily generated household waste is estimated to increase to approximately 3,045 tons/day by 2025.

(2) Situation of collection and transportation/intermediate treatment/final disposal

Regarding collection and transportation, intermediate treatment and final disposal, Hai Phong Urban Environment One Member Limited Company (URENCO Hai Phong) is responsible for general waste generated in urban areas, and collects and disposes approximately 900 tons of waste daily. Two hundred tons of 900 tons is treated as composting raw materials at composting facility in Trang Cat, and the rest of 700 tons is landfilled at final landfill site。

(3) Waste Characteristics

1) Method of analysis

With Hai Phong URENCO and ETM Center's cooperation, we conducted a waste characteristics analysis on two types of waste (one sample of household waste and one sample of market waste). Household waste was taken from four wards (totally approximately 200 kg) and reduced into one sample. Market waste was taken from four markets (totally approximately 150 kg) and reduced into one sample.

2) Results of analysis

Regarding the composition of the waste, the proportion of food waste is very high, which

accounts for approximately 90% of the whole market waste, and almost 80% of the whole household waste (wet weight). The low calorific value of market waste is 406.3 kcal/kg, and that of household waste is 697.9 kcal/kg because of a large proportion of moisture and food waste.

Item	Market waste	Household waste
Moisture (%ww)	75.9	65.4
Ash (%ww)	6.8	13.1
VS (Volatile Solid) (%ww)	17.3	21.5
HCV (High Calorific Value) (kcal/kg)	816.1	1,051.0
LCV (Low Calorific Value) (kcal/kg)	406.3	697.9

Chart 1-1 Three-Component and Calorific Value

1-1-3. CFCs

According to the World Bank's study report, Vietnam has already abolished the use of CFC, and mainly uses HCFC at present.

Substance	2008	2009	2010	2011	2012	Baseline of consumption
CFCs (CFC-11,CFC-12,CFC-113,CFC-114,CFC-115)	20.4	8	0	0	0	500 (average between 1995-1997)
Other CFCs (CFC-13,CFC-111,CFC-112,CFC-211,CFC-212,CFC-213,CFC-214,CFC-215,CFC-216,CFC-217)	0	0	0	0	0	0.2 (average between 1998-2000)
HCFC	173.7	207.5	234.9	223.27	199.93	221.2 (average between 2009-2010)

Chart 1-2 Change in Consumption of CFCs (unit: ODP ton)

In 1994, Vietnam ratified the Montreal Protocol. In a framework for developing countries in Article 5 of the protocol, the use of CFCs is regulated, such as making a schedule toward abolishing the use of CFCs. Concretely, they set a goal to abolish the use of CFCs by 2010, and HCFC by 2040 by regulating the use with target level of every five or ten years after 2016.

In Vietnam, Regulations on Hazardous Waste Management (No. 12/2011/TT-BTNMT) is the only law which stipulates handling CFC-related treatment.

(1) Parts of Regulations on Hazardous Waste Management (No. 12/2011/TT-BTNMT) which mention CFC.

This regulation provides the responsibility of related bodies for hazardous waste management, making a list of hazardous waste and criteria of hazardousness. Below is a CFC-related part in the list of hazardous waste, in which there is no concrete definition of treatment method.

Code (Note 1)		Waste	EC Code	AB code in the Basel Law (Production Code)	Y code in the Basel Law (Route and category of waste)	Hazardousness category	State (Solid/ Liquid/ Sludge)	Remarks
17	08	Organic solvent, Refrigerant and Foam/aerosol propellant waste	14 06					
	08 01	CFCs, HCFC, HFC	16 02 11	A3150	Y45	Toxicity, Ecotoxicity	Liquid	** (dealt as hazardous object regardless of threshold (Note 2))
19	02 03	CFCs, Wasted device containing HCFC, HFC	14 06 01		Y45	Toxicity, Ecotoxicity	Solid	* (dealt as hazardous waste only if hazardous substance exceeds threshold)

Chart 1-3 CFC-Related Article in Regulation on Hazardous Waste Management

(2) Rules of license

In order to collect and transport, or treat substances in the list as waste, it is required to be licensed by DONRE (business activities within Hai Phong City), or MONRE (business activities across many provinces). License is classified into categories such as collection and transportation, storage and disposal. Hazardous waste generators are required to contract with licensed operators of collection and transportation, storage, disposal, to consign treatment. It is also required to fill in a manifest to deliver shipment. There have been no cases that DONRE in Hai Phong City issues a license for dealing CFCs so far.

1-1-4. Electrical and electronic waste

(1) Overview of electrical and electronic waste (hereinafter called E-waste) in Vietnam

At present, Vietnam has no specific legal system for E-waste, instead, disposal method is managed in the Regulations on Hazardous Waste Management. The Regulation on Hazardous Waste Management targets E-waste from business operators, while collection

and treatment method for E-waste from household are left to markets. E-waste is regarded as valuable resources of iron, copper and rare metals, and its collection is realized. While iron, copper and rare metals are collected, for instance, unnecessary part of printed board without copper wire is not properly treated. Regarding collectors who collect e-waste from business operators, there are licensed large collectors and informal small collectors without license. E-waste, which is collected by small local collection/transportation operators, are bought by large collection/transportation operators and finally sold to China. Reusable waste such as used TV and mobile phone is flown into reuse markets, waste judged unreusable is decomposed and then material recycled after removing iron, copper and rare metals.

(2) Estimation of generated E-waste in Hai Phong City

Below is an estimation result of each E-waste.

We have estimated the change of generated amount of six kinds of E-waste (TV, PC, telephone (including fixed-line phone and mobile phone), washing machine, refrigerator, air conditioner) through 2030 in Hai Phong City. The generated amount of E-waste from PC and telephone is likely to double by 2030.

FY	Item (number of unit)					
	TV	PC	Telephone	Refrigerator	Air conditioner	Washing machine
2014	20,957	9,149	58,461	19,313	7,392	10,806
2020	20,714	12,191	66,071	17,538	8,613	8,233
2030	22,431	19,670	125,383	24,143	9,810	10,129

Chart 1-4 Estimation Result of Generated Amount of E-waste

1-1-5. Feed-In Tariff (FIT)

The Decision of Prime Minister (No.: 31/2014/QD-TTg: On support mechanism for the development of power generation projects using solid waste(s) in Vietnam) was declared in May, 2015, and a tariff was set at 2,114 VND/kWh (10.05 UScent/kWh) (1,532 VND/kWh (7.28 UScent/kWh) for power generation directly from burning solid waste). The Decision of Prime Minister above is effective from Jun 20, 2014, and operating bodies (investors) are allowed to start construction only if they meet Article 72 of the Law on Construction (Conditions for commencement of construction) and have relevant documents (investment certificate, written approval for electricity buying of a buyer, connection agreement with distributing unit or power transmitting unit, etc.)

2. Target Project

2-1. Project summary (including chart) and purpose

In Vietnam, the level of waste treatment and recycling is rising, while there are problems such as landfilled hazardous waste mixed with non-hazardous waste. This project aims to introduce an "advanced whole waste treatment system", which achieves both lowering of carbon and recycling of resources, by realizing a more appropriate treatment and recycling system along with an already established system, which reuses and recycles valuables in accordance with market principles (Refer to Chart 2-1). Concretely, the following (i) to (iv) are considered, and (ii) and (iv) are studied in this project.

(i) Complete segregation of solid waste, effective utilization of valuables such as metal, plastic and paper, and composting of food waste (organic)
(ii) Utilization of residual foreign materials as energy (Waste to Energy)
(iii) Conversion of industrial solid waste including hazardous waste into raw fuel
(iv) Reuse/recycling/appropriate treatment of CFCs and E-waste

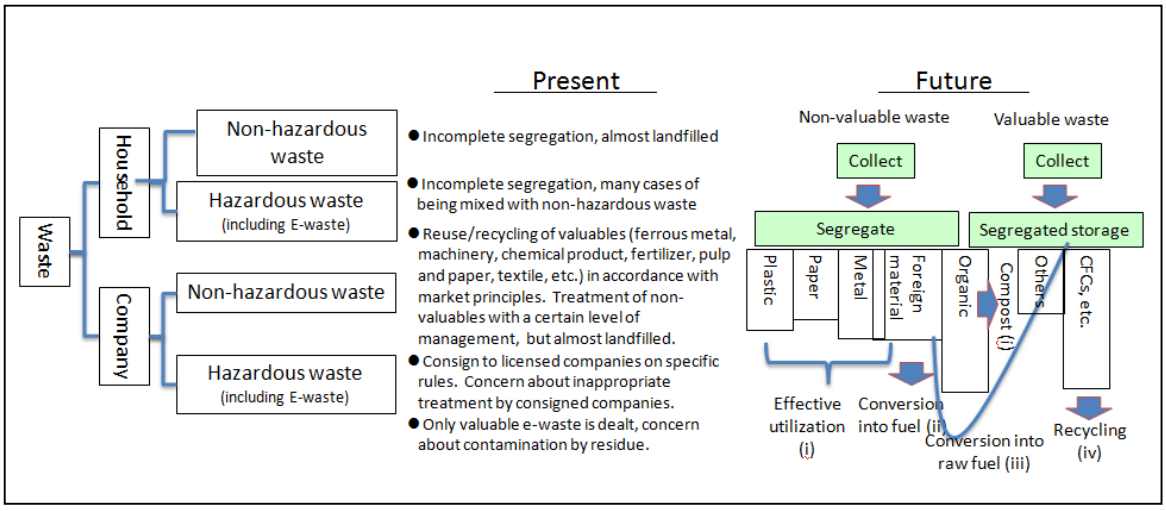


Chart 2-1 Outline of "Advanced Whole Waste Treatment System"

3. Implementation Structure of the Study

3-1-1. Waste power generation

Implementation structure of the study is shown in Chart 3-1. URENCO (Urban Environment One Member Limited Company) is a local counterpart, and we have conducted waste characteristics analysis which is important for considering waste power generation jointly with ETM Center.

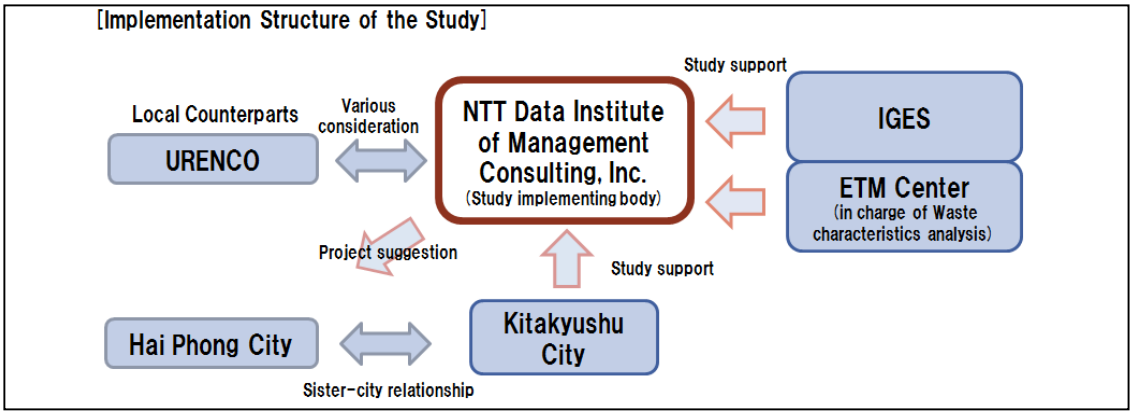


Chart 3-1 Implementation Structure of the Study toward Consideration of Waste Power Generation

3-1-2. CFCs

Implementation structure of the study is shown in Chart 3-2. Local counterparts are private waste treatment operators and companies which are presently maintaining air conditioner by using CFC. In the implementation of the study, NTT Data Institute of Management Consulting, Inc. was a study implementing body, and IGES and Kitakyushu City supported the study in cooperation with Hai Phong City.

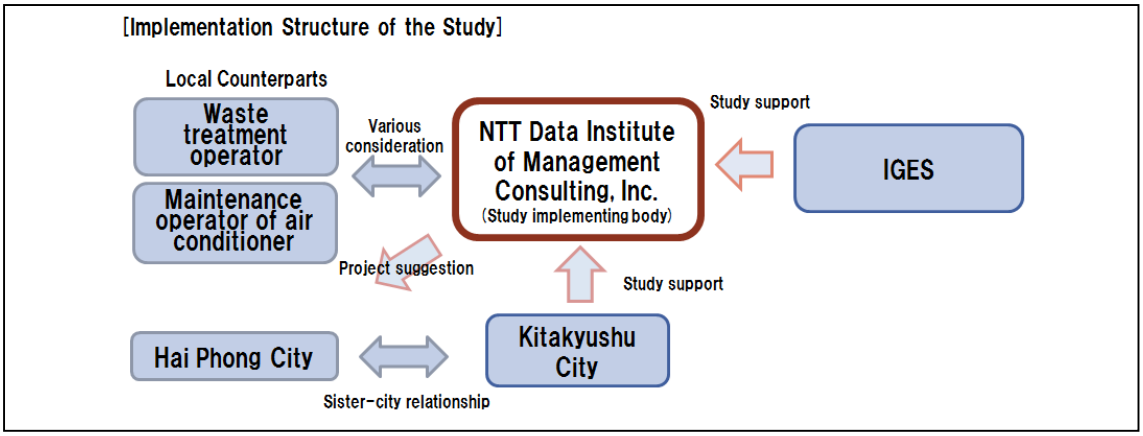


Chart 3-2 Implementation Structure of the Study toward Establishing a Scheme for Proper CFC Recovery

4. Study Results

4-1. Reduction effect of CO2 emission from energy resources (and reduction effect of CO2 emission from non-energy resources)

4-1-1. Waste power generation

CO2 reduction effect is calculated to be 45,929 t-CO2/year by adding up greenhouse gas emission from energy/non-energy resources and greenhouse gas reduction.

Item	Increase or decrease in greenhouse gas (t-CO2/year)
(i) Greenhouse gas emission from waste incineration of fossil fuel origin	80,220
(ii) Greenhouse gas emission included in exhaust incineration gas	2,791
(iii) Greenhouse gas emission from auxiliary fuel	281
(iv) Greenhouse gas reduction effect by waste power generation	▲35,043
(v) Leakage	0
Avoided amount of methane by avoiding landfilling	▲94,178
Total	▲45,929

Chart 4-1 CO2 Reduction Effect

4-1-2. CFCs

If it is possible to recover HFC (R410A, R32), that could be included in credit because both R410A and R32 are in the framework of the Kyoto Protocol as substances with GWP of relatively 2090 and 675. However, R-22 of HCFC is mainly used for spreading-type products as refrigerant at present, and products using HFC are expensive. Therefore, it is likely to take long to start recovering R410A and R32 mainly. Especially, R32 has just been launched since FY2014, so it will be possibly recovered after around 2030 at the earliest because the life span of air conditioner is between 10 and 15 years in Vietnam.

4-2. Operating cost

4-2-1. Waste power generation

Below is an initial investment cost and maintenance cost for waste power generation facility supposed this time.

Item	Amount*	Remarks
Initial investment cost (Project development cost and construction cost of facilities)	USD 62.5 million (7,375 million yen)	Project development cost, Construction cost for waste power generation facility (Installation cost, Electric construction cost, Material cost of equipment, Design management cost), and Incidental facility (Electric power/Grid-connected facility, Water treatment facility, Site construction cost, etc.)
Maintenance cost	USD 310,000/year (36.58 million yen/year)	Labor cost, Utilities cost, Maintenance and inspection cost, etc. 20-year average

Chart 4-2 Initial Investment Cost and Maintenance Cost for Waste Power Generation Facility

* Yen-dollar exchange rate: USD 1 = 118 yen (as of Nov 2014)

4-2-2. CFCs

Below is an initial investment cost and maintenance cost for CFC depletion facility supposed this time.

Item	Amount*	Remarks
Initial investment cost (Introduction of equipment)	35 million yen	Introduction cost of dececomposition equipment for CFC, Export and customs cost from domestic plant in Japan (excluding assembly/installation cost for equipment、Utilities cost such as primary source of electricity and water supply, CFC gas cost for test operation, etc.)
Maintenance cost	2.8 million yen/year	including Labor cost, Utilities cost, Maintenance and inspection cost, etc.

Chart 4-3 Initial Investment Cost and Maintenance Cost for CFC Depletion Facility

4-3. Cost-effectiveness

(Total cost for the whole project / Reduction of CO2 emission from energy resources)

(at the time of project implementation)

4-3-1. Waste power generation

(1) Cost-effectiveness on implementation cost (Introduction cost of facility)

Cost-effectiveness on implementation cost (Introduction cost for facility) is approximately USD 1,360 ((i) / (ii)).

Breakdown	Amount
(i) Initial cost	USD 62.5 million
(ii) Annual reduction of CO2 emission	45,929 t-CO2/year

Chart 4-4 Cost-Effectiveness on Implementation Cost

(2) Cost-effectiveness on the whole project (for 20 years)

With adding avoided amount of methane by avoiding landfilling to reduction of CO2, the total cost-effectiveness (cost required for CO2 reduction of one ton) of the whole project is approximately USD 147.

* Interest payment on a loan from a bank isn't included in the amount.

Breakdown	Amount
Initial cost	USD 62.5 million
Maintenance cost (for 20 years)	USD 72.92 million
Total	USD 135.42 million
Reduction of CO2 emission	918,580 t-CO2/20 years

Chart 4-5 Cost-Effectiveness on the Whole Project

4-3-2. CFCs

Below is a cost supposing that CFC depletion facility is introduced and operated for ten years. Cost at the time of introduction such as installation cost, and cost related to the recovery of CFC are not included in the followings.

Breakdown	Amount
Initial cost	35 million yen
Maintenance cost (10 years)	28 million yen
Total	63 million yen

Chart 4-6 Total Cost for the Project

4-4. Co-benefit effect excluding GHG reduction

4-4-1. Waste power generation

"Waste reduction amount of waste" and "avoidance of odor emission" are included in co-benefit effect excluding GHG reduction by waste power generation.

4-4-2. CFCs

Proper recovery of R-22, which avoids air emission, contributes to the Ozone Layer protection. At present in Vietnam, R-22 is mainly used for air conditioners. It is expected to be recovered at approximately 5 tons (5,329 kg as of 2014), equivalent to 96 ODP tons divided by 0.055. That means the recovery can reduce 96 ODP tons of Ozone Layer depleting substance emission.

5. Considerations toward the Project

5-1. Project Implementation Structure
(Including partner country's CP and government)

Below is a project implementation construction for waste power generation (plan). URENCO is a local counterpart, and a special purpose company of URENCO and Japanese companies (plant manufacturer, etc) is set.

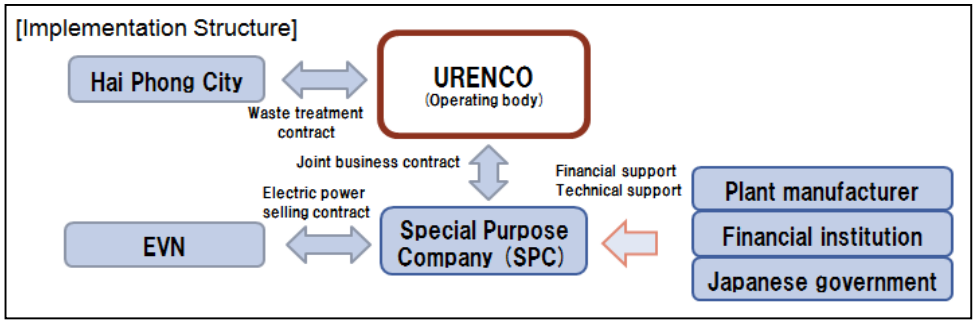


Chart 5-1 Project Implementation Construction for Waste Power Generation (Plan)

Regarding CFCs, in order to establish a scheme for recovery and depletion of CFC, it is necessary to approach from two points of view such as development of legal systems and introduction of technology. For the project, MONRE and DONRE will forward establishment of systems to oblige collection and depletion of CFC, or to provide incentives for collection and depletion of CFC. On the other hand, we will consider positions which are responsible for recovery and depletion of CFC, such as local maintenance companies of air conditioner for the recovery of CFC, and local private treatment operators of waste for the depletion of CFC.

5-2. Financial support scheme at the time of project implementation

As a financial support scheme, we suppose using overseas investment and lending by JICA.

5-3. Project schedule

In the results of this time's waste characteristics analysis, low calorific values are less than required value for waste power generation. Only two samples (one sample of household waste and one sample of market waste) were used for the waste characteristics analysis this time. Therefore, it is necessary to continue to analyze more samples in more various sampling period, in order to improve the degree of accuracy of waste characteristics. The following schedule is suggested.

FY	Implementation Contents
2015	detailed F/S
2016	P/S
2017	EIA, Basic/detailed design
2018	Construction work
2019	Construction work
2020	Final completion/Operation

Chart 5-2 Project Schedule

6. Issues and Requests toward the Project

Issues and requests toward the project are summarized as below.

(1) Accurate understanding of the present amount and characteristics of waste

In order to formulate policies for a proper treatment and recycling of waste as well as consider waste power generation, it is imperative to understand the present amount and characteristics of waste accurately. In addition, it is necessary to improve the situation that some final landfills don't have calculators, and there is very little data of composition, three-component and calorimetric analysis. Therefore, it is required to ensure to introduce equipment such as scale to acquire accurate data, analyze waste characteristics with various samples (household waste, market waste, residue from composting facilities, etc.) with certain frequency after budgeting by the city.

(2) Understanding of waste treatment cost (tipping fee)

The ministry of construction says in our interview that they have been offered the construction and operation of waste power generation facility by Chinese company, but declined because they were requested to pay USD12/t of tipping fee. However, if it is expected to reduce the amount of landfilled waste at landfill (which leads life extension of landfill) by introducing waste power generation, construction cost for new landfills would be possibly unnecessary. Therefore, in case that the effects on economics and environment are fully expected, government is recommended to consider the payment of tipping fee positively.

(3) Flexible management of subsidy for facilities

Current JCM subsidy for facility is applied to reduction of CO2 emission from energy resources, but not to methane avoidance. Waste power generation leads a large CO2 reduction (absolute amount), and is a technology which contributes largely to greenhouse gas reduction. However, it is resulted in this study that CO2 is not reduced without methane avoidance. As for the subsidy for facility, it is recommended to consider the effects with the introduction of technology in a comprehensive manner, and determine its application flexibly.

Survey Report on the Project to Support the Development of the Green Growth Action Plan in the City of Hai Phong through Cooperation with the City of Kitakyushu
(Waste Sector: Project on Composting of Organic Waste)

February 2015

Nishihara Corporation

Table of Contents

Chapter 1: Systems & Project Environment of Target Cities and Countries

1-1. State of environmental impacts related to the project

1-1-1. Solid waste (amount generated)

According to interviews with the Hai Phong Department of Construction, the amount of waste generated in FY 2013 for the entire city was 2,000 tons. A breakdown of this figure shows that 1,600 tons/year was generated from the urban area in Hai Phong (eight districts), and 400 tons/year were generated in the suburbs and rural areas around Hai Phong.

1-1-2. General waste

(1) Amount of waste generated

According to a report on solid waste management and the potential to collect waste in Hai Phong, the current waste discharge rate per capita in the city is approximately 0.7 kg/person per day (Nguyen Hoai Duc, 2014). When multiplying the population (1.9252 million) by the discharge rate, the amount of waste generated in the entire city is about 1,347.7 tons/day (waste tons/day). Future forecasts indicate that the discharge rate will increase to 1.3 kg/person per day in the city area, and about 1.2 kg/person per day in the region. Lifestyle-related waste that is discharged every day is forecast to reach approximately 3,054 tons/day by 2025.

(2) State of collection and transport, intermediate treatment, and final disposal

Hai Phong Urban Environment Company (Hai Phong URENCO) is responsible for the collection and transport, intermediate treatment, and final disposal of generation waste that is generated in the urban area. Each day, approximately 900 tons of waste is collected and treated. Of that 900 tons, 200 tons are converted into raw materials for compost at the Trang Cat composting facility. The remaining 700 tons are sent to the final landfill site.

The discharge rate and collection fees for generated waste (household and business waste) are indicated in Fig. 1-1.

Item	Household waste	Business waste
Discharge rate	80%	20%
Waste collection fees	VND 20,000-26,000/month per household (JPY 100-130/month)	Government offices: VND 120,000/m3 (JPY 600/m3)
		General businesses: VND 180,000/m3 (JPY 900/m3)

Fig. 1-1. Discharge rate and collection fees for general waste

(3) Waste quality

1) Analysis method

Waste quality analysis of samples was carried out in cooperation with Hai Phong URENCO and the ETM Center for two types of waste: waste generated from households and waste generated from markets. Samples from sample reductions of waste from households (about 200 kg) in four areas, and waste from four markets (about 150 kg) were used as the samples for households and markets, respectively. The features of the markets that were sampled are listed in the Fig. 1-2 and 1-3 below.

Market name	Location	Scale	Main merchandise	Operating hours	Amount of waste generated	Collection times
Gia Vien Market	Cia Vien, Quan Ngo district	Small-scale	Food (vegetables, meats, fish)	6：00–12：00	~ 0.5 trucks/day	Continuous collection
Cau Rao Market	Cat Bi, Hai An district	Large-scale	General	4：00 –12：00	6 to 7 trucks/day	2x/day Between 9:00-10:00, and 13:00
Con Market	Trai Cau, Le Chan district	Large-scale	General	6：00-17：00	Details unclear	Continuous collection
Hoa Binh Market	Thuong Ly, Hong Bang district	Large-scale	General	6：00 –19：30	4 trucks/day (AM: 2 trucks, PM: 2 trucks)	15:00

Fig. 1-2. Characteristics of waste sample markets

Area name	Area population density (people/km2)	Total amount of waste collected (m3/day)
Dong Khe ward, Ngo Quyen district	15.193	50-60
Cat Bi ward, Hai An district	1.036	50-60
Trai Cau ward, Le Chan district	18.500	90 -100
Hung Due Vuong street, Thuong Ly ward, Hong Bang district	7.238	60- 70

Fig. 1-3. Characteristics of waste sample households

2) Results of analysis

① Composition of waste

The composition of waste is listed in Fig. 1-4. The percentage of kitchen waste in the overall composition is extremely high, with market waste at approximately 90% of the overall composition (wet base) and household waste at slightly less than 80%.

No.	Composition	Physical composition (wet base) (%)		Physical composition (dry base) (%)	
		Market waste	Household waste	Market waste	Household waste
1	Food waste (can be composted)	85.9	74.1	61.5	49.0
2	Food waste (cannot be composted)	4.9	4.3	14.6	8.9
3	Disposable diapers	2.1	0.9	2.8	0.5
4	Paper	2.0	3.7	4.0	5.3
5	Plastic	2.4	5.0	7.9	9.3
6	Textiles	0.4	2.2	1.4	3.0
7	Vegetation	0.5	1.0	1.2	1.1
8	Rubber and leather	0.1	0.2	0.4	0.3
9	Metal	0.1	0.1	0.4	0.3
10	Glass	0.5	0.9	2.2	2.4
11	Ceramics and stone	0.3	0.1	1.1	0.4
12	Charcoal and ash	0.8	7.2	2.5	18.7
13	Hazardous waste	-	0.2	-	0.6
14	Other	-	0.1	-	0.2

Fig. 1-4. Composition of waste

② Three components and calorific value

The lower calorific value (LCV) for market waste was 406.3 kcal/kg and 697.9 kcal/kg for household waste. This is due to the high water content of the waste, as well as the high ratio of kitchen waste in the overall composition of waste.

Item	Market waste	Household waste
Water content (%ww)	75.9	65.4
Ash content (%ww)	6.8	13.1
Combustibles (%ww)	17.3	21.5
Higher calorific value (kcal/kg)	816.1	1,051.0
Lower calorific value (kcal/kg)	406.3	697.9

Fig. 1-5. Three components and calorific value

Chapter 2: Survey Targets

2-1. Project overview and aim

In Viet Nam, standards for waste treatment and recycling continue to improve; however, the country faces various problems, such as the mixing and disposal of hazardous wastes with non-hazardous waste. Systems and mechanisms for the reuse and recycling of recyclable materials that conform to market principles and are already in place are being utilized, and the country is aiming to create improved systems for the proper treatment and recycling of waste, as well as to introduce an advanced treatment system for all waste to be compatible with the development of a low-carbon city and resource recycling (Refer to Fig. 2-1). Detailed activities (① to ④) that are considered to be a part of the development of improved systems are listed below. This survey examines the activities listed in ①.

① **Complete separation of solid waste and effective use of recyclables, such as metals, plastic, and paper; composting of kitchen waste (organic waste).**
② Conversion of waste residue to fuel (Waste-to-Energy)
③ Conversion of solid waste from industries, including hazardous waste, to raw materials and fuel
④ Reuse, recycling, and proper treatment of electric/electronic waste (e-waste), including fluorocarbons

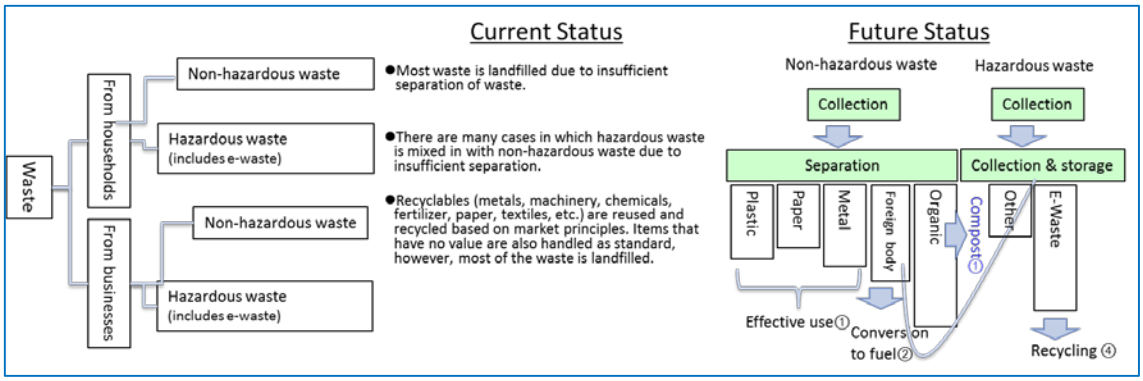


Fig. 2-1. Overall picture of advanced waste treatment system for each waste cycle

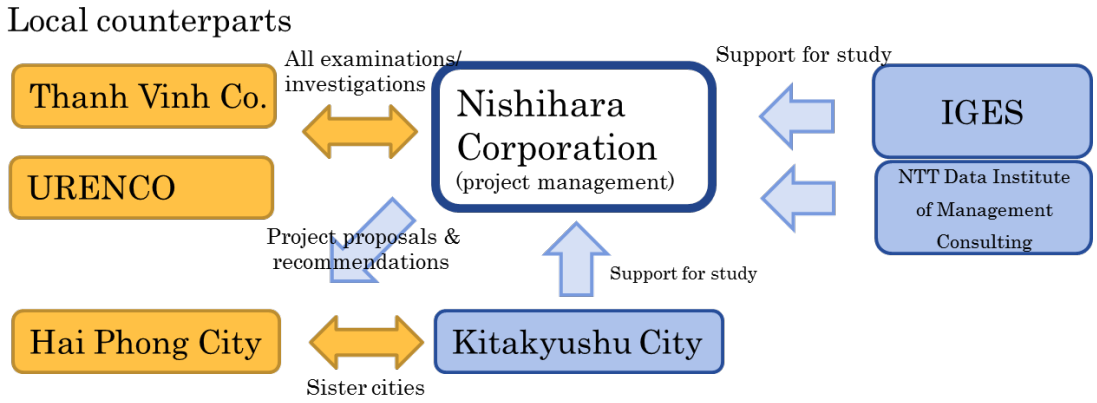
Chapter 3: Survey Methods

3-1. Project implementation system (national CP, host country CP, national and local government bodies in host country and city)

The study team conducted a survey on the potential of a project to establish a waste separation line composting center in a rural area, and the sale of recyclables and the raw materials for compost from organic waste, in cooperation with a local waste collection and transport company (Thanh Vinh Co.)

This is model is referred to as the “Rural Model.” If a sales network for compost can be established, the team will look at expanding activities to form an “Urban Model,” which will use existing large-scale facilities (composting facilities adjacent to the Trang Cat final disposal site: operated by URENCO) as the next step in the project.

Nishihara Corporation will be the organization responsible for the implementation of the study, with support provided by the Institute for Global Environmental Strategies (IGES), the City of Kitakyushu, and NTT Data Institute of Management Consulting.



Chapter 4: Results of Survey

4-1. CO2 emission reduction effects from energy sources (and reduction effects from non-energy sources)

The amount of greenhouse gas (GHG) emissions that will be reduced in this project will come from the control of the generation of methane gas through composting. Based on the draft methodology attached in section 5-4, the project estimates that about 60% (24 tons/day) of the 40 tons of waste/day will be used to produce compost. Trial calculations for CO2 emission reductions were performed.

【Reference emissions】

The reference emissions for the 24 tons/day of organic waste that will be composted and which accounts for 60% of the 40 tons/day capacity are calculated to be 2,650 t- CO2/year in accordance with methodology.

【Project emissions】

Data (such as the amount of electricity used in the composting process) is needed to determine the amount of project emissions during the composting process. However, the practical use of the compost center in its current state has not been elaborated, and it is unclear how much electricity is used and how much energy is consumed. In this case, figures for GHG emissions generated during the composting process, as indicated by existing studies and surveys, are used as project emissions. The specific figure used is the generation of GHG emissions through composting (0.14 t CO2/ton (waste)), as referenced in a Ministry of Economy, Trade, and Industry (METI) project development study on private sector infrastructure for an integrated waste-to-energy project in the city of Malang and surrounding areas in East Java, Indonesia, which was carried out in FY 2011. Calculations using the above values resulted in a figure of 1,226 t- CO2/year, which was used as the reference value for project emissions.

【Amount of emission reductions】

The amount of emission reductions in this project can be found using “reference emissions – project emissions.” The amount of emission reductions through the implementation of this project are calculated at 1,424 t- CO2/year (below).

2,650 ton-CO2/day － 1,226 ton-CO2/year ＝ **1,424 ton-CO2/year**

4-2. Project costs

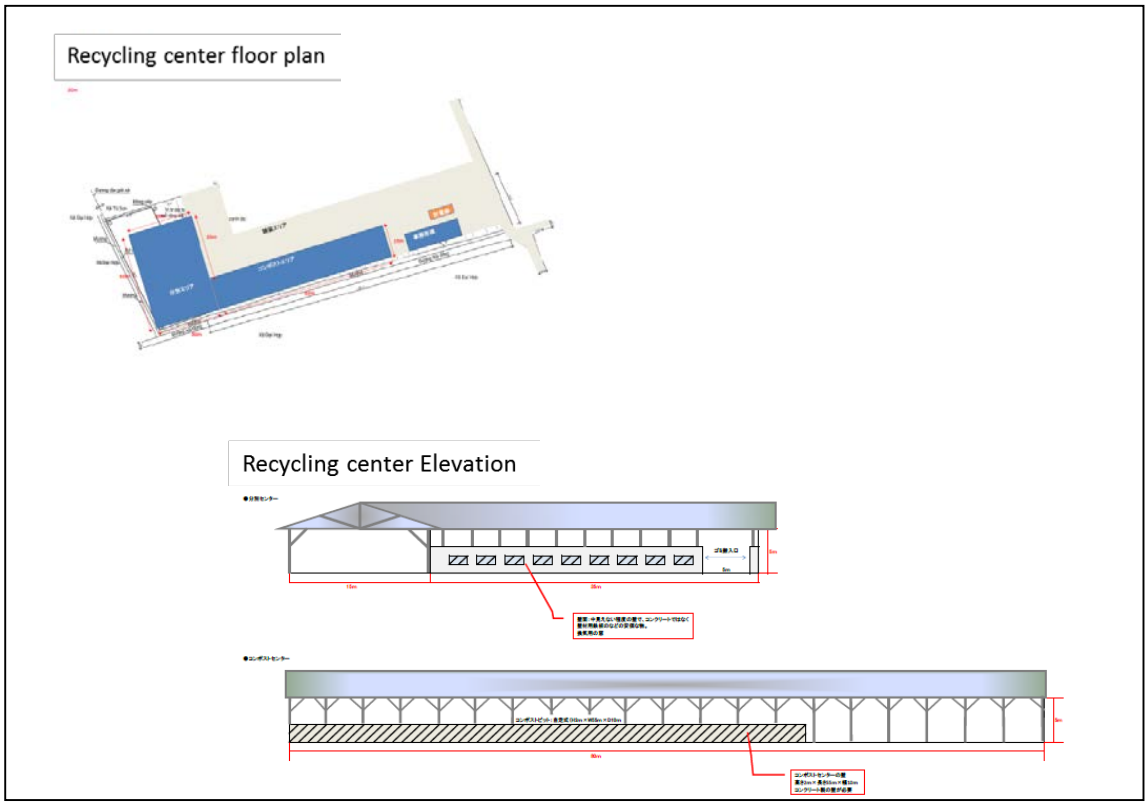
4-2-1. Requirements

Requirements for the rural model (separation line, composting facilities) are listed in Fig. 4-1.

Item	Requirements	Notes
Separation line treatment capacity	40 tons/day	Separation line, composting production line
Building site	Kiến Thụy district (rural area)	Land owned by Thanh Vinh Co.
Treatment costs	Expected to be covered by transportation costs collected from households and partial government subsidies.	
Disposal costs for waste residue	Costs required for disposal at neighboring Do Son disposal site is VND 160/kg.	Depending on amount to transport, there may be charges from operating company.
Compost sales price	600VND/kg	Expected to be VND 600, taking transportation fees into account.

Fig. 4-1. Requirements for rural model (separation line, composting facilities)

The following is an image of the center (floor plan, elevated view).



4-2-2. Project costs

A rough estimate of project income and expenditure is provided in Fig. 4-2. Initial costs can be reduced with changes in construction costs and specifications for compost manufacturing equipment (at this time, costs are estimated based on the use of Japanese-made agitators). Personnel costs in this case are estimated based on the full mobilization of waste separation employees.

Business Implementation Potential (per month)			
Income	Material sales (plastics, VND 900/kg)	40 t/day X 30% (component ratio of materials) X VND 900/kg X 25 days	VND 270 million (JPY 1,350,000)
	Sales of compost as fertilizer (VND 600/kg)	40 t/day X 60% (ratio of organic waste) X 60% (amount reduced by composting) X VND 600/kg X 25 days	VND 260 million (JPY 1,080,000)
	Costs for commissioned waste treatment (VND 160/kg)	40 t/day X VND 160/kg X 25 days	VND 160 million (JPY 800,000)
Expenditures	Initial costs (building, equipment, other)	Investment in plant and equipment at about JPY 75 million	VND 125 million (JPY 625,000)
	Running costs (electricity, fuel, other)	*Mean value of rate increases (15%) X 10 years	VND 100 million (JPY 500,000)
	Landfill costs at final disposal sites (VND 160/kg)	40 t/day X 20% (other waste 15% X composting residue 5%) X VND 160/kg X 25 days	VND 32 million (JPY 160,000)
	Personnel costs	No. of employees (100) X VND 3 million *Mean value of wage growth rate (15%) X 10 years	VND 300 million (JPY 1,500,000)
Profit (Income - expenditures)			VND 89 million/month (JPY 445,000)

Fig. 4-2. Project income and expenditure (rough estimate)

4-3. Cost benefits (PJ overall costs ÷ CO2 emissions related to energy use) (during project implementation)

GHG emissions in this project will be reduced through the control of methane gas only. Therefore, the amount of CO2 emissions reduced from energy sources will be zero. The calculations of cost benefits based on the control of methane gas are listed below for reference.

JPY 75 million (40 t/day facility) ÷ 1,424 t- CO2/year ≒JPY 52,670　※only includes CO2 emission reductions from control of methane gas

In the shift to the second stage (development of the urban model), basic initial costs will be unnecessary because the composting facility is already constructed.

4-4. Co-benefits other than GHG emission reductions

The recycling of organic waste (avoidance of landfilling and simple burning) can be listed as a co-benefit from this project other than GHG emission reductions.

Chapter 5: Considerations for Business Development

5-1. Implementation system for business development (includes CP in other country and national government)

(1) Two business models can be established based on this field survey.

Rural Model

Establishment of small- and mid-sized waste separation line and compost production line in rural districts

【Features】

The rural model is positioned as a model facility for a resource recycling society, and features resource recycling and composting of organic waste as its main components, in which 40 tons/day of waste will be accepted for treatment and properly separated by employing local residents.

The composting of organic waste incorporates stable production and product development. In this model, the compost produced from organic waste is sold as the raw materials for organic fertilizer to fertilizer manufacturers, and the facilities are managed using the profits from these sales.

Urban Model

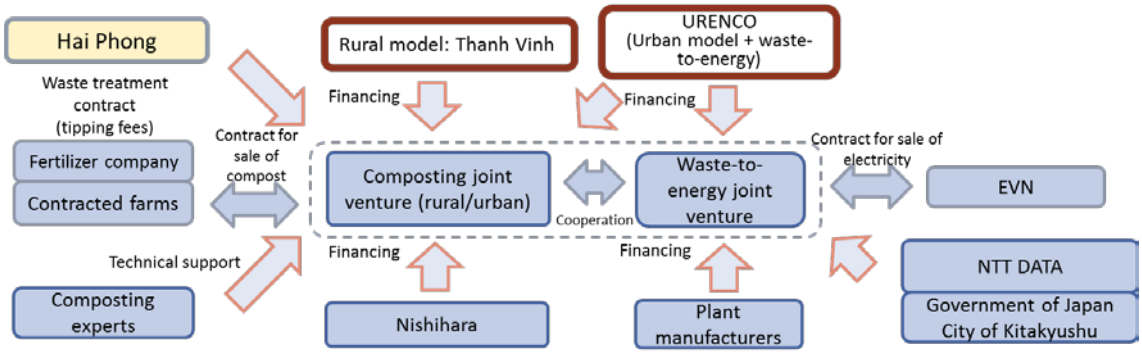
Use and efficiency of large facilities where waste treatment is already in being carried out in urban areas

【Features】

Similar to the compost that will be produced in the rural model, the quality of compost from organic waste that is produced at the existing Trang Cat separation facility will be improved, and the facility will be overhauled as a plant that can produce compost for sale. The project will also focus on efficiency from an intangible perspective (based on knowledge) with the reassessment of the plant as a facility where residents can be informed about how waste is recycled, and public awareness on waste separation when waste is disposed can be promoted. From a tangible perspective (such as for infrastructure and equipment), the facility can contribute to energy savings and prevention of global warming through the efficient waste collection, such as regular collection, and separation processes.

The figure for the implementation system is below.

【Diagram of Implementation System (Draft) 】



- Two types of business for the recycling of compost from organic waste can be formed through the urban model and the rural model.
- In the urban model, URENCO and Nishihara Corporation will establish a specialized SPC for composting, and implement a single project from the start of the production process to the final sale of compost. This model will use equipment already in use at the Trang Cat composting plant that is operated by URENCO (treatment capacity: 200 tons/day)
- The urban model will establish a waste-to-energy business (treatment capacity: 600 tons/day) using collected waste and waste residue generated at the Trang Cat composting plant, in order to further reduce CO2 emissions and the amount of waste sent to landfill.
- In the rural model, Thang Ving Co. and Nishihara Corporation will establish a specialized SPC for composting. The treatment capacity of the SPC is expected to be 40 tons/day. (※Thanh Vinh Co. has submitted a plan to the Vietnamese Ministry of Construction for treatment of solid waste (treatment capacity: about 10 tons/day) through a private sector model in the Kiến Thụy area. The facility and equipment are expected to be installed by Thanh Vinh Co.)
- NTT Data Institute of Management Consulting will provide support for the development of the project, including various types of surveys. The project will also be promoted with the support of the Government of Japan, City of Kitakyushu, and composting experts.

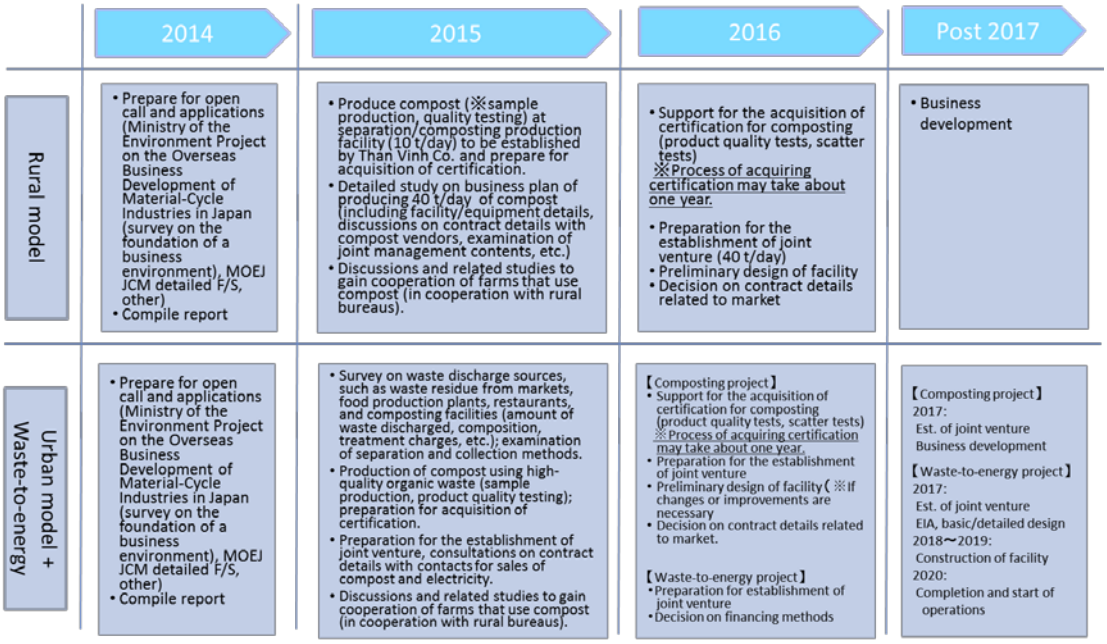
5-2. Financial support scheme and prices during business development

In the first stage of the project, it will be necessary to newly construct a facility in a rural area. Investment in the construction of the plant and installation of equipment will be a major

cost in this stage because it will be necessary to consider future treatment costs. The project hopes for the introduction of JCM assistance projects for CO2 emission reduction technology.

5-3. Business development schedule

The business development schedule from 2015 is below.



Chapter 6: Issues & Requirements for Business Development

A major problem when considering business development is how to acquire initial investment. The project would like to make use of support from Japan in order to develop this plan for the establishment of a separation facility and composting plant.

From a policy perspective, the team would request consideration of assistance for the designation of a destination for the treatment of waste that is suitable for the raw materials for compost, such as market waste and pruning waste, in order to produce quality compost, as well as costs related to transport.

It is necessary to create a clear mechanism for payment of treatment costs for the waste being transported in order to develop sustainable treatment and operation.

Project to Support the Large-Scale Formation of Joint Crediting Mechanism Programs to Realize Low Carbon Societies in Asia from Fiscal 2014

The Project to Support Formulation of the Green Growth Program for Haiphong City in Cooperation with Kitakyushu City

Summary of Reports on the "Study of Conversion of Industrial Wastes into Raw Materials or Fuels to Contribute to Realization of Low-Carbon Society"

AMITA CORPORATION

1. Objectives of the project

Production of alternative materials and fuel, such as those used mainly by cement manufacturers, which are made from industrial wastes, some containing poisonous substances, should promote the material recycling and reduce the use of fossil fuel and natural resources. The objectives of the project are to survey the effect of reducing the emission of the greenhouse gases, resulting from the reduced use of fossil fuel and natural resources and, simultaneously, to verify the possibility of realization of the business in which the system of JCM is utilized.

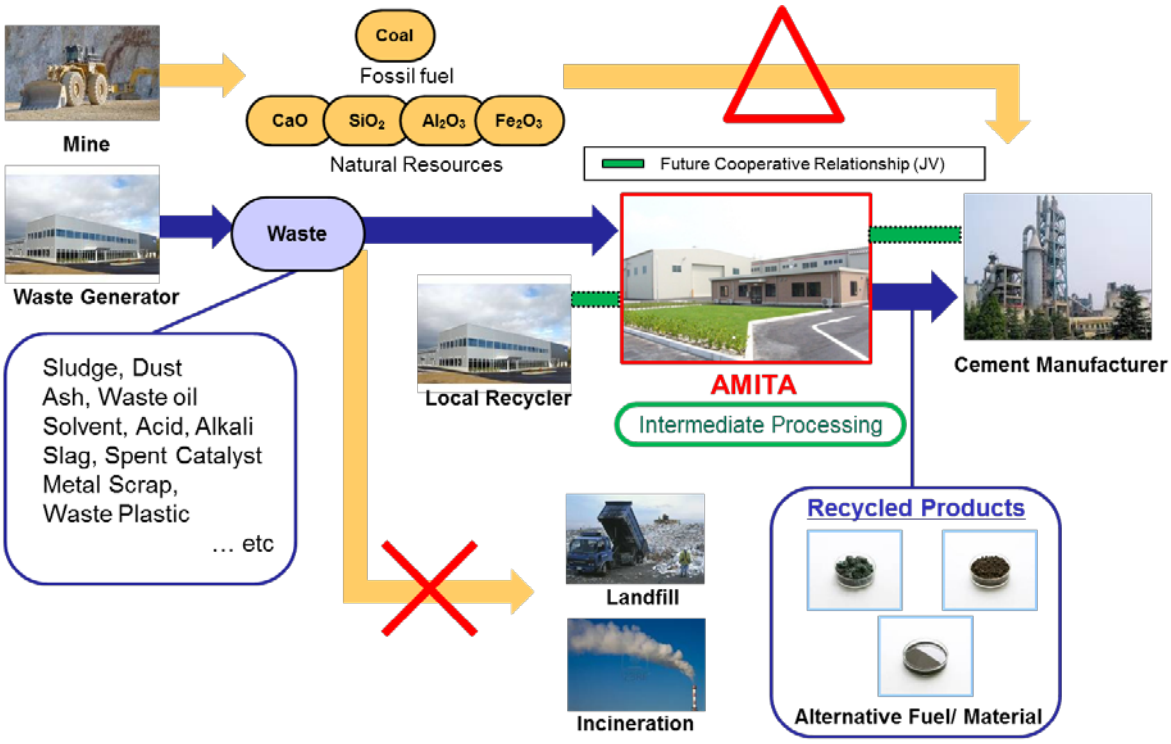


Figure 1 The Business Model

2. Technologies applied

AMITA CORPORATION has been engaged in the resource recycling business in which it applies the unique “blending” technology to process various industrial wastes of more than 4,000 kinds and produce such terrestrial resources as cement materials, alternate fuels and metallic raw materials.

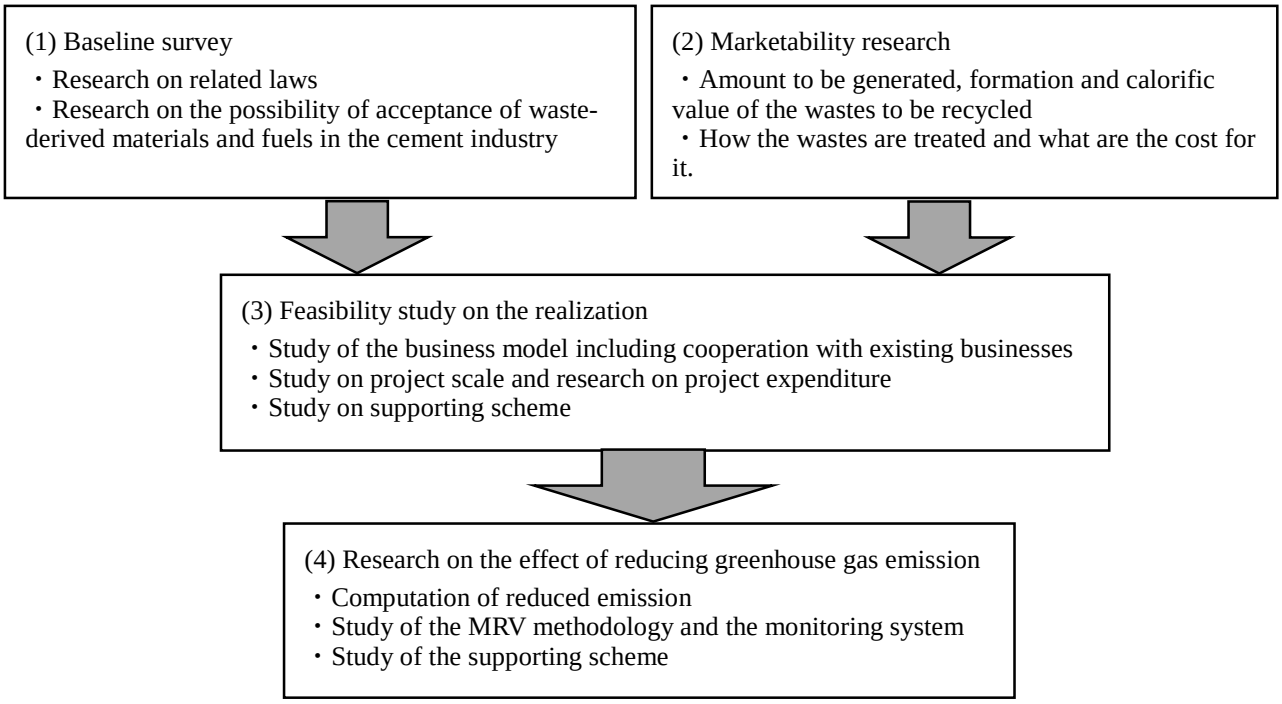
SlurMix® is an alternative fuel with good handling which is produced by making such liquid industrial wastes as waste oil, oil-containing sludge and waste solvents into the emulsion status by compounding and equalizing them so as to meet the users’ specifications. This process realizes complete recycling of resources in which no

secondary wastes are generated, since, when SlurMix® is used as the fuel to substitute coals in calcination furnaces and rotary kilns in the calcination process of cement plants, the cinders left after being burned can be used as raw materials for making cement.

The CRM (Cement Raw Material) is the alternative material and fuel for making cement which is made by blending such industrial wastes as sludge, cinders and soot particles so as to meet the users' specifications. CRM with low calorific value is used in cement plants mainly to substitute clay while CRM with high calorific value is used in calcination furnaces in the burning process. As in the case of SlurMix®, this enables complete recycling of resources without generating secondary wastes as the cinders left after being burned are mixed with the raw materials.

3. The system and procedures for implementation of the research

The research has been conducted with AMITA CORPORATION at the nucleus, supported by the City of Kitakyushu and the Institute for Global Environmental Strategies (IGES), and in cooperation with our counterpart, City of Haiphong, Vietnam. The procedures for the research as mentioned below.



4. Results of the researches

(1) Related legal system

The national technical standard for the treatment of hazardous waste at cement kilns was promulgated in 2011 and became effective in 2012 (National Technical Regulation

on Co-processing Hazardous Waste in Cement Kiln (QCVN41:2011/BTNMT)). This standard stipulates whether hazardous wastes may be accepted as alternative fuel for the cement baking process and it also provides for the standard values for accepting those wastes.

(2) The acceptance of wastes by companies in the cement industry

The survey reveals that the acceptance of wastes by cement companies is not in the mainstream in Vietnam and only very limited number of companies are engaged in it. There are two companies which are authorized to process hazardous wastes in Vietnam and are positive in accepting wastes, but the standard unit of utilization of wastes corresponds to only approximately 6% in both of them. It, moreover, has also been found that the business model that cement companies are granted processing expenses for acceptance and treatment of hazardous wastes has not been penetrated and, therefore, general belief is that cement companies have to purchase the wastes. However, it has been confirmed that the two companies mentioned above which accept wastes are granted the treatment expenses, suggesting that the recycle market is being formed.

The Vietnam National Cement Association (VNCA) forecasts an increase in cement production in Vietnam: Production amounted to 58 million tons in fiscal 2013 (actual results) and is forecasted to increase to 70 million tons in fiscal 2014 and further to 75 million tons in 2015. Given that only a very small portion of the total production is presently accounted for by accepted wastes, Vietnam cement industry is believed to have sufficient potential to receive wastes.

(3) Wastes being generated

To conduct further market researches and to grasp more accurately the overall amount and kinds with the cooperation of competent administrative agencies are required, since there are no available and reliable data on the most recent amount of wastes generated. The "National State of Environment 2011" shows that 6.88 million tons of the non-hazardous industrial wastes were generated in 2009; it also reports that the hazardous wastes generated stood at 0.7 million tons in 2009 as the total of responses received from 35 administrative wards out of 63 administrative wards; however, the actual amounts generated is believed to surpass those reported as there is no fully established information collecting system on generation of wastes.

We have conducted a survey by interviewing about the amount, kinds, current treatment situation and treatment expenses of wastes with 34 Japanese-affiliated companies in Northern Vietnam centering at Haiphong City: As the result, monthly

average generation of non-hazardous wastes was calculated at approximately 31 tons and that of hazardous wastes at approximately 6.3 tons. We have also analyzed the components of the 18 specimens of wastes, including both hazardous or non-hazardous ones, received on the occasion of the survey, with the energy-dispersive X-ray fluorescence analyzer and have subsequently conducted a simulation for CRM fuel-related products based on the results: The results have been obtained that they satisfy the criteria for accepting wastes stipulated in the QCVN41:2011/BTNMT mentioned above. In future, we should be able to verify with higher accuracy the possibility of the project in relation to the inputs for the resource recycling business, aided by the grasp of the overall amount of wastes generated and further analysis of waste samples.

(4) Wastes being treated

It is the Ministry of Natural Resources and Environment (MONRE) that authorizes the enterprises which conduct treatment and transportation of hazardous wastes covering more than one city or province; it is the Department of Natural Resources and Environment (DONRE) of the city or province that authorizes those which conduct treatment and transportation of hazardous wastes in a city or in a province. Nationwide in Vietnam, approximately 20 companies are authorized by the MONRE for hazardous waste treatment. In the City of Haiphong, there are five treatment companies which have obtained authorization for treatment of hazardous wastes, four of which are authorized by the MONRE; however, very few accept wastes from outside the city and our interviews revealed that in many cases they entrust the business to the local treatment companies. Regarding the treatment of the hazardous wastes, while a part of the waste oil is recycled, most of the wastes are incinerated and not many cases of recycling them into resources were found.

We have conducted a survey by interviewing with local Japanese-affiliated companies and the Hanoi Urban Environment Company (URENCO), and found that the average waste treatment prices set in Vietnam is realistic in view of realization of the business.

5. The amount of reduced greenhouse gas emission and methodology of measurement

At present, there is no methodology available concerning the reduction of greenhouse gases by the use of alternative fuels derived from more than one industrial waste. No internationally standardized method has been established to deal with these alternative fuels in computing the amount of greenhouse gas, either.

The Cement Sustainability Initiative (CSI) of the World Business Council for Sustainable Development (WBCSD) has publicized its “Standard for Computation of

CO2 and Energy for the Cement Industry, Cement CO2 and Energy Protocol; Manual for the Protocol Third Edition" in which it indicates the idea that to use wastes as alternative fuel may offset the CO2 exhausted when burning fuel derived from wastes since, though depending on the local situation, it will lead to indirectly reduce the greenhouse gases which would be generated by landfilling or burning. We are in support of this idea.

As contrasted with the idea mentioned above, the following shows the methodology for the measurement of greenhouse gas reduction when taking into consideration the amount of greenhouse gas emission resulting from burning CRM with high calorific value or SlurMix®.

The emission coefficients for the burning of alternative fuels derived from more than one industrial waste, such as CRM with high calorific value and SlurMix®, are yet to be known at present, and it is not easy to measure or set up those. We have, therefore, taken the method that similar alternative fuel emission coefficients are selected from among those generally known presently to be used for the computation. For the CRM fuel we took the coefficient for the RDF (0.775t-CO2/t) and for SlurMix® that for waste oil (2.92t-CO2/t).

We have then classified the wastes derived from fossil fuels contained in the CRM with high calorific value and SlurMix® and computed the respective percentage. The results are shown below.

Table 1 Percentages of CRM with high calorific value and SlurMix® Accounted for by Wastes Derived from Fossil Fuels

Percentage of wastes derived from fossil fuels contained in the CRM with high calorific value	63%
Percentage of wastes derived from fossil fuels contained in SlurMix®	96%

Note: Computed based on the results of acceptance of wasted materials at AMITA CORPORATION's Himeji Resource Recycling Plant, for fiscal 2013

Based on the above data, the amounts of the baseline emission and project emission are calculated as follows:

・Baseline emission

The baseline scenario:
If ordinary fuel coals are used without using SlurMix® (2,000t/year) or CRM with high calorific value (24,000t/year)

Baseline emission amount =
Emission coefficient for fuel coals × Substitution rate × Amount inputted

Emission coefficient for fuel coals: 2.409t-CO2/t
Substitution rate (in terms of difference in calorific values):
For SlurMix® 3,350kcal/6,500kcal
For CRM 1,800kcal/6,500kcal
Amount substituted: 1,031 tons by SlurMix®
6,646 tons by CRM

⇒If fuel coals are used with no SlurMix® used:
2.409t- CO2/t×1,031t = 2,483t- CO2/year

⇒If fuel coals are used with no CRM used:
2.409t- CO2/t×6,646t = 16,010t- CO2/year

Baseline emission: 18,493t-CO2/year

・Project emission
Project scenario: Assuming that SlurMix® (2,000t/year) and CRM (24,000t/year) are used to substitute general fuel coals

Project emission
= Emission coefficients for the fossil fuel-derived wastes contained in the CRM or SlurMix® × Amount inputted

Emission coefficient for SlurMix®: Set at that of waste oil-derived fuels (2.92t-CO2/t)
Emission coefficient for CRM: Set at that of the RDF (0.775t- CO2/t)
Percentage of SlurMix® accounted for by fossil fuel-derived wastes: 96%
Percentage of CRM accounted for by fossil fuel-derived wastes: 63%

Amounts inputted: 2,000 tons of SlurMix®
24,000 tons of CRM
⇒If SlurMix® is used to substitute fuel coals:
2.92t- CO2/t×2,000t×96%=5,606t-CO2/year
⇒If the CRM is used to substitute fuel coals:
0.775t- CO2/t×24,000t×63%=11,718t-CO2/year

Amount of project emission: 17,324t-CO2/year

Reduction of greenhouse gas emission = Baseline emission – Project emission

=18,493t-CO2 - 17,324t-CO2

= 1,169t-CO2/year

Since there is no emission coefficient available at present, the emission coefficients for the RDF and waste oil have been assumed to be identical to those for the CRM and SlurMix®, it does not mean that these are very similar in formation or characteristics. Furthermore, in this project, alternative fuels are produced by "blending" various different kinds of wastes, which makes prescribing the emission coefficients difficult as the proportion of fossil fuel-derived wastes is not necessarily constant. These are the points to be verified in the future.

6. Method of monitoring

The matters to be monitored and the methods for the monitoring are as mentioned in the table below.

Matters to be monitored	Examples of monitoring methods	Frequency of monitoring
Weight of waste-derived fuels supplied after implementing the project	・Measurement with weighing devices ・Bills requesting payments issued at the time of supply	Cumulative total for the period of project
Calorific power of the waste-derived fuels after implementing the project	・In conformity with the specifications of the cement manufacturers to which the delivery is made. ・Computation of the average of the results of analyzing samples at the time of shipment	Computation for the period of project
Percentage of waste-derived fuels after implementation of the project accounted for by fossil fuel-derived wastes	・Computation based on the records of products being delivered	Computation for the period of project
The emission coefficient for the alternative fuels to be used in the relevant facilities after implementation of the project	・The default values of the emission coefficients for similar waste-derived fuels are used for the time being.	The latest ones at the time of verification are used.

7. Co-benefit obtained from the implementation of the project

Promotion of waste recycling by the project is expected to bring various co-benefits. In the first place, it will contribute to reducing the use of natural resources, since the use of SlurMix® will result in reduced use of fossil fuels and CRM with high calorific value can be used both as alternative fuel thanks to its calorific power and as the cement material substituting clay.

In addition, the project is the complete recycling of wastes into resources by the unique "blending" technology and, therefore, there will be no secondary residues as the recycled alternative fuels are entirely used in the cement manufacturing processes. Due to its clearly defined treatment process, it can be guaranteed that the wastes will be treated highly properly and transparently. Moreover, realization of proper treatment of wastes is expected to reduce the burden on environments, compared with the current situation where the simple incineration or landfill is in the mainstream, and to enable to promote better environmental management.

One of its important effects is the prolongation of the life of the final disposal sites by evading the simple landfill of wastes and landfill of the ash after incineration or the wastes after being stabilized. Furthermore, as it enables to avoid the landfill treatment, it will reduce the generation of methane gas and will also contribute to the lessening of the burden on the environments surrounding the final disposal sites.

As the project assumes the model in which cement manufacturers will be, as in Japan, granted treatment expenses by accepting and disposing of wastes, it may become an incentive for the cement industry to willingly accept wastes. When the model of the project penetrates among Vietnamese businesses, proper prices based on the market mechanisms will be set, which should lead to the formation of sound recycling market. The formation of sound recycling market should lead to the clear flow of treatment operations and, further, to the elimination of improper treatments.

8. Estimated expenses for the business and the cost effectiveness

While we at present assume that the following expenses will be needed for carrying out the project, we will in future conduct closer examinations by doing more specific study of equipment to be introduced.

Table 2 Estimated Business Expenses, Reduction in CO2 Emission and Cost Effectiveness

	Expenses for carrying out the business (for introduction of equipment)	Reduction in CO2 Emission	Cost effectiveness (in t- CO2 per year)
SlurMix® plant (Disposal capacity of approximately 2,000 tons/year)	Approximately ¥300 million	Approximately 1,169-CO2/year	Approximately ¥250,000
CRM plant (Disposal capacity of approximately 24,000 tons/year)			

If it is supposed that the CO2 generated when waste-derived fuels are burned is not taken into consideration, the cost effectiveness would be computed to be approximately ¥16,000.

9. The structure for carrying out the project

We have been considering the three patterns simultaneously for implementation of the project as shown below, from the start of planning; however, if we were to take into consideration the advantage of securing sources of income by accepting and treating wastes, as practiced in Japan, in Vietnam, where the business model of cement manufacturers being granted expenses for treatment when accepting wastes has not penetrated, the structure of cooperating with cement manufacturers (i.e., pattern 2 or pattern 3) seems to be more realistic. While cement plants will be required to modify the existing equipment or to newly establish equipment, given that we have already received responses from some certain cement manufacturers that they wish to promote the planning of receiving wastes, we can say that we are at the stage of starting to make specific suggestion for the introduction of such equipment. In addition, after holding discussions with cement manufacturers, it has become known that it is also useful to consider the possibility of a package-type planning which combines several kinds of businesses which are believed to be helpful for cement manufacturers to comprehensively solve environmental problems, such as introduction of the scheme of power generation by recovered waste heat. We will continue arranging the conditions for business with cement manufacturers, in anticipation of starting the project, through more specific study or introduction of such equipment. If it is found more profitable to establish a cooperative structure covering cement manufacturers and local disposal companies from various points of view, the structure of the pattern 3 would also be possible. For establishing the business structure, further discussions need be held with local partner candidates.

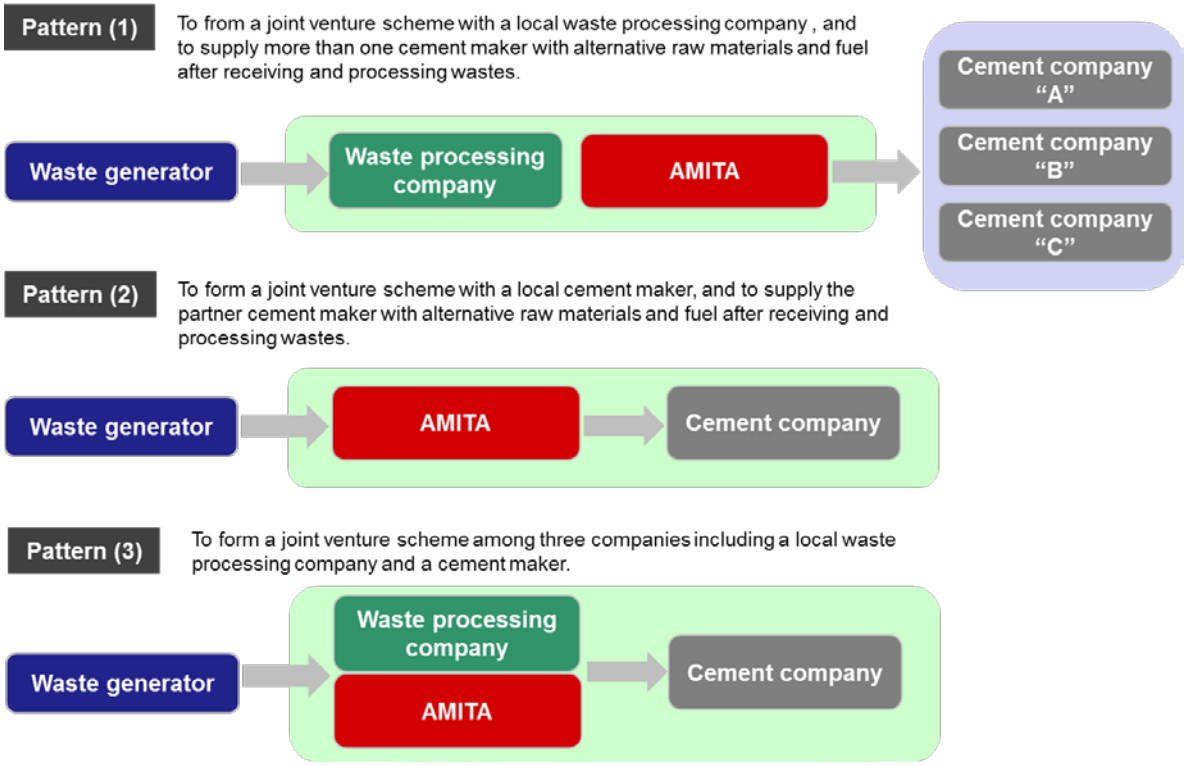


Figure 2 Patterns of Project Carrying Out Structure

10. Fund raising scheme

The cost effectiveness of reducing CO2 emission by this project differs significantly depending on whether or not to take into consideration the CO2 emission generated when CRM with high calorific value or SlurMix® is burned; however, it is targeted to effect the sponsorship to cover a maximum of 50% of equipment purchases making use of the JCM system. In addition, we will study the formation of the structure such as the one in which we can receive the support of JICAs overseas investment and loan.

11. Necessary measures to be taken

The scheme of the cement industry accepting and treating wastes is not yet very acknowledged. It is therefore necessary that the effects which the scheme will bring and the significance of the business models should be understood even more: And then the principles of the Construction Ministry, which supervises the cement industry, need to be established and be promoted in the future.

To realize it, it should be effective to share experience with Japan, where the acceptance of wastes is becoming a part of the cement industry and has marked the result among the best in the world. One example is the structure and supporting system which promotes the sponsoring of capital investment and technological cooperation for pilot businesses. It is an important first step, as a pilot business, to make the scheme of the business visible by concrete promotion of it in cooperation with

local cement manufacturers. We believe realization of such businesses will become realistic if we can receive the support by both Japanese and Vietnamese governments.

In this connection, for further promotion of utilization of wastes as raw materials or fuels, formal standards are needed. The acceptance criteria of the QCVN41:2011/BTNMT mentioned above is so strict that it may obstruct positive acceptance of wastes. As in Japan, focusing on the point of whether the final products can meet the product specifications, to have the idea is important that the acceptance of wastes may be managed at the side of output by the discretion of the manufacturers, rather than strictly screening inputs.

12. Future schedules

This project is expected to contribute greatly to Vietnam by its co-benefits, although the effects of reducing the CO2 emission vary significantly depending on whether the CO2 emission generated by burning the alternative fuels AMITA manufactures. Taking these factors into consideration, we plan to continue the feasibility study as the survey on the possibility of forming a large-scale JCM project.

The followings are the draft of the schedule for the carrying out of this project:

Fiscal 2015: Detailed FS

- ・Study of introducing equipment to specific cement manufacturers; study of the quality of alternative raw materials and fuels to be accepted
- ・Research on wastes to be generated; analysis of waste samples
- ・Close examination of the costs of local capital investments
- ・Negotiation of conditions with the partner companies which we will carry out the project
- ・Forming agreement with relevant administrative offices
- ・ Computation of the reduction in greenhouse gas emission; establishment of the MRV methodology and monitoring methods
- ・Finalization of the fund raising scheme

Fiscal 2016: PS

- ・Start of plant construction
- ・JV agreements with partner companies with which the project will be carried out
- ・Various applications necessitated for carrying out the project

Fiscal 2017: Start of business

Feasibility Study on Joint Crediting Mechanism Large-scale Project Development for Creating Low-Carbon Society in Asia (FY2014)

Green Growth Action Plan Support Project in Hai Phong City in Collaboration with Kitakyushu City

Summary
"Project Formation Feasibility Study for Low-Carbon Projects in Cat Ba Island, Hai Phong City"

NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc.

1. Background

1.1 Overview of Cat Ba Island, Hai Phong City

Cat Ba Island belongs to the administrative unit of Cat Hai province consisting of Cat Ba and Cat Hai Islands and is located in approximately 60 km southeast of Hai Phong City in the mainland. Cat Ba is the largest of the 366 islands in Ha Long Bay. Cat Ba Island has an area of 354km^2; with a population of 16,000 inhabitants. In order to protect the rich and valuable nature in island and coastal waters, approximately half of the area of the island has been designated as a national park. Cat Ba National Park has the rich biodiversity and various ecosystems and became the first national park having both marine and terrestrial ecosystems. Therefore, Cat Ba National Park was designated as the UNESCO World Biosphere Reserve List in 2004 and Vietnam National Site of Scenic Beauty in 2012.

Main industries in Cat Ba Island are service industry including tourism and fish farming. Especially in the tourism sector, the number of tourists has continued to increase since 2004; thus, the development of the island has promoted. The bridge connecting Hai Phong City and Cat Hai Island will complete the construction in 2017. Cat Ba Island is less than one kilometer away from Cat Hai Island, so more tourists and citizens are expected to come to visit to Cat Ba Island when the bridge completes. There is no bridge and construction plan to directly go to Cat Ba Island in order to protect its biodiversity and ecosystem. Access to Cat Ba Island is only by sea.

1.2. Administrative Organizations and Their Roles

Regarding tourism and environmental conservation in Cat Ba Island, not only Cat Hai District but also Hai Phong Department of Culture, Sports and Tourism has jurisdiction over the tourism as a city project. In addition, Management Commission of Cat Ba Biosphere Reserve (CBBR) of Vietnam headquartered in the Hai Phong City manages villages and animals. Also, the Administration developed "Cat Ba Island Sustainable Tourism Development Master Plan: until 2025

and toward 2050" and Hai Phong City People's Committee approved this master plan in December, 2014.

1.3. Legislation system and condition

The Vietnam Government has been working on efficient use of energy in order to correspond to the rapid increase of energy demand. They promote the development of power source in the supply side and establish "Vietnam Energy Efficiency Program (2006~) (VNEEP)" in the demand side. "Law on Energy Efficiency and Conservation" was enforced in 2011 to promote the development of renewable energy and energy saving in a wide range of fields. Particularly, the priority of introducing renewable energy into the islands is high.

Ministry of Industry and Trade (MOIT) and its extra-department body Energy Conservation Center (ECC) has jurisdiction over and operate VNEEP, and it is currently Phase 1 stage (2006-2015). Phase 2 (2015-2020) has been examined but VNEEP has been determined to terminate in July 2015.

VNEEP regulates mass energy consumption businesses by Law on Energy Efficiency and Conservation as one of the energy saving promotion plan. On the other hand, the program promotes subsidies and exemptions for energy diagnosis cost to small and medium-sized enterprises whose energy consumption is less than a certain level. At the time of VNEEP implementation, the mechanism which covers 30% of the initial cost (up to 7 billion VND: about 35 million yen) has already been developed. However, the maximum amount and the maximum rate of initial cost auxiliary are depending on the size of business and other factors, so subsidy rates are set possibly more than 30%. This measure is intended for the whole country and Hai Phong City has been assigned 10 cases of the energy audit. Based on the energy audit results, the companies obtain the subsidy which covers 30% of initial cost and implement the energy saving projects. However, only three frames have been implemented so far, because the companies have to bare 70% of the initial cost. Thus, Hai Phong City examines the active and speedy use of this mechanism.

2. Methodology

Research topics are to conduct field survey to find business candidate sites and partners which contribute to make Cat Ba Island low carbon society, examine measures based on the present situation diagnosis of energy and environmental impact, evaluate commercialization and GHG reduction potential, and review MRV methodology. Financial mechanism was also examined to promote the businesses.

The approaches examined were energy saving of various facilities, introduction of renewable energy, and water conservation.

We had local meetings (five times total) and home meetings (two times total) as the milestone, examined low-carbon measures, evaluated GHG reduction potential, reviewed MRV methodology, evaluated feasibility study, and made the report.

3. Results

3.1. Business Sites Selection

Firstly, we conducted survey to the tourism sector, which is the main industry of Cat Ba Island, particularly to large-scale hotels and factories which consume relatively high amount of energy. In addition, we obtained the information of tourism transportation service company from the Cat Hai District People's Committee and carried out interviews and field diagnosis to these factories and companies. As the result of the field survey (eight times at 24 sites in total), there are four candidate sites having the potential of low-carbon business. The next section summarized these four sites ([A]～[D]).

[A] The Introduction of Solar Power Generation and EV

Quoc Hung Trading Company Limited (QH) providing transportation services for tourists currently owns 10 diesel buses and 17 diesel tourism cart. It also has been developing 16 hectares site for tourist farm and zoo and botanical garden, which is plan to open in 2017. QH already starts to provide eco-tourism service in some completed area.

There are currently two diesel bus routes with 28.5km each within the island. Carts also run within approximately two kilometers diameter of Cat Ba town for sharing use. Chinese electronic cart has been introduced on a trial basis, but QH was not satisfied with the results; therefore, electric vehicle has not been fully introduced yet. When the bridge between mainland Hai Phong City and Cat Hai District completes in 2017, the number of passengers coming to Cat Ba Island would increase. QH has been planning to introduce EV buses to cope with the increase and is highly interested in introducing Japanese EV buses as a JCM project.

Restaurants, hotels, shops, and offices will be constructed in the tourism farm, zoo and botanical garden. QH has been planning to introduce a solar power generation system covering the farm ground by the panels to generate necessary electricity for these facilities. They also plan to use the electricity generated by solar power to charge EV bus. In addition, electric community bus and two-seater compact EV are suitable to make a tour around the 16ha-size tourism farm, zoo and

botanical garden.

QH has set their business vision with providing environment friendly transportation means and eco-tourism and plans and implements the projects. They would like to introduce high-quality and less environmental impact products, such as products made in Japan. We already obtained the approval of the Cat Hai District People's Committee for this business plan and their support is expected. Thus, QH has a certain potential as a project partner candidate.

Tourist farm, zoo and botanical garden and diesel tourism cart by QH

[B] Energy Saving at Hotels

We selected the seven largest hotels based on the size and scale in the island as targets for energy saving. Feature of Cat Ba Island tourism is that the occupancy rates of high season in the summer (June to August) and low season in the winter are excessively different. It is depending on each hotel, but room occupancy rate is several to 10 times difference between the high season and low seasons. Many cases indicated that it is more efficiency in the year to install and use home air conditioner in each room rather than to set the central control chiller system. Therefore, the hotels are equipped with home air conditioners in each room except for Cat Ba Island Resort and Spa Hotel, which is the largest hotel in the island. Installed air conditioners are often with inverters.

The Cut Hai District People's Committee held the environmental conservation and energy efficiency workshop for two days in March, 2012 to promote energy saving measures in the hotels. Approximately 70 representatives of the hotels in the island gathered. This workshop greatly contributed to the promotion of energy saving measures in the hotels. The participants did not have interest in the measures before, but its economic effect attracted them. Therefore, currently interests are grown among them and supporters for energy saving measures are increasing. In response to this workshop, many hotels introduced LED lights (mainly made in China) and all seven hotels we surveyed already installed.

Regarding enhancing the efficiency of energy equipment, such as air conditioners, the result of the seven hotels survey indicated it is difficult to create energy-saving effect due to the low occupancy rate. Furthermore, some hotels installed solar water heaters, inverter air conditioner, and LED lights. Most of the hotels in the island already implemented energy saving measures at their best.

On the other hand, Cat Ba Island resort and Spa Hotel uses a chiller system to the hotel room buildings with relatively higher occupancy rate and owns freezer and refrigerated room running

through 365 days 24 hours. Thus, Cat Ba Island resort and Spa Hotel has some potential of energy saving effect and is selected as a project candidate site.

[C] Road Lighting

Cat Hai Urban Service & Public Work Management Company (the public corporation herein after) manages and operates road lighting in Cat Ba Island. There are 313 lightings in the island and the public corporation considers replacing all sodium lamps with LED. Therefore, the public corporation is selected as an energy-saving project candidate site. Particularly, the public corporation desires to start to replace the lamps with LED at the main street (see below the photo) near the harbor for Cat Ba Island tourists as their priority.

[D] Energy Saving at Factories

There are ice manufactories, namplaa factories, and a fish meal factory in the island. Especially, ice manufactories consume large amount of electricity and there are three factories (Nguyen Hoang Co., Ltd owns two factories and Anh Tuan owns one.) in the island. Nguyen Hoang Co., Ltd produces about 20,000 tons ice/ year and Anh Tuan produces about 10,000 tons ice/year, which is mainly used for cold storage of fishing boats in Cat Ba Island.

Based on the result of the energy diagnosis of each factory, we selected Nguyen Hoang Co., Ltd. We examined the renewal of old Japanese refrigeration compressor (used goods) and asked the manufacturer of this product in Japan about sale of refrigeration compressor. However, most products are used goods in the Vietnamese ice machine market and there is little demand for new products, maintenance and part replacement to manufacturers. Thus, business outlook is very poor and we decided only to estimate its GHG reduction potential as a reference in this study.

Ice manufactory（Nguyen Hoang Co., Ltd）

3.2. Project Overview

We examined five projects at the selected four sites. Basically, all projects mainly focus on the model selling out energy saving and low carbon facilities

Table 1. List of Project Candidates

Project Title	Local Partner	Content
[A1] Introduction of EV buses	Quoc Hung Trading Company Limited	• Introduction of EV buses （Replacement of diesel buses）
[A2] Introduction of a solar power generation system	Quoc Hung Trading Company Limited	• Introduction of solar power generation for EV buses and power sources of facilities in tourism farm
[B] Energy saving at a hotel	Cat Ba Island Resort and Spa Hotel	• Renewal air conditioner • Renewal freezer and refrigerated room
[C] Energy saving for road lighting	Cat Hai Urban Service & Public Work Management Company	• Introduction of LED for road lighting
[D] Energy saving at an ice manufactory	Nguyen Hoang Co., Ltd	• Renewal refrigeration compressor

3.3 Proposed Funding Mechanism

3.3.1. Improvement of Tourism Commission Collection System

Currently, tourists visiting Cat Ba Island pay Cat Ba National Park tourist fee and Cat Ba Bay tourism commission at the entrance. Annual revenue from the commission based on 2013 result is that the former is 3.8 billion VND and the latter is 1.5 billion VND. It has been used as a fund for environmental conservation activities, such as salaries for cleaning staffs and educational activities in Cat Ba Island.

However, the current collected amount is not enough to provide sufficient environmental conservation measures and new environmental conservation projects. We also found that only one person is allocated at the ticket booth to collect Cat Ba Bay tourism commission. It is not able to collect all commission. Therefore, we proposed increasing the collection rate through the mechanization of ticket sales, which improves Cat Ba Bay tourism commission collection system, to Hai Phong City and Cat Hai District People's Committee.

Both the People's Committees agreed with this proposal, and Cut Hai District People's Committee already submitted the improvement plan for Cat Ba Bay tourism commission collection system to Hai Phong City. Currently, they have been waiting to obtain the final approval from the city. Furthermore, the current Cat Ba National Park tourist fee and Cat Ba Bay tourism commission are set as lower prices than other tourist areas in Vietnam, so they have been planning to increase the charge by 20%.

3.3.2. Proposed New Funding Scheme: Environmental Conservation Commission

Besides the funding mentioned above, additional funding are required to realize environmental conservation projects in Cat Ba Island, such as low carbon projects in Table 6. We proposed introduction of a new environmental conservation commission as an idea of the scheme with AMITA Institute for Sustainable Economies to the Hai Phong City and Cat Hai District People's Committees.

The collection scheme is to add island entrance fee on passage tickets of speed boats and ferries, because the access to Cat Ba Island is limited only to the sea routes. Hai Phong City government entrusts speed boat and ferry companies with collection of the fee. Hotel guests can be the fee payer based on an idea making tourists take the burden.

We have proposed the introduction of this new environmental conservation commission to the Hai Phong City and Cat Hai District People's Committees and the related organizations since the beginning of this survey project. Therefore, we heard positive attitude of the Vietnamese side and the progress of more concrete plan at the progress report workshop held in January 2015.

Hai Phong City and Cat Hai District is planning to adopt the scheme, which collects the environmental conservation commission fee from tourists visiting Cat Ba Island by speed boats and ferries. In addition to these vessel tickets, tourists will be obliged to purchase this commission fee ticket at the time of boarding. The prices of tickets for tourists and Cat Ba Island residents will be different, and the commission ticket for tourists will be less than 20,000VND (about 100yen). Questionnaire survey to the residents and tourist will be carried out in order to set the appropriate price.

Currently, the Cat Hai District People's Committee has been making the proposal to introduce this environmental conservation commission. They plan to complete the proposal by March, 2015 and expect to obtain the approval from Hai Phong City by June, 2015.

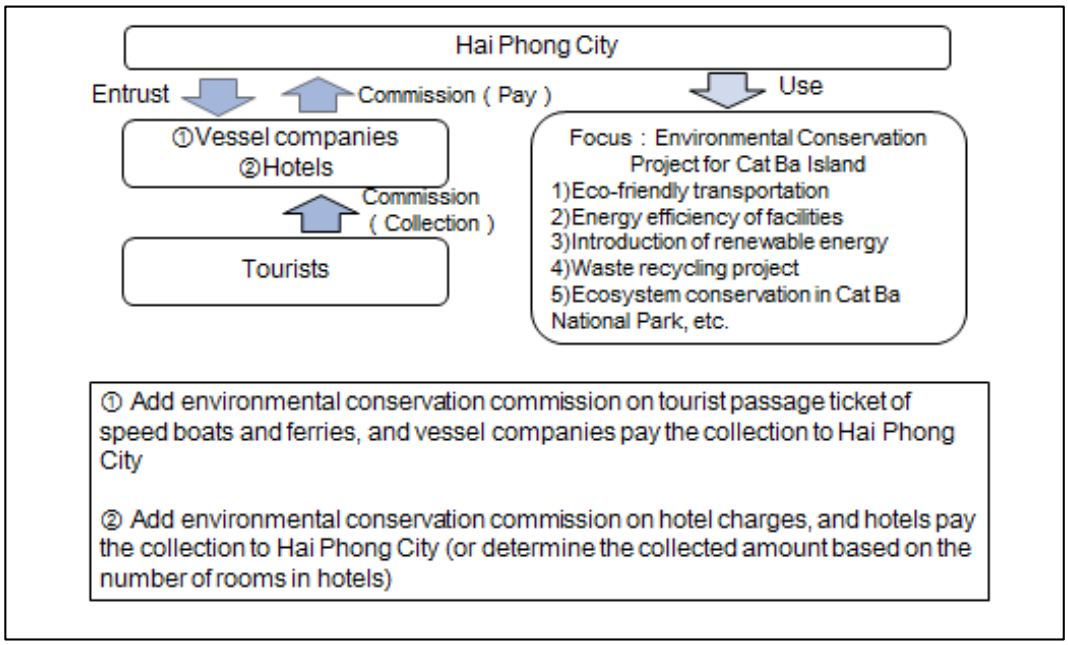


Figure 1. Proposed New Funding Scheme

3.4 Technology Application

Japanese company's technologies considering applying to the low-carbon projects in Cat Ba Island are listed below.

Table 2. Application Technologies

Project Title	Proposed Application Technologies	Japanese Companies under discussion
[A1] Introduction of EV buses	• Ultralight electric bus and related technologies (EV charging system, battery, and remote monitor by solar power generation and co-operative energy)	Company S
[A2] Introduction of a solar power generation system	• Solar power generation system	Company K
[B] Energy saving at a hotel	• High efficiency chiller • Energy saving freezer and refrigerated room	Company H
[C] Energy saving for road lighting	• LED lighting	TBD
[D] Energy saving at an ice manufactory	• High efficiency refrigeration compressor	Company M

Especially, EV bus project is considered as having a high potential of implementation. Therefore, it is desired to introduce the product (ultralight electric bus) and technologies of Company S located in Kitakyushu City being a sister city of Hai Phong City. Features of the technologies are ultralight vehicle body with aluminum-semi monocoque structure, the world smallest power consumption (less than 1kWh/km), and the latest real-time battery management system by remote monitoring system.

Microbuses with about 25 seats were selected considering the QH's business plan. The microbuses have sufficient gradeability and mileage per one charge even for steep slopes in Cat Ba Island. QH plans to introduce 20 microbuses.

3.5. GHG Emission Reduction Potential

We estimated the potential of GHG emission reduction of five projects and listed GHG reduction estimates (tCO^2/year) below. The total amount is 800 tCO^2/year, excluding D due to the low feasibility as business.

Table 3. Estimation Result of GHG Reduction Amount

Project Title	Reduction Amount [tCO2/year]	Assumption for calculation
[A1] Introduction of EV buses	480	- Introduce 20 busses - Annual mileage：60,000km Electric power consumption ：0.6kWh/km Fuel consumption：4.0L/km - 50% of mileage is assumed run on grid power
[A2] Introduction of a solar power generation system	175	- Generation capacity：200kW - Operation time：8 hours/day
[B] Energy saving at a hotel	45 （30 from air conditioning, 15 from freezer and refrigerator）	- Air conditioning operation rate：50％ - Energy saving rate：25% (air conditioning), 20% (freezer and refrigerated room)
[C] Energy saving for road lighting	97	- Renewal to LED for all the road lighting in the island
[D] Energy saving at an ice manufactory	35	- Energy saving rate：7.5%

3.6. Estimated Project Cost and Cost-effectiveness

Estimated initial cost, simple payback period (assume after applying JCM subsidy for facilities), and cost-effectiveness (cost/CO^2 reduction amount) is listed below. The initial cost of EV bus should be reduced by local production and other measures. Applying LED to all road lighting is evaluated as most cost-effectiveness, but it is necessary to further examine the feasibility of the introduction of Japanese LED.

Table 4. Estimated Project Cost and Cost-effectiveness

Project Title	Estimated initial cost	Simple payback period	Cost-effectiveness
[A1] Introduction of EV buses	315 million yen	11 years	660,000 yen／tCO^2
[A2] Introduction of a solar power generation system	30 million yen	Under consideration	170,000 yen／tCO^2
[B] Energy saving at a hotel	6 million yen	19 years	60,000 yen／tCO^2
[C] Energy saving for road lighting	3 million yen	6 years	30,000 yen／tCO^2

4. Implementation plan for commercialization

4.1. Project Organizational Structure

Organizational Structure of Project [A] and [B] is shown below.

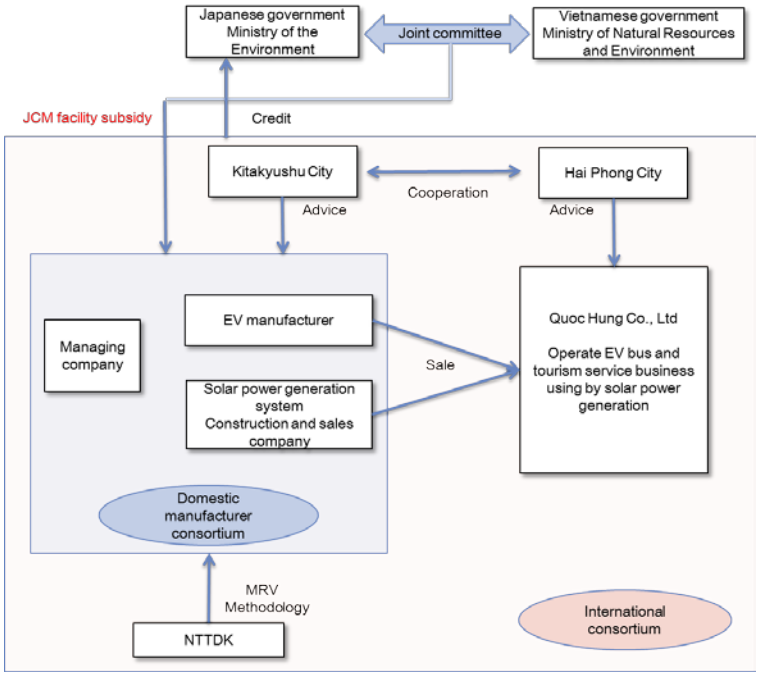


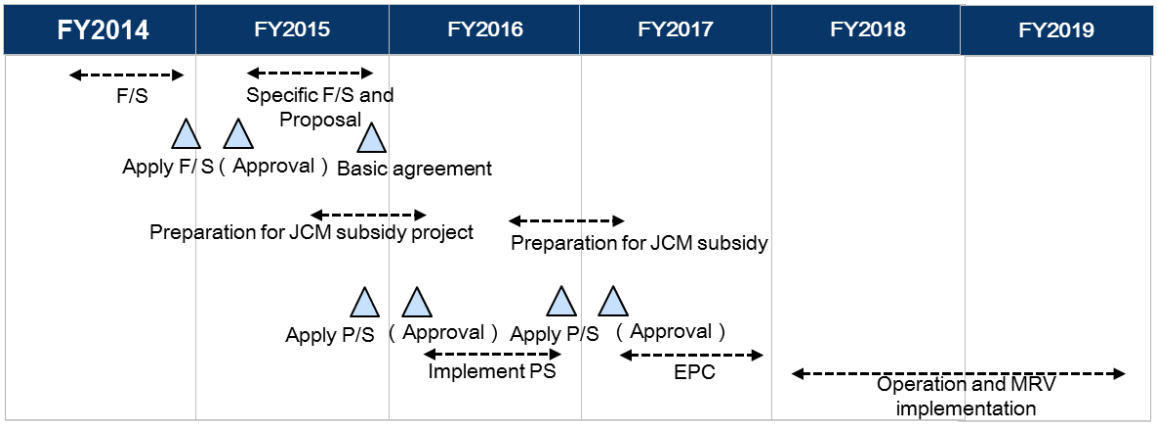
Figure 2: Project Organizational Structure (QH)

4.2. Schedule

We are going to discuss with QH about the details of project scale and system design toward the agreement. Regarding applying LED to road lighting, we need to examine and establish the project organizational structure with a public corporation as the local partner. It is also necessary to assess the feasibility of energy saving of the hotels.

We concluded that it is necessary to conduct the feasibility study one more year, because QH will complete development design in the early 2015, start EV bus, and open the tourism farm, zoo and botanical garden in 2017. Proposed schedule is shown below.

Figure 3. Proposed Schedule for Commercialization (Project for QH)



2014 Feasibility Study for the Formation of a Large-Scale JCM Project to Realize a Low Carbon Society in Asia

"Project to Support the Enactment of a Growth Plan for the City of Haiphong through Collaboration with the City of Kita-Kyushu"

Report

Cat Ba Island － Project to Build a Comprehensive Resource Recycling System for Waste

AMITA Institute for Sustainable Economies Co., Ltd. (AISE)

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Chapter 1　Project Aim and Implementation System

1.1　Project Outline (Aim and Applicable Scope)

Cat Ba Island is a large island in Ha Long Bay, a world natural heritage site. It is also a treasure house of bio-diversity where more than 4,000 species of flora and fauna exist. With a population of about 16,000 people, the island is one of Vietnam's leading tourism attractions that is visited by more than a million tourists annually. However, due to the rapid increase in the number of tourists and large-scale developments etc. in recent years, Cat Ba Island is facing problems in treating its waste and sewage. This project aims to build a comprehensive resource recycling system for waste on Cat Ba Island. The project aim and applicable scope are as shown below.

■Aim

The aim of the project is to reduce GHG and conserve the environment through comprehensive recycling of waste generated on Cat Ba Island and by reducing the amount of waste disposed in landfills. In addition, the project also aims to contribute to the sustainable development of the island by promoting eco-tourism, environmentally sustainable farming and fishing industries, etc.

■Applicable Scope

・Bio-gasification of organic and other waste with a high water content
・Solid fuel processing of flammable waste with a low water content
・Cement raw material processing of flammable waste that cannot be used for the above
・Waste sorting and collection system, incentive design

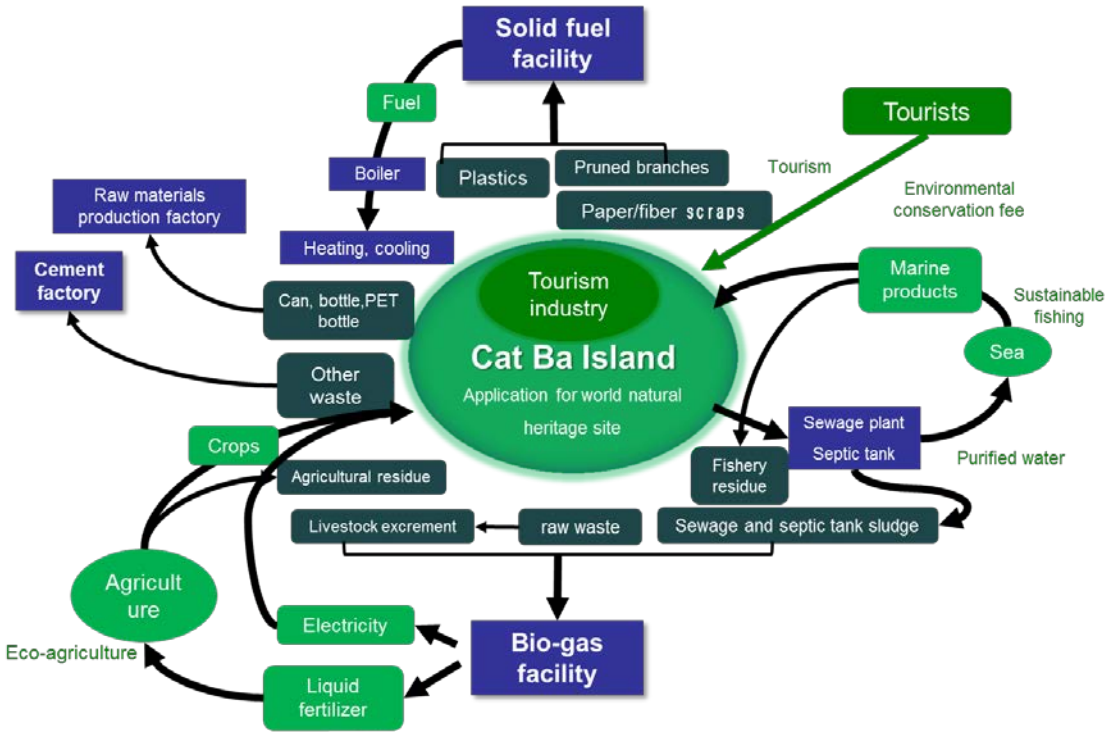


Figure 1.1. (1) Overall Concept

1.2 Applicable Technologies and Related Legal System

(1) Bio-gasification

Bio-gasification is a technology to produce bio-gas and liquid fertilizers by heating and fermenting organic waste with a high water content such as raw waste and sewage sludge etc. Bio-gas is a fuel mixture containing about 60% methane gas and 40% carbon dioxide which can be used as an energy source to generate electricity and heat. Besides this, it can also be used as a fuel gas to replace LPG. Liquid fertilizers can be used as low-cost, organic fertilizers in environmentally sustainable agriculture and so on.

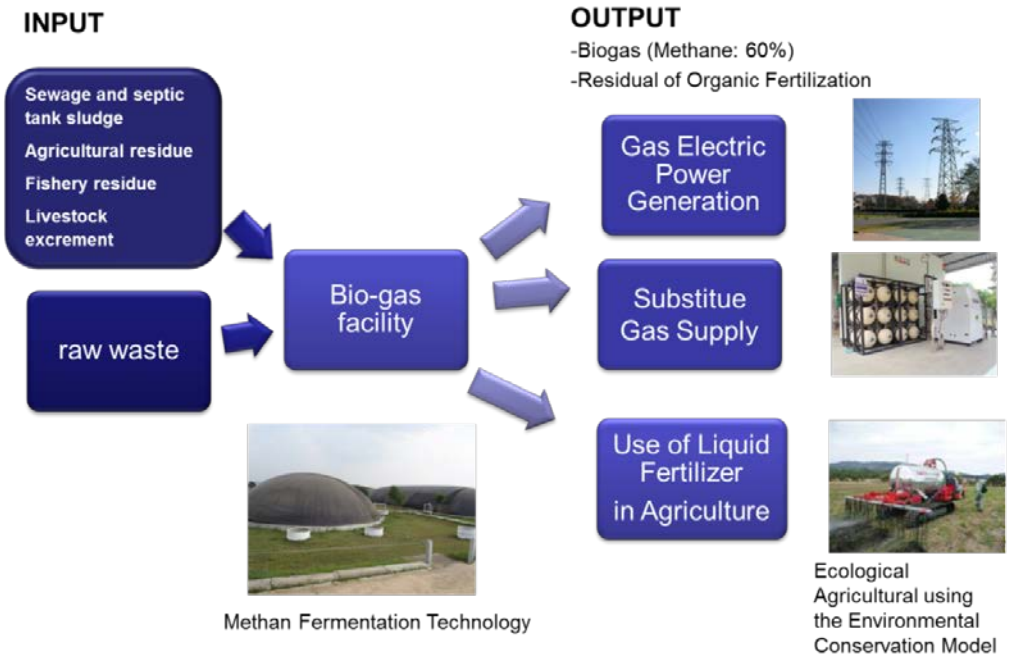


Figure 1.2. (1) Overall Flow of Bio-gasification

(2) Solid fuel processing

Solid fuel processing is a technology to produce solid fuel with a fixed calorific value by crushing, mixing and pressurizing flammable waste with a low water content. This solid fuel can be used as an alternative fuel to fossil fuels such as coal etc. in boilers and other equipment.

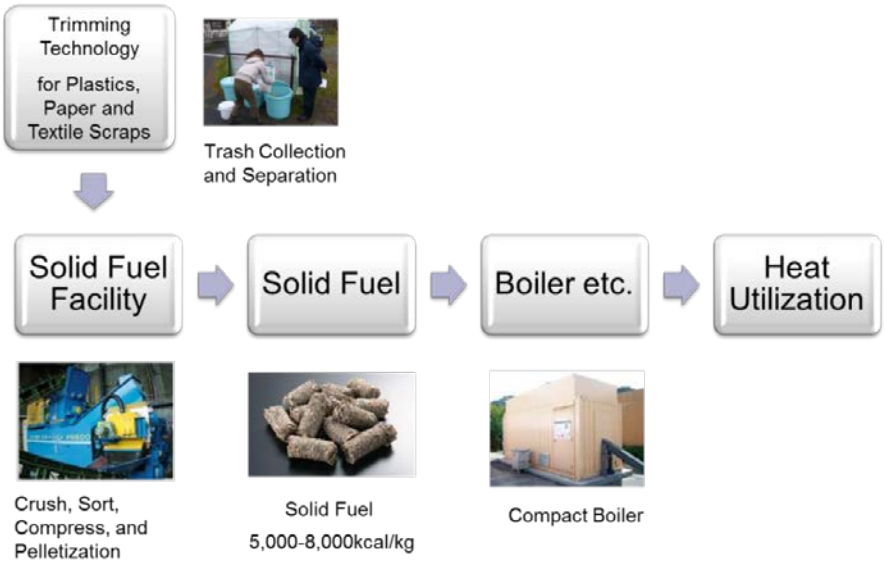


Figure 1.2. (2) Overall Flow of Solid Fuel Processing

(3) Cement raw material processing

Cement raw material processing is used to sort and regulate other flammable waste that cannot be used in bio-gasification and solid fuel processing, into alternative products to replace fuel and raw materials for use in the cement manufacturing process in cement factories.

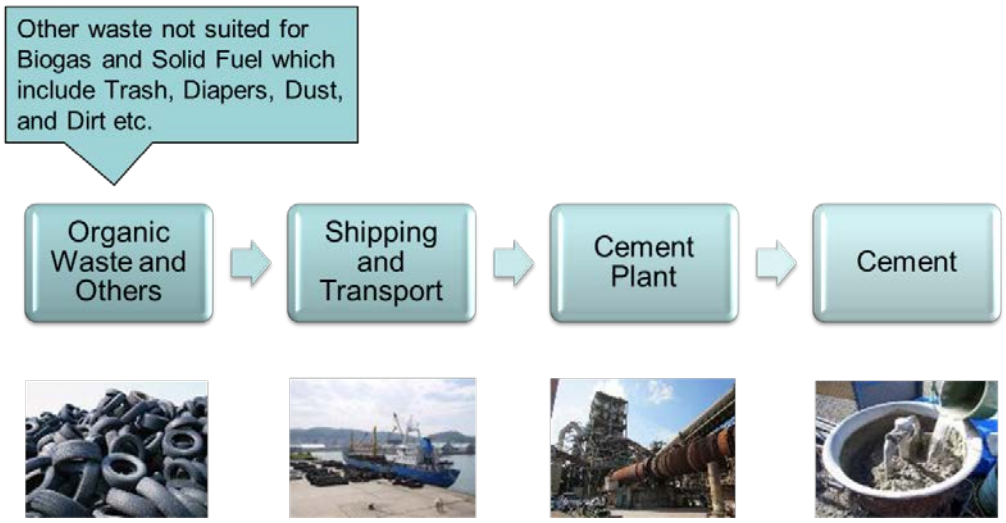


Figure 1.2. (3) Overall Flow of Cement Raw Material Processing

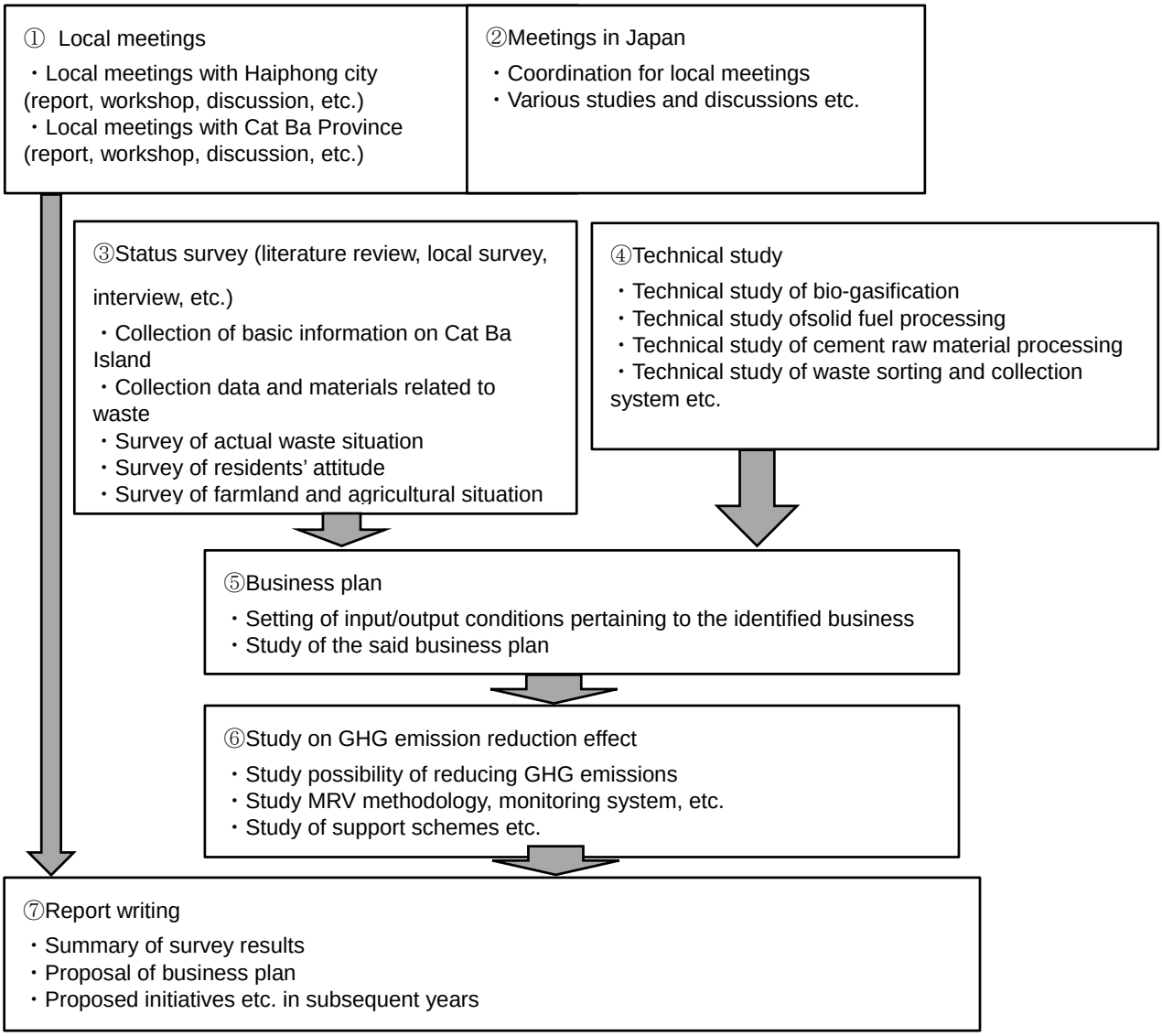
(4) Waste sorting and collection system, incentive design

To recycle waste into a resource, it is extremely important to “sort and collect” the waste in an efficient and effective manner, starting from the source of the waste all the way to the individual recycling technologies. In order to do so, it is necessary to design a practical sorting and collection system based on the needs and circumstances of the residents and the actual condition of the waste discharged. A preliminary survey of these themes has been carried out in the current survey.

1.3 Project Implementation System

This survey was commissioned by the city of Kita-Kyushu and the Institute for Global Environmental Studies (hereinafter known as IGES) and carried out mainly by the AMITA Institute for Sustainable Economies Co., Ltd. with the support of the commissioning parties and the cooperation of the People’s Committee etc. in Cat Ba Province, Haiphong, Vietnam.

1.4 Project Procedure



Chapter 2　Survey Results

2.1　Status Survey Results

A survey of the current situation for each of the items (1) – (9) mentioned below was carried out.

(1) Waste collection and disposal status

・Waste collection and disposal is handled single-handedly by a public facility management service company (hereinafter known as “public corporation”). The waste collection frequency is 1-2 times/day for urban areas and 6 times/month for rural areas. The waste is collected in a mixed state without being sorted.

・The waste collection fee is 1USD/month per household and set individually based on the business scale for commercial establishments.

(2) Waste recycling status

・Beverage bottles and paper from commercial establishments are bought over by junk buyers. Raw waste from hotels and restaurants is mainly bought over by pig farmers for use as fodder (raw waste except those used as fodder are discarded).

(3) Sewage treatment status

・Current, there is only one sewage treatment facility in the urban area along the coast of the island which was built in 2007. The treatment capacity is about 1,000m^3/day. Sewage sludge is extracted regularly and scattered on landfills (volume generated: about 1 m^3/day).

・The sewage treatment facility for treating wastewater in District No. 7-10 is currently under construction. The treatment capacity is 800m^3/day. There are 601 households and 2,431 persons in District No. 7-10.

・Besides these, there are also plans to build incineration facilities.

・Sewage from districts which are not linked to the sewage treatment facility are treated by a septic tank. Most of the sludge accumulated in the septic tank is left unextracted and untreated.

・The public corporation was requested to collect a sample of the sewage sludge for analysis. Based on the results of the analysis, the proportion of solid waste in the sewage sludge was 6.3% and no component that would pose problems was found.

・An estimate of the sewage sludge volume was derived from the treatment capacity of the sewage treatment facility. The results indicate that the amount of sewage sludge generated by the existing sewage treatment facility is 2.4t/day (proportion of solid waste is 6.3%),

while the amount of sewage sludge (dehydrated sludge) to be generated by the sewage treatment facility under construction is 0.8t/day (proportion of solid waste is 15%). It is possible to recycle the entire amount of this sewage sludge in a bio-gas facility.

(4) Agricultural situation (users of bio-gas and liquid fertilizers)

・The area of the farmland on the island is about 200 ha, consisting of 40 ha of paddy fields, 64 ha of vegetable plots, and about 90 ha of fruit trees.

・Farmlands of considerable scale are present in KHE SAU village, GIA LUAN village, and HIEN HAO village. On the whole, fertilizer is lacking and many feel that chemical fertilizers are too expensive.

・Some farmers have introduced simple bio-gasification facilities using the faeces and urine of reared pigs. The gas is used for cooking while the liquid fertilizer is used for farming.

Photo 2.1. (1) Relatively large-scale paddy cultivation land

Photo 2.1. (2) Relatively large-scale farmland

(5) Potential users of solid fuel

・About 1.5 -2.0t/day of coal is consumed for drying purposes in the fish feed manufacturing plant. As the price of coal is high and unstable, some people have expressed a desire to use solid fuel derived from waste.

(6) Status survey of cement factory

・The survey results of the waste acceptance status in cement factories are as shown in Table 2.1. (1).

・Concerns over the impact on cement quality and the need to prioritize stable production have been cited as reasons why widespread acceptance of waste is still not seen yet. However, if technical (scientific), systemic and psychological barriers can be overcome,

waste is likely going to be accepted more widely in future.

Table 2.1. (1)　Waste Usage Situation in Cement Companies

Company Name	Location	Waste Usage	Remarks
Cement Co. A	Haiphong city	No previous record. Interest shown.	
Cement Co. B	Haiphong city	No previous record.	Waste acceptance cannot be studied at the present moment.
Cement Co. C	Hai Duong Province	A little of the waste is used.	Unwanted waste generated in the factory is thrown behind the kiln.
Cement Co. D	Hai Duong Province	Waste (intermediate treatment waste) is used in small incinerators. Amount used is 19,500t/year.	Waste heat of the incinerator is used in the kiln.
Cement Co. E	Quang Ninh Province	No previous record.	
Cement Co. F	Quang Ninh Province	Uses bottom ash of thermal power plants. Amount used is 120,000t/year.	
Cement Co. G	Ho Chi Minh city	Uses waste. Amount used is 90,000t/year.	

(7) Survey of commercial waste composition

・A waste composition survey was carried out over 3-5 days in August 2014 for 3 hotels and 3 restaurants. One day (24 hours) worth of waste was collected and analyzed for each establishment.

・In the current composition survey, the waste was classified into the following 14 categories and the respective weights were measured

Table 2.1. (2)　Classification in waste composition survey

No	Item	No	Item
1	Raw waste – Suitable waste	8	Plastic - Badly-stained waste
2	Raw waste- Unsuitable waste	9	Grass, leaves, wood
3	Paper - General waste	10	Rubber, leather
4	Paper - Badly-stained waste	11	Metals
5	Fiber	12	Glass, ceramics
6	Plastic - Soft	13	Others
7	Plastic - Hard	14	Unclassified

∗No.1) Waste suitable for bio-gasification

∗No.2) Waste unsuitable for bio-gasification (seashells, crab shells, egg shells, thick bones, coconut husks, etc.)

- In summary, the amount of waste deemed to be recyclable in a bio-gas facility (=raw waste - suitable waste) was about 30-35% (*excluding raw waste for reared pigs) while the amount deemed to be usable in solid fuel processing is about 20-30% (=paper, fiber, plastic, trees and plants).
- That is, among commercial waste, about 50-65% of the waste may be recycled using bio-gasification and solid fuel processing. Even for raw waste (=raw waste - unsuitable waste) which cannot undergo bio-gasification, it is possible to recycle the waste into a fertilizer. Once this is included, 90% or more of the waste can be recycled.
- The raw waste for rearing pigs constituted about 45% of the overall waste (raw waste for reared pig, raw waste - suitable waste, raw waste - unsuitable waste).

Photo 2.1. (3) Collecting waste for waste composition survey

Photo 2.1. (4) Scene from waste composition survey

Photo 2.1. (5) Scene from waste composition survey

Photo 2.1. (6) Raw waste suitable for bio-gasification

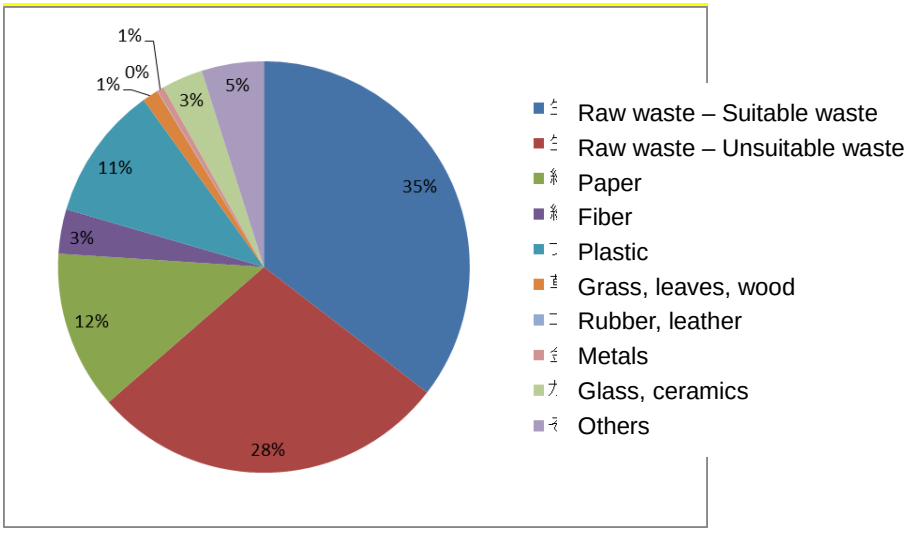


Figure 2.1. (1)　Survey results on waste composition of hotels

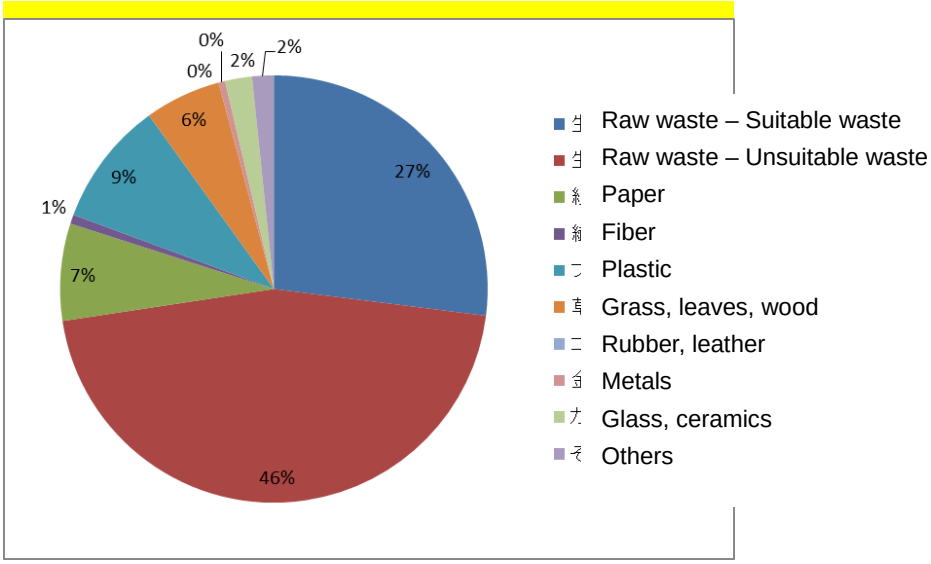


Figure 2.1. (2)　Survey results on waste composition of restaurants

(8) Survey of household waste composition and volume

・For the household waste composition in Vietnam, the composition in the current survey was estimated based on past survey material. Past survey material of a small city like Hue which is relatively similar was used as reference material.

・Based on the survey results of the household waste composition in the city of Hue (2010 Waste Composition Survey Results In Hue City), household waste contains about 80% of raw waste and 18% of waste that is usable in solid fuel processing (＝plastic, paper, trees and plants, fiber).

・In this survey, the household waste composition on Cat Ba Island was estimated based on the following assumptions.

＊The waste composition on Cat Ba Island shall be the same as the city of Hue.

＊Regarding the breakdown of the raw waste, a commercial waste composition of 90:55:55 (“Raw waste for pigs”: “Raw waste - Suitable waste”: “Raw waste - Unsuitable waste”) was used as a reference, and taking into consideration the fact that ”Raw waste - Unsuitable waste” is clearly less than commercial waste, a composition ratio of 100:70:30 for “Raw waste for pigs”: “Raw waste-Suitable waste”: “Raw waste-Unsuitable waste” was assumed.

・As a result, the proportion of raw waste was assumed to be about 66%, of which approximately 46% is deemed to be recyclable in a bio-gas facility (＝Raw waste - Suitable waste). In addition, the amount of waste deemed to be usable in solid fuel processing was about 30% (＝plastic, paper, trees and plants, fibers).

・That is, about 76% of household waste is deemed to be recyclable using bio-gasificationand solid fuel processing. Moreover, even if the raw waste (＝Raw waste - Unsuitable waste) cannot be used in bio-gasification, it can still be recycled into fertilizers. If this amount is included, it means that more than 90% of the waste can be recycled.

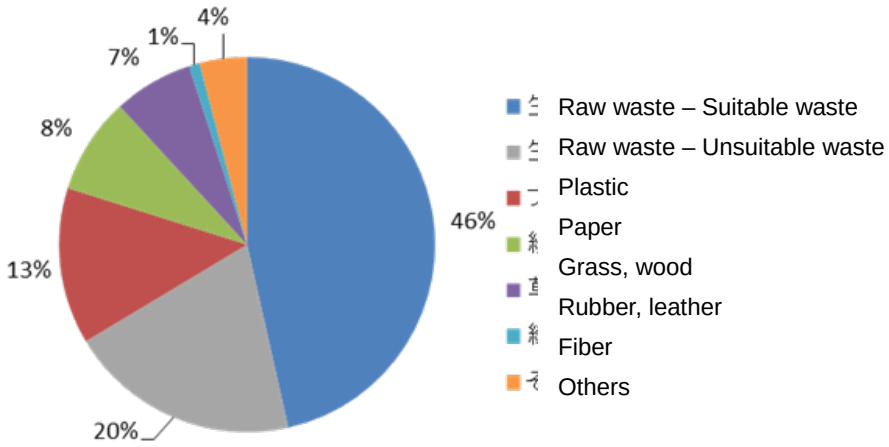


Figure 2.1. (3)　Estimated Household Waste Composition on Cat Ba Island

(9) Survey of residents’ level of awareness

・Interviews with a total of 16 persons including 2 community leaders were conducted.

・In summary, many of the interviewees are supportive of a sorting and recycling system even if it requires a little time and effort to do so. Raw waste was often used as feed for livestock (ducks, dogs, etc.) and pigs.

■Summary of interview survey results

Q: Do you think it is better to sort and recycle waste on Cat Ba Island?

→About 90% of the interviewees think that it is better to sort and recycle waste.

Q: What kind of image do you have of waste sorting?

→No one answered that they “dislike” sorting wasting.

Q: What do you think of the system to charge more for treating waste taken out as general waste and less for waste that has been sorted out properly?

→All interviewees expressed agreement on a system that charges different waste treatment fees for sorted waste and general waste.

Q: Do you want to make Cat Ba Island a beautiful place with no waste?

→All interviewees answered that they want to make Cat Ba Island a beautiful place with no waste.

2.2 Estimation of Project Scale

The project scale of the bio-gasification project and solid fuel processing project was calculated based on the following assumptions.

■Common assumptions

・No. of tourists visiting Cat Ba Island annually (G): 1.3 million persons

・Lodging capacity of Cat Ba Island (C): 5,800 persons/day, room occupancy rate (K): 45%

・No. of visits to a restaurant (U): 3 times/person per day of stay (assumed)

■Bio-gasification project (*hereinafter targeted at raw waste and sewage sludge that is suitable for bio-gasification)

・Weight of raw waste generated per person per night of stay in a hotel (F1): 0.4 kg

・Weight of raw waste generated per person per meal in a restaurant (F2): 0.1 kg

・Raw waste collection ratio in a hotel/restaurant (R1): 80%

・Weight of commercial raw waste collected ＝ (F1×C×K+F2×C×K×U+F2× (G/365－C×K))×R1＝1.5t/day…①

・Weight of household waste generated (W1): 0.139g/person/day

・Proportion of raw waste in household waste (N): 46%, household raw waste collection ratio (R2): 80%

・Population of Cat Ba Island (H): 16,850 people

・Weight of household raw waste collected＝W1×N×R2×H＝0.9t/day…②

・Estimated weight of sewage sludge generated by existing facility (S1): 2.4t/day

・Estimated weight of sewage sludge generated by new facility (S2): 0.8t/day

・Collection ratio of sewage sludge (R3): 100%

・Weight of sewage sludge collected ＝ (S1+S2)×R3＝3.2t/day…③

Based on the above, the amount of raw materials targeted in the bio-gasification project is set at ①+②+③＝5.6t/day.

■Solid fuel processing project (*hereinafter targeted at “fuel waste” that is suitable for solid fuel processing)

・Weight of fuel waste generated per person per night of stay in a hotel (P1): 0.29 kg

・Weight of fuel waste generated per person per meal in a restaurant (P2): 0.07 kg

・Suitability ratio of commercial fuel waste (T1): 70%, commercial fuel waste collection ratio (R4): 80%

・Weight of commercial fuel waste collected ＝ (P1×C×K+P2×C×K×U+P2× (G/365－C×K))×T1×R4＝0.77t/day…①

・Weight of household waste generated (W1): 0.139g/person/day

・Proportion of fuel waste in household waste (N): 30%, suitability ratio of household fuel waste (T2): 70%

・Household fuel waste collection ratio (R2): 80%

・Population of Cat Ba Island (H): 16,850 people

・Weight of household fuel waste collected＝W1×N×T2×R2×H＝0.39t/day…②

Based on the above, the amount of raw materials targeted in the solid fuel processing project ＝①+②＝1.2t/day. On the other hand, the demand for solid fuel that can be expected at the present moment shall be taken into consideration and thus the targeted amount of raw materials shall be set as 0.8t/day as a first step.

Chapter 3　Commercialization Plan

3.1　Business Plan and Business Scheme
(including estimated business costs (including funding aid scheme during commercialization) and the cost versus benefits)

(1) Bio-gas project

The business plan for the bio-gas project was studied based on the following assumptions.

・Target raw materials: 5.6t/day (raw waste: 2.4t/day, sewage sludge: 3.2t/day).
・The bio-gasification technology is expected to be a simple technology with an established track record in other Asian countries.
・2 bio-gas usage patterns are studied. One pattern uses the entire volume for power generation (“①Power generation pattern”) and the other pattern compresses the entire volume into CBG (Compressed Bio Gas) for further use (“②CBG pattern”). In ①, excess electrical power after deducting the amount used for self-consumption shall be sold to the power companies. In ②, local gas pipelines shall be laid to sell the CBG to each household.
・All the liquid fertilizer produced shall be used in the surrounding farmlands etc.
・A (fixed) basic outsourcing fee using the environmental conservation charge as a source of funds shall be set as a form of business revenue (*Waste treatment fee will not be estimated for the time being.)
・The proposed flow of goods and funds in the bio-gas project is as shown in Figure 3.1. (1).

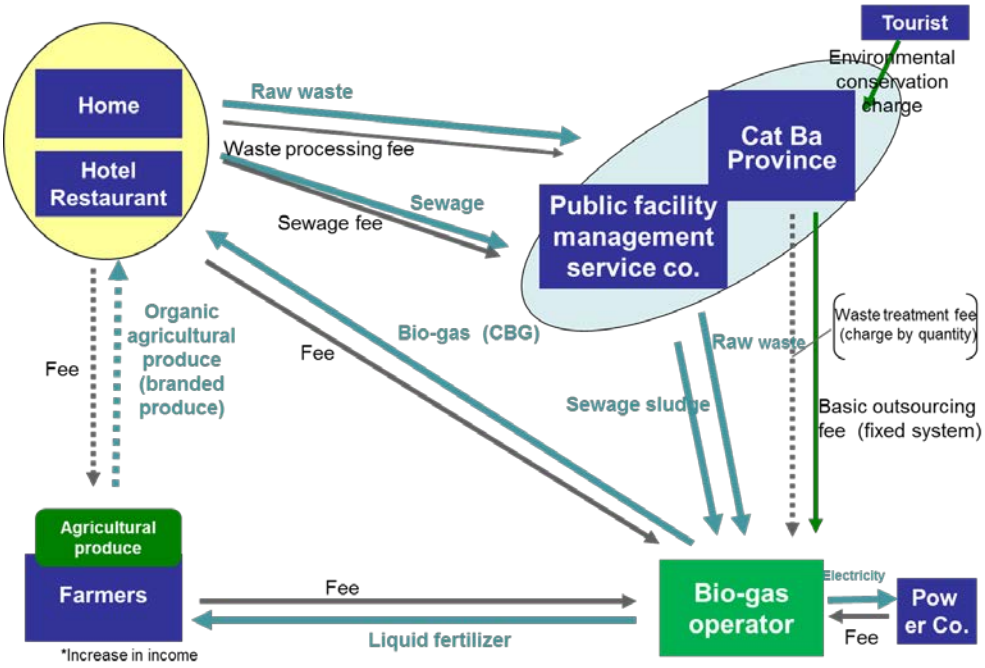


Figure 3.1. (1)　Proposed Flow of Goods & Funds for Bio-Gas Project

The proposed business scheme and funding support scheme for the bio-gas project is as shown in Figure 3.1. (2).

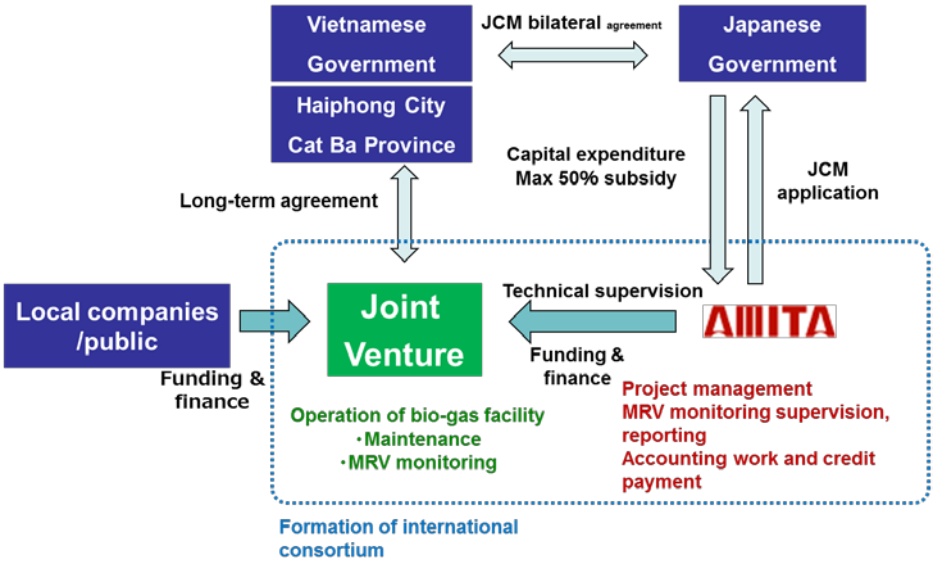


Figure 3.1. (2) Proposed Business Scheme/Funding Support Scheme of Bio-Gas Project

A summary of the business plan outline for the bio-gas project is as shown in Table 3.1. (1).

Table 3.1. (1) Outline of Business Plan for Bio-gas Project

	Power Generation Pattern	CBG Pattern
Amount of waste recycled	5.6t/day (approx. 2,000t/year) (raw waste; 2.4t/day, sewage sludge : 3.2t/day)	Same as on the left
Amount of bio-gas generated	approx. 225 m^3/day (82,000m3/year)	Same as on the left
Amount of power generated	400-500 kWh/day (150,000-180,000kWh/year)	—
Initial cost	90 - 100 mil yen (max 50% JCM subsidy)	110 - 120 mil yen (max 50% JCM subsidy)
Running cost *Figures within parentheses exclude depreciation cost	16 - 18 mil yen/year (11 - 13 mil yen/year)	18 - 20 mil yen/year (12 - 14 mil yen/year)
Investment recovery	5 years *In the case of JCM 50% subsidy	Same as on the left *In the case of JCM 50% subsidy
Basic outsourcing fee with environmental conservation fee*1 as a source of funds (fixed)	Approx. 19 - 21 mil yen/year (20 - 22 yen/person)	approx. 19 - 21 mil yen/year (20 - 22 yen/person)
Electricity sales price	10 yen/kWh	—
CBG sales price	—	110 yen/ kg
GHG reduction	2,000-3,000t-CO2/year (energy origin : 10 - 20t-CO_2/year)	

*1) Collection of waste treatment fee etc. as a source of funds is also possible

Photo 3.1. (1) Bio-gas plant in actual operation in Thailand

Photo 3.1. (2) CBG plant

(2) Solid fuel processing project

The business plan for the solid fuel processing project was studied based on the following assumptions.

・Target raw materials: 0.8t/day (plastic, paper, fiber, trees and plants, etc.).

・The solid fuel processing technology is expected to be Japanese technology with an established track record in Japan.

・All the solid fuel produced shall be sold as an alternative fuel for coal. New boilers need to be installed by users of the solid fuel. In the business plan below, a study was carried for the case in which the solid fuel supplier invests in the boilers. The boiler is expected to be a Japanese (steam) boiler using solid fuel.

・A (fixed) basic outsourcing fee using the environmental conservation charge as a source of funds shall be set as a form of business revenue (*Waste treatment fee will not be estimated for the time being.)

・The proposed flow of goods and funds in the solid fuel processing project is as shown in Figure 3.1. (3)

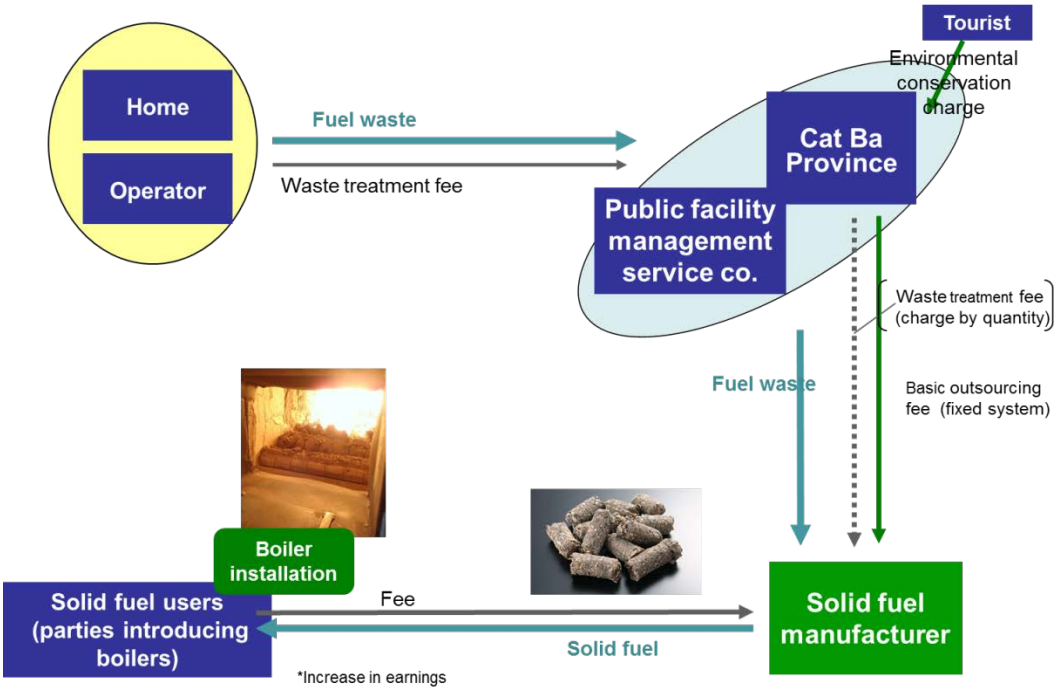


Figure 3.1. (3) Proposed Flow of Goods & Funds for Solid Fuel Processing Project

The proposed business scheme and funding support scheme for the solid fuel processing project is as shown in Figure 3.1. (4)

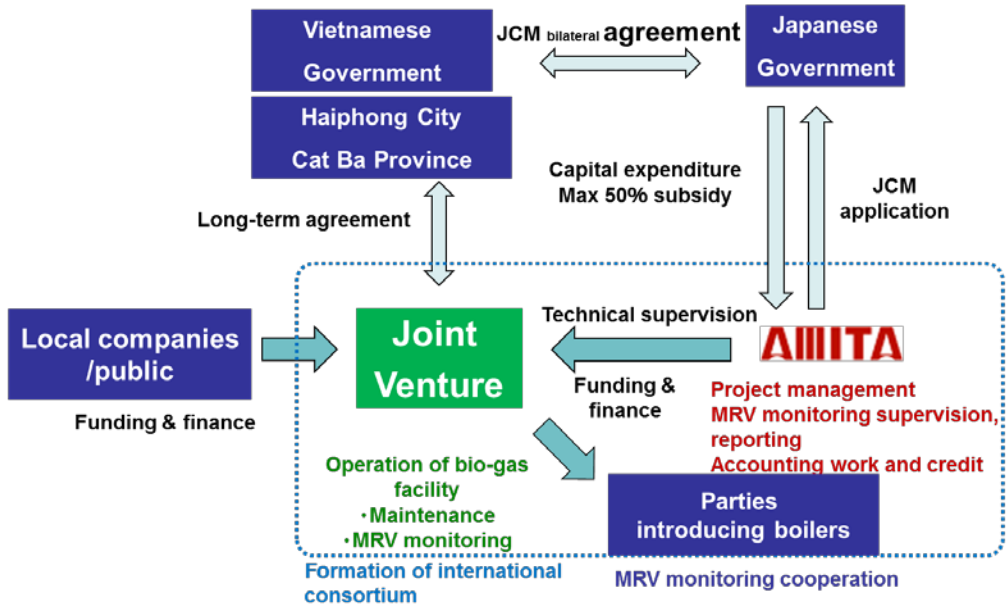


Figure 3.1. (4) Proposed Business Scheme/Funding Support Scheme of Solid Fuel Processing Project

A summary of the business plan outline for the solid fuel processing project is as shown in solid fuel processing Table 3.1. (2).

Table 3.1. (2) Outline of Business Plan for Solid Fuel Project

Amount of waste recycled	0.8t/day (approx. 300t/year) - plastics, paper, fiber, plants, etc.
Amount of solid fuel generated	0.8t/day (approx. 300t/year)
Amount of power generated	6,500 - 7,500GJ/year
Initial cost (production of solid fuel)	55 - 60 mil yen (max 50% JCM subsidy)
Initial cost (use of solid fuel)	30 - 35 mil yen (max 50% JCM subsidy) *Borne by supplying party (some patterns require the user to bear the cost)
Running cost *Figures within parentheses exclude depreciation cost	15 - 16 mil yen/year (9 - 10 mil yen/year)
Investment recovery	5 years *In the case of JCM 50% subsidy
Basic outsourcing fee with environmental conservation fee*1 as a source of funds (fixed)	Approx. 14 - 15 mil yen/year (15 - 16 yen/person)
Solid fuel sales price	15,000 - 16,000 yen/t
GHG reduction	350 - 400t-CO2/year (energy origin: 40 - 60t-CO2/year)

*1) Collection of waste treatment fee etc. as a source of funds is also possible

Photo 3.1. (3) Solid fuel production equipment (Example)

Photo 3.1. (4) Steam boiler (Example)

3.2 Methodology of Measuring Greenhouse Gas Emissions, Monitoring, Emission Reduction Possibility

(1) Methodology and monitoring

The methodology for measuring greenhouse gas emissions and so on are summarized as shown below.

① Bio-gasification project

■Methodology targets

This methodology shall be targeted at emission reduction activities to replace system power and fossil fuels used in the past. It uses bio-gas (methane gas produced by anerobic fermentation) in private, co-generation facilities (hereinafter known as target facilities) that are going to be newly installed.

■Calculation of reference emissions

$$RE_y = RE_{CH4,SWDS,y} + RE_{electricity,\ y} + RE_{heat,\ y}$$

Symbol	Definition	Unit
RE_y	Reference CO2 emissions in y-year	tCO2/year
$RE_{CH4,SWDS,y}$	Reference CH4 emissions converted to CO2 emissions that are discharged from the waste treatment venue in y-year	tCO2/year
$RE_{electricity,\ y}$	Expected CO2 emissions if the power generated by the target facility (co-generation) after project implementation is obtained from system power instead in y-year	tCO2/year
$RE_{heat,\ y}$	Expected CO2 emissions if the calorific value generated by the target facility (co-generation) after project implementation is obtained by using fossil fuels at a facility in a reference scenario (standard facility) instead	tCO2/year

■ Calculation of project emissions

$$PE_y = PE_{y,\ M} + PE_{y,\ transport,\ feedstock} + PE_{y,\ process,\ biogas} + PE_{y,\ transport,\ biogas} + PE_{y,\ treat}$$

Symbol	Definition	Unit
PE_y	Post-project implementation emissions in y-year	tCO2e/year
$PE_{y,\ M}$	Post-project implementation emissions accompanying the use of the subject facility (co-generation) in y-year	tCO2/year

$PE_{y, process, biogas}$	Post-project implementation emissions by the bio-gasification treatment facility in y-year	tCO2/year
$PE_{y, transport, feedstock}$	Post-project implementation emissions due to the use of fossil fuels accompanying the transport of bio-mass raw materials in y-year	tCO2/year
$PE_{y, transport, biogas}$	Post-project implementation emissions due to the use of fossil fuels accompanying the transport of bio-mass in y-year	tCO2/year
$PE_{y, treat}$	Post-project implementation emissions by the post-treatment facility for post- fermentation residue in y-year	tCO2e/year

②Solid fuel processing project

■Methodology targets

This methodology shall be targeted at emission reduction activities to replace fossil fuels used in the past. It uses refuse derive fuel (RPF) that employs paper, plastic, etc, as its raw materials to produce heat sources in thermal facilities (hereafter known as target facilities) that are going to be newly installed.

■Calculation of the reference emissions

$$RE_y = RE_{CH4,SWDS,y} + RE_{M\_RPF, y}$$

Symbol	Definition	Unit
RE_y	Reference CO2 emissions in y-year	tCO2/year
$RE_{CH4,SWDS,y}$	Reference emissions discharged from a waste treatment plant in y-year	tCO2/year
$RE_{M\_RPF, y}$	Expected CO2 emissions if the calorific value generated by the thermal facility after project implementation is obtained from a baseline thermal facility in y-year instead	tCO2/year

■ Calculation of project emissions

$$PE_y = PE_{y, M, boiler} + PE_{y, transport, waste} + PE_{y, process, RPF} + PE_{y, transport, RPF} + PE_{y, M, aircon} + PE_{y, CFC, leak} + PE_{CFC, aircon}$$

Symbol	Definition	Unit
PE_y	Post-project implementation emissions in y-year	tCO2e/year
$PE_{y, M, boiler}$	Emissions due to the use of refuse derived fuel (RPF) in a target facility (thermal facility) in y-year	tCO2/year

$PE_{y, transport, waste}$	Post-project implementation emissions due to the transport of waste in y-year	tCO2/year
$PE_{y, process, RPF}$	Post-project implementation emissions accompanying the use of facilities to manufacture refuse derived fuel (RPF) in y-year	tCO2/year
$PE_{y, transport, RPF}$	Post-project implementation emissions accompanying the transport of refuse derived fuel (RPF) in y-year	tCO2/year

(2) Emission reduction possibility

Based on the methodology etc. mentioned in (1) above, a summary of the estimated results in the possible reduction of greenhouse gas emissions is given below.

① Bio-gasification project

Greenhouse gas reduction	
Total greenhouse gas reduction	2,619t-CO2/year
Energy-based greenhouse gas reduction	16t-CO2/year

② Solid fuel processing project

Greenhouse gas reduction	
Total greenhouse gas reduction	370t-CO2/year
Energy-based greenhouse gas reduction	50t-CO2/year

3.3 Secondary (Co-Benefit) Effect

The co-benefits of the comprehensive resource recycling system for waste are summarized below.

・Reduce land-fill waste

→Reduce landfill cost and extend the life of landfills = Reduce the risk involved in securing new landfills

→Contribute to conservation of the natural environment and registration as a world natural heritage site

・Create locally-produced energy

→Contribute towards energy self-sufficiency

・Create environmental business (bio-gas project, solid fuel processing project)

→Create regional employment and build up the local economy

・Improve value as an eco-island

→Improve the branding power of the island and stimulate the tourism industry and economy

・Create low-cost, organic fertilizers

→Supply organic agricultural produce to hotels etc.

→Increase value-add of agricultural produce to increase the income of farmers

3.4 Measures required to promote commercialization (issues, requests, etc.)

The key measures required to promote commercialization (issues, requests, etc.) are summarized below.

■Secure project funding

・Total funding of about 28-33 mil yen a year needs to be secured for the bio-gas project and solid fuel processing project. The collection of an environment conservation charge has been proposed as one of the concrete measures to raise this money.

■Conclude a long-term (10 years or longer) public-private cooperation agreement with the lead project implementation body (Japan-Vietnam joint venture)

・Since the investment recovery period is 5 years (*with a 50% JCM subsidy), a business continuity of 10 or more years needs to be guaranteed (by the public-private cooperation agreement) to the lead project implementation body.

■ Promotion and systemization of effective waste sorting measures

・Start with waste sorting measures by all residents and operators etc. It is necessary to promote and systemize measures to incentivize and make it easy for residents etc. to accept the measures.

・As specific examples, measures such as “escalating waste treatment charges to be borne by the residents[1)]” and the “prohibition of waste dumping and regular collection[2)]” are probably going to be effective as well.

■ Securing project partners

・It is necessary to secure a business partner which will take on the role of the lead project implementation body (Japan-Vietnam joint venture) for the respective bio-gas project and solid fuel processing project.

*1 … A system that charges a low processing fee for properly sorted waste and a high fee for all other waste.

*2 … A system in which waste collection vehicles come at a fixed time and place and waste is taken out at certain time periods.

3.5 Summary and Future Plans

The “Comprehensive Resource Recycling System for Waste” proposed by AISE has been discussed with the people’s committees of Haiphong city and Cat Hai Province over several meetings.

As a result, the people’s committees of Haiphong city and Cat Hai Province maintain a very positive outlook on the introduction of a ”Comprehensive Resource Recycling System for Waste” and wish to continue with the study and survey to realize such a system. Regarding the issues highlighted in the preceding section, e.g. the systemization of an environmental conservation charge to secure the necessary funding, these are already being planned and promoted and a decision is due to be reached in several months’ time. They have also opined that a new waste sorting system can be implemented without any problems. As for the potential business partners, several local companies have expressed their interest in participating in the projects.

Based on the above, AISE intends to continue the study and survey to realize a ”Comprehensive Resource Recycling System for Waste” together with Haiphong city, Cat Hai Province, and other relevant parties, so as to achieved both economic development and the conservation of a beautiful environment on Cat Ba Island.

Lastly, the future plans are summarized in Table 3.5. (1).

Table 3.5. (1) Future Plans

FY	Implementation Theme	Implementation Points	Funding Support Measures
FY2015	Detailed F/S (verification test, detailed business plan)	・Check quantity/quality of waste through sorting verification tests ・Detailed study of business plan, examine business feasibility ・Design of necessary system and policies etc. ・Check precise intent of Haiphong city (Cat Hai Province) (structure, funding, organization, etc.) and counterparts (structure, funding, etc.)	Ministry of Environment JCM (F/S) project etc.
FY2016	P/S (design, quotation, consensus building, fundraising)	・Design, quotation ・Conclude agreement with Haiphong city (Cat Hai Province) regarding decision-making, council decision, etc. ・Conclude contract with counterpart	Ministry of Environment JCM (P/S) project etc.
FY2017	EPC, operation (design, procurement, construction, operation)	・Confirmation of development subsidy ・Detailed design, procurement, construction ・Start of operations, MRV	Ministry of Environment JCM development project, JICA cooperation fund, Ministry of Foreign Affairs non-compensated project etc.