FY2015

Project to Support the Formation of JCM Programs
to Realize Low-Carbon Societies in Asia

Report on
Programme for the Establishment
of Low-Carbon Historic City in Vientiane
based on City-to-City Cooperation
between Vientiane Capital and Kyoto City

March 2016

Global Environment Centre Foundation

(GEC)

Ⅰ. Summery

1. Overview of the Task

1.1 Purpose of the task

The purpose of the task is to build a low-carbon city, preserve and amalgamate cultural and historical assets, and establish a scheme for operating, maintaining, and managing them through the utilisation of the Joint Crediting Mechanism (JCM) by comprehensively offering to Vientiane Capital City, the capital of Lao PDR, the experience in regulations, ordinaces, and plans of Kyoto City and their implementation and environmental technology accumulated in the process of developing as a historical eco-city, and to introduce a model of sustainable development for many historical cities scattered throughout other countries in Asia.

1.2 Contents of the task

The contents of the task of this project are shown below.

(1) General plan for studies

(2) Implementation of studies

1) Formulation of urban development and environmental policies relating to the building of a low-carbon historic city

2) JCM Feasibility study (FS)

"Project for the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory"

"Project for the generation and use of biogas from sorted organic waste"

(3) Promotion of City-to-City collaboration and Public–Private cooperation

(4) Holding of local workshops, etc.

(5) Public relations activities

(6) Reporting the output of this city to city cooperation project

Progress briefing in Japan

Working group in Japan before local workshops, etc.

Conferences designated by the Ministry of the Environment

1.3 Flow of the task

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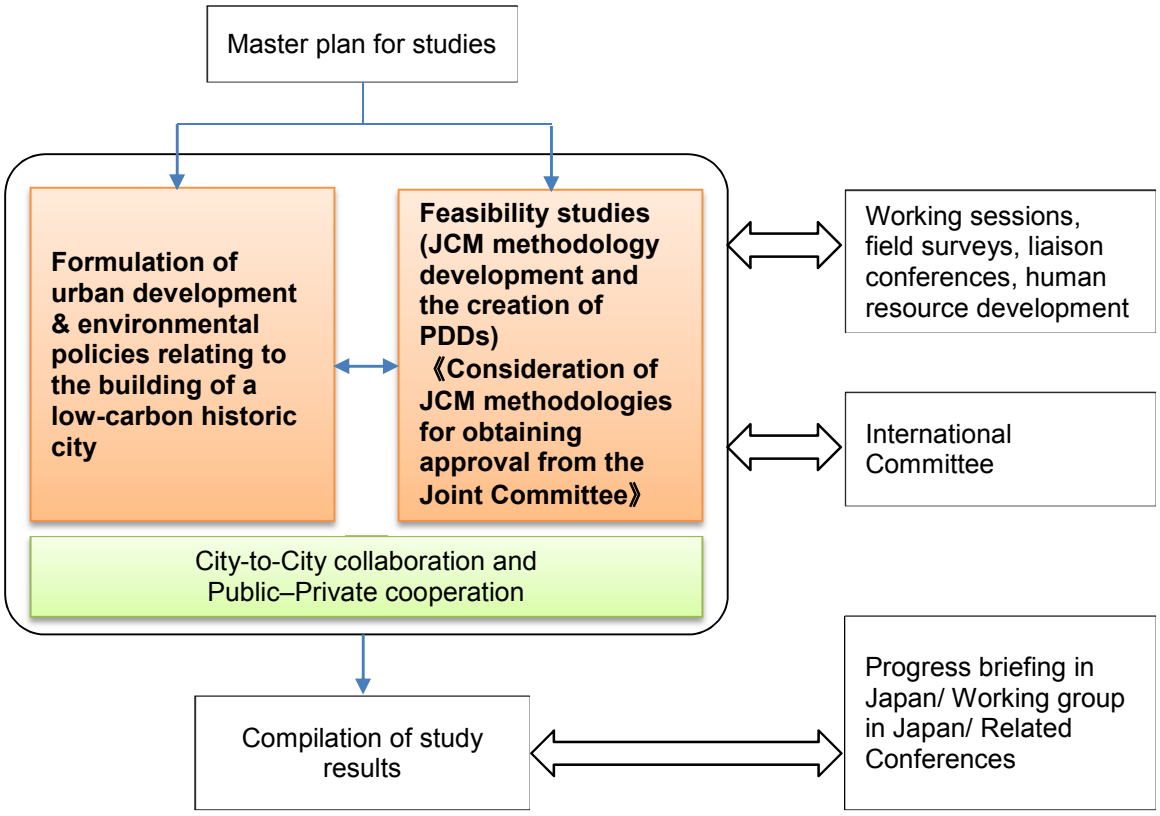

Figure: Flow of the task

1.4 Organisation for promoting the project

The organisation for promoting the project is shown below.

1) Vientiane, which is the capital city of Laos, Kyoto City, and GEC

Kyoto City is the one of the most famous historical and environmental model city in the world which implementing advanced, original and practical activities for sustainable development. Moreover, Kyoto City where the third Session of the Conference of the Parties (COP3) was held (December 1997) has implemented advanced and comprehensive efforts to address global warming with city-level, for example setting up the Global Environment Policy Office in the Environment Bureau to focus on studies, research, planning, coordination, and promotion of countermeasures against global warming. Vientiane, the capital of Laos, does not yet have a division dedicated to countermeasures against global warming, but we will advise the city on the need to establish such a division through this project. The Global Environment Centre Foundation (GEC), which serves as the secretariat of an international committee, secured coordination between the two cities as the secretariat for the whole project, and also organised the entire project, such as hosting international committee meetings, etc., coordinating among Japan-side related institutions including Kyoto City, envisaging the needs in Vientiane, managing the progress of feasibility studies, and supporting the development of JCM methodology, PDD, etc.

2) International workshop for collaboration

Consisting of Vientiane Capital, Kyoto City, FS vendors, experts, etc. and the secretariat (GEC), the international committee reviewed studies for the building of a low-carbon historical city and JCM project feasibility studies based on experience and findings obtained from the formulation and implementation of the "Kyoto City Program of Global Warming Countermeasure" by Kyoto City, as well as the knowledge of private companies.

3) Working group and progress briefing for collaboration in Japan

The working group and the progress briefing for collaboration held in Japan before an international committee meeting, etc. were organised by Kyoto City, FS vendors, experts, etc. and the secretariat (GEC), promoted collaboration among parties concerned by sharing information on studies for building a low-carbon society and project feasibility studies, and examining the contents and results of those studies, furthered shared information with private enterprises in Vientiane Capital which had an interest in the JCM project, and assisted the participation of more private enterprises and the implementation of the project.

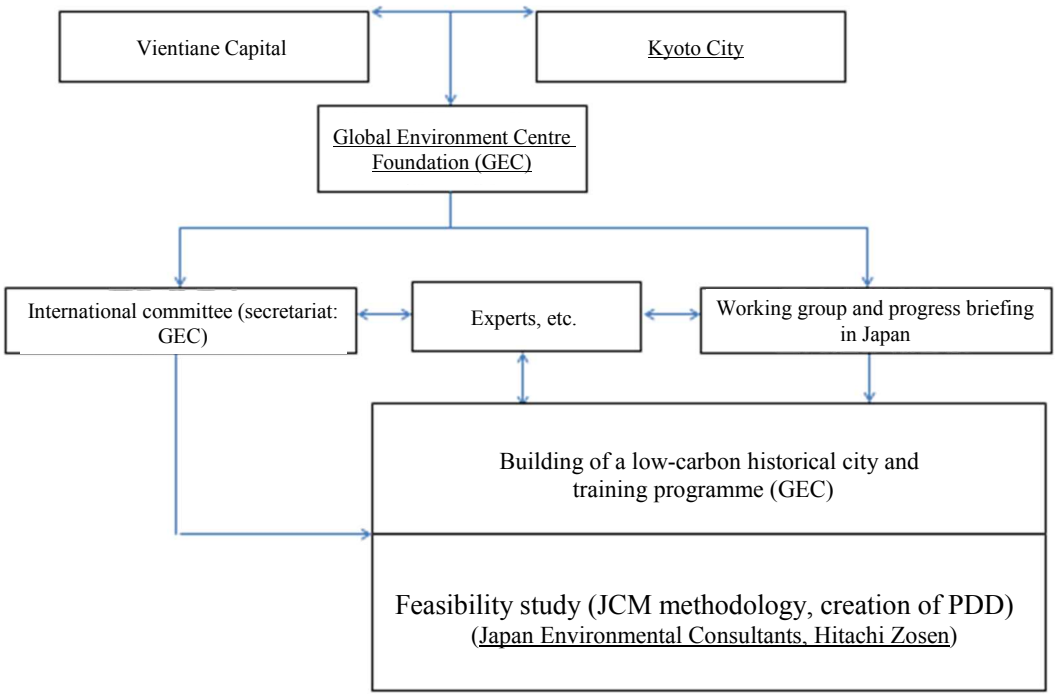

Figure: Organisation for promoting the project

2. Formulation of Urban Development and Environmental Policies relating to the Building of a Low-carbon Historical City

To promote medium- and long-term countermeasures against climate change, such as the cultivation of large-scale JCM projects to enable Vientiane Capital to build a low-carbon historical city and the expansion of these projects across the whole city, we assisted Vientiane Capital in drawing up urban development and environmental policies relating to the building of a low-carbon historical city by utilising the experience of Kyoto City in environmental policies related to countermeasures against global warming.

Based on the collaboration between Vientiane Capital and Kyoto City established in a FY2014 project "JCM Feasibility Study of GHG Mitigation Project Contributing to Low Carbon Historic City based on City-to-City Cooperation between Vientiane and Kyoto", we conducted studies for the building of a low-carbon historical city by Vientiane Capital and identified the need for creating a low-carbon historical city and sustainable development by Vientiane Capital. Concurrently, with the aim of carrying out JCM projects broadly as a package, we helped Vientiane Capital to establish a practical scheme for transferring Kyoto City's experience, knowledge, know-how, technology, and systems concerning urban development, including countermeasures against global warming, and formulate plans and policies.

We also provided Vientiane's administrative officers, etc. with information about Kyoto City's administrative organisation, systems and environmental technology, such as the superiority of Japanese technology, and helped them to develop potential ability and human resources. In FY2015, we held a technology seminar on "waste separation" which is part of technical cooperation for grassroots supported by Japan International Cooperation Agency (JICA) related to the fundamental action plan for the building of a low-carbon historical city/for waste the JCM feasibility study (FS) "Project for the production of biogas from organic waste and its use." When providing information about technology, we clarified what information was actually required by accurately grasping the needs of the partner country through field studies.

2.1 to 2.6 Implementation of field studies

With the aim of establishing a scheme for operation, maintenance, and management for the building of a low-carbon historical city in Vientiane Capital, we conducted field studies with the schedule below for the purposes of consulting and coordinating with Vientiane Capital's personnel about the basic plan for the building of a low-carbon historical city, the "MOU concerning cooperation in the field of the environment" contributing to the strengthening of the partnership between the two cities, etc. and of visiting Vientiane Capital.

Table: Overview of field studies conducted

Name of field study	Period	Main counterpart
1st field study (FY2015 Kick-off Meeting)	2nd(Tuesday) – 6th(Saturday) June, 2015	DONRE, VUDAA, MONRE
2nd field study	13th(Monday) – 16th(Thursday) July, 2015	DONRE, VUDAA, Hotels and restaurants (FS site)
3rd field study	30th(Sunday) – 5th(Saturday)	DONRE

	September, 2015	VUDAA Other related divisions
4th field study	14th(Monday) – 19th(Saturday) December, 2015	DONRE, VUDAA
5th field study (International Workshop)	1th(Monday) – 5th(Friday) February, 2016	DONRE, VUDAA FS local counterpart vendors

* DONRE: Department of Natural Resources and Environment
VUDAA: Vientiane Urban Development Administration Authority
MONRE: Ministry of Natural Resources and Environment

2.7 Supporting the formulation of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital

To build a low-carbon historical city in Vientiane Capital, we conducted field studies, collected and organised existing materials, and held hearings, among others, thereby grasping and organising an overview of the area of Vientiane Capital and needs and considering commitments to the building of a low-carbon historical city, which should be preferentially carried out.

Based on these results, we created elements of the fundamental action plan for the sustainable and low-carbon historic city (draft) in Vientiane Capital. In addition, a rough plan for the action plan for the building of a low-carbon historical city/for waste was presented by the Vientiane side at the international committee meeting (held in February).

2.8 Capacity development for the building of a low-carbon historical city

Capacity development is required to provide training on Kyoto City's administrative organisation, systems and environmental technology, such as the superiority of Japanese technology, to create an organisational structure for the building of a low-carbon historical city by Vientiane Capital and formulate the basic plan for the building of a low-carbon historical city/for waste. Under such circumstances, we held a technology seminar on waste separation for Vientiane's administrative officers.

3. Implementation of JCM project feasibility studies

We implemented feasibility studies on projects 3.1 to 3.4 below, which are expected to be realised early and which are likely to develop into subsequent similar projects.

We also developed JCM methodology, which can be applicable when realising a target project as a JCM project (setting eligibility requirements, identifying and calculating the reference amount of CO2 emissions, calculating the project emissions, establishing monitoring techniques, setting the default values and preset values necessary for the quantitative evaluation and calculation of emission reductions, and creating calculation sheets (Excel spreadsheets)), and created a project plan document (PDD) based on the JCM methodology.

3.1 Project for Reduction of Fossil Fuel Consumption involving Biomass Fuel Conversion at Salt Producing Factory (Japan Environmental Consultants, Ltd.)

(1) Overview of the project

This project is to realise considerable CO2 emission reductions by using a biomass fuel instead of coal fuel that is currently used in the process of evaporating water in the kettle to manufacture salt from the salt water pumped under the ground at a saltery operating in the suburbs of Vientiane Capital, Lao People's Democratic Republic (referred to as "Laos" in the remainder of this document). As biomass fuel, the chaff unused and disposed of at a rice mill in Vientiane Capital, Laos will be processed with Japans' briquette (compaction) technology and supplied as a substitute for coal.

(2) Target projects

Target projects are to (1) make effective use of chaff discharged from the rice mill to manufacture "Rice Husk Briquette" (referred to as "RHB" in the remainder of this document) and (2) use "RHB" produced as described in (1) above as a substitute for coal in salt production. In addition, if possible, consider increasing the efficiency of existing furnaces.

(3) Study results

If the 2,400 tonnes of coal used at the saltery are replaced with chaff briquettes, the CO2 emission reduction is expected to be 2,584 tCO2/year.

3.2 Project for Generation and Use of Biogas from Sorted Organic Waste (Hitachi Zosen Corporation)

(1) Overview of the project

The project is to promote the creation of a proper waste management system through collaboration between Vientiane Capital and Kyoto City and, at the same time, generate methane gas from organic waste in a fermenter as a measure to make effective use of separated organic waste. Methane gas (biogas) thus generated will be supplied as gas fuel for kitchens in hotels and restaurants, among others, and substitute the LPG (liquefied petroleum gas) used there, thereby reducing the CO2 emissions generated from fossil fuel.

(2) Target project

The target project is to subject 12 tonnes of the organic waste currently transported directly from hotels, restaurants, and so on to landfill to methane fermentation in a food waste methane fermentation system (WTM system), thereby collecting about 960 m3 of biogas per day and using it as gas for kitchens in a nearby hotel (Best Western Vientiane Hotel) and restaurants. In addition, the fermentation residue after fermentation will be reused as liquid organic fertilizer (liquid fertilizer) in farmland and elsewhere. By using the organic waste, which is currently subject to landfill disposal, it is possible to contribute to the reduction in environmental load, avoiding the generation of methane gas associated with the landfill and decomposition of the organic waste, prolonging the life of landfill sites, and reducing the water seeping from landfill.

(3) Study results

If a methane fermentation facility with at least a capacity of five tonnes per day is introduced, the CO2 emissions reduction due to the avoidance of methane from kitchen garbage and the substitution of LPG is expected to be up to 1,901 tCO2/year.

4. Promotion of intercity collaboration and government–private sector collaboration

Through the studies on the building of a low-carbon historical city by Vientiane Capital, we endeavoured to identify the requirements for realising a low-carbon historical city and sustainable development by Vientiane Capital. To promote the transfer of Kyoto City's experience, knowledge, know-how, technology, and systems relating to urban development, we considered establishing a basic system in Vientiane Capital. We sought the participation of additional private companies in JCM projects and new JCM projects for subsequent fiscal years by expediting the sharing of information with private companies, etc. having an interest in the implementation of JCM projects in Vientiane Capital.

The signing ceremony of the Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City was held at the Kyoto City Zoo on November 3, 2015. The signed MOU contains matters relating to the project and is therefore expected to help expedite intercity collaboration and government–private sector collaboration.

5. Holding of local workshop

5.1 FY2015 Kick-off meeting (June 2015)

We held a kick-off meeting with DONRE and VUDAA to share information and exchange views on projects, policy, and schedule of FY2015.

We explained a general overview of the project to Mr. Bounhom, director of DONRE, reported the results of the events of FY2014, and confirmed the matters agreed upon (Co-chairs' Summary: February).

Following an explanation and confirmation of the project policy and plan for FY2015, we exchanged views about two specific objectives set by the Japanese delegation: (1) the formulation of a the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital and (2) a joint action programme between Vientiane Capital and Kyoto City ("Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City" described later (hereinafter referred to as "MOU environmental cooperation") relating to the building of a low-carbon historical city.

Regarding (1), we decided to focus on waste management in FY2015, and confirmed that the working processes would be carried out in the following order: Selection of items (framework) of the fundamental action plan, drafting of the fundamental action plan, and drafting of items relating to waste.

Regarding (2), we also agreed to establish it as a three-year plan ending in 2018, and explained that the plan would deal with waste management like the fundamental action plan of (1). We confirmed the following schedule up to formulation of the specific action programme: Completion of the first draft in August and agreement in November.

DONRE said that it would be necessary to exchange and harmonise views on the abovementioned plans with VUDAA because both of them focused on waste management. DONRE also requested us to confirm the specific steps of drafting. Mr. Phoudone, vice president of VUDAA, stated that verification and coordination of consistency with the national strategy of Laos would be necessary within VUDAA before everything, and confirmed that Vientiane Capital would be committed to drafting and Japan would support it. We explained

to the counterpart's attendants Kyoto City's actual plans, the "Basic Plan for Establishing a Sound Material-Cycle Society" and the "Action Plan for General Waste Treatment" (only the tables of contents were translated into English and provided) as reference materials for drafting.
In addition, we presented the Grass Roots Technical Cooperation Project that Kyoto and GEC applied to JICA for (hereinafter referred to as "JICA Grass Roots Project"). We explained that this project would offer technical assistance for the efficient recovery and separate collection of waste in the centre of Vientiane Capital and the utilisation of separate refuse, and requested smooth cooperation from DONRE and VUDAA if the project was adopted. The counterpart expressed a strong interest in this project.

5.2 International Workshop (February 2016)

We held an international committee in Vientiane Capital on Thursday, February 4, 2016 for the building of a low-carbon historical city by Vientiane Capital. This was intended to report the progress of the formulation of the fundamental action plan for the building of a sustainable low-carbon historical city by Vientiane Capital and the implementation status of the JCM projects, as well as having discussions on promoting transfer of Kyoto City's experience, knowledge, know-how, technology, and systems concerning urban development and training staff members of Vientiane Capital.
Mr. Bounhom, director of DONRE, and Mr. Imai, manager of Environmental General Affairs Section, Kyoto City, addressed the committee as co-chairs, starting with their opening speech. Mr. Bounhom said that he wished to make Vientiane Capital a low-carbon city with cooperation of Kyoto City and utilisation of the JCM. After the secretariat GEC explained the project overview, Japan Environmental Consultants, Ltd. and Hitachi Zosen Corporation showed the implementation status of the JCM projects of FY2015. Then, Ms. Rotchana, chief of Environmental Section, DONRE, introduced the basic idea of the fundamental action plan for the sustainable and low-carbon historic city /for waste by Vientiane Capital. After these announcements, Vientiane Capital and Kyoto City talked over their future partnership for the building of a low-carbon historical city by Vientiane Capital and confirmed that the two cities would continue to cooperate with each other.

6. Public relations activities

To introduce this project and to promote the deepening and expansion of the understanding of JCM, we conducted public relations activities by using opportunities at local workshops, etc.

7. Reporting the output of this city to city cooperation project

7.1 Working Group in Japan before workshops, etc. in Vientiane Capital (May 2015)

A meeting for mutually introducing personnel involved in the study for the project in FY2015 was held, and they shared and discussed information and an overview of the studies for FY2015 and their schedules.
The personnel concerned also shared the latest information for the first field study, confirmed the matters to be discussed with the counterparts of Vientiane Capital, and confirmed the finalised local schedule.

7.2 Attendance and reporting at the progress briefing sessions in Japan

We attended the inception meeting held at the Ministry of the Environment (May 12, 2015), the 2nd work progress briefing session (August 2015), the 3rd work progress briefing session (December 2015), and the final briefing session (February 2016), and reported on the progress of the project.

7.3 Presentations at conferences designated by the Ministry of the Environment

COP21 (December 2015)

At the 21st United Nations Climate Change Conference (COP21) (November 30 to December 13), held in Paris, France, Kyoto City made presentations about the environmental policies implemented by the City and efforts to international cooperation in side events such as Japan Pavilion, established by the Japanese government, and ICLEI, which is an international association of local governments in the area of global environment issues. As an example, this project was presented. Also introduced in the events were some of the environmental policies characteristics of Kyoto City, the birthplace of the Kyoto Protocol, such as the "project of producing biodiesel using tempura oil," which Kyoto City is promoting jointly with citizens, and the "DO YOU KYOTO?" promotion project.

7.4 Presentations at related conferences

ADB JCM workshop (February 2016)

The "A Workshop on the Joint Crediting Mechanism - Promoting Bilateral Mechanisms in Asia and the Pacific -," hosted by the Asian Development Bank (ADB), was held on February 2nd and 3rd in Vientiane Capital, where GEC and Hitachi Zosen Corporation, made a presentation about this project. The main results of the workshop are as described below.

Ⅱ. Main Text of the Report

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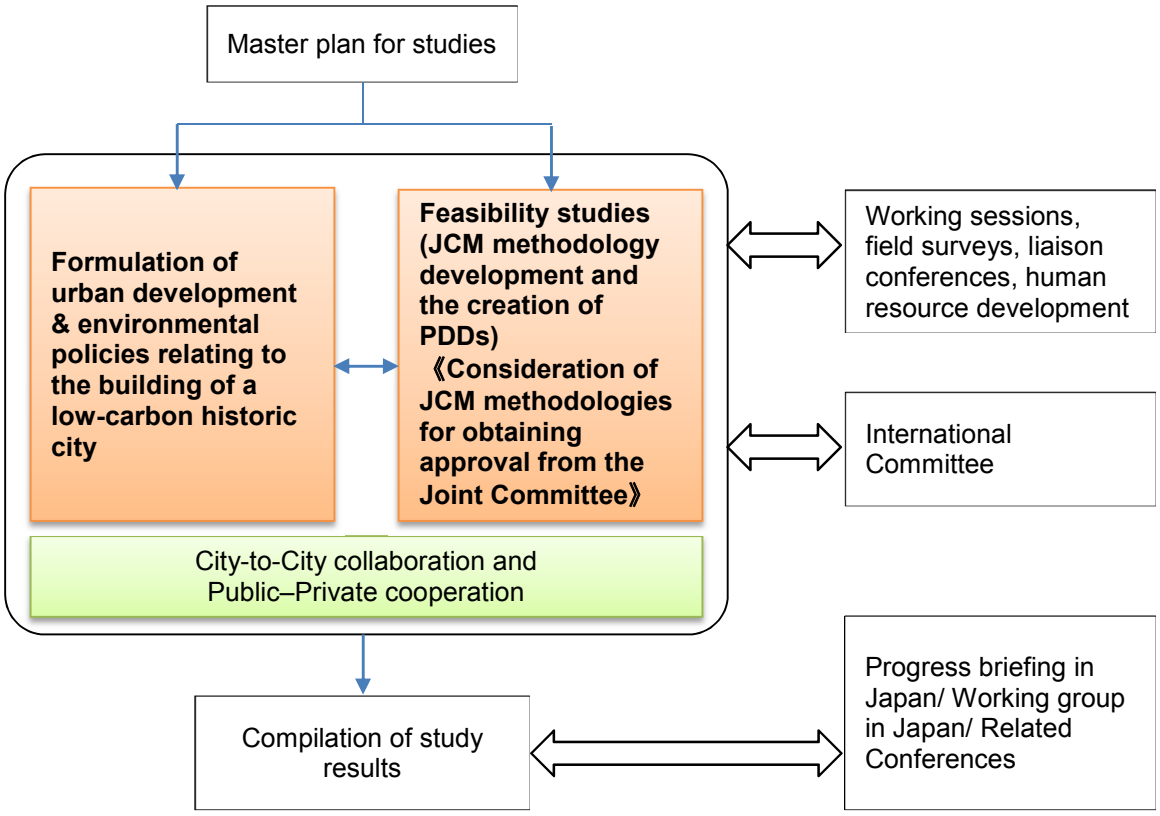

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2) International workshop for collaboration

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3) Working group and progress briefing for collaboration in Japan

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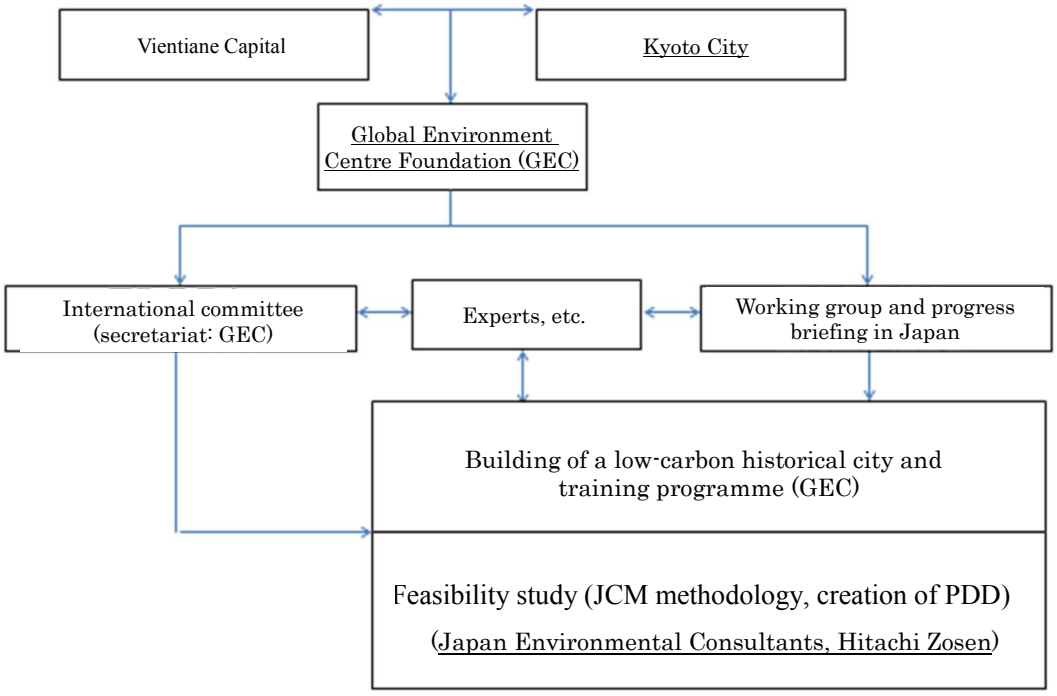

Figure: Organisation for promoting the project

2. Formulation of Urban Development and Environmental Policies relating to the Building of a Low-carbon Historical City

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We also provided Vientiane's administrative officers, etc. with information about Kyoto City's administrative organisation, systems and environmental technology, such as the superiority of Japanese technology, and helped them to develop potential ability and human resources. In FY2015, we held a technology seminar on "waste separation" which is part of technical cooperation for grassroots supported by Japan International Cooperation (JICA) related to the fundamental action plan for the building of a low-carbon historical city/for waste the JCM feasibility study (FS) "Project for the production of biogas from organic waste and its use." When providing information about technology, we clarified what information was actually required by accurately grasping the needs of the partner country through field studies.

2.1 Implementation of field studies

We conducted the field studies listed below for consulting and coordinating with the local counterpart and for visiting Vientiane Capital to draw up urban development and environmental policies relating to the building of a low-carbon historical city.

Table: Overview of field studies conducted

Name of field study	Period	Main counterpart
1st field study (FY2015 Kick-off Meeting)	2nd(Tuesday) – 6th(Saturday) June, 2015	DONRE, VUDAA, MONRE
2nd field study	13th(Monday) – 16th(Thursday) July, 2015	DONRE, VUDAA, Hotels and restaurants (FS site)
3rd field study	30th(Sunday) – 5th(Saturday) September, 2015	DONRE, VUDAA Vientiane Bureau of Foreign Affairs Vientiane Bureau of Education and Sports
4th field study	14th(Monday) – 19th(Saturday) December,	DONRE, VUDAA

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5th field study (International Workshop)	1th(Monday) – 5th(Friday) February, 2016	DONRE, VUDAA FS local counterpart vendors

* DONRE: Department of Natural Resources and Environment
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2.2 First field study

We visited Vientiane Capital from Tuesday, June 2 to Saturday, June 6, 2015 to coordinate the commencement of field studies in 2015 with Vientiane Capital's personnel, and to visit the facilities to be covered by the field studies.

(1) FY2015 Kick-off meeting

[Date and time] Wednesday, June 3, 9:10–11:30

[Place] Office of the Vientiane Urban Development Administration Authority

[Attendants of local counterpart] DONRE, VUDAA

[Attendants of Japan] Kyoto City, Hitachi Zosen Corporation, GEC

[Description]

We held a kick-off meeting with DONRE and VUDAA to share information and exchange views on projects, policy, and schedule of FY2015.

We explained a general overview of the project to the director of DONRE, reported the results of the events of FY2014, and confirmed the matters agreed upon (Co-chairs' Summary: February).

Following an explanation and confirmation of the project policy and plan for FY2015, we exchanged views about two specific objectives set by the Japanese delegation: (1) the formulation of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital and (2) a joint action programme between Vientiane Capital and Kyoto City ("Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City" described later (hereinafter referred to as "MOU environmental cooperation") relating to the building of a low-carbon historical city.

Regarding (1), we decided to focus on waste management in FY2015, and confirmed that the working processes would be carried out in the following order: Selection of items (framework) of the fundamental action plan, drafting of the a fundamental action plan, and drafting of items relating to waste.

Regarding (2), we also agreed to establish it as a three-year plan ending in 2018, and explained that the plan would deal with waste management like the fundamental action plan of (1). We confirmed the following schedule up to formulation of the specific action programme: Completion of the first draft in August and agreement in November.

DONRE said that it would be necessary to exchange and harmonise views on the abovementioned plans with VUDAA because both of them focused on waste management. DONRE also requested us to confirm the

specific steps of drafting. Vice president of VUDAA, stated that verification and coordination of consistency with the national strategy of Laos would be necessary within VUDAA before everything, and confirmed that Vientiane Capital would be committed to drafting and Japan would support it. We explained to the counterpart's attendants Kyoto City's actual plans, the "Basic Plan for Establishing a Sound Material-Cycle Society" and the "Action Plan for General Waste Treatment" (only the tables of contents were translated into English and provided) as reference materials for drafting.

In addition, we presented the Grass Roots Technical Cooperation Project that Kyoto and GEC applied to JICA for (hereinafter referred to as "JICA Grass Roots Project"). We explained that this project would offer technical assistance for the efficient recovery and separate collection of waste in the centre of Vientiane Capital and the utilisation of separate refuse, and requested smooth cooperation from DONRE and VUDAA if the project was adopted. The counterpart expressed a strong interest in this project.

(2) Meeting with MONRE

[Attendants of local counterpart] MONRE

[Description]

We reported the results of the JCM project in FY2014, explained an overview of the action plan for FY2015, and reconfirmed the role of MONRE in the project.

Regarding the action plan for FY2015, we explained (1) the formulation of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital and (2) the two FS projects, and reported (3) the feasibility of the JICA Grass Roots Technical Cooperation Project currently in the process of application. We explained that the fundamental action plan of (1) would focus on waste management, and that the two FS projects of (2) were an alternative fossil fuel project and the introduction of a biogas production facility utilising organic waste.

We were asked about the compatibility of the utilisation of chaff with the JCM project which Taiheiyo Enginieering Corporation is conducting in the Vang Vieng area. We answered that the utilisation of chaff would be unlikely to conflict with the JCM project because there is a large amount of chaff available in Laos, and the amount of chaff estimated to be consumed by the FS project and the site where it would be used would not coincide. This explanation was understood by MONRE.

We confirmed that in FY2015, we were expecting MONRE to offer advice on the formulation of the fundamental action plan to be carried out by Vientiane Capital and to participate in the committee to be organised in Vientiane Capital to carry out the project. Regarding a concern about the relationship between the committee and a national-level committee (JC), we firmly explained that the committee would be established with a different purpose to avoid confusion between the two committees, and acquired the understanding of MONRE.

(3) Meeting with the Laos Hotel and Restaurant Association (LHRA)

[Attendants of local counterpart] LHRA, Luang Paseuth Construction Sole Co., Ltd. (LCC))

[Description]

The meeting was held with the participation of Mr. B (LCC), who was introduced by Mr.A (LHRA) and the

president of a construction company and who took a strong interest in the construction of the facility in the area. We confirmed an overview of the project, particularly the details of introducing biogas production technology. We also explained the project plan and objectives for FY2015 to achieve an early launch of the project. Mr. B owns a (candidate) construction site for the facility, and his construction company is participating in the small-scale hydropower generation project of JICA.

Hitachi Zosen Corporation explained the technological details of the biogas production facility, and we examined and confirmed the specific requirements for installing the facility in Vientiane Capital, and acquired the counterpart's understanding of the necessity to perform an FS to review the requirements. Mr.A, agreed to lend the support of hotels and/or restaurants where possible for the implementation of the FS.

Mr.A also showed a strong interest in the commercialisation of a garbage collection and transportation scheme and the supply of produced gas, both of which are necessary to fulfil the project, and seemed to consider setting up a company for each plan. The Japanese delegation assumed that VUDAA would undertake garbage collection and transportation; this matter will probably need to be discussed in depth with Mr.A and VUDAA.

We confirmed that as an immediate schedule, Hitachi Zosen Corporation, which will run the business, would present to Mr.A a specific request for cooperation in addition to the introduction of restaurants and hotels to be studied. Meanwhile, Mr.A proposed setting up a team in the local counterpart to cooperate with the study and including market garbage in the separate collection of garbage.

(4) Visit to the Japanese Embassy Counsellor

[Attendants of local counterpart] Japanese Embassy Counsellor, JICA's Laos office, person responsible for LPP-E, Kokusai Kogyo Co., Ltd.

[Description]

We paid a visit to the Japanese Embassy in Laos and JICA's Laos office, which have been assisting us since FY2014, to report the results of the project of FY2014 and explained an overview of the project of FY2015.

We explained that we remain committed to building a low-carbon historical city by Vientiane Capital as in FY2014 under the partnership between Vientiane Capital and Kyoto City, and also to strengthening the partnership between the two cities with a focus on waste (efficient collection and transportation of garbage, proper waste management, including 3R, etc.) as Kyoto City's specific support in FY2015. In connection with the JCM project, we reported that two feasibility studies (biogas project, project for using chaff briquettes as an alternative fuel to coal) would be additionally conducted in FY2015 and that a proposal had been made on the JICA Grass Roots Technical Cooperation Project as a scheme in the field of waste (under examination). The Japanese Embassy promised to give us further agreement and cooperation concerning these commitments.

We also reported that the "Project for promoting the diffusion of electric automobiles," which had been carried out as a JCM project feasibility study in FY2014, was proposed to the Ministry of the Environment also in FY2015 but that it was finally rejected because of the small reduction in GHG. The Ministry of the Environment concurrently advised us to consider using the JCM-related fund contributed to ADB by the Ministry of the Environment. (Later, we obtained some materials from the Ministry of the Environment and

submitted them to the Japanese Embassy.)

(5) Visit to JICA

[Attendants of local counterpart] JICA

[Description]

We paid a courtesy visit to JICA and confirmed clerical procedures to ensure smooth initial activities, assuming that the currently proposed JICA Grass Roots Technical Cooperation Project would be adopted. JICA said that a memorandum of understanding between the counterpart of Vientiane Capital (director of DONRE, etc.) and the mayor of Kyoto City would be necessary, particularly for the commencement of the JICA Grass Roots Technical Cooperation Project.

(6) Visit to a saltery

[Description]

We visited a saltery of Veunkham, which is the site for the JCM project feasibility study "Project for the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory" in FY2015, and Veunkham explained the saltery to us. The key points of the explanation were as follows:

- There are three salt production processes:

1) Process of burning sawdust in an oven → Salt for food. Salt is of low quality because ash is included.

2) Process of using briquette coal as fuel in an oven → Salt for food. Salt is of excellent quality because no ash is included.

3) Drying in the sun → For industrial use. Laotians do not like coarse salt. Since salt produced by drying in the sun is raw salt, it is not permitted by law to be used as salt for food. To use such salt for food, iodine must be added to it.

The consumption of coal (briquette coal) is 200 tonnes per month.

- A single oven burns 120 kg of briquette coal to manufacture 200 kg of salt.
- The oven is made of ash and salt and rebuilt every four months.
- Veunkham wishes to acquire cooperation in refining the oven and to improve the efficiency of salt production.
- Although Veunkham also tried ovens made of concrete and brick, the current oven was more efficient.
- The current oven produced salt of six iron plates in a single burning (for 18 hours), whereas the concrete oven produced salt of four iron plates.
- The annual salt production is 500 tonnes for food and 1,000 tonnes for industrial use.
- There are two salteries in Vientiane Capital and seven salteries in Laos.

(7) Meeting with VUDAA

[Attendants of local counterpart] Mr. Khampiane (vice president), Mr. Phoudone (vice president), Mr. Sisouk (vice director), Mr. Sonethavy (director)

[Description]

We explained to VUDAA the details and results of the meeting with DONRE (Mr. Phoudone, vice president,

also attended the meeting) held on Wednesday, June 3. We also explained the activities of the JICA Grass Roots Technical Cooperation Project and studied its needs, assuming that the project would be adopted. We explained that the main purposes of the Project were: (1) to deepen citizens' understanding and knowledge about appropriate treatment and separate collection of waste, (2) to construct an effective and efficient waste collection and transportation system through collaboration between citizens of Vientiane Capital and business operators, and (3) to establish a framework that would ensure effective use of waste; we also explained the details each of these activities. VUDAA promised to actively welcome and cooperate with the project.

In addition, we told VUDAA that the collection of organic waste was the focus of the JCM project feasibility study "biogas project" being conducted by Hitachi Zosen and that we desired the cooperation of VUDAA. In response, VUDAA said that they can cooperate, but it depends on the amount of waste to be transported, the location of transportation, and waste collection and transportation costs.

(8) Summary

As the first field study of the JCM large-scale project feasibility study "Study for assisting in building a low-carbon historical city through collaboration between Vientiane Capital and Kyoto City" in FY2015 to realise a low-carbon society in Asia, which was promoted by the Ministry of the Environment, we consulted with the main local counterparts and cooperating institutions, DONRE, VUDAA, the Japanese Embassy, JICA, and FS vendors, and exchanged views on the policy, issues, etc. of the study of FY2015.

We confirmed that DONRE and VUDAA would continue with reviews, consultations, and coordination with us for: (1) the formulation of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital and (2) the formulation of a joint action programme between Vientiane Capital and Kyoto City relating to the building of a low-carbon historical city. In addition, we requested MONRE, the Japanese Embassy, and JICA to cooperate with us in these activities.

We confirmed that the two JCM project feasibility studies would be carried out in cooperation with the local counterparts to commence the projects in or after FY2016.

We found that the local counterparts (DONRE, VUDA) were very interested in and keenly desired the JICA Grass Roots Technical Cooperation Project although the main subject of the project was intangible assistance for waste management in the centre of Vientiane Capital.

2.3 Second field study

For consultations in Vientiane Capital and on the occasion of the provisional adoption of the JICA Grass Roots Technical Cooperation Project, which is intended to improve the separation, collection, and transportation of waste to contribute to the FS project "Project for the generation and use of biogas from sorted organic waste" conducted by Hitachi Zosen Corporation in the project, we visited Vientiane Capital from Sunday, July 12 to Thursday, July 16, 2015 to report on the provisional adoption of the JICA project to related organisations and to discuss its commencement with them.

(1) Visit to the Japanese Embassy

[Attendants of local counterpart] Japanese Embassy

[Description]

We reported the provisional adoption of the JICA Grass Roots Project and an outlook in FY2015 for the FS project "Project for the generation and use of biogas from sorted organic waste" conducted by Hitachi Zosen Corporation and the policy for expanding the project plan.

We exchanged views and information about organisations which produce large amounts of organic waste, which Hitachi Zosen Corporation considers important to fulfil the project, users of produced biogas, and the local situation of the filling of gas cylinders. We also exchanged views on the effective use of liquid manure produced concurrently with biogas and the situation of local agriculture.

(2) Visit to JICA

[Attendants of local counterpart] JICA

[Description]

We explained the overview of the JICA Grass Roots Project again, assuming that the project would be adopted. We also explained an overview of the JCM project and its relationship with the FS project conducted by Hitachi Zosen Corporation and with the JICA-ASEAN partnership Laos pilot project "Environmental Component" (LPP-E), which is expected to be completed in the coming October.

JICA asked us engineering questions about the biogas plant to be introduced in the FS project conducted by Hitachi Zosen Corporation and questions about the achievements and performance of biogas plants in Japan. Hitachi Zosen provided a supplemental explanation of issues that needed to be resolved for cylinder filling, etc. and the fact that liquid manure to be produced concurrently with biogas would be the key to success of the project.

From our explanation, JICA understood that the JICA Grass Roots Project would be indispensable for the success of the FS project, and we asked JICA for cooperation for an early launch of the Grass Roots Project.

(3) Field study of the FS project "Production of biogas from waste"

[Attendants of local counterpart] Restaurant owners, service managers, etc.

[Description]

For the realisation of the FS project "Project for the generation and use of biogas from sorted organic waste," we visited restaurants from which efficient garbage collection could be expected and conducted a survey to roughly clarify the production and collection of organic waste in Vientiane Capital.

As a preliminary study, we interviewed the owners or service managers of five restaurants with which we had made an appointment, about the production, amount, treatment method, etc. of kitchen garbage.

The results of the interview will be reported as the FS project conducted by Hitachi Zosen Corporation together with details of the in-depth study.

(4) Meeting with DONRE

[Attendants of local counterpart] Mr. Bounhom (director), Ms. Rotchana

[Description]

We reported the provisional adoption of the JICA Grass Roots Project and confirmed and coordinated specific

activities and their execution plan for the commencement of the project. We also reviewed the procedure for coordinating with related divisions, and confirmed that DONRE would serve as the contact with the Vientiane Bureau of Education and Sports, which would be a new related division in the Grass Roots Project concerned, to ensure coordination.

In addition, we defined the relationship with the FS project "Project for the generation and use of biogas from sorted organic waste" which was expected to make progress as a result of the commencement of the Grass Roots Project, and requested DONRE to continue supporting the study.

(5) Meeting with VUDAA

[Attendants of local counterpart] Mr. Khampiane (vice president), Mr. Phoudone (vice president), Mr. Sonethavy (director)

[Description]

We reported the provisional adoption of the JICA Grass Roots Project and confirmed and coordinated specific activities and their execution plan for the commencement of the project. We also reviewed the specific procedure for concluding an MOU between Kyoto City, GEC, and Vientiane Capital, which would be required to complete formalities for commencing the Grass Roots Project. VUDAA thought that Mr. Keopholavanh, vice governor (in charge of the environmental division), was the appropriate person representing Vientiane Capital to sign the MOU. However, VUDAA suggested the possibility that the governor (mayor) would represent Vientiane Capital and sign the MOU if the mayor of Kyoto City would sign it. We confirmed that details would be coordinated by consultation with JICA and Kyoto City.

We reconfirmed that the separate collection of garbage in Vientiane Capital, which is one of the achievements expected from the Grass Roots Project, was an important factor for the success of the joint FS project "Project for the generation and use of biogas from sorted organic waste" between the two cities, and requested VUDAA to continue supporting the study.

(6) Visit to the garbage collection vehicle station (KM7)

[Attendants of local counterpart] Mr. Sonethvy (general manager), Mr. Phounpaseuth

[Description]

We visited a garbage collection vehicle station (workshop) under the control of VUDAA to conduct a feasibility study of the separate collection of garbage in Vientiane Capital, which is an important factor for the early realisation of the FS project "Project for the generation and use of biogas from sorted organic waste."

The workshop mainly maintains and manages garbage collection vehicles, but also seemed to serve partly as a relay station in the transportation of collected garbage to the final disposal site. It was also confirmed that valuable materials, such as PET bottles, were sorted. However, the person in charge said that such sorting operations were activities spontaneously carried out by field workers and were not officially controlled by VUDAA (the person also said that sorted PET bottles were sold by individual workers and they kept the money as income).

(7) Meeting with Japanese-side personnel concerned

[Description]

We had a discussion with personnel concerned, including a surveyor, to conduct a basic study of the properties of local garbage for the realisation of the FS project "Project for the generation and use of biogas from sorted organic waste."

We reconfirmed the overview of the FS project, confirmed details of the specific study, and coordinated the procedure and schedule of the study. To accurately estimate the percentage and total amount of organic waste that is effective for the production of biogas, we reviewed the facilities to be studied (hotels, restaurants), the period of the study, the number of studies, etc. In addition, we confirmed coordination and cooperation with VUDAA, the core garbage collection operator in Vientiane Capital.

We confirmed that we would study the ratio and amount of organic garbage effective for the production of biogas and an overview of the facility to be studied for the time being, such as its scale, and arranged the study for August.

(8) Field study (survey) of the FS project "Project for the generation and use of biogas from sorted organic waste"

[Attendants of local counterpart] Owners, managers, or service managers

[Description]

For the realisation of the FS project "Project for the generation and use of biogas from sorted organic waste," we visited hotels from which efficient garbage collection could be expected and conducted a survey to roughly clarify the production and collection of organic waste in Vientiane Capital.

As a preliminary study, we interviewed the owners or service managers of three hotels with which we had made an appointment, about the production, amount, treatment method, etc. of kitchen garbage.

(9) Wrap-up of the field study

[Description]

The Japanese-side personnel concerned confirmed the activities and results of the field study and discussed future actions to be carried out.

In this meeting, the detailed situation of Vientiane Capital in connection with the FS project "Project for the generation and use of biogas from sorted organic waste" was clarified, the organisation of the Japanese-side study team for future specific study activities was confirmed, and preparations for the study were discussed and coordinated with the local counterpart. The personnel concerned confirmed cooperation with DONRE and VUDAA, the principal C/Ps of Vientiane Capital, and shared information about the hotels and restaurants to be covered by the field study, the results of interviews, and information about the facilities expected to produce a large amount of organic waste, coordination with the Laos Hotel and Restaurant Association, specific study schedules, study approaches, etc.

2.4 Third field study

For consultation with related divisions of Vientiane Capital about the details on the MOU environmental cooperation as a joint action programme between Vientiane Capital and Kyoto City to build a low-carbon

historical city, we visited Vientiane Capital from Sunday, August 30 to Saturday, September 5, 2015. We also had local consultations and documentation required for the commencement of the JICA Grass Roots Project that would contribute to the realisation of the FS project "Project for the generation and use of biogas from sorted organic waste," one of joint action programmes between Vientiane Capital and Kyoto City. This is expected to strengthen the partnership between Vientiane Capital and Kyoto City for establishment of a scheme for operation, maintenance, and management to build a low-carbon historical city by Vientiane.

(1) Meeting with DONRE

[Attendants of local counterpart] Ms. Rotchana, etc.

[Description]

Based on the achievements from FY2014, we told DONRE that Kyoto City was seeking comprehensive environmental cooperation with Vientiane Capital and therefore wished to conclude an MOU between the mayors of the two cities.

We emphasised that we wished to prepare for concluding the MOU in this and the next field studies, so Ms. Ratchana contacted Mr. Thavone, deputy director of the Vientiane Bureau of Foreign Affairs, and arranged an appointment for us for discussions on the following day.

DONRE also said that they would have a meeting with VUDAA on the afternoon of the same day to discuss the MOU concerning the JICA Grass Roots Project, and confirmed that they were involved in this matter as the administrative agency in charge of waste management.

(2) Meeting with MONRE

[Attendants of local counterpart] MONRE

[Description]

We reported the progress of the project from the first field study conducted in June of this year. We reported on the JICA Grass Roots Project with VUDAA and DONRE to realise the efficient recovery of organic waste and support the project of utilising organic waste by Hitachi Zosen, and to contribute to proper waste management in Vientiane Capital.

We also reported the progress of each of the two FS subjects of the project, and explained the adopted PS/FS subjects for JCM projects in other cities of Laos, which had been inquired in the last meeting. We reported that the utilisation of biomass by a cement factory, which had been an FS subject in FY2014, was adopted as a PS subject in FY2015 and was moving toward commercialisation in the near future, and that the stable supply of chaff (biomass) to be mixed with cement was an issue to be addressed.

In addition, we told MONRE that an event for introducing our activities would take place in COP21 to be held in Paris, and requested MONRE to tell their staff members who would participate in COP21 to adjust their schedules to attend or make a presentation at the event. We decided to make final adjustments relating to COP21 based on the results of the ADP (the special working group of UNFCCC negotiations for discussing the framework, etc. in and after 2020) to be held in Bonn, Germany.

(3) Meeting with VUDAA

[Attendants of local counterpart] Mr. Khampiane (vice president), Mr. Sonethavy (Director)
[Description]
We requested VUDAA again to provide cooperation for the success of the "Project for the generation and use of biogas from sorted organic waste" by Hitachi Zosen which is undertaking the FS, and discussed details of the JICA Grass Roots Technical Cooperation Project intended for the separation of waste produced in Vientiane Capital and the realisation of efficient collection and transportation of organic waste, etc. (and the establishment of a system for that purpose), both of which are indispensable for the success of the project.
We agreed that the signing ceremony of the MOU concerning the JICA Grass Roots Project would be held at 16:30 on Friday, September 4, 2015 and Director of Environment Policy Bureau, Kyoto City on behalf of Kyoto City Mayor Kadokawa, and Mr. Keophilavanh, vice governor of Vientiane Capital, would sign the MOU. We confirmed that VUDAA had already arranged a press release and newspapers and TV crews would come to the signing ceremony.

(4) Visit to the Japanese Embassy
[Attendants of local counterpart] Japanese Embassy
[Description]
We reported the progress of the project and the JICA Grass Roots Project. We informed Japanese Embassy that concluding the MOU concerning the JICA Grass Roots Project would take place on the evening of Friday and that it was desirable to conclude the MOU environmental cooperation on the occasion of the visit to Kyoto by the delegation, including the governor of Vientiane Capital.
We confirmed that we would promote the project and conduct other related activities in cooperation with the Japanese Embassy while sharing information.

(5) Meeting with JICA
[Attendants of local counterpart] JICA
[Description]
We exchanged views about the activities of the JICA Grass Roots Technical Cooperation Project, which was intended to contribute to the FS project "Project for the generation and use of biogas from sorted organic waste" by Hitachi Zosen and to achieve proper management and treatment of waste in Vientiane Capital, and about the achievements expected from the project. We concurrently carried out the final confirmation for concluding the MOU between the parties concerned, which is required to conduct the JICA Grass Roots Project.

(6) Meeting with the Vientiane Bureau of Foreign Affairs
[Attendant of local counterpart] Mr. Thavone (deputy director)
[Description]
Kyoto City told Mr. Thavone, deputy director of the Vientiane Bureau of Foreign Affairs, that Kyoto City wished to conclude the MOU concerning the JICA Grass Roots Project between the mayors of Vientiane Capital and Kyoto City on Friday to constantly promote comprehensive environmental cooperation

under the partnership between the two cities developed by the project and to improve expertise and establish a system for proper waste management. Mr. Thavone stated that there was no particular problem with concluding the MOU concerning the JICA Grass Roots Project and the MOU environmental cooperation, and replied that a delegation of about ten personnel, including the governor and deputy governor of Vientiane Capital, would visit Kyoto City in the coming October (mid to late October) and that the Vientiane City Government would make arrangements for concluding the MOU environmental cooperation during the visit.

(7) Meeting with the Vientiane Bureau of Education and Sports

[Attendant of local counterpart] Mr. Bounthanh

[Description]

To realise the FS project "Project for the generation and use of biogas from sorted organic waste" by Hitachi Zosen, organic waste must be separated from waste produced in Vientiane Capital and utilised. At present, waste is not separated in Vientiane Capital, and therefore it is important to disseminate and teach the importance of waste separation in the JICA Grass Roots Project in order to contribute both to the diffusion and development of the project of Hitachi Zosen and to the 3R of waste in Vientiane Capital. Thus, we told Mr. Bounthanh that we wished to provide such information to students in school education as part of the activities for developing and educating citizens in the JICA Grass Roots Project in particular.

We had worked together with Mr. Bounthanh at the request of divisions of Vientiane Capital in past JICA projects and projects conducted by other overseas support organisations. He said that he would be able to respond to a specific request from DONRE without any particular problem also in this project.

(8) Visit to DM Company

[Attendants of local counterpart] DM Company

[Description]

We were contacted a parson who had been a counterpart of the project in FY2014 and wanted to talk with us about a special economic zone development project, and held a meeting in light of the possibility of the contribution of this development project to the future development of a JCM project.

Ms. On said that the special economic zone development project (a Green Industry Zone would also be constructed) was under consideration in Thakhek City, Khammouane Province, about 700 km from Vientiane Capital, and that DM Company had won a concession for land there and wanted her to introduce a Japanese company to participate in the project. We mentioned that a trading company was expected to participate in the development of a special economic zone as a developer and that proper waste and wastewater control within the special economic zone would be a favourable condition for attracting such a company, and advised her to consult with JETRO and other similar organisations.

This special economic zone in Thakhek City is still at the planning stage, and it will probably take a lot of time to develop a JCM project.

(9) Visit to a waste relay station

[Attendants of local counterpart]

[Description]
We visited the construction site of the waste relay station, which is being promoted as a JICA gratis-fund-aid project to improve the efficiency of waste collection and transportation in Vientiane Capital, to check the progress of the construction work and the situation of the site.
In the waste relay station, which is being constructed between Vientiane Capital and the KM32, waste will be reloaded from small vehicles for waste collection in the city to large vehicles for carrying waste to the final disposal site.
Kokusai Kogyo, which is the contractor for this construction work, said that the waste relay station would be handed over on site by the end of 2015. Waste separation work is not planned to be carried out in the waste relay station, but VUDAA owns a lot of land around the station which could be used for waste separation work, etc.
We confirmed that waste transportation from Vientiane Capital to the waste relay station after its completion needed to be considered as a prerequisite for establishing an efficient waste collection and transportation system.

(10) Signing ceremony of the MOU concerning the JICA Grass Roots Project
[Attendants of local counterpart]
Mr. Keophilavanh (vice governor), Mr. Bounhom (director of DONRE), Mr. Thavone (deputy director of the Vientiane Bureau of Foreign Affairs),
Mr. Khampiane (vice president of VUDAA), Mr. Phoudon (vice president of VUDAA), etc.
JICA
[Description]
At the signing ceremony of the MOU concerning the JICA Grass Roots Project, Vice Governor Keophilavanh and Director of Environment Policy Bureau, Kyoto City and on behalf of the mayor of Kyoto City, signed the MOU. JICA's Laos office, put his signature on the MOU as the witness of the signing.
(The signed MOU is shown in the appendix. It was executed in duplicate, with Vientiane Capital and Kyoto City retaining one each.)

2.5 Fourth field study

For local consultations with related divisions of Vientiane Capital, seeking of new JCM projects, and participation in the JICA Grass Roots Project kick-off meeting, we visited Vientiane Capital from Monday, December 14 to Saturday, December 19, 2015.

(1) Consultation with DONRE
[Attendants of local counterpart] Mr. Bounhom (director of DONRE), Ms. Rotchana
[Description]
We coordinated for an international committee and consulted on the the fundamental action plan for the sustainable and low-carbon historic city.
With an international committee scheduled to be held in the first week of February, we requested DONRE to

set a meeting with Mr. Keophilavanh, vice governor of Vientiane Capital, at the Vientiane City Hall. We also confirmed that Ms. Rotchana would be responsible for creating a draft of the fundamental action plan for the building of a low-carbon historical city and DONRE would introduce the plan in the international committee. The draft was set to be shared with GEC by the end of January.
In addition, we confirmed that two persons invited to the intercity collaboration workshop (hosted by the Ministry of the Environment/IGES) held in Tokyo in January would be one from DONRE, preferably Mr. Bounhom (director), and one from VUDAA.

(2) Consultation with VUDAA
[Attendants of local counterpart] Mr. Sisouk (deputy director of VUDAA), Mr. Phoun
[Description]
We checked the progress and future activities of the FS project "Project for the production of biogas from organic waste" currently conducted by Hitachi Zosen Corporation.
The Japanese delegation confirmed how to secure 10 tonnes/day of organic garbage required to run the planned facility. VUDAA told us that waste from the market, considered one of organisations which produce large amounts of organic waste, as well as hotels and restaurants, is not supplied to others.
We also decided which persons from Vientiane Capital would participate in the intercity collaboration workshop held in Tokyo: One from DONRE and one from VUDAA.

(3) Grass Roots Technical Cooperation Project kick-off meeting
[Attendants of local counterpart] Vientiane Vice Governor Keophilavanh, DONRE, VUDAA, and others
[Description]
A kick-off seminar was held for the JICA Grass Roots Project called "Project for Assistance to Develop an Effective Waste Utilization System with Citizen Cooperation in Vientiane Capital, Lao PDR" starting in November. This was intended to provide future visions on separate collection of waste and proper treatment in Vientiane Capital while understanding the situation of waste treatment and management in Vientiane Capital and finding problems by introducing garbage administration frameworks and examples of measures for separate collection of waste and proper treatment in Kyoto City.
Kyoto City said that it has promoted "2Rs ("Reduce" and "Reuse")," "Separation/Recycling," and "maximizing energy collection using biogas from garbage and power generation from waste together" as the basic policy of separate collection of waste, collection system, and waste treatment. The city also introduced "specific paid garbage bags" as a specific initiative of reducing the amount of produced waste by changing the mindset of citizens.
Meanwhile, separate collection of waste is not conducted at all in Vientiane Capital. The capital said that each household has a contract with VUDAA or a private collecting company and pays 6,000 Kip per collection box, but only about 35% of all households in Vientiane Capital make such contracts (however, the waste collection rate is about 90% in the inner city). Since separate collection of waste is conducted in other ASEAN countries, some said that it should be done in Vientiane Capital as well.

(4) Visit to the Japanese Embassy in Laos

[Attendants of local counterpart] Japanese Embass

[Description]

We reported the progress and forecast of the project and the JICA Grass Roots Project. The embassy said that it would expect the initiatives and accomplishments of reducing garbage in Kyoto City to be applied to Laos in the future. It also showed information on the JC committee in Laos related to the JCM projects.

(5) Consultation with the Institute of Renewable Energy Promotion

[Attendants of local counterpart] Mr. Seumkham (deputy director general), Mr. Boualom (deputy director)

[Description]

We discussed in detail on possible commercialization of two biomass fuel projects (biomass fuel project and bio-diesel project using palm oil) with the aim of using JCM equipment subsidy in the future, which may lead to JCM equipment subsidy projects.

In Vientiane Capital, private companies are conducting bio diesel projects, such as using palm oil and vernicia montana, a kind of tung oil tree. There is an example of test-applying it to motorcycles, but it has not yet been commercialized.

The Japanese delegation told the institute that JCM equipment subsidy could be used to introduce test equipment, including production and sales of biomass fuel. It also gave advice on the necessity of investigating the current situation of biomass fuel in Vientiane Capital.

For future consultations, the institution said that a MOU would be required for official procedure if the government needs to be highly involved in the project, and an official letter from Vientiane Capital would be required to acquire detailed documents from Ministry of Energy and Mines. It also introduced us a practitioner as a future contact.

In addition, we received information that Laos was considering changing the lights to LED in the fields of households, industries, and traffic with the aim of reducing electricity consumption by 10% by 2030 as a measure to save energy.

(6) Visit to KM32, KM7, and new relay station (under test operation)

[Attendants of local counterpart] Local person in charge

[Description]

We visited the final disposal site and vehicle station again, which are facilities related to the projects, to share local information with new members from Kyoto City.

In the final disposal site, we checked the control building, truck scale, medical (infectious) waste incinerator, separation site (operated by Japan Fund Poverty Reduction (FPR)), dumping site, and excretion treatment plant in that order.

The incinerator had stopped operation due to malfunction when we visited in November, but it was operating again because it received repair parts as planned. In the site, we checked new collection vehicles (under test operation) supplied by grant aid in November.

We also visited KM7 and checked maintenance of collection vehicles and transshipment conducted only for

some waste in the same station (moving commercial waste collected by a container car to a dump truck). In this station as well, we confirmed that multiple new collection vehicles were in test operation.
With the new relay station (under test operation) scheduled to be delivered to Vientiane Capital in the early January, training on operation of the relay station was being conducted, such as operation of collection vehicles and transshipment equipment (grant aid by Soft Components). In addition, we checked the operation status of the screw conveyor, a waste transshipment device. It needs about 40 minutes to transship to a large packer vehicle (20m3). The station plans to operate from 8:30 to 17:30 (because the final disposal site (KM32) cannot accept waste during night), which means that a maximum of 150 tonnes/day can be transshipped in an eight-hour operation. For the time being, it is used only for transshipment (about 50 tonnes/day) from the container collection cars (skip loader type, which is dedicated for commercial waste collection; 5 trucks now) currently operated in KM7.

2.6 Fifth field study

For the building of a low-carbon historical city by Vientiane Capital, we visited Vientiane Capital from Monday, February 1 to Friday, February 5, 2016. This was intended to hold an international committee to consult between related divisions of Vientiane Capital, Kyoto City, and FS vendors, participate in consultation with each FS vendor and local vendor about commercialization, and introduce this project in a JCM workshop hosted by the Asian Development Bank (ADB). An international committee will be described later in "5. Holding of local workshop" and "7. Reporting the output of this city to city cooperation project."

(1) Consultation with the local vendor about the JCM feasibility study (FS) "Project for the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory"
[Attendants of local counterpart] hamphengphet Chengsavang Agriculture Promotion Import-Export Co., Ltd. (KPC))
[Description]
For application for equipment subsidy, GEC explained about the equipment subsidy system to the rice milling plant KPC, a local vendor.
It was presented that an idea of KPC being the local representative vendor because it would take time and cost to establish a new company for the international consortium in Vientiane Capital and be difficult to build credibility without any accomplishments. To raise the reliability of the consortium agreement, she also considered a plan of negotiating a registration at the courthouse.

(2) Visit to a verification test on the JCM feasibility study (FS) "Project for the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory"
[Description]
In a saltery using chaff briquettes as an alternative to coal, a test was already conducted to burn the chaff briquette mold imported from Japan as an alternative fuel to coal. We visited the saltery to check the test status and burning results.
According to the saltery person in charge, the burning time was shortened, but the quality of salt produced

was not bad. Together with Japan Environmental Consultants, Ltd., we checked the status, burning time and salt quality. As briquettes are generally more slender than coal (briquette coal), this test was designed to find a better method by changing the way of placing briquettes or the settings for burning points. We were reported that the day's test results were better than the day before. He changed how to place briquettes (laying them) and reduced the number of burning points from three (which is normal when burning coal) to two (closing the centre burning point) from the day before. He told us that he would conduct tests the next day or so with the number of burning points reduced to one or the position of briquettes changed (changing the direction after laying).

(3) Consultation with the local vendors and VUDAA on the JCM feasibility study (FS) "Project for the generation and use of biogas from sorted organic waste "
[Attendants of local counterpart] LHRA, LCC
[Description]
For commercialization of the JCM project, Hitachi Zosen Corporation, Mr.A (LHRA), and Mr.B (LCC) were considering concluding the MOU with VUDAA about garbage collection cooperation and had a prior consultation with VUDAA. We requested VUDAA to cooperate providing and separating garbage and agreed that Hitachi Zosen Corporation, Mr.A, and Mr.B would continue to have a talk with VUDAA on the details of the MOU.

2.7 Supporting the formulation of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital

Through the above activities, we drafted "the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital.

(1) Elements of the fundamental action plan for the building of a low-carbon historical city (draft)
To build a low-carbon historical city by Vientiane Capital, we conducted field studies, collected and organised existing materials, and held hearings on the following matters:

- Grasping an overview of the area of Vientiane Capital
- Grasping and collating existing related laws and action plans
- Identifying and sorting out the needs of Vientiane Capital relating to environmental problems and historical and cultural conservation
- Considering commitments to the building of a low-carbon historical city, which should be preferentially carried out
- Proposing details of assistance by Kyoto City

Based on these results, we proposed the following elements as assistance in formulating a fundamental plan for low-carbon historical city establishment by Vientiane Capital.

Table: Elements of structure of “fundamental plan for low-carbon historical city establishment in Vientiane Capital (draft)”

Introduction	Position of the plan: fundamental action plan for the development of a low-carbon city, which is based on the urban development master plan (MP) and ensures historical and cultural conservation and economic development
Background	Background situation (Laos, world, Vientiane Capital) Purpose: Making a concrete national plan as a plan for Vientiane Capital
Overview	Progress of the MP Current situation of Vientiane Capital: Environmental problems, urban problems (traffic, waste, etc.) Development policy of Vientiane Capital (MP) Harmonisation with history, culture, and sightseeing
Basic information	General policy Period covered by the plan Geographical scope covered by the plan (whole Vientiane Capital (+ by area?)) Current reduction in GHG Target reduction in GHG Establishment of environment and system
Characteristics of plan	Vision Role of the main body: Low Carbon Control Committee (tentative name)
Measures (strategy) for promoting plan	Measures and strategy by sector: Sectors of agriculture/food, forestry/land use change, water resources, energy/transportation, industry, urban development, and public health based on the "National Strategy on Climate Change of Laos"
Progress management	PDCA

(2) Fundamental action plan for the sustainable and low-carbon historic city in Vientiane capital /for waste (draft)

Vientiane Capital announced the following as a draft of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital /for waste.

1) Background

With rapid development trends in cities, Vientiane Capital may have urban problems, such as concentration of the population in cities, shortage of public projects against demands, and traffic jams, and environmental problems, including an increase in garbage, air pollution, water contamination, and soil contamination.

To efficiently solve these problems, resident engagement practice of environmental conservation measures is required, so educating residents would be important.

2) Purpose

- Active involvement in sustainable environmental control measures by residents
- Reducing and reusing waste
- Transferring knowledge and technology for development of a sustainable low-carbon society

3) Existing law and system

- Environment protection Law
- National Strategy on Climate Change of Lao PDR

4) Goal

- Promoting beautification for a clean and green city
- Conserving the environment and improving residents' living environment
- Improving residents' awareness of environmental protection measures

5) Specific actions
- Promoting 3Rs
- Conducting a program to raise residents' awareness of 3Rs and climate change mitigation measures
- Promoting pesticide-free farming
- Carrying out the above programs with a focus on village, factory, or farm

2.8 Capacity development for the building of a low-carbon historical city

Capacity development is required to provide training on Kyoto City's administrative organisation, systems and environmental technology, such as the superiority of Japanese technology, to create an organisational structure for the building of a low-carbon historical city by Vientiane Capital and formulate the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital /for waste. Under such circumstances, we held a technology seminar on waste separation for Vientiane's administrative officers.

(1) Technology seminar on waste separation
[Date and time] Wednesday, February 3, 9:15-16:00
[Place] VUDAA
[Attendants of local counterpart] VUDAA, DONRE and other related organisations
[Description]
The fundamental action plan for the sustainable and low-carbon historic city /for waste by Vientiane Capital (draft) includes the promotion of 3Rs, and waste separation is essential to efficiently conduct the JCM feasibility study (FS) "Project for the generation and use of biogas from sorted organic waste." Therefore, we held a technology seminar on garbage separation together with the JICA Grass Roots Project, showing the background of separation, execution methods, advantages and disadvantages of each method, application conditions, and enlightenment activities to residents, using examples of Kyoto City. The textbook was developed by the JICA Grass Roots Project.

1) Discussion
- We know that waste separation by residents would be more efficient, but they do not cooperate unless waste collection boxes are supplied to them. As it generates costs, however, it may be better for the vendor to separate waste. (VUDAA)
⇒ It does not make any difference if VUDAA continues to separate waste at the final disposal site. We need to change the structure with the visions of future Vientiane Capital. The JICA Grass Roots Project can supply waste collection boxes. (Japan)
- Cooperation from residents would be significantly important for waste separation. To get their cooperation, we need to visualize that separated waste is recycled into resources. Why don't you separate waste that can

be sold? (Japan)

- It is difficult to receive cooperation from residents unless they get some cash back. (VUDAA)

⇒ If waste is collected at schools (brought by students or nearby residents), would it be highly profitable for villages? (Japan)

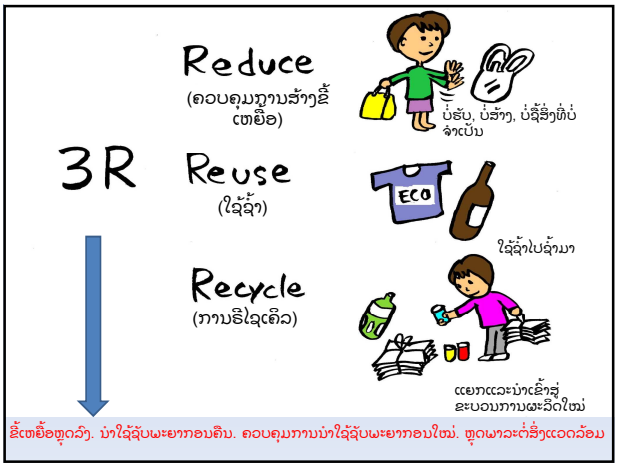
ການແຍກຂີ້ເຫຍື້ອ

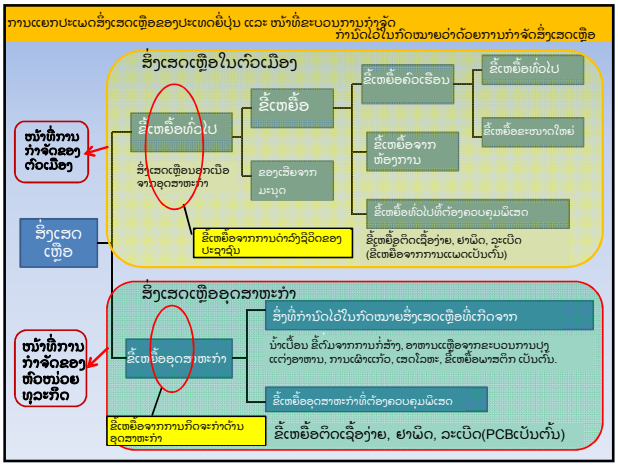
2016.2

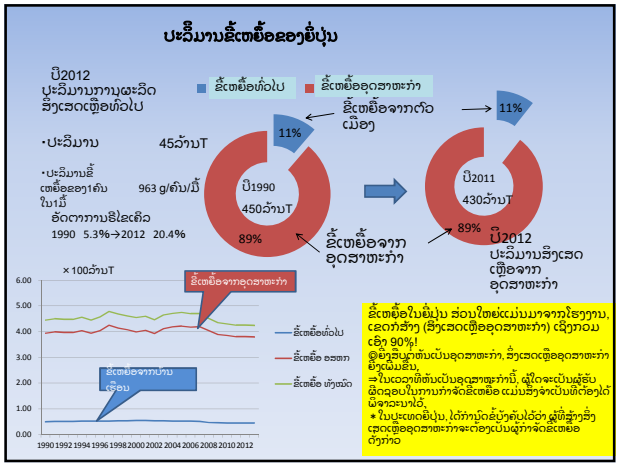
ສາລະບານ

- 1 ເປັນຫຍັງການແຍກຂີ້ເຫຍື້ອຈຶ່ງຈຳເປັນ
- 2 ວິທີການ ແລະ ລະບຽບການກ່ຽວກັບການຣີໄຊເຄິນຂອງ ປະເທດຍີປຸ່ນ
- 3 ວິທີການແຍກຂີ້ເຫຍື້ອ
- 4 ຕົວຢ່າງການໃຫ້ຄວາມຮູ້ດ້ານສິ່ງແວດລ້ອມແກ່ ປະຊາຊົນ

ເປັນຫຍັງການແຍກຂີ້ເຫຍື້ອຈຶ່ງຈຳເປັນ

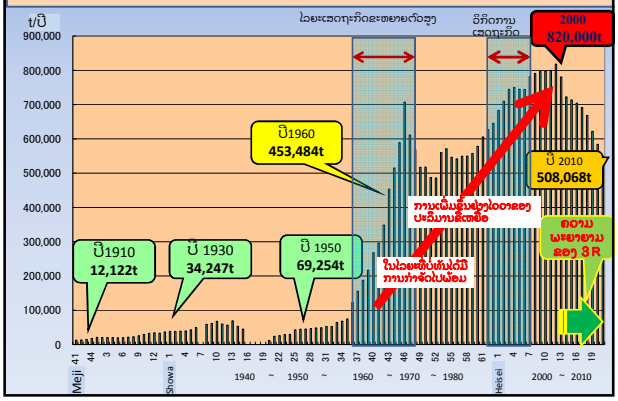






ຂີ້ເຫຍື້ອທີ່ເພີ່ມຂຶ້ນຕາມການຂະຫຍາຍຕົວຂອງເສດຖະກິດ (ຂີ້ເຫຍື້ອຄົວເຮືອນ)

ເມືອງກຸງໂຕ(ປະຊາກອນປະມານ1,5ລ້ານຄົນ)ແນວໂນ້ມປະລິມານຂີ້ເຫຍື້ອ



ຂີ້ເຫຍື້ອເພີ່ມຂຶ້ນຢ່າງໄວວາ,ເມື່ອກຳຈັດບໍ່ໄດ້ ⇒⇒⇒ຂີ້ເຫຍື້ອຂະຍະ!! (ສະພາບຂອງຍີ່ປຸ່ນໃນຊຸມປີ1970)

ຂີ້ເຫຍື້ອທີ່ຖືກຖິ້ມຕາມຖະໜົນຫາງ

ກອງຂີ້ເຫຍື້ອທີ່ຖືກຖິ້ມຕາມຖະໜົນຫາງ

ຂີ້ເຫຍື້ອທີ່ຖືກຖິ້ມໃນສວນສ່ຳຫາລະນະ ການນັ່ງຫຼິ້ນ ຄ້ອມຮອບດ້ວຍກອງຂີ້ເຫຍື້ອ!

ຂີ້ເຫຍື້ອທີ່ຖືກຖິ້ມຕາມຫາງຂົ້ນພ

ຄຳອ້າງອີງຈາກຄວາມຮ່ວມມືຂອງພະແນກທ່ອງທ່ຽວ ນະຄອນຫຼວງໂຕກຽວ

ສະພາບຂີ້ເຫຍື້ອຂະຍະໃນສະໄໝທີ່ຂີ້ເຫຍື້ອເພີ່ມຂຶ້ນຢ່າງໄວວາ

ການຖິ້ມຂີ້ເຫຍື້ອຂອດສາທະລ່ຳທີ່ບໍ່ຖືກກົດໝາຍ・ການກຳຈັດຂີ້ເຫຍື້ອທີ່ບໍ່ເໝາະສົມ

ການກຳຈັດ ຂີ້ເຫຍື້ອທີ່ຖືກຖິ້ມແບບຜິດກົດໝາຍ ຢ່າງບໍ່ເໝາະສົມ

●ບັນຫາຂີ້ເຫຍື້ອໃນປະເທດຍີ່ປຸ່ນ ໄລຍະທີ່ບໍ່ທັນໄດ້ມີການກຳຈັດໄປພ້ອມ

ການເຄື່ອນໄຫວຂອງປະຊາຊົນທີ່ຕ້ານການກໍ່ສ້າງສະຖານີກຳຈັດຂີ້ເຫຍື້ອດ້ວຍຄວາມຮ້ອນສູງ !

ການເຄື່ອນໄຫວຕ້ານການຝັງຂີ້ເຫຍື້ອ ຂອງປະຊາຊົນທີ່ອາໄສຢູ່ບໍລິເວນດັ່ງກ່າວ

ການສະກັດກັ້ນບໍ່ໃຫ້ເຄົ້າຂີ້ເຫຍື້ອເຂົ້າເຂດ ເອໂດະ (ປີ1971) (ຂໍ້ມູນ) ປະຫວັດຮ້ອຍປີໃຄງການທ່າຄວາມສະອາດໂຕກຽ

ຕົ້ນDioxinຈາກການຈຸດຂີ້ເຫຍື້ອ ການເຄື່ອນໄຫວຕ້ານສະຖານີຈຸດຂີ້ເຫຍື້ອແມ່ນຮຸນແຮງຫຼາຍ

「ປິດໂຮງງານຈຸດຂີ້ເຫຍື້ອ」

ຄ່ຳຟ້ອງຂອງປະຊາຊົນເຂດIbaraki

ໃນວັນທີ21 ປະຊາຊົນເຂດ Ibaraki ທີ່ອາໄສຢູ່ບໍລິເວນໃຮ້ໆງານ Shiroto ໄດ້ຍື່ນເຟ້ອງຕໍ່ສານຂໍຄຳສັ່ງປິດໃຮ້ໆງານ ແລະ ຢຸດຊົ່ວຄາວການກໍ່ສ້າງໂຮງງານໃໝ່ດ້ວຍເຫດຜົນວ່າມັນລະພິດທີ່ບໍ່ອຍຈາກຕົ້ນຈຸດ ເປັນຕົ້ນແມ່ນ Dioxin ມັນທ່ຳລາຍສຸຂະພາບ.

～ໜັງສືພິມAsahiສະບັບຄ້ຳວັນທີ1997/11/21～

→ NIMBY

ບໍ່ສາມາດຕັ້ງສະຖານີບ່ຳບັດຂີ້ເຫຍື້ອແບບງ່າຍດາຍໄດ້

• NIMBY

ບ່ໍໄດ້ຢູ່ເດີ່ນຫຼ້ງບ້ານຂ້ອຍ⇒「ສະຖານີກຳຈັດຂີ້ເຫຍື້ອເປັນສິ່ງທີ່ຈຳເປັນ, ແຕ່ຖ້ຳມີສ້ຳງຢູ່ໃນບ້ານຂ້ອຍແມ່ນບ່ໍຕ້ຳນດີ ! 」

NIMBYຂອງຍີ່ປຸ່ນ

ປ້ຳຍຕ່ຳຕ້ຳນໂຮງງານຈຸດຂີ້ເຫຍື້ອທີ່ຕ້ຳງຢູ່ພ້ອມທ່ີ່ສວນບຸກຄົນ

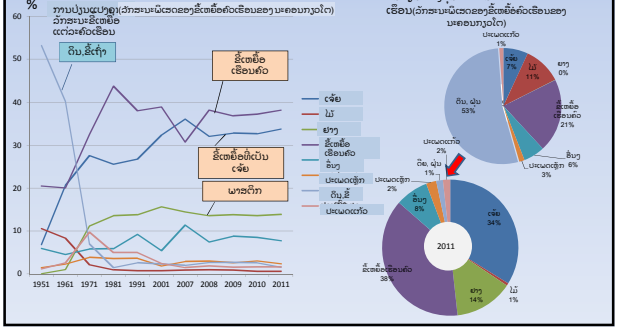
ປ້ຳຍຕ່ຳຕ້ຳນໂຮງງານຈຸດຂີ້ເຫຍື້ອ

ບ່ໍອະນຸຍຳດໃຫ້ຕັດຕ້ຳນໄມ້ທ່ີ່ມີຄ້ຳຂອງໃນເຂດແຜນການກໍ່ສ້ຳງ. ຂຶ້ນຕ່ຳ「ການເຄື່ອນໄຫວເຊ່ືອໝ້ັນຕ້ຳນໄມ້」。

●ບັນຫາຂີ້ເຫຍື້ອຂອງຍີ່ປຸ່ນ ການປ່ຽນແປງຄຸນລັກສະນະຂອງຂີ້ເຫຍື້ອ

ການເພີ່ມຂຶ້ນຂອງຂີ້ເຫຍື້ອຂະໜາດໃຫຍ່ທີ່ມີນ້ຳໜັກເບົ້ຳ (ການເພີ່ມຂຶ້ນຢ່າງໄວວາຂອງຂີ້ເຫຍື້ອພາສຕິກ ແລະ ເຈ້ຍ)

→ **ການຕັບຂີ້ເຫຍື້ອແມ່ນສ້ຳງລາຍຈ່ຳຍ !**

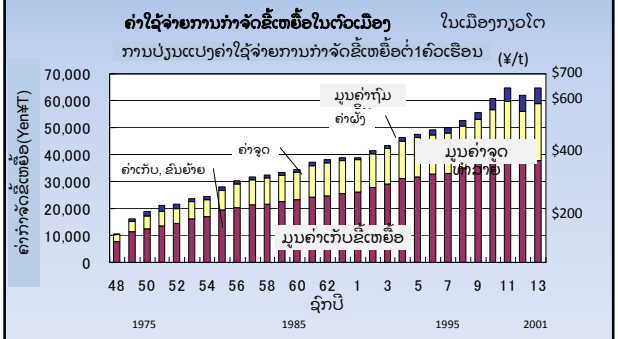


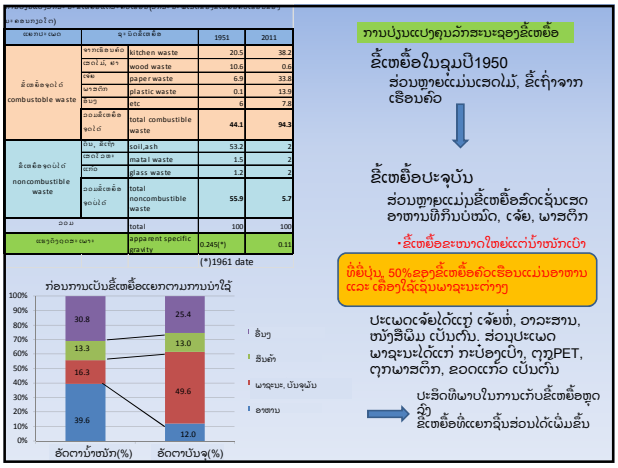
ການປ່ຽນແປງຄຸນລັກສະນະຂອງຂີ້ເຫຍື້ອ

ປີ1960

ປີ 2000

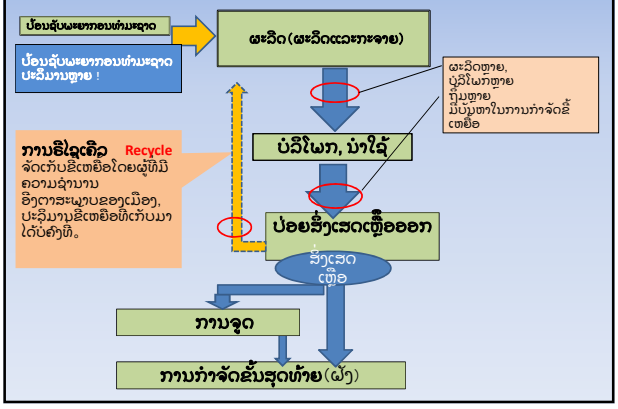
○ ຄ່າໃຊ້ຈ່າຍທີ່ໃຊ້ໃນການກຳຈັດຂີ້ເຫຍື້ອແມ່ນເພີ່ມຂຶ້ນ



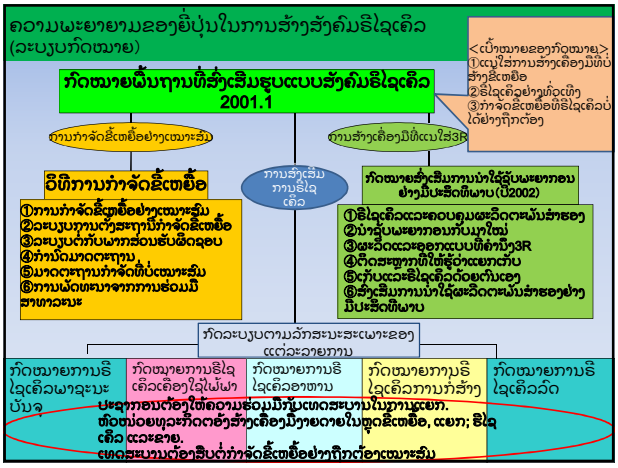


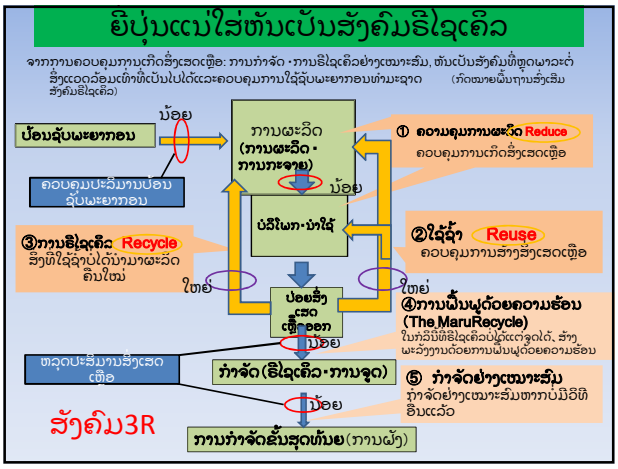
ກົດໝາຍວ່າດ້ວຍການຮີໄຊເຄິ ນ ຂອງຍີ່ປຸ ນ

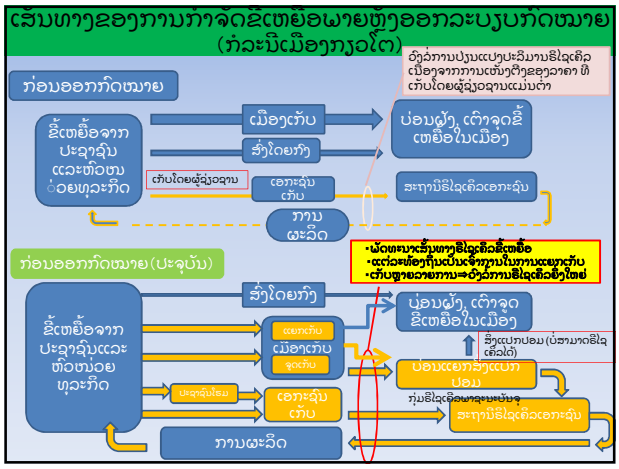
ການກຳຈັດຂີ້ເຫຍື້ອທີ່ຜ່ານມາ

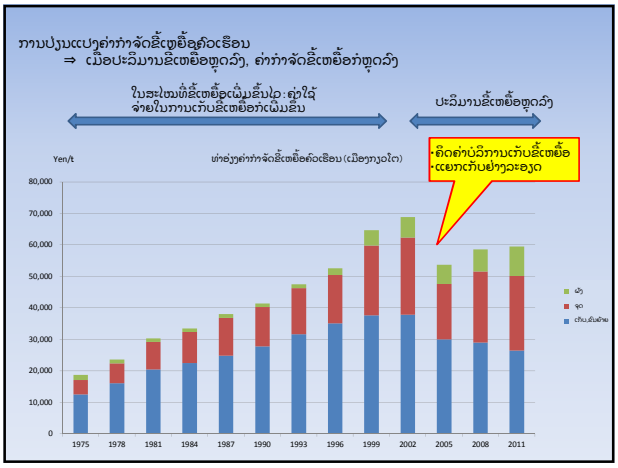


ຄວາມພະຍາຍາມຂອງຍີ່ປຸ ນໃນການສ ້ າ ງ ສ ັ ງ ຄົ ມ ຮ ີ ໄ ຊ ເ ຄ ິ ນ (ລ ະ ບ ຽ ບ ກ ົ ດ ໝ າ ຍ)



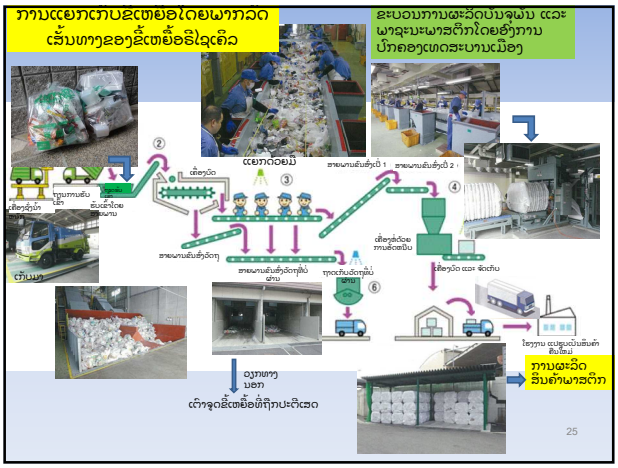


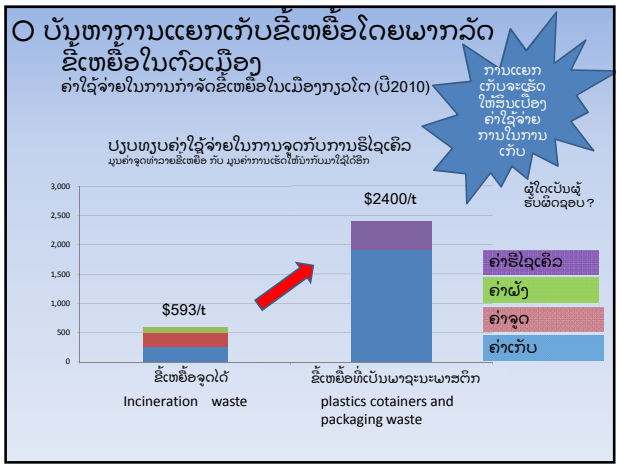




ວ ິ ທ ີ ກ ານ ແ ຍ ກ ຂ ີ ້ ເ ຫ ຍ ື ອ

1 ວ ິ ທ ີ ແ ຍ ກ ເ ກ ັ ບ ຂ ີ ້ ເ ຫ ຍ ື ອ ໂ ດ ຍ ພ າ ກ ສ ັ ດ
2 ວ ິ ທ ີ ເ ກ ັ ບ ຂ ີ ້ ເ ຫ ຍ ື ອ ໂ ດ ຍ ກ ຸ ່ ມ ປ ະ ຊ າ ຊ ົ ນ ໃ ນ ທ ້ ອ ງ ຖ ິ ่ ນ
3 ວ ິ ທ ີ ແ ຍ ກ ຂ ີ ້ ເ ຫ ຍ ື ອ ຕ າ ມ ຈ ຸ ດ ເ ກ ັ ບ
(1) ກ ານ ແ ຍ ກ ຂ ີ ້ ເ ຫ ຍ ື ອ ຕ າ ມ ຮ ้ า ນ ค ้ า (ເ ກ ັ ບ ຢ ู ่ ร ้ า น)
(2) ก า ร แ ย ก ข ี ้ เ ห ย ื อ โ ด ย ป ะ ช า ช ุ ม ห ร ื อ ห ่ ว ย ง า น ค ้ า
(3) แ ย ก เ ก ็ บ ข ี ้ เ ห ย ื อ ย ู ่ จ ุ ด ท ี ่ พ า ห น ะ ก ำ ห น ด

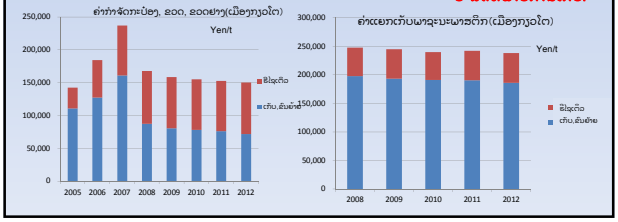




ບັນຫາການແຍກເກັບ

ຄ່າກຳຈັດ	(ເມືອງກຸງວຽ ປີ2010)			ເຢັນ/T
	ຂີ້ເຫຍື້ອຈຸດໄດ້	ກະປ໋ອງ · ຂວດ · ຂວດຢາງ	ພາຊະນະພາສຕິກ, ບັນຈຸພັນ	
	ການຈຸດຂີ້ເຫຍື້ອ	ຂີ້ເຫຍື້ອທ່ວາໃຊ້ຄືນໄດ້ (ກະປ໋ອງ, ຂວດ, ຂ ວດຢາງ)	ຂີ້ເຫຍື້ອປະເພດ ພາຊະນະ ພາສຕິກ ແລະ ບັນຈຸພັນ	
ຄ່າເກັບ	$	270	780	1,910
ຄ່າຈຸດ	$	235		
ຄ່າຜ້ຽ	$	87		
ຄ່າຣີໄຊເຄິ້ລ	$		770	490
ຄ່າກຳຈັດທັ້ງໝົດ	$	593	1,550	2,400

ປະເພດເຄື່ອງຂະໜາດໃຫຍ່ ບ່ໍໜ້ກເປ?
⇒ ບ່ໍໜ້ກທີ່ລົດເກັບຂີ້ເຫຍື້ອ1ຄັ້ນບັນຈຸໄດ້ແມ່ນໜ້ອຍ
ການແຍກເກັບນີ້ ຈ່ຳເປັນຕ້ອງມີລົດຫຼາຍຄັ້ນຖ້ຽ້ບ່ກ ຕ້ອງແມ່ນລົດຂະໜາດໃຫຍ່
ການແຍກເກັບນີ້ ຈ່ຳເປັນຕ້ອງໄດ້ວາງແຜນການເດີນລົດ ໃຫ້ພຽງພໍ່ໂດຍຄ່ານຶ່ງ ປະສິດທິພາບການເກັບ.



ເງື່ອນໄຂການແຍກເກັບ(ການເກັບຂີ້ເຫຍື້ອໂດຍພາກລັດ)

1 ກ່ຳນົດພາລະບົດບາດຂອງປະຊາຊົນ, ຫ້ວໜ່ວຍການຄ້ຳ, ພາກລັດໃຫ້ ຈະແຈ້ງ.
⇒ ຮຽກຮ້ອງໃຫ້ມີການພັດທະນາລະບຽບກ໋ດໝາຍຊັ່ນ:ກ໋ດໝາຍຣີໄຊເຄິ້ລ
⇒ ຕ້ອງມີວິທີການທີ່ສາມາດຣີໄຊເຄິ້ລຂີ້ເຫຍື້ອທີ່ແຍກເກັບມາໄດ້.

2 ຮັບປະກັນພະນັກງານແລະເຄື່ອງມືໃນການເກັບ.
(ຄ່າເກັບຂີ້ເຫຍື້ອມີທ່າອ່ຽງຈະສູງຂຶ້ນ。)
⇒ ຮຽກຮ້ອງໃຫ້ອ້ງຜ ແຜນການດີນລົດ, ວ້ງແຜນການເກັບທີ່ຄ່ານຶ່ງປະສິດທິພາບການເກັບຂີ້ເຫຍື້ອ.

3 ຕ້ອງໄດ້ຮັບຄວາມຮ່ວມມືແລະເຂ້ົ້າໃຈຈາກປະຊາຊົນ
(ຄວາມຕ້ອງການຂອງປະຊາຊົນແລະຄວາມຕ້ອງການຂອງສ້ງຄົມເປັນສິ່ງ ສ້ຳຄັນ)
⇒ ຮຽກຮ້ອງໃຫ້ມີການຮ່ວມມືກັບລະຫວ່ຳງອ ການຈ ດ ັ້ງປະຊາຊົນໃນ ທ້ອງຖ ່ນກ ບການຍ ກລະດ ບການສ ກສາດ ານສ ງ ແວດລ ອມ.

ຈຸດດີແລະຈຸດອ່ອນຂອງການແຍກເກັບ(ໂດຍພາກລັດ)

◎ຈຸດດີ
1 ,ສາມາດໂຮມຂີ້ເຫຍື້ອຣີໄຊເຄິ້ລເຊ່ັນກະປ໋ອງອາລູ, ຂວດPET ໄວ້ໄດ້ຫຼາຍ.
2 ຫຼຸດປະລິມານສິນຄ້ຳລ ງ)ໄດ້ຫຼາຍ。
3 ມີປະສິດທິພາບສ ງໃນເພ ມທະວີຈິດສ ານ ກດ ານສະພາບແວດ ລ ອມຂອງປະຊາຊົນ.,
4 ບ່ໍມີຜົນກະທົບຕ່ໍສະພາບແວດລ ອມ, ສາມາດເກັບເປັນປະຈ ຳ.
◎ຈຸດອ່ອນ
1 ,ຕ ອງມ ອ ປະກ ອນ ແລະ ພະນ ກ ງານແຍກເກັບ, ສ ້າງຄ ່າ ໃ ້ຈ ່າຍໃນການເກັບ
2 ຫ ກຄ ວ ມຖ ກຕ ອ ໃນການແຍກຄ ນ ນ ພ ບຕ ່ ຳ, ຕ ອ ໄ ້ ຂ ດ ວ ອ ກ ພ ອ ພ ມ ຄ ນ ນ ພ ບ.
(ໂດຍ ກ ກ ະ ຕ ແ ວ ້ ອ, ກ ນ ຮ ບ ຮ ້ ຂ ອ ປ ະ ຊ ກ ອ ນ ເ ນ ສ ່ ງ ຈ ່ ຳ ເ ນ)

ແຍກຂີ້ເຫຍື້ອໂດຍກຸ່ມປະຊາຊົນໃນທ້ອງຖິ່ນ

ແຕ່ລະບ້ານແຍກຂີ້ເຫຍື້ອທີ່ສາມາດຣີໄຊເຄິ້ລໄດ້

ແຍກຂີ້ເຫຍື້ອທີ່ເປັນຈ ່ຍ(ແກ້ວ, ໜ ງສ ພ ມ, ວ ກ ະ ສ ນ), ກ ະ ປ ອ ງ ອ ລ ມ ນ ຽ ມ, ກ ະ ປ ອ ງ ເ ຫ ກ, ເ ຄ ື ອ ງ ນ ່ ງ ຕ ່ ຳ ກ

ມາໂຮມໄວ້

ຕົວຢ ່ ງ ກ ນ ຂ ຍ (ຕ /kg)
ປ ອ ງ ອ ລ ມ 40Yen
ແ ກ ້ ວ 3Yen
ໜ ງ ສ ພ ມ 2.5Yen
ວ ກ ະ ສ ນ 1.5Yen
ອ ນ ງ (ຖ ກ ເ ຈ ຍ ເ ປ ນ ຕ ນ) 1.5Yen
ເ ຄ ື ອ ງ ນ ່ ງ ຕ ່ ຳ 6Yen (2015.9)

ຂີ້ເຫຍື້ອຣີໄຊເຄິ້ລທີ່ລວມລວມມານີ້ຈະຖືກຮັບຊື້ໂດຍພາກສ ວນ ເ ອ ກ ະ ຊ ນ ທ ມ ີ ຮ ດ ສ ນ ຍ ນ ຳ

ເງື່ອນໄຂຂອງການແຍກຂີ້ເຫຍື້ອໂດຍກຸ່ມປະຊາຊົນໃນທ້ອງຖິ່ນ

1 ຕ້ອງມີຜູ້ນຳພາໃນເຂດດັ່ງກ່າວ(ຄົນທີ່ຮັບຜິດຊອບໃນການໂຮມຂີ້ເຫຍື້ອແມ່ນຈຳເປັນ)
⇒ຮຽກຮ້ອງໃຫ້ມີອົງກອນໃນກຸ່ມຄົນຫຼືປະຊາຊົນໃນທ້ອງຖິ່ນ

2 ຕ້ອງມີພາກສ່ວນມາຮັບຊື້ຂີ້ເຫຍື້ອທີ່ໂຮມມາ
⇒ຮຽກຮ້ອງໃຫ້ເພີ່ມທະວີຄຸນນະພາບຂອງຂີ້ເຫຍື້ອຣີໄຊເຄິລທີ່ໂຮມມາ(ຕ້ອງໄດ້ແຍກຢ່າງຖືກຕ້ອງ)

3 ຕ້ອງໄດ້ຮັບຄວາມຮ່ວມມືແລະເຂົ້າໃຈຈາກປະຊາຊົນ.
⇒ຮຽກຮ້ອງໃຫ້ມີການລົມກັນພາຍໃນທ້ອງຖິ່ນ, ທຸກຄົນເຂົ້າໃຈແລະໃຫ້ຄວາມຮ່ວມມື.

ຈຸດດີແລະຈຸດອ່ອນຂອງການແຍກຂີ້ເຫຍື້ອໂດຍກຸ່ມປະຊາຊົນໃນທ້ອງຖິ່ນ

◎ຈຸດດີ
1 ບໍ່ເສຍຄ່າໃຊ້ຈ່າຍໃນການເກັບຂີ້ເຫຍື້ອ. (ມີພາກສ່ວນເອກະຊົນເກັບແລ້ວ, ພາກລັດຈຶ່ງບໍ່ຈຳເປັນຕ້ອງເກັບ.)
2 ຍ້ອນເຮັດດ້ວຍຄວາມຕັ້ງໃຈຂອງປະຊາຊົນໃນທ້ອງຖິ່ນ, ຄຸນນະພາບໃນການແຍກຈຶ່ງສູງ.

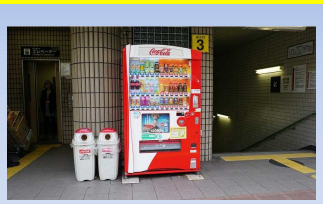
◎ຈຸດອ່ອນ
1 ຕ້ອງມີຕົວແທນຜູ້ຄຸ້ມຄອງໃນການເກັບໂຮມມາແລະຂາຍອອກ.
2 ສິ່ງທີ່ໂຮມມາຖືກກຳນົດຄ່າສູງ
3 ມີຜົນສະທ້ອນຕໍ່ສະພາບຕົວເມືອງ, ສິ່ງທີ່ໂຮມມາຫາກບໍ່ມີຄ່າບໍ່ມີລາຄາແລ້ວ, ກໍກາຍເປັນຂີ້ເຫຍື້ອ.

ວິທີແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ
(1) ການເກັບແຍກຂີ້ເຫຍື້ອຕາມຮ້ານຄ້າ(ເກັບຢູ່ຮ້ານ)

ລູກຄ້າທີ່ມາໃຊ້ບໍລິການຢູ່ຮ້ານສາມາດນຳເອົາຂີ້ເຫຍື້ອມາຖິ້ມຕາມທີ່ລະບຸເທິງຖັງ.
ຂີ້ເຫຍື້ອທີ່ໂຮມໄດ້ຈະຖືກນຳມາໃຊ້ຄືນດ້ວຍການຣີໄຊເຄິລ
ຄ່າໃຊ້ຈ່າຍໃນການຖິ້ມແມ່ນທາງຮ້ານເປັນຜູ້ຮັບຜິດຊອບ, ເປັນການບໍລິການລູກຄ້າໃນໂຕ.

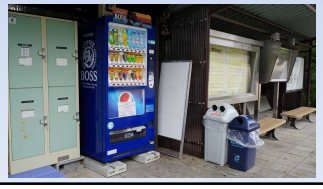
ຖາດໂຟມທີ່ໄດ້ຮັບຄືນມາ
ແມ່ນຖືກທຳຄວາມສະອາດແລ້ວ

ວິທີແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ
(1) ການເກັບແຍກຂີ້ເຫຍື້ອຕາມຮ້ານຄ້າ (ທີ່ຕູ້ຂາຍເຄື່ອງອັດຕະໂນມັດ)



ໃຫ້ກັບຕູ້ຂາຍເຄື່ອງດື່ມອັດຕະໂນມັດ ຕ້ອງໄດ້ວາງຖັງຂີ້ເຫຍື້ອໄວ້ເປັນຂໍ້ບັງຄັບ.

ຖກPET, ກະປ໋ອງທີ່ໂຮມໄດ້ແມ່ນຄວາມຮັບຜິດຊອບຂອງຜູ້ມາຕັ້ງໃນການຈຳໜ່າຍ(ຣີໄຊເຄິລ)



ທີ່ເມືອງກຸງໂຕ, ເພື່ອປ້ອງກັນການຖິ້ມກະປ໋ອງເປົ່າຊະຊາຍ ແລະ ນຳໃຊ້ລົດເກັບຂີ້ເຫຍື້ອຢ່າງມີປະສິດທິພາບ, ໄດ້ປະກາດຂໍ້ບັງຄັບໃຫ້ຜູ້ຂາຍເປັນຜູ້ໂຮມບັນດາກະປ໋ອງເປົ່າຕ່າງໆ.

3 ວິທີແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ
(2) ການແຍກຂີ້ເຫຍື້ອໂດຍປະຊາຊົນຫຼືຫ້ວໜ່ວຍການຄ້າ

ຖົງເກັບທີ່ຕັ້ງໄວ້ຢູ່ພື້ນທີ່ສາທາລະນະໃນຕົວເມືອງ

ໃນເວລາທີ່ປະຊາຊົນນຳໃຊ້ພື້ນທີ່ສາທາລະນະດັ່ງກ່າວ, ກໍນຳຂີ້ເຫຍື້ອໄປຖິ້ມແຍກຕາມປ້າຍທີ່ສະແດງເທິງຖັງ.

ປະຊາຊົນສາມາດນຳຂີ້ເຫຍື້ອຣີໄຊເຄິລມາຖິ້ມໄດ້ຕະຫຼອດເວລາໂດຍບໍ່ເສຍຄ່າໃຊ້ຈ່າຍໃດໆ.

*** ເນື່ອງຈາກວ່າການຖິ້ມຂີ້ເຫຍື້ອໃດທີ່ບໍ່ເປັນເສຍຄ່າ, ດັ່ງນັ້ນປະຊາຊົນກໍຈະໜ້ໍາມາໃຊ້ບໍລິການຂີ້ເຫຍື້ອນີ້, ກໍຈະສາມາດຫຼຸດປະລິມານການຖິ້ມຂີ້ເຫຍື້ອແບບເສຍຄ່ານີ້ລົງ.**

3 ວິທີແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ
(2) ການແຍກຂີ້ເຫຍື້ອໂດຍປະຊາຊົນຫຼືຫ້ວໜ່ວຍການຄ້າ

ການແຍກເກັບຂີ້ເຫຍື້ອດ້ວຍຖັງໃນສະຖານທີ່ກິດຈະກຳ

ຂີ້ເຫຍື້ອທີ່ໂຮມມາໄດ້ແມ່ນຖືກເປັນຄວາມຮັບຜິດຊອບຂອງຜູ້ຈັດງານໃນການກຳຈັດ.

ການເກັບຂີ້ເຫຍື້ອໃນລະດັບທ້ອງຖິ່ນ (ການເກັບນ້ຳມັນປຸງແຕ່ງອາຫານທີ່ໃຊ້ແລ້ວ)

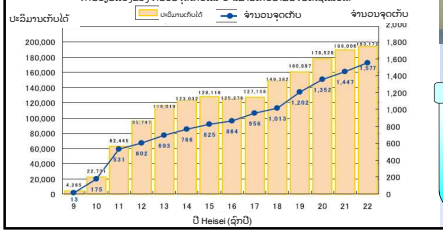
ເກັບຈາກທ້ອງຖິ່ນ

ພາກລັດຫັນມາໃຊ້ນ້ຳມັນ BDF(ນ້ຳມັນເຊື້ອໄຟ)

ຄວາມພະຍາຍາມໃນການເອົານ້ຳມັນປຸງແຕ່ງອາຫານທີ່ໃຊ້ແລ້ວໃນທ້ອງຖິ່ນມາເປັນນ້ຳມັນເຊື້ອໄຟສຳລັບລົດເກັບຂີ້ເຫຍື້ອ

ໃຊ້ເປັນນ້ຳມັນເຊື້ອໄຟໃນການເກັບຂີ້ເຫຍື້ອ

ການປ່ຽນແປງຂອງຈຳນວນຈຸດເກັບແລະປະລິມານເກັບນ້ຳມັນຈືນທີ່ໃຊ້ແລ້ວໄດ້



ຜົນຂອງການໃຊ້ນ້ຳມັນຊ້ຳພາບ

- ເປັນການຮີໄຊເຄິນ
- ຄວບຄຸມການປ່ອຍ CO_2
- ເປັນການໃຊ້ຊັບພະຍາກອນຢ່າງມີຄວາມຮັບຜິດຊອບ
- ຊ່ວຍສ້າງຈິດສຳນຶກດ້ານສິ່ງແວດລ້ອມ
- ເປັນກິດຈະກຳຂອງຊຸມຊົນທ້ອງຖິ່ນ
- ປ້ອງກັນມົນລະພິດທາງນ້ຳ
- ກິດຈະກຳກະຕຸ້ນ

ຄວາມພະຍາຍາມໃນການເອົາຂີ້ເຫຍື້ອລະດັບທ້ອງຖິ່ນ (ຕິດຕັ້ງຈຸດເກັບນ້ຳມັນປຸງແຕ່ງອາຫານທີ່ໃຊ້ແລ້ວ)

ສະພາບການເກັບໂຮມທີ່ຮ້ານຄ້ຳMatsuya

ນ້ຳເອົາການໂຮມນ້ຳມັນປຸງແຕ່ງອາຫານທີ່ໃຊ້ແລ້ວມາເປັນກິດຈະກຳໃນທ້ອງຖິ່ນ

ກິດຈະກຳທີ່ຊ່ວຍຫຼຸດປະລິມານຂີ້ເຫຍື້ອໃນທ້ອງຖິ່ນ

ການຮ່ວມມືຂອງພາກລັດແລະທ້ອງຖິ່ນເພື່ອຫຼຸດປະລິມານຂີ້ເຫຍື້ອ ຫຼາກຫຼາຍກິດຈະກຳໃນໂຮງຮຽນປະຖົມ (ຂະໜາດ6,000ຄົນ) ໃນເມືອງເພື່ອຫຼຸດປະລິມານຂີ້ເຫຍື້ອ

ວິທີການຕົ້ນຕໍ

1 ວິທີການໂຮມຊຸບພະຍາກອນໃນທ້ອງຖິ່ນ

ການໂຮມຂີ້ເຫຍື້ອຮີໄຊເຄິລຊຸ້ນນ້ຳມັນປຸງແຕ່ງອາຫານທີ່ໃຊ້ແລ້ວ

ການໂຮມນ້ຳມັນປຸງແຕ່ງອາຫານ

2 ວິທີການຄວບຄຸມການສ້າງ ແລະ ຫຼຸດປະລິມານຂີ້ເຫຍື້ອ

ຮ່ວ່ຽມການຫຼຸດການໃຊ້ຖົງຢາງ (ໃຊ້My Bagແທນ)
ການຍ່ອຍສະຫຼາຍຂີ້ເຫຍື້ອສົດ
ຈັດເທດສະການຫຼິ້ນໃຊ້ຈານທີ່ໃຊ້ແລ້ວຖິ້ມເລີຍ
ຈັດຕະຫຼາດນັດເຄື່ອງມືສອງ Flea Market

3 ການຮຽນຮູ້ສິ່ງແວດລ້ອມພາຍໃນທ້ອງຖິ່ນ

ການຮຽນຮູ້ສິ່ງແວດລ້ອມໃນໂຮງຮຽນປະຖົມ

ເທດສະການທີ່ນຳພາຊະນະເກົ່າມາໃຊ້ຊ້ຳ

ກຸ່ມໂຮມຂີ້ເຫຍື້ອຮີໄຊເຄິລ

ການຈັດແຂ່ງຂັນMy Bag

3 ວິທີແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ (3)ການແຍກເກັບຂີ້ເຫຍື້ອຮີໄຊເຄິລຕາມໂຮມທີ່ພາກລັດ

ພາກລັດ ທຳການແຍກເກັບຂີ້ເຫຍື້ອໂດຍການຈັດງານຜົນທີ່ໃຫ້ປະຊາຊົນນຳເອົາຂີ້ເຫຍື້ອຮີໄຊເຄິລທີ່ກຳນົດໄວ້ຂ້ຶນມາ.

ເນື່ອງຈາກປະຊາຊົນແຍກເອົາຂີ້ເຫຍື້ອຮີໄຊເຄິລມາໄວ້, ປະລິມານຂີ້ເຫຍື້ອທີ່ຖິ້ມຈຶ່ງຫຼຸດລົງ.

ເນື່ອງຈາກມີເນື້ອທີ່ເກັບມ້ຽນ, ຈຶ່ງສາມາດແຍກເປັນຫຍ້ອຍປະເພດ

3 ວິທີແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ (4) ຈຸດເກັບແບບເຄື່ອນຍ້າຍໄດ້

◎ແນ່ນອີວິທີການແຍກເກັບຂີ້ເຫຍື້ອ ທີ່ຕັ້ງຈຸດເກັບໃນສະຖານທີ່ ທີ່ປະຊາຊົນເຂົ້າເຖິງໄດ້ງ່າຍແບບຊ້ອຄອາ.

◎ຕັ້ງຈຸດເກັບໄວ້ຢູ່ໂຮງຮຽນປະຖົມຫຼືສວນສາທາລະນະ, ພະນັກງານຈະສາມາດແນະນຳວິທີແຍກໄດ້ແບບໂຕຕ່ໂຕ.

◎ເຈ້ົ້ງບອກຊ່ວງເວລາແລະສະຖານທີ່ໃຫ້ປະຊາຊົນຮູ້ລ່ວງໜ້ຳ

ເງື່ອນໄຂການແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ

1 ຕ້ອງມີຮ້ານຄ້ຳຫຼືປະຊາຊົນທ້ອງຖິ່ນທີ່ສາມາດບໍລິການທີ່ຕັ້ງຖ້ັງເກັບແລະຈັດເກັບໃຫ້ໄດ້.
(ຈຳເປັນຕ້ອງມີບໍລິສັດທີ່ມີຈິດສຳນຶກດ້ານສິ່ງແວດລ້ອມສູງ)
⇒ຮ່ວ່ມຮ້ອງໃຫ້ມີອົງກອນອິດສະຫຼະ ແລະ ລະບົບທີ່ສາມາດປະຕິບັດໃຫ້ເປັນຈິງໄດ້, ບ່ອ່ານຈະໃນນາມສະມະຄົມອຸດສາຫະກຳຫຼືທ້ອງຖິ່ນ
(➡ຈຳເປັນຕ້ອງມີການໂນ້ມນ້ຳວຈາກພາກລັດ)

2 ຕ້ອງມີວິທີການໃນການຮີໄຊເຄິລສິ່ງທີ່ເກັບມາໄດ້
(ຕ້ອງມີຫ້ອໜ່ວຍທຸລະກິດທີ່ມາຮັບຊື້ໄປ)

3 ຕ້ອງໄດ້ຮັບຄວາມຮ່ວ່ມມື ແລະ ຄວາມເຂົ້ົ້າໃຈຈາກປະຊາຊົນທ້ອງຖິ່ນ(ຮ່ວ່ມມືໃນການແຍກຂີ້ເຫຍື້ອ)
⇒ຮ່ວ່ມຮ້ອງໃຫ້ມີການລົມກັນພາຍໃນທ້ອງຖິ່ນ, ທຸກຄົນເຂົ້ົ້າໃຈ ແລະໃຫ້ຄວາມຮ່ວ່ມມື.

ຈຸດດີແລະຈຸດອ່ອນຂອງການແຍກຂີ້ເຫຍື້ອຕາມຈຸດເກັບ

◎ຈຸດດີ
- ບ່ຳໃຊ້ໂດຍບຸກຄົນທີ່ມີຄວາມເອົາໃຈໃສ່, ການແຍກຈຶ່ງມີຄວາມຖືກຕ້ອງສູງ. ໂດຍສະຫຼຸບແລ້ວ, ກ່ຳໄວຂອງການຂາຍຂີ້ເຫຍື້ອຣີໄຊເຄິ, ສາມາດ ຄວບຄຸມຄ່ຳໃຊ້ຈ່າຍໃນການເກັບໄດ້.
- ເນື່ອງຈາກເປັນການບ່ລິການແກ່ລູກຄ້ຳ, ຈຶ່ງມີຜົນຕ່ຳການປະເມີນຮ້ານຄ້ຳ.
- ເປັນກິດຈະກ່ຳດ້ານສັງຄົມທີ່ຊ່ວມໂຍງປະຊຳຊົນໃນທ້ອທ້ອງຖິ່ນ.,
- ພາກລັດສາມາດສົ່ງເສີມການແຍກຂີ້ເຫຍື້ອດ້ວຍຕົ້ນທຶນຕ່ຳເຊັ່ນການຕິດຕັ້ງຖັງ ເກັບຜົ້ມ.
- ກ່ລະນີແບບເຄື່ອນຍ້ຳຍ, ພະນັກງານສາມາດແນະນ່ຳການແຍກໃຫ້ປະຊຳຊົນໄດ້ ໂດຍກົງ

◎ຈຸດອ່ອນ
- ທຸນໃສ່ການເກັບໂດຍພາກລັດແລ້ວ, ປະລິມານທີ່ເກັບໄດ້ແມ່ນໜ້ອຍ.
- ຕ້ອງໄດ້ຄຸມຄອງຖັງຈັດເກັບຸ ເປັນປະຈ່ຳ.
- ຕ້ອງໄດ້ຮັດປ້ຳຍອະທິບຳຍທີ່ເຂ້ຳໃຈງ່ຳຍ ແລະ ໃຫ້ທຸກຄົນຮັບຮູ້
- ຕ້ອງມີພື້ນທີ່ວ່ຳງຖັງຈັດເກັບເປັນປະຈ່ຳ
- ກ່ລະນີແບບເຄື່ອນຍ້ຳຍ, ຫຍຸ້້ງຍາກໃນການກະກຽມ ບຸກຄະລາກອນ, ອຸປະກອນ, ຂະບວນການຈັດການສິ່ງທີ່ເກັບໂຮມມາ(ຂີ້ເຫຍື້ອມີພິດ)ເປັນຕົ້ນ.

ຕົວຢ່ຳງການໃຫ້ຄວາມຮູ້ດ້ານສິ່ງແວດລ້ອມແກ່ປະຊຳຊົນ (ການຮັບຮູ້ຂອງປະຊຳຊົນ)

ຄວາມພະຍາຍາມຂອງພາກລັດ

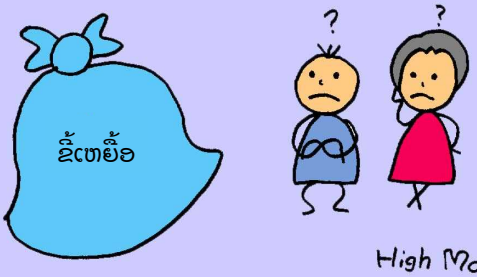
◎ແຈກຍ່ຳຍໃຫ້ແຕ່ລະຄອບຄົວໃນຕົວເມືອງ ຄອບຄົວຕົ້ນຕ່ຳງປະເທດກ່ຳຊັ່ນກັນ (ສ້ຳງເປັນ3ພ່ຳສ: ອັງກິດ, ຈີນ, ເກ່ຳຫຼີ)

◎ແຍກອີ່ຫຍັ່ງ?
◎ວິທີ່ກ່ຳນແຍກຂີ້ເຫຍື້ອ?
◎ວິທີ່ສ້ຳງຂີ້ເຫຍື້ອ?
◎ວິທີ່ຫຼຸດປະລິມ່ຳນຂີ້ເຫຍື້ອ?

ແຈກຍ່ຳຍໃຫ້ແຕ່ລະຄອບຄົວໃນຕົວເມືອງ ສ່ຳມ່ຳດເບິ່ງໃນຄ້ອບໃຊ່ໄດ້

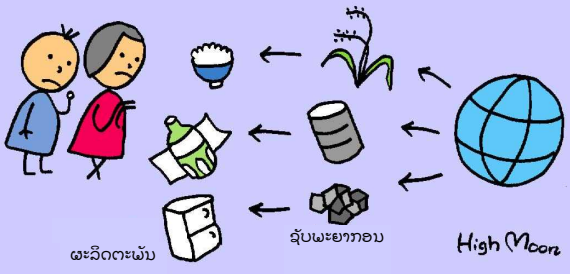
http://www.city.kyoto.lg.jp/kankyo/cmsfiles/contents/0000065/65614/tyuugokugo.pdf

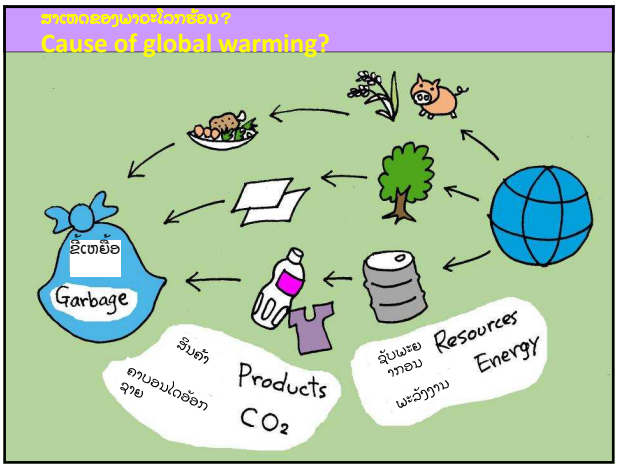
ທ່ຳງໃນຂີ້ເຫຍື້ອແມ່ນຫຍັງນັ້ ?

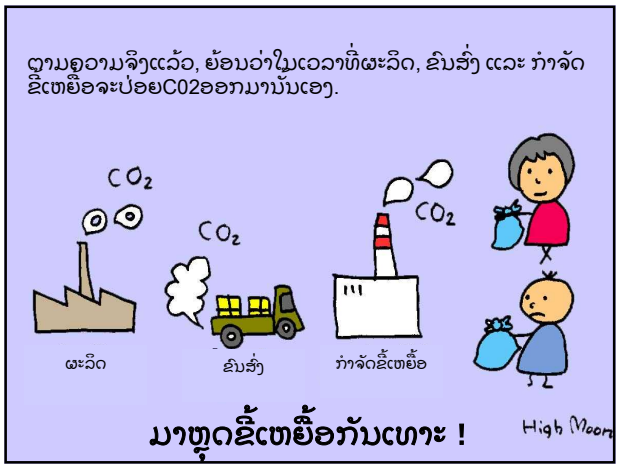


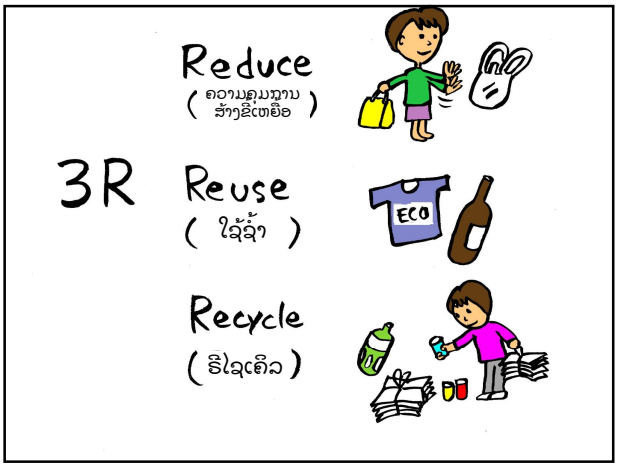
ທ່ຳງໃນແມ່ນເຄື່ອງນຸ່ງ, ເຄື່ອງໃຊ້ທີ່ຖືກຖິ້ມແລ້ວ.

ເຊ່ິງສິ່ງເຫຼ່ຳນັ້ນແມ່ນເຮັດມ່ຳຈຳກພະລັງງ່ຳນ ແລະ ຊັບພະຍ່ຳກອນທີ່ມີຄ່ຳຂອງໂລກ.

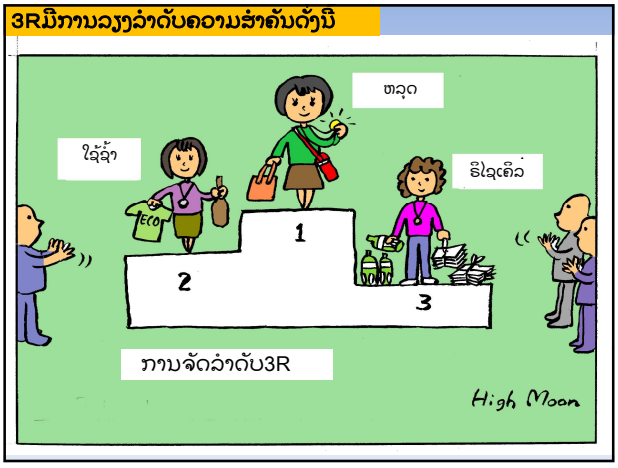


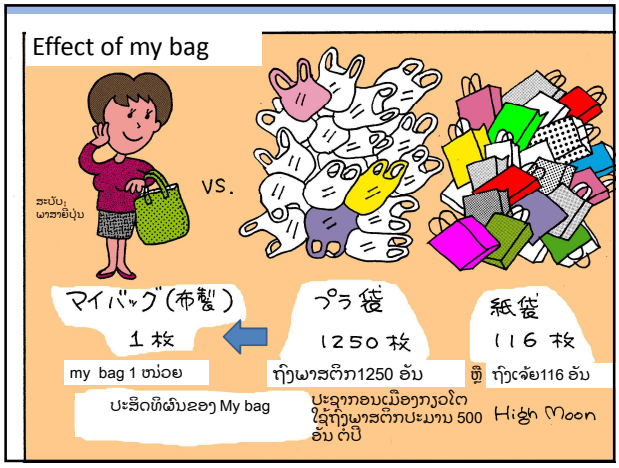

ສາເຫດຂອງພາວະໂລກຮ້ອນ?
Cause of global warming?
ຂີ້ເຫຍື້ອ
Garbage
Products
CO2
Resources
Energy


ຕາມຄວາມຈິງແລ້ວ, ຍ້ອນວ່າໃນເວລາທີ່ຜະລິດ, ຂົນສົ່ງ ແລະ ກຳຈັດ ຂີ້ເຫຍື້ອຈະປ່ອຍC02ອອກມານັ້ນເອງ.
CO2
ຜະລິດ
ຂົນສົ່ງ
ກຳຈັດຂີ້ເຫຍື້ອ
ມາຫຼຸດຂີ້ເຫຍື້ອກັນເທາະ !
High Moon


3R
Reduce
(ຄວາມຄຸມຄ່ານ ສ້າງຂີ້ເຫຍື້ອ)
Reuse
(ໃຊ້ຊ້ຳ)
Recycle
(ຣີໄຊເຄິລ)


ການຣີໄຊເຄິລ
「 ປິດກອກນ້ຳຊິບໍ່ໄດ້ບໍ ? 」
High Moon

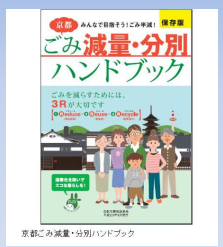

3Rมีการจัดลำดับความสำคัญนี้
ຫລຸດ
ໃຊ້ຊ້ຳ
ຣີໄຊເຄິລ
1
2
3
ການຈັດລຳດັບ3R
High Moon


Effect of my bag
VS.
マイバッグ(布製)
1 枚
my bag 1 ໜ່ວຍ
ถุงพลาสติก1250 อัน
ถุง
1250 枚
紙袋
116 枚
ຫຼື ถุงเจ้ย116 อัน
ประสิทธิผลของ My bag
ประชากรในเมืองกรุงเทพ ใช้ถุงพลาสติกประมาณ 500 อัน ต่อปี
High Moon

ແໜ່ງຂໍ້ມູນການສຶກສາດ້ານສິ່ງແວດລ້ອມ ກຽວໂຕ

ຊຸມຊະນົບນິເວດ ກຽວໂຕ
http://www.miyako-eco.jp/

ສະພາສົ່ງເສີມການຫຼຸດປະລິມານຂີ້ເຫຍື້ອເມືອງ ກຽວໂຕ
http://kyoto-gomigen.jp/



京都ごみ減量・分別ハンドブック
http://www.city.kyoto.lg.jp/kankyo/page/0000103069.html

Keyword ແມ່ນທຸກຄົນຕ້ອງຊ່ວຍກັນຫຼຸດປະລິມານຂີ້ເຫຍື້ອ !

3. Implementation of Feasibility Study of JCM Project

Feasibility studies of the following two projects have been implemented under the request of the Vientiane city, with expectation of subsidy as compensation of the credit based on carbon emission reduction project (Joint Crediting Mechanism (JCM) project) for its early realization. Also, for applying those projects for JCM project, the preparation for applicable methodologies (setting eligibility, specifying and calculating reference emissions, calculating project emissions, establishing monitoring methods, evaluating quantity of emission reductions and configuring default values and pre-set values used for calculating quantity evaluation of emission reductions and preparing calculation sheets (excel spreadsheet)) and project design documents was made. Particularly, Global Environment Centre Foundation (GEC) and survey implementing company (CUS) have carefully discussed over to create the JCM methodologies in order to formulate methodologies that can pass the approval review by the JCM joint committee. In addition, the feasibility studies have implemented with attention to their utilization for formulating the Low Carbon Historical City Formation Implementation Plan described above.

3.1 Project for Reduction of Fossil Fuel Consumption involving Biomass Fuel Conversion at Salt Producing Factory

3.1.1 Project overview

3.1.1.1 Project Overview and Objectives

This project will bring about a large CO2 reduction by using biomass instead of fossil fuels in the process of manufacturing salt by evaporating the water content of brine pumped up to the surface in open pans in the factory located near Vientiane, the Capital city of the Lao People's Democratic Republic (hereafter, Laos).

The biomass fuel will be provided using Japanese briquetting (compaction) technology to process rice husks which are discarded as waste from rice milling plants in Vientiane. The consumers of the fuel are assumed to be salt-production factory as the target of the survey, but the establishment of a mechanism for sale to other potential buyers is intended for the future.

Through the execution of the project, as well as a reduction in CO2 of salt factories by substituting fossil fuels, the improvement of transportation efficiency of biomass fuel due to briquetting and the improvement in practicability of transport and consumption are expected.

Also, this project consists of projects targeting largely two businesses shown in the figure below.

1) ‘Rice Husk Briquette’ production with efficient use of the husks from the rice milling plant (hereafter, RHB).

2) Using the ‘RHB's’ produced in 1) above as a substitute fuel of coal in the salt producing factories. Investigation of efficiency improvements in the existing furnaces may be conducted if it is reasonable..

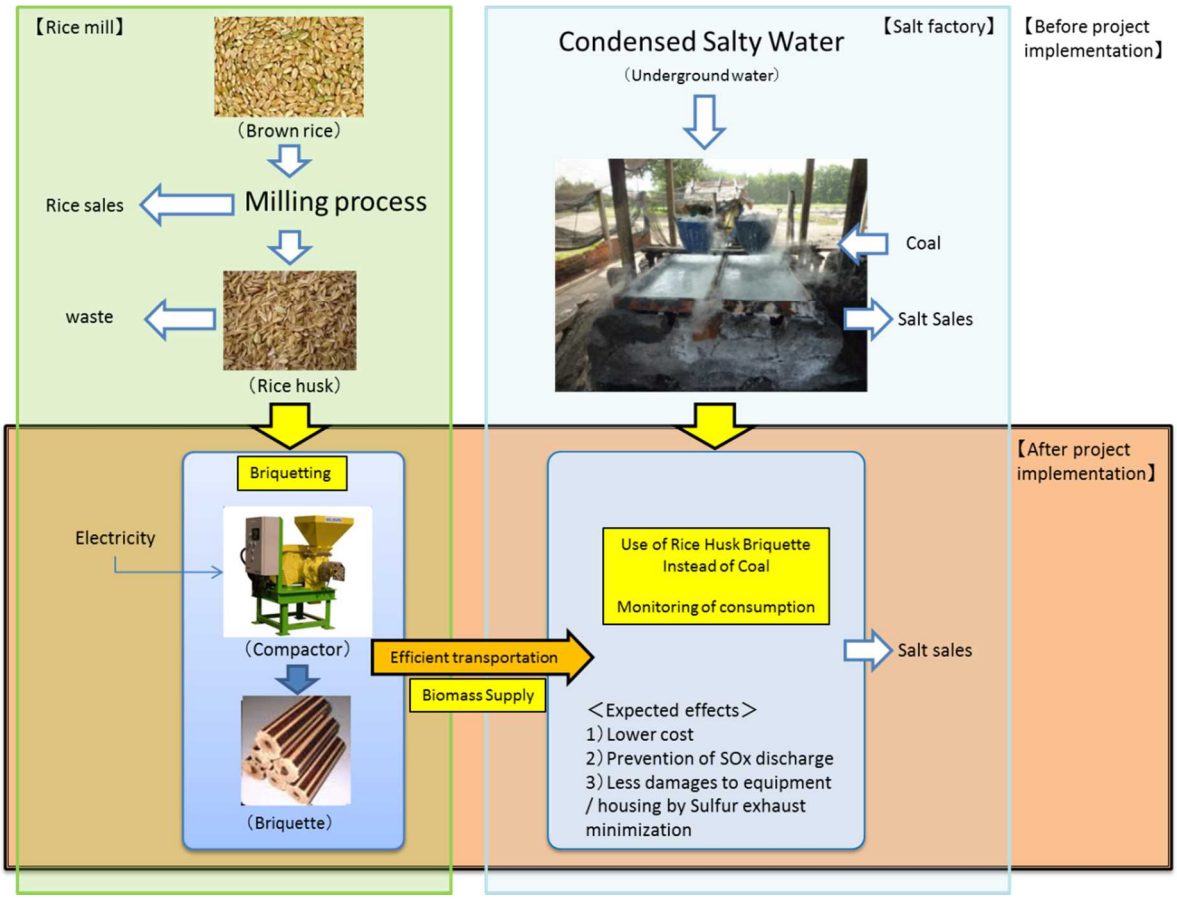


Fig. Project Overview

3.1.1.2 Expected CO2 reduction

3.1.1.2.1 Project Reduction

Expected emission reduction through the implementation of this project is shown in following table.

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2016	863	2	861
2017	2,590	6	2,584
2018	2,590	6	2,584
2019	2,590	6	2,584
2020	2,590	6	2,584
2021	2,590	6	2,584
2022	2,590	6	2,584
2023	2,590	6	2,584
2024	2,590	6	2,584
2025	2,590	6	2,584
Total (tCO_{2e})	24,173	56	24,117

Table Expected emission reduction by the project

1) Calculation method of the reduction effect

Following emission reduction calculation is based on substituting all coal consumed in V-salt (2,400t per year) to RHB.

Operation is planned to start on September 2016.

2） Calculation method of CO2 reduction cost per tCO2

Expected cost per tCO2 at this project is calculated as following table.

	Project	Reference	Difference
Initial investment	93,600 thousand yen	0 yen	93,600thousand yen
Operation cost	47,470 thousand yen per year	44,400 thousand yen per year	27,707 thousand yen per 9 years
Sub total			121,307thousand yen
CO2 reduction	56 tCO2 per 9years	24,173 tCO2 per 9years	24,117tCO2 per 9 years
CO2reduction cost	**5,029.9 yen per tCO2**		

Table Calculation result of CO2 reduction cost

3.1.1.2.2 Future potential

Potential reduction in Laos after expansion of this project is as following table.

Year	2017 ~ 2025	Accumulated
GHG reduction (t-CO2 per year)	144,702	1,302,318
Energy source CO2 reduction (t-CO2 per year)	144,702	1,302,318

Table Future potential of emission reduction

1） Calculation method of reduction effect

No.2 rice mill factory will start up in 2016. RHB will reach up to 66t/day, and the above calculation is based on this number.

3.1.1.3 Plan Background

3.1.1.3.1 Needs of Concerned Project in Target Field of the Host Nation

1） Characteristics of Laos: Greenhouse gas (GHG) reduction effect due to fuel substitution.

As Laos is rich in hydroelectric power, the CO2 emission coefficient of the grid power is low. Therefore, control of consumption of fossil fuels such as coal and petroleum and fuel conversion are effective projects in Laos.

2) Characteristics of Laos: Rich Biomass Resources

The quantity of rice produced in 2011 was 3,070,000 tons, and even with a population of 1/20 of Japan the production of rice equates to one third of that of Japan. As the rice husks make up 20% of the weight of paddy rice, this makes 610,000 tons/year of husks are potentially existing in the country, which means a potential to substitute 900,000tCO2/year coal equivalent. According to statistical data, Laos does not export any rice, so it can be said that the all rice husks stays within the country.

3) Characteristics of Coal: Reduction in Effects of Sulfur Content

Atmospheric pollution due to the release of sulfur oxides (SOx) caused by the burning of sulfur content in coal can be reduced. In the surroundings where coal is burnt, various materials degrade on contact with the flames or smoke (metals, concrete, walls etc.), shortening their lifespan. In the salt manufacturing process of the salt production company which was the subject for this project, consumption of the corrugated iron used for open pans which boils down the brine has become rapid, as well as the degradation of the concrete structural parts of the building.

4) Characteristics of the Husks

Because unprocessed husks are bulky and difficult in handling, and the speed at which they burn is remarkably quick compared to coal, it is not useful except in a few cases such as in factories where a large amount of heat energy is released in a short time (salt, spirits etc.). Also, as the husks have a low water content compared to sawdust etc., compression is difficult, and because they contain a high proportion of silica, this can easily damage the forming machines.

5) Consistency of legal system and policies in the host country

The Energy & Environment Partnership Program and Renewable Energy Development Strategy were announced in Laos in 2010 and 2011 respectively, which aim to provide 30% of energy consumption from renewable sources by 2025 (under 7% at the current situation).

3.1.1.4 Project Plan and Content

The present remit of this project is Vientiane and the Vientiane near-by area where the supplier and consumer are both located. The subject biomass resource will be husks produced from a rice milling plant operated by KHAMPHENGPHET CHENGSAWANG EXP-IMP CO.LTD (hereafter "KC co.") and the briquetting will be delivered to Veukham Salt Co., Ltd (hereafter "V Co.") who manage a salt factory (located 25km away from KC co.'s number 2 factory). Currently 2,400t/year of coal is consumed at V Co., and if this can be entirely substituted with biomass (as a thermal base), a reduction of 2,584tCO2/year can be achieved.

1) Effect and Efficiency

Although biomass such as wood is used in Laos, as rice husks are too bulky, and potential consumers are somewhat limited. This project provides an advanced case study to evidence the improvement in transportation efficiency through the introduction of briquetting technology. The result shows that there will be large demand such as cement factory, to the small scale of restaurants and other heat sources for cooking, meaning further effectiveness in substitution of fossil fuels.

Also, according to consultations conducted up until the present time, KC Co. is eager to progress the project which will enable them to effectively use the rice husks which is currently discarding, which will have time saving efficiency in bringing the project to a quick realization. In the same way, by substituting biomass for the coal normally purchased, V Co. has expressed an interest in the potential for contribution to reductions in fuel costs which account for the large part of the salt production cost.

2) Suitability

As the large part of Laos's electricity supply is taken up by hydroelectric power, at least in the wet season 100% of the domestic electricity demand is met by hydroelectric power. With the recent economic development, the demand for electricity has increased, and although plans for new coal-fired power stations have been put forward, the emissions coefficient of electricity remains low. Consequently, the energy saving electricity consumption reduction projects which Japan is good at would have a limited contribution to GHG reduction, which is one of the factors in the slow realization of Laos's Joint Crediting Mechanism.

As there are few sites in Laos where fossil fuels are used, this project was undertaken with V Co. which uses coal as its main fuel, so this is suitable for a JCM project. In the execution of this project, consumption of electricity for processing and fuels increases, as well as fuel consumption for transports becoming necessary. However, because 1) Laos's domestic electricity supply is from hydroelectric power, which emits almost no CO2, and 2) coal itself requires fuel to be transported, it is expected that the transportation fuel consumptions will cancel each other out, giving a high-suitability project which can be carried out achieving an overall CO2 reduction. Also, due to the execution of this project, we can expect to be able to investigate other sites which use fossil fuels for possibility of enacting similar projects.

3) Feasibility

As stated previously, as the producers of the RHB's, KC Co., a well-resourced company, is highly interested, while the end-users of the RHB's, V Co., welcome the project due to its fuel cost reductions, the project became realizable. Stabilization of the cost of production and supply tariff will finally be necessary, but conversely, if this can be addressed, the project will become realizable with a high degree of certainty sooner than later.

4) Level of Advancement

As a rice producing country, Japan's agricultural technology has a high degree of applicability in respect of other countries in Asia's rice-cuisine sphere. As Japan has advanced its agricultural technology, it can provide more advanced technology to the rest of Asia. Especially in the usage applications of husks, with the handling performance having been increased and made distributable, the fact that the country possesses advancement as a country of rice culture is one of the unique features of this project. Although equipment with high wear-resistance will be required due the silica content of the rice husks being particularly high, Japanese RHB machine manufacturers are developing ways to address this. As currently in Laos, the briquetting technology does not exist, so this project will be an advanced example of pioneering a new application of husks which would otherwise have only become waste in Laos, a country which produces the 1/3 amount of rice as Japan.

5) Area Expansion

As stated previously, by the implementation of this project, RHB biomass fuel use in the end-use site will be pioneered, and the same kind of project can be scaled up.

Husks are produced at the rate of 16 .7tons per day at the fuel supplier, KC Co.'s No. 1 factory. No. 2 factory is currently under construction, and together it can be expected to have an output of 66 tons per day of rice husks. The output for V Co. project requires 11 tons per day. In total, 13-18 units of RHB machinery are to

be installed.

In V Co., there are no special costs incurred in at the beginning phase of the project, and will be based on exchanging the volume of coal used for a similar volume of RHB in calorific value basis. This is because in this project, it has been shown that increasing the efficiency of the open salt pans and furnace will not lead to a reduction within the existing production costs.

Consequently, the initial investment (currently predicted) will comprise of the cost to install the briquette production system at KC Co. only, estimated at ¥121,397,000. As this represents of cost of CO2 reduction of ¥5,029.9 /CO2t, this makes for a relatively favorable CO2 reduction investment.

3.1.1.5 Implement structure of the project

Project is planned to be implemented as following structure;

Table Project implementation structure

Company	Role
Veukham Salt Co., LTD. (V Co.)	Long-term RHB purchase contract, monitoring of RHB consumption
KHAMPHENGPHET CHENGSAWANG EXP-IMP CO.,LTD (KC Co.)	Participating to International Consortium, raw material supply, RHB production and sales, Monitoring of RHB sales
INV	Participating to International Consortium, business planning and marketing of KC Co.
Japan Environmental Consultants (CUES)	Participating to International Consortium, business planning and technical support of KC Co., monitoring of data.
Climate Consulting Co. (CC)	Monitoring data confirmation

Following cases were discussed between KC on implementation structure of using biomass fuel.

1）Case 1：General sales transaction（Long-term purchase contract between KC and V-salt）

KC sets up biomass fuel manufacturing and sales division. Conclude long term contract between KC and V with condition of monitoring responsibility at V. CUES and I-company will sign contract with KC and conduct necessary services on MRV and other activities.

2）Case 2：Business Cooperation Contract between KC(Local)＋I(Local)＋CUES

This is one of contract method based on investment law of Laos. New company will not be established but Laos and foreign company will conclude a contract and conduct the business. Purpose, cooperation content, term of operation, rights/ obligations/ responsibilities and benefits of both parties, are described freely to the contract. This option is the most feasible way in present. The business will be positioned inside KC company as one division. Necessary actions to be taken are, to change KC charter (adding new business) and notarization of the contract.

3）Case 3： Joint venture establishment among KC and CUES, long term purchase contract between JV and V company

This case is to establish new company together with KC and CUES based on investment law of Laos. J V will conclude a contract with V-company for long-term purchase of RHG and to monitor V company

consumption of RHG.

It requires certain period to develop new company in Laos. It also needs to spend money. Also the investment law has an article which gives direction to foreign company to invest at least 10 million JPY when establishing a company in Laos. This option will not be selected from these matters.

3.1.1.5.1 Stakeholder Validity, Reliability, Project Interest.

The briquette supplier, KC Co. is the chair company of Laos's Rice Trade Association. For KC Co.,the raw material which is rice husk is their byproduct, so it shall have cost competitiveness. They have been also collecting information on investment possibility to rice husk utilization by themselves, which shows their great desire to implement the project.

V Co., which is the consumer of the briquettes, has about half of open salt pans which use sawdust as a fuel. As it does not contain sulfur, biomass will not harm the open salt pans. However, as the ash produced from the burning of the biomass fuel can contaminate the salt product as the ash flies in; it reduces the unit selling price of the salt. Consequently, they have an intention to advance conversion to biomass fuel of the remaining pans which use coal if the cost is acceptable and the biomass of good quality.

3.1.1.6 Superiority/Versatility of Japanese technology

As well the potential production in Laos of rice husk biomass fuel being large, there is no need for preparation such as crushing, and distribution will be simple with stable supply from rice milling plants. On the other hand, although it contains a constituent prone to causing physical damage to the machines (silica), and due the water content being too low, there being some difficulty with processing, Japan has the technology and know-how to overcome these problems.

The briquetting equipment necessary for this project is not present in Laos, and introducing this from outside the country will be necessary. There are many briquetting equipment manufacturers in Japan such as Kitagawa Iron Works Co., Ltd., Kansai Corporation, and Tromso Co., Ltd.. Kitagawa Iron Works Co., Ltd. has supported the major milling plant producer “Satake Corporation” to sell and develop biomass briquetting technology. Kansai Corporation and Tromso Co., Ltd. have track records both domestically and internationally. They evaluate the importance of maintenance systems, and seeking possibility of sourcing parts locally. Below is an overview of the Japanese manufacturing companies.

Supplier	Input (kg/hr)	Output (kg/hr)	Electricity consumption (kW)
Kitagawa	150	150	22.6
Tromso	120	120	20
Kansai	100	100	20.6
	250	250	42.9

3.1.2 Contents of the survey

This chapter describes implementation structure, contents and method of survey activity on development of JCM project.

3.1.2.1 Study implementation structure

Implementation structure of the study is as follows;

Company	Role	Expected Results
KHAMPHENGPHET CHENGSAWANG EXP-IMP CO.,LTD	RHB supplier, head of RHB production and sales activity	Cooperation to the survey (data, information sharing)
Veukham Salt Co., LTD.	RHB consumer	Cooperation to the survey (data, information sharing)
Kyoto city		Output to MOEJ
Global Environment Center		Output to MOEJ
CUES	Head of Survey	Output to MOEJ
Climate Consulting	Methodology and PDD development	Methodology and PDD draft
Macro Engineering organization	Facility and installation planning	Drawings, specification installation plans
Chittakone Sengdavong	Interpretation, translation, arrangement	Support to the survey

Table Survey implementation structure

- Local portion such as installation planning and sub-main equipment purchasing planning will be considered together with company which has transaction with.

3.1.2.2 Survey contents, problems and directions to solve

3.1.2.2.1 Business planning survey

Survey contents on business planning are as follows;

Table Business development survey content and survey method

Contents		Survey method
Finance plan	Credit	Financial report of KC and V Interview
	Long term contract	Experimental use Interview Discussion with V
Legal survey	Import procedure, Duties	Literature research, Interview
	Installation permission, Environmental protection, Fire protection	Literature research, Interview
	Labor safety	Literature research, Interview
	Company law, investment law	Literature research, Interview
Site confirmation	Water, electricity, waste water	Site survey
	Working, storage, and transportation area	Site survey
	Confirmation of present facility	Site survey
Business plan	Raw material supply stableness	Track records of KC, Business plan
	Fuel consumption tendency	Track records of V, Business plan
	Implementation structure	Proposal → Discussion
	Work flow	Proposal → Discussion

Equipment plan	Capacity and phasing	Analyzing of collected information
	Work flow, material flow	Analyzing of collected information
	Specifications	Analyzing of collected information
Cost estimation		Ask cost estimation to manufacturer, transportation company, installation company.
Construction plan		Plan with manufacturer, transportation company, installation company.
Others	Maintenance structure	Manufacturer information →Plan
	Procurement route finding of consumables	Manufacturer information →Ask KC for possibility of local procurement

3.1.2.2.2 JCM Methodology Development

1） Basic concept of the methodology

This methodology is applicable to「Substitution of fossil fuel by manufacturing and sales of RHB」. The project produces rice husk briquette from unutilized rice husk, and sells it to the consumers to substitute fossil fuels combusted in boilers and other combustion facilities, thus reduces CO_2 emissions.

Reference emission is calculated by multiplying rice husk briquette consumption, net calorific value of the rice husk briquette and CO_2 emission factor of the reference fossil fuel. For this emission, take into account conservativeness and potential effects of fossil fuel consumption reductions through efficiency improvement of boiler and other combustion facilities, multiply "Energy efficiency improvement factor of the reference fossil fuel combustion machine" to the above emission.

Project emission is the emission associated with electricity consumption of rice husk briquette production, and emissions with transportation of rice husk and rice husk briquette.

RHB consumption is the most important parameter among the monitoring parameters. RHB consumption is monitored based on purchased amount of the RHB buyer, and cross-checked by sales amount of RHB supplier. The condition required to use this methodology is the purchase contract between supplier and buyer is signed and can be monitored through purchasing/sales documents issued by both parties, to ensure the purchase and sales data.

Following methodologies were referred for developing this methodology.

- Large-scale CDM Approved Methodology「ACM0017: Production of biodiesel for use as fuel, version 2.1.0」
- Small-scale CDM Approved Methodology「AMS-III.AK.: Biodiesel production and use for transport applications, version 2.0」
- Small-scale CDM Approved Methodology「AMS-III.B.: Switching fossil fuels, version 15」
- J-Credit Methodology「EN-R-001 replacement of fossil fuel or grid electricity by biomass solid fuel（Wood biomass）, ver.1.0」

2） Setting up Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The project produces and sells rice husk briquette.
Criterion 2	The feedstock of rice husk briquette should be the rice husks which are currently not used as any materials or energy sources.
Criterion 3	The rice husk briquette produced in the project should be produced by the rice husk briquette machine with electricity and without any materials or additives other than rice husk.
Criterion 4	The rice husk briquette produced in the project substitutes fossil fuels which are used in boilers and other combustion facilities in demand sides.
Criterion 5	The producer and the consumer of the rice husk briquette are bound by a purchase and sales contract, and through sales/purchase documents of both companies, the producer can monitor the sales and consumptions of the rice husk briquette.
Criterion 6	The rice husk briquette produced should be certainly consumed by the consumer, and the consumer should not resale or export to other consumers.

3） Emission resource and GHG type

All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Combustion of coal briquette in open pans of the salt factory	CO_2
Project emissions	
Emission sources	GHG type
Electricity consumption of rice husk briquette production	CO_2
Transportation of rice husk	CO_2
Transportation of rice husk briquette	CO_2

4） Calculation of reference emission

a) Reference scenario

Reference emission is calculated by multiplying rice husk briquette consumption, net calorific value of the rice husk briquette and CO_2 emission factor of the reference fossil fuel. For this emission, take into account conservativeness and potential effects of fossil fuel consumption reductions through efficiency improvement of boiler and other combustion facilities, multiply “Energy efficiency improvement factor of the reference fossil fuel combustion machine” to the above emission.

Coal will be continuously used in the reference scenario. The type of fuel may be changed when the circumstances of fuel use changes in some reason.

Open pan will be the objectives of the parameter “efficiency of the combustion equipment”. Present efficiency of fuel consumption is 0.79 kg-coal/kg-salt (records from 2015 operation). This efficiency must be studied and adjusted.

Open pan efficiency data besides V-company (fuel consumption for producing 1kg of salt) is limited. Following table shows similar data. V-company efficiency seems to be better comparing to these data, although the precondition of these data is not clear. Therefore it is not suitable to use these figures as reference to set up efficiency improvement ratio.

Table: Sample of fuel consumption of salt production using open-pan

	Fuel consumption（t-coal/t-salt）	Calorific value（MJ/t-salt）	Source
This Project (Lao)	0.79	17,741	Data of V-salt company
Literature values (oversea)	0.5	11,250	The Salt Industry, Andrew and Annelise Fielding, A Shire Book, 2006, UK
Literature values (oversea)	0.5	11,250	Salt, salt making, and the rise of Cheshire
Literature values (oversea)	0.817	18,387	The changing technology of post medieval sea salt production in England, Jeremy Greenwood
Literature values (Japan)	1.15	24,058	http://www.geocities.jp/t_hashimotoodawara/salt6/salt6-00-03.html
Literature values (oversea)	1.5	33,750	Lancashire and Cheshire from AD1540, C. B. Phillips, J. H. Smith
Literature values (Japan)	2.15	44,978	http://www.geocities.jp/t_hashimotoodawara/salt6/salt6-00-03.html

On the other hand, fuel consumption efficiency of V-salt is around .71～1.1 kg-coal/kg-salt (from experience). From this information, there is a possibility that the fuel consumption sufficiency can be improved from 0.79 kg-coal/kg-saltto0.71kg-coal/kg-salt, which is 10% improvement. This methodology takes 20% of improvement ratio.

b) Calculation of reference emission

Reference emission in the methodology is defined as “CO2 emission associated with combustion of fossil fuel that would have been used by the consumer in the absence of the rice husk briquette”.

Reference emission is calculated by multiplying rice husk briquette consumption, net calorific value of the rice husk briquette and CO2 emission factor of the reference fossil fuel. For this emission, take into account conservativeness and potential effects of fossil fuel consumption reductions through efficiency improvement of boiler and other combustion facilities, multiply “Energy efficiency improvement factor of the reference fossil fuel combustion machine” to the above emission.

$$RE_p = BC_p \times NCV_{biomass} \times EF_{CO2,i} \times (1 - EI)$$

Where,

BC_p Consumption of rice husk briquette during the period p [t/p]

$NCV_{biomass}$ Net calorific value of rice husk briquette [MJ/t]

$EF_{CO2,i}$ CO_2 emission factor of the reference fossil fuel i [tCO_2/MJ]

EI Energy efficiency improvement factor of the reference fossil fuel combustion machine

By using efficiency of the combustion equipment of reference scenario and project（η_{RE} and η_{PJ}）, above formula can be described more in detail as follows;

$$RE_p = \frac{BC_p \times NCV_{biomass} \times \eta_{PJ}}{\eta_{RE}} \times EF_{CO2,i} \times (1 - EI)$$

As $\eta_{PJ}/\eta_{RE} = 1$ is conservative and in general, $\eta_{PJ} \geq \eta_{RE}$ is general, proposed formula was simplified based on referring such as small-scale CDM Methodology「AMS-III.B.: Switching fossil fuels, version 15」and J-credit methodology「EN-R-001 Fossil fuel or grid electricity switch to biomass solid fuel (wood biomass), ver.1.0」

5）Calculation of project emission

Project emission consists from following items.

1. Emission associated with electricity consumption of rice husk briquette production
2. Emission associated with transportation of rice husk
3. Emission associated with transportation of rice husk briquette

$$PE_p = PE_{elec,p} + PE_{tp1,p} + PE_{tp2,p}$$

1. Emission associated with electricity consumption of rice husk briquette production

$PE_{elec,p} = EC_p \times EF_{CO2,elec}$

EC_p Electricity consumption of rice husk briquette production during the period p [MWh/p]

$EF_{CO2,elec}$ CO_2 emission factor for electricity [tCO_2/MWh]

2. Emission associated with transportation of rice husk

Calculate emission associated with transportation of rice husk from the source of the rice husk to the rice husk briquette machine. The emission can be neglected if the source and the rice husk briquette machine are located in the same factory.

$$PE_{tp1,p} = \frac{DT_{tp1,p}}{FE_{tp1}} \times NCV_j \times EF_{CO2,j}$$

$DT_{tp1,p}$ Transportation distance of rice husk during the period p [km/p]

FE_{tp1} Fuel economy of motor vehicle for rice husk transportation [km/liter]

NCV_j Net calorific value of fossil fuel j of motor vehicle for rice husk transportation [MJ/liter]

$EF_{CO2,j}$ CO_2 emission factor of fossil fuel j of motor vehicle for rice husk transportation [tCO_2/MJ]

3. Emission associated with transportation of rice husk briquette

Calculate emission associated with transportation of rice husk briquette from the rice husk briquette machine to consumers. The emission can be neglected if the incremental transport distance compared with the reference fossil fuel transportation is equal or less than 200km. Only consumers with incremental transportation distance is over 200km should be counted.

$$PE_{tp2,p} = \sum_i \left(\frac{DT_{tp2,m,p}}{FE_{tp2,m}} \times NCV_{k,m} \times EF_{CO2,k,m} \right)$$

$DT_{tp2,m,p}$ Increment distance for rice husk briquette transportation to consumer m during the period p [km/p]

$FE_{tp2,m}$ Fuel economy of motor vehicle to transport rice husk briquette to consumer m [km/liter]

$NCV_{k,m}$ Net calorific value of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [MJ/liter]

$EF_{CO2,k,m}$ CO_2 emission factor of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [tCO_2/MJ]

6） Data and parameters fixed *ex ante*

The source of each data and parameter fixed ex ante is listed as below.

Parameter	Description of data	Source
$NCV_{biomass}$	Net calorific value of rice husk briquette [MJ/t]	Default value set through ex-ante measurement.
$EF_{CO2,i}$	CO_2 emission factor of the reference fossil fuel i [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
EI	Energy efficiency improvement factor of the existing fossil fuel combustion machine	Default value: 20% (=0.2)
$EF_{CO2,elec}$	CO_2 emission factor for electricity [tCO_2/MWh]	Grid electricity: i) The most recent official value in Laos or ii) average emission factor considering all power plants connected to the grid Captive electricity: The most recent default value available from CDM approved small scale methodology AMS-I.A.
FE_{tp1}	**In case, necessary to calculate $PE_{tp1,p}$* Fuel economy of motor vehicle for rice husk transportation [km/liter]	Default value set through ex-ante measurement.
NCV_j	**In case, necessary to calculate $PE_{tp1,p}$* Net calorific value of fossil fuel j of motor vehicle for rice husk transportation [MJ/liter]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$EF_{CO2,j}$	**In case, necessary to calculate $PE_{tp1,p}$* CO_2 emission factor of fossil fuel j of motor vehicle for rice husk transportation [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$FE_{tp2,m}$	**In case, necessary to calculate $PE_{tp2,p}$* Fuel economy of motor vehicle to transport rice husk briquette to consumer m [km/liter]	Default value set through ex-ante measurement.
$NCV_{k,m}$	**In case, necessary to calculate $PE_{tp2,p}$* Net calorific value of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [MJ/liter]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$EF_{CO2,k,m}$	**In case, necessary to calculate $PE_{tp2,p}$* CO_2 emission factor of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.

7） Monitoring items and frequency

Parameters requiring monitoring are follows;

a) Consumption of rice husk briquette during the period p [t/p]（BC_p）

The importance of this project is to confirm the consumption of RHB produced and delivered to the consumer's site.
The consumption volume is justified through the difference in the total volume of RHB purchase records and slip of the month, and remained amount of RHB in the storage at the end of the month. This amount will be cross-checked between sales records/slips of the supplier. Purchase contract will have article to avoid the RHB to be re-sold to third party or foreign country by the consumer.

Reference 1：Monitoring method of biomass fule consumption volume in CDM Metodologies
Large-scale CDM approved methodology「ACM0017: Production of biodiesel for use as fuel, version 2.1.0」shows the monitoring method of bio diesel as follows. In this methodology, it says to directly monitor the supplied amount of diesel though oil meter.
The project in Laos is using solid biomass fuel. Therefore, the above methodology is not suitable for the project in Laos.

Description in Applicability
The consumer and the producer of the (blended) biodiesel are bound by a contract that allows the producer to monitor the consumption of (blended) biodiesel and that states that the consumer shall not claim CERs resulting from its consumption;

Description in Monitoring Methodology
Contractually the biodiesel producer has to monitor consumption by the consumer as follows:
- The receiving amount of blended biodiesel in the gas station or final distributor has to be recorded by a calibrated metering system and the storage fill level is recorded by a calibrated filling level indicator;
- The amount of the blended biodiesel filled into the installation or vehicle where combustion takes place must be recorded by a calibrated metering system;
- If blending is done by a third party contractual arrangement shall be made, that the same monitoring procedure as described above can be applied.

Reference 2：Monitoring method of RHB consumption in CDM projects
There are several CDM projects registered which involves fuel substituting by biomass briquette. Among these projects, the monitoring method of briquette consumption of「Thermal Energy Generation using Biomass Briquette at M/s. Garware Polyester Limited, Waluj, Aurangabad, India」is referred. This project designs to set up a weigh inside the boiler room, and to measure the eeight of the trolly transporting briquette by this weigh.
In the case of Laos project, it is not reasonable to locate weighs to all salt production stoves as there are to many stoves (more than 50). It is theoritically possible to set up a weigh inside the RHB storage house and can be weighed and recorded when the consumer takes RHB back to their stove. Although this is possible, we recommend the way we propose from the point of view of work efficiency and unity of the measurement among the RHB consumers which is the individual salt producing labor.

The quantity of biomass briquette will be monitored using weighing scale installed near boiler. The briquettes are fed manually and each trolley is weighed with loaded and empty conditions. The difference of Gross weight and Tare weight is considered as quantity of briquette fed. The log sheet is maintained at boiler house and records of each trolley will be entered to derive the total quantity of biomass consumed. The weighing scale is calibrated annually. Monitoring shall be done as below.

1) Manual collection of briquettes in trolley by shovels.

2) Weighing of trolley on local weighing scale in boiler house (Make: Libra, Range 0 - 1500kg) - Gross weight.-Kg

3) Tare weight of trolley. - Tare weight.-Kg.

4) For each trolley, the net weight would be calculated as (Gross weight – Tare weight.) in Kg

5) Monthly consumption shall be considered from above data.

6) Recording Frequency will be maintained as Daily.

b) Electricity consumption of rice husk briquette production during the period p [MWh/p]（EC_p）

Electricity consumption of RHB production machine will be monitored. Electric meter will be monitored last day of every month and recorded to the monitoring notes.

c) Transportation distance of rice husk during the period p [km/p]（$DT_{tp1,p}$）

This parameter is counted when there are necessity to transport rice husk itself. Although it will be ignored when the transportation distance between rice husk generate location and RHB production point is less than 200km. The source in ignoring distance of 200km and under is referring such as small-scale CDM methodology「AMS-III.AK.: Biodiesel production and use for transport applications, version 2.0」. Distance is followed by odometer of the truck and recorded in daily basis. The sum-up of the distance will be calculated in the beginning day of next month.

d) Increment distance for rice husk briquette transportation to consumer m during the period p [km/p]（$DT_{tp2,m,p}$）

This parameter will be counted when RHB will be transported. This parameter can be ignored if the transportation distance between producer and consumer is under 200km The basis of 200km is from small-scale CDM Methodology「AMS-III.AK.: Biodiesel production and use for transport applications, version 2.0」and others. Distance of the transportation will be monitored by odometer of the transportation vehicle and recorded every transportation. The result of previous month will be calculated on first day of every month.

8）Calculation of emissions reductions

Emission reduction is calculated based on following formula;

$ER_p = RE_p - PE_p$

ER_p Emission reduction during the period p [tCO_2/p]

RE_p Reference emission during the period p [tCO_2/p]

PE_p Project emission during the period p [tCO_2/p]

3.1.2.2.3 Development of draft JCM PDD

Draft PDD is attached in the appendix.

Emission reduction was calculated as follows;

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2016	863	2	861
2017	2,590	6	2,584
2018	2,590	6	2,584
2019	2,590	6	2,584
2020	2,590	6	2,584
2021	2,590	6	2,584
2022	2,590	6	2,584
2023	2,590	6	2,584
2024	2,590	6	2,584
2025	2,590	6	2,584
Total (tCO_{2e})	24,173	56	24,117

※emission amount and emission reduction after September 1st, 2016

MRV structure is planned as follows;

KC will conduct the monitoring by monitoring expert. CUES and Climate Consulting Co. (CC) receive the monitoring result (monthly report, annual report) from the monitoring expert. CUES and CC checks the report and calculate emission reduction, develop monitoring report, and submit to third-party organization via KC. Third-party organization verifies the report. After the verification, KC will register to issue the credit to the Joint Committee.

The target emission source is the briquette production machine of Khamphengphet Chengsawang EXP-IMP Co., Ltd.（KC） and open-pan of Veukham Salt Co., Ltd.（V）. Monitoring point is described in the red square of following figure.

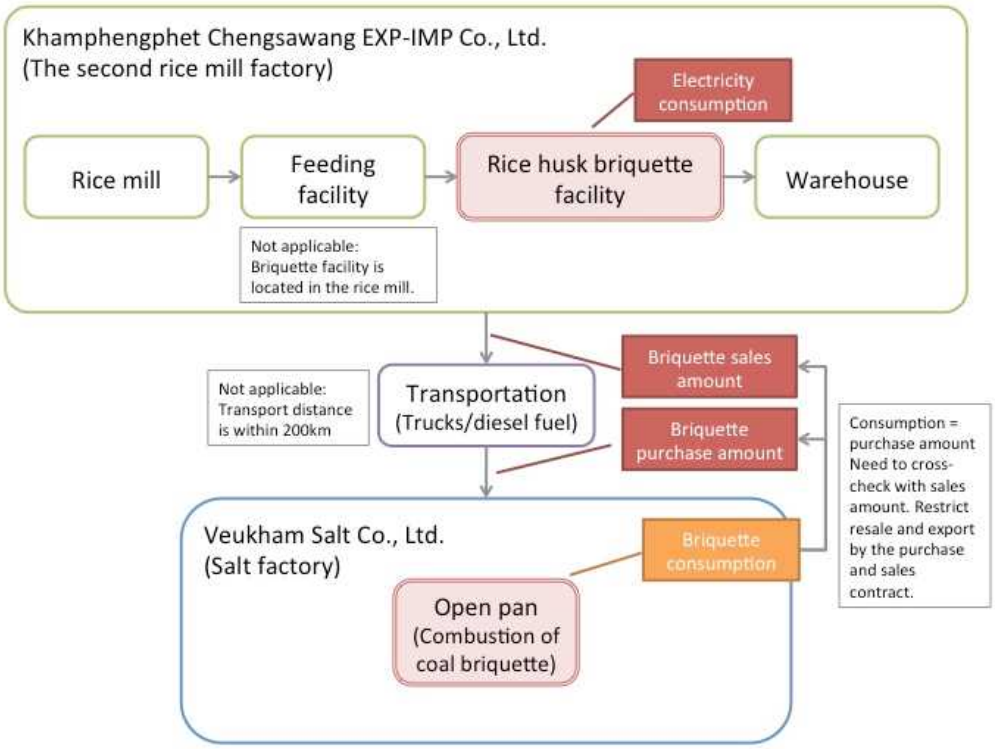


Figure: Emission source and monitoring point

3.1.2.3 Survey schedule

Survey schedule was planned as follows in the beginning.

table Planned Survey Schedule

	4	5	6	7	8	9	10	11	12	1	2	3
Finance plan												
Detail design												
Construction plan												
Project operation plan												
JCM methodology development												
PDD development												
MRV structure planning												
Reporting												★

Conferences in Japan		●								●		
Workshop in Laos			●								●	
Meetings in Japan	●		●			●		●		●		
Site survey		▬	▬▬		▬▬					▬▬		

3.1.3 Current condition of the host country and the project

We conduct JCM project feasibility studies on the following two matters.

1) Use of rice husk briquettes (RHB) as an alternative fuel to coal at a saltery

2) Production of RHB at a rice mill

To provide information on the target business establishments and describe the direction of this project, this chapter first states 3.1 “Current condition of the saltery and project overview” and 3.2 “Current condition of the rice mill and project overview.”

3.1.3.1 Current condition of the saltery and project overview

Since the saltery will be an RHB user, we clarify the current condition of the customer, look into requirements (quality, price, etc.) of the customer for RHB as an alternative fuel to coal, and discuss the possibility that the requirements will be satisfied.

3.1.3.1.1 Current condition of the saltery

1) Overview of Veunkhaum Salt factory LTD.

[Capital and location]

Veunkhaum Salt factory LTD. (hereinafter, “Company V”) is a private company capitalized by Laos and located on the outskirts of Vientiane.

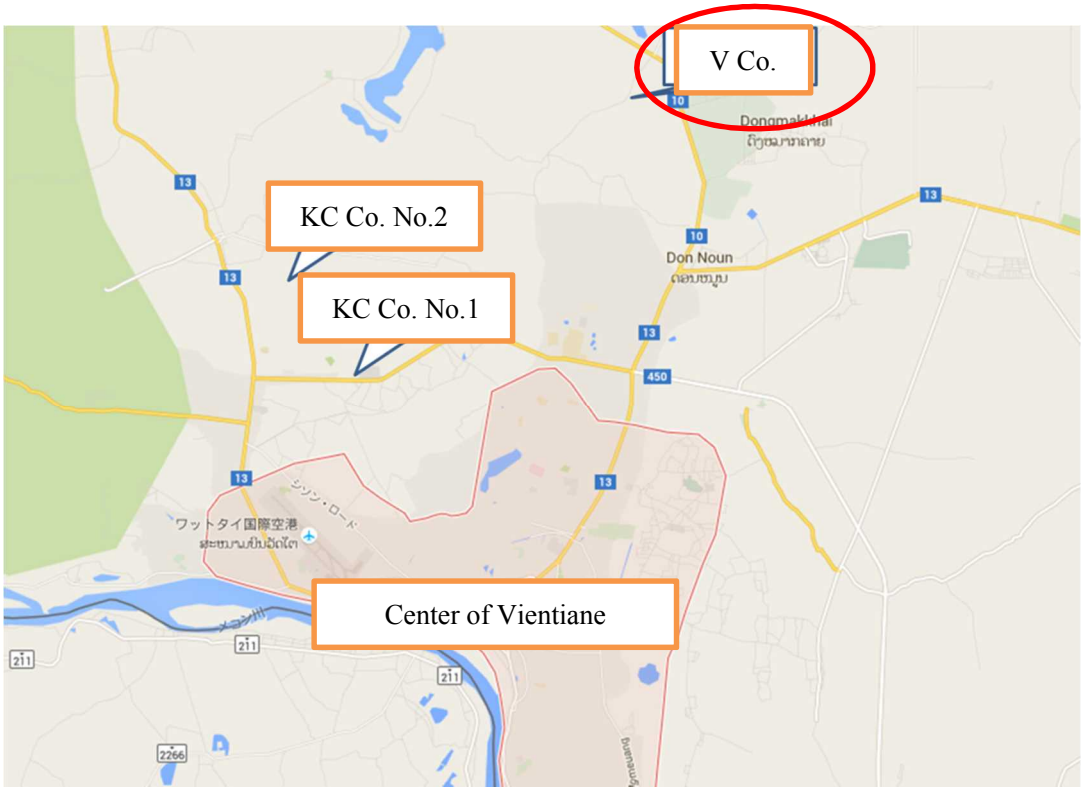


Figure　Location of the salt Company V

[Business operation model]

Most of salt factories including Company V in Laos have signed a so-called “production consignment contract” with individuals, outsourcing salt making work by providing the individuals with raw materials and workshops and purchasing their end products.

Company V also provides individuals (about 20 contracts at present) with salt making furnaces and a residence area free within its site. The company supplies raw material brine, fuel for salt making, materials (galvanized iron) for kettles, etc. free, and purchases their end products.

Company V adds iodine to the salt purchased, wraps it, and then ships and sells it. Markets in Laos are its main targets.

[Overview of salt making method]

Salt is produced by solar drying (performed in the future) or evaporation by heating. Solar drying is performed only in the dry season (around the season from November to February). Evaporation by heating is performed throughout the year.

Evaporation by heating is performed by using briquettes or biomass (sawdust and waste wood at present). Salt making using these fuels is characterized as follows.

- Biomass fuel

  Its fuel cost is low (the cost is less than or equal to that of briquettes, and its heating power is about half of that of briquettes). However, biomass has the following disadvantages: 1. since it tends to disperse ash easily, end products contain more impurities than products produced by using briquettes do; 2. its combustion temperature causes salt grains to become coarser than that produced by using briquettes.

- Briquettes

Although their fuel cost is high, they produce salt containing fewer impurities and having fine grains.

Therefore, salt produced by using briquettes is sold at higher prices than that produced by using biomass fuel.

[Production cost structure]

As seen in the following table, the production cost due to sawdust fuel is about 75% of that due to briquette fuel.

Production cost per 10kg salt	65	KIP/ JPY				
	Saw dust			Briquette coal		
	Ratio	KIP/10kg	JPY/10kg	ratio	KIP/10kg	JPY/10kg
fuel cost	28.92%	3,900	60	46.91%	8,471	130
Packing labor cot	8.90%	1,200	18	6.65%	1,200	18
Salt purchase	8.65%	1,166	18	6.46%	1,166	18
Package	7.77%	1,048	16	5.80%	1,048	16
Package (external)	3.93%	530	8	2.94%	530	8
Iodine	2.32%	313	5	1.73%	313	5
Salt water (electricity, tax)	2.33%	314	5	1.74%	314	5
Material cost for open pans	1.64%	221	3	1.22%	221	3
Strings	0.04%	5	0	0.03%	5	0
Others	64.50%	8,698	134	73.49%	13269	204
Mangement cost	35.50%	4,787	74	26.51%	4,787	74
Total	100.00%	13,485	207	100.00%	18,056	278

Table Production cost structure corresponding to each fuel type

[Quality]

The quality of end products is managed by checking the following items.

- Water content: 2% or lower (4-5% for domestic markets (mainly salt produced by using sawdust))
- IOD (iodized rate): 40-60 ppm (regardless of whether coal or sawdust is used)
- Impurities: Only by visual check
- Grain size: Not checked at present (since the grain size is clearly different due to the fuel type, only classification by the two types is used); under planning for the future

The above-mentioned quality standards are in-house standards. We have heard that Laos domestic standards are in the process of being established.

2) Situation of production field

[Raw material]

Company V pumps up brine (almost saturated at about 25% salinity) from a rock salt bed at a depth of 120 m from the ground surface by using an airlift.

[Overview of processing procedure]

In the process of evaporation by heating, brine is put into a galvanized-iron kettle. Salt crystals are deposited in the kettle by combusting biomass or briquette fuel in the lower part of the furnace to evaporate water. The deposited salt crystals are ladled out into a basket and set aside for about four to five days until water is drained (water content: about 4-5%). Coarse salt is thus produced.

Photograph Appearance of typical salt making furnace (briquette fuel)

Subsequently, export products are dried in a drying room using heaters and sunshine until their water content is reduced to about 0.3%. The heat source of the heater is electricity.

[Production volume]

Fuel is added once a day (120 briquettes and 0.7-m^3 sawdust are consumed). This fuel addition is considered one batch. The total amount of brine initially added for one batch is 180 L/day. After that, a cycle consisting of water evaporation and crystallization, ladling out salt, and adding brine is repeated. Finally, about 180 kg of salt by coal combustion or about 150 kg of salt by sawdust combustion is produced in about 18 hours including time for evaporation by remaining heat after fire is put out.

Company V has 156 units of briquette furnaces and biomass furnaces (78 sets of two furnaces) in total. In full operation, its salt making capacity is 156 × 120 kg = 18,720 kg/day.

Since production by solar drying will start this year, the production volume is unknown.

[Furnace structure]

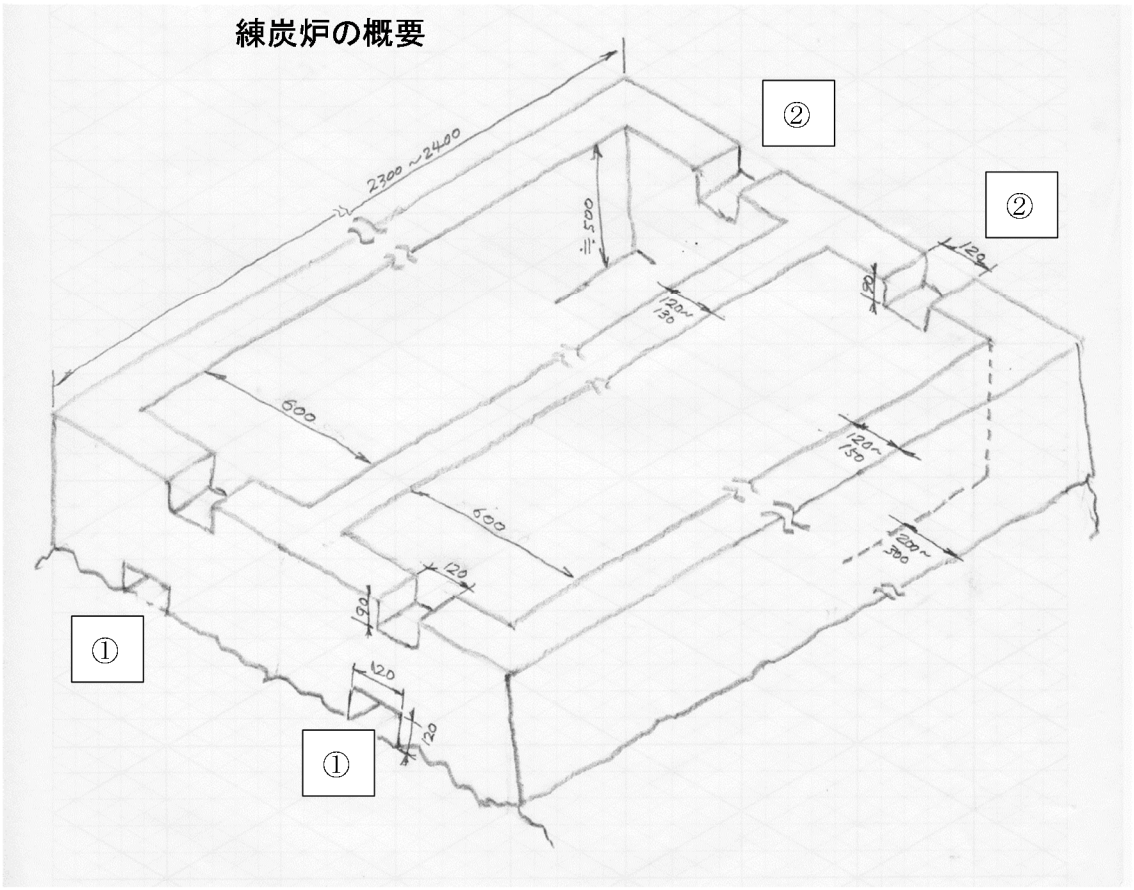


Figure　Structure of salt making furnace

The above diagram illustrates the structure of an existing briquette furnace. Briquettes are placed in a two-tiered form on the fire grate under the kettle. After they are ignited, the kettle is placed over the fire grate. Generally, two furnaces are installed as a pair, and a kettle is placed on each of the furnaces. The later-described biomass furnaces have basically the same structure as that of the briquette furnaces. However, biomass furnaces do not use a fire grate.

[Construction cost of furnaces]

These furnaces are made of a mixture of incineration ash, salt, and clay, and their material costs are not taken into consideration in the cost calculation. The furnaces are easily damaged and undergo a scrap-and-build process once every six months on the average. Since work for this process is performed by the individuals to whom furnace operation is outsourced, labor costs are also included in the payment for salt from Company V to the individuals. Therefore, no costs are virtually taken for furnace construction.

The kettle placed on the upper portion is made of galvanized iron. Its raw materials are supplied to the individuals by Company V. The individuals machine a galvanized iron sheet (214 cm × 64 cm) to form a kettle about 13 cm deep. The cost of the galvanized iron sheets is paid by Company V but accounts for only a very small rate of about 1.5% of the production cost.

[Furnace operation]

Working hours per day are basically 18 hours. However, when all the fuel added at the time of the start of salt making is exhausted, work for the day will be ended.

As described in the following, fuel is arranged in a briquette furnace and a biomass furnace in different manners. After the fuel is ignited, a kettle is placed on the furnace, and brine is put into the kettle. During water evaporation and crystallization, salt crystals are appropriately ladled out into a basket hung above the kettle, until all the fuel is burned out. While the crystals are left standing, water contained in the crystals gradually and spontaneously drops into the kettle to be drained. The basket can contain about 50 kg of salt. When filled with salt, a basket is brought into a storehouse and left hung for a while to drain water.

- Briquette furnace

  A fire grate is placed in the furnace, and briquettes (about 150 mmφ × 120 mmH) are arranged in a two-tiered form on the fire grate. The nominal weight of a briquette is 1 kg but fluctuates between 0.9 and 1.1 kg. In one furnace, 120 briquettes are placed. The delivered price of a briquette at the saltery is 1200 KIP (about 18.5 yen)/kg.

Photograph　Briquette and briquette production

For ignition, 10 or so of ignited briquettes are prepared and arranged in appropriate locations.

Combustion air enters the furnace through the holes located in both ends of the lower portion of the furnace (Figure 3-1-1-2 ①), and exhaust gas exits from the holes located around the lower portion of the kettle (Figure 3-1-1-2 ②). The combustion duration of the briquettes is about 16 hours.

The life of kettles used for briquette furnaces, which are exposed to sulfur content, is about 45 days. It is shorter than that of kettles used for biomass furnaces (about three months). In addition, roof materials undergo strong corrosion caused by smoke containing sulfur content.

- Biomass furnace

About 40% of furnaces at this saltery use sawdust. Its consumption is about 24,000 m^3/year. Sawdust is

purchased at an average price of about 26,000 KIP/m^3 including transportation cost from lumber mills at distances of up to 150 km.

A sawdust furnace is filled with sawdust (0.7 m^3 (about 0.9 m^3 for the style of sawdust packing) is pushed into the furnace) in advance, and then, the sawdust is tamped with a stick while a fire channel (combustion air supply channel) is ensured with a log. After that, a kettle is placed on the furnace, and then sawdust is ignited. Air flows as is the case in a briquette furnace. The combustion duration of the tamped sawdust is about 12 to 13 hours, but heat remaining duration at a level allowing continuous evaporation is longer than that brought about by coal combustion. As a result, heating hours almost as many as those brought about by coal combustion can be ensured.

Photograph Salt making furnace with sawdust added

The wood combusting furnaces are more primitive. They have a large opening in their lower portion, and wood is added through the opening when necessary. Combustion in wood combusting furnaces just looks like a bonfire.

3.1.3.1.2 Basic concept of the project at the saltery

At the initial stage of the study, the following two projects were underway at Company V.

1) CO_2 reduction by using RHB as an alternative fuel to coal

2) CO_2 reduction by improving the efficiency of existing salt making furnaces to reduce fuel consumption

To the above 1), we adopt the following two approaches and relate the results to the result of this study.

- Advantages in cost, compared with those brought about by the currently-used fuel
- Usability of RHB, compared with that provided by the currently-used fuel (effectiveness in salt making, easiness of handling, etc.)

The previous study suggests that any measure for improvement will increase particularly the production cost on the premise that the conventional salt making method (evaporation by heating under normal pressure) is used as requested by Company V. Therefore, we concluded that it is impossible to implement the above 2). We have started considering a "hybrid" salt making furnace, which can reduce coal usage in the subsequent-stage coal furnace to produce fine-grain products by evaporating a certain amount of water in the previous-stage biomass furnace. However, since we must develop some elements for this furnace, its examination will not be completed during the period of this study.
The record of the above-mentioned examination is as follows.

3.1.3.1.3 CO_2 reduction by using RHB as an alternative fuel to coal

We conducted an actual RHB field trial at Company V as follows and examine the degree of the possibility that RHB can be an alternative fuel to coal from the perspectives of cost and operation.

Table Project proposal for usage test on RHB for Veunkham Salt Co. (draft)

Subject	Test for effectiveness of RHB as fuel for salt making
Proposal	We import briquettes produced from Japanese rice husks to Laos, perform salt making by using the briquettes, and evaluate their performance.
Test type	Collaborative test (CUES – Veunkham)
Purport	To perform evaluation by comparing with the current salt making method using coal from the perspectives of cost, convenience, and the quality of end products
Background	Subsidy for the RHB production unit is obtained by securing a guarantee that Company V will use RHB at a low price for a long time.
Matters for study	1. On site: Comparison with conventional fuel 1) "Time taken for 100% consumption" and the "amount of salt" produced during the time 2) Examining the optimum operation method and considering the improvement of workability 3) Comparing costs and comparing selling prices 4) Comparing product quality (grain sizes and the amounts of contained impurities)
Implementation period	Three days from February 3 to 5, 2016 (after that, Company V performs the test on its own as long as RHB is available.)
Cost	Briquette production (CUES) Briquette transport (CUES) Transport between the rice mill to the saltery (rice mill) Use of briquettes (Company V) Sale of products (Company V)
Expected effects	Cost reduction: The salt price will be reduced by about 10%, compared with that of salt produced by using coal. Improvement of workability: Workability will be improved from salt making using conventional fuel. Quality of end products: Equivalent to that of salt produced by using coal.
Matters for examination	* Properties of rice husks, coal, and sawdust on site * How to supply (place) fuel must be examined. It will be examined during the test. The necessity of adjusting the briquette length on an as-needed basis before shipment needs to be considered. * A "drawer-type" kettle will be created as a means for adding fuel during the salt making process.

From the field trial, the following major matters were identified.

[Quality]

・It was judged that salt produced by using RHB is equivalent in quality to that produced by using coal.

[Combustion duration]

・The combustion duration of RHB is about 60% of that of coal (the combustion duration of coal is about 18 hours), and the corresponding production volume is about 70% of that in salt making using coal (the corresponding production volume in salt making using coal is about 180 kg).

・Although there seems to be some room for improvement, we judge that the combustion duration cannot be increased to the level of that of coal.

[Summary]

・The fact that the product quality becomes equivalent to that of the salt produced by using coal is a great finding and advantage. The short combustion duration was expected, and it is essential to establish an operation method by considering this characteristic in the future.

・The currently promising operation method is two-batch RHB operation, which increases the combustion duration to that of coal. We have estimated that if we can establish this method and make the fuel cost per 1 kg of product salt lower than that of coal, quality salt can be produced by 109 to 135% of the salt produced by using coal. Since it is expected that more efficient operation methods will be found through additional field trials, this value is expected to become larger.

・Company V has already judged that RHB can be used as an alternative fuel to coal, considering that its feasibility will be increased by operational efficiency enhancement and the cost reduction brought about by the efforts of the RHB production side.

Based on the above discussion, we summarized matters for examination as follows.

Advantages in cost, compared with current fuel

We estimated maintenance cost of the briquette production unit and compared the cost with that due to the current use of coal.

(1) Cost price of RHB

The following table shows the RHB production cost determined by current estimation. This estimation was made under the condition that all the coal currently used by Company V is replaced with equivalent RHB.

Table: RHB production cost

Product cost	No subsidy			795.27	LAK/kg
	50% subsidy for Initial cost			708.19	LAK/kg
CO2 reduction amount	CO2 emission factor of coal			0.10	tCO2/GJ
	calorific value of coal			26.7	GJ/t
	Annual CO2 reduction amount			6,299.06	tCO2/y
	Co2 reduction amount 9 years			56,691.58	tCO2
Subsidy				3,134,882,143	LAK
CO2 reduction unit cost				55,297	LAK/t
V-Co. cost	Coal	1239.5	LAK/kg	2,974,800,000	LAK/y
	Rice husk without subsidy	795.27	LAK/kg	3,181,064,830	LAK/y
	Rice husk with subsidy	708.19	LAK/kg	2,832,744,592	LAK/y

Current coal fuel cost at Company V is 44,400,000 yen per year. According to the above-mentioned estimation, RHB will lead to cost increase (47,478,580 yen/year) based on the cost price if no subsidy is obtained, whereas a subsidy of 50% of the initial investment will reduce RHB cost (42,279,770 yen/year) based on the cost price. However, this value is just based on the cost price. To produce profit, cost reduction on the RHB production side is essential.

(2) Unit fuel price for salt making

On the basis of the result obtained on February 3 and 4, 2016, we calculated the unit fuel price per 1 kg of salt and the production volume expected from two-batch RHB operation.

Table: Unit fuel price for salt making

	Condition				Result					Estimation		
Date	Furnace	Fuel	Fuel settings	grate	Fuel amount	Unit price	Total price	Salt volume	Cost/ salt kg	batch	production	Coal comparison
3rd, Feb	I	Coal	Original	Yes	126	1,200	151,200	192	787.50	–	–	–
	II	Sawdust	Original	No	130	140	18,200	158	115.19	–	–	–
	III	RHB	Horizontal	Yes	116	710	82,360	105	784.38	2	210	1.09
	IV	RHB	Horizontal	No	130	710	92,300	130	710.00	2	260	1.35
4th, Feb	I	RHB	Vertical	Yes	111	710	78,810	113	697.43	2	226	1.18
	III	RHB	Horizontal	Yes	120	710	85,200	115	740.87	2	230	1.20

* The unit briquette fuel price is almost equal to the estimated cost price.

The operation in which RHB is vertically arranged on a fire grate (this arrangement allows combustion air to flow easily) is the most efficient, reducing the unit fuel price per 1 kg of salt to less than 700 KIP.

3.1.3.1.4 CO_2 reduction by reducing fuel consumption through the efficiency enhancement of existing salt making furnaces

For the following reasons, we will not improve existing salt making furnaces in this study.

1) Efforts for improvement and cost effectiveness

The enhancement of heat insulation of the furnace main body is a possible qualitative measure to reduce heat energy loss. Current furnaces are made of a mixture of mud, incineration ash, and salt. It seems that replacing this material with heat-insulating firebricks can somewhat reduce heat emission from the furnace main body. However, current furnaces are constructed at almost no cost, and furnace construction cost cannot be increased any more from the perspective of salt making cost.

The selling price of an imported firebrick in Laos is about US $5. Covering the wall of a furnace with such firebricks will require about 200 bricks (about L200 mm × H60 mm). In such a case, about US $1,000/furnace is necessary as material cost alone, and the heat insulation will not be beneficial unless 9.5% or higher improvement in fuel consumption is realized even on the premise that the durability of the firebricks is two years (about six months at present). Although about 5% improvement will be beneficial in the first term with the JCM subsidy, 10% or higher improvement in heat efficiency must be ensured in the later terms without the subsidy.

2) Difficulty in numerical evaluation of efficiency

The following three approaches are also possible as means for enhancing the heat efficiency of existing furnaces without changing the production method.

- Eliminating gaps around the kettle
- Ensuring an air channel that allows complete combustion of fuel
- Mending the exhaust channel

However, the implementation of these approaches is expected to bring about only qualitative effects to some extent, and it is almost impossible to evaluate their effectiveness numerically.

To monitor the effectiveness of these improving measures, it is generally necessary to use the amount of salt produced during the time to determine the theoretical amount of heat energy that is used to evaporate water from added brine. Therefore, the following measurement must be performed on each furnace. However, it is difficult to perform actual measurement periodically on site.

- Amount of added brine (oral information: 180 L)
- Amount of salt produced per day (oral information: 120 kg; water content: 1-2% (briquette combustion) and 4-5% (sawdust combustion))
- Amount of brine remaining in a kettle (oral information: almost zero)

In any location in the existing facilities, temperature management is not performed at present. This is because temperature management is not necessary as long as salt is produced by the current production method. Raw material brine is just added until “it reaches a certain height in the kettle,” and its quantitative management is not performed each time. The only amount measured is the weight of salt crystals produced within a specific period of time (working hours per day), but it is not recorded separately for each furnace.

We judged that under the current condition that salt is produced by the above-mentioned primitive method, it is very difficult to monitor improvement in heat efficiency brought about by the modification or improvement of existing furnaces.

3） Further considerations

It is natural that salt production company expects cost reduction and better quality by obtaining benefits of both fossil fuel and biomass fuel, and CO2 reduction as a result.

Present understood fuel characteristics are as follows;

- Salt made from coal fuel has fine particles and white color. It can be sold in higher price than salt made

by biomass.

- Biomass fuel is cheaper than coal

From above facts, even though it still requires further considerations, there is a possibility of CO2 reduction and obtaining better quality and lower the cost by placing a pre-heating pan fired by biomass before the original pan and condense the salted water before the final coal fire process.
Technical problems to be considered are controlling of pre heating pan to prevent excessed condensing and prevention of the pipeline stuck between preheating and original pan.

3.1.3.1.5 Problems and countermeasures as developing the project as JCM project

1） Fuel consumption management and consideration on possible monitoring method in the future

【Present】

There is no severe management of fuel is existing at consumer side. General consumption volume of both biomass fired furnace and coal fired furnace is given from the experience (0.7m3 for biomass fired furnace, 120 briquette coal for coal fired furnace). Managers of V-company just confirm the operation of each furnace and assume the consumed fuel volume.
It is necessary for JCM project to recognize accurate amount of RHB consumption. As same as other fuels, the general consumption volume of RHB can be assumed from experience, but it also has to design a system/method in order to confirm that RHB is definitely consumed at the site or not.

【Considerable countermeasures】

Considerable countermeasures in present are periodically calculate the difference of delivery volume and stored volume of RHB as the consumption volume. Procedure is as follows;

① RHB will be kept in sand bag after its production. At this time, the sand bag will be weighed and controlled to be around 30kg per bag. The work volume of putting RHB into the sand bag is only 4 to 5 times per hour per RHB production machine(once in 12 to 15 minutes frequency), so it is considerable to be done.

② Obtain orders from consumer then supplier delivers to the consumer. Supplier must receive a receipt showing that the consumer had received the product. Supplier brings back the receipt and keep it.

③ Consumer must periodically check the stored RHB volume in order to know the consumed volume of RHB.

④ Supplier shall confirm the stored amount of RHB at consumer’s storage and calculate the difference between delivered volume and count the difference as GHG reduction amount.

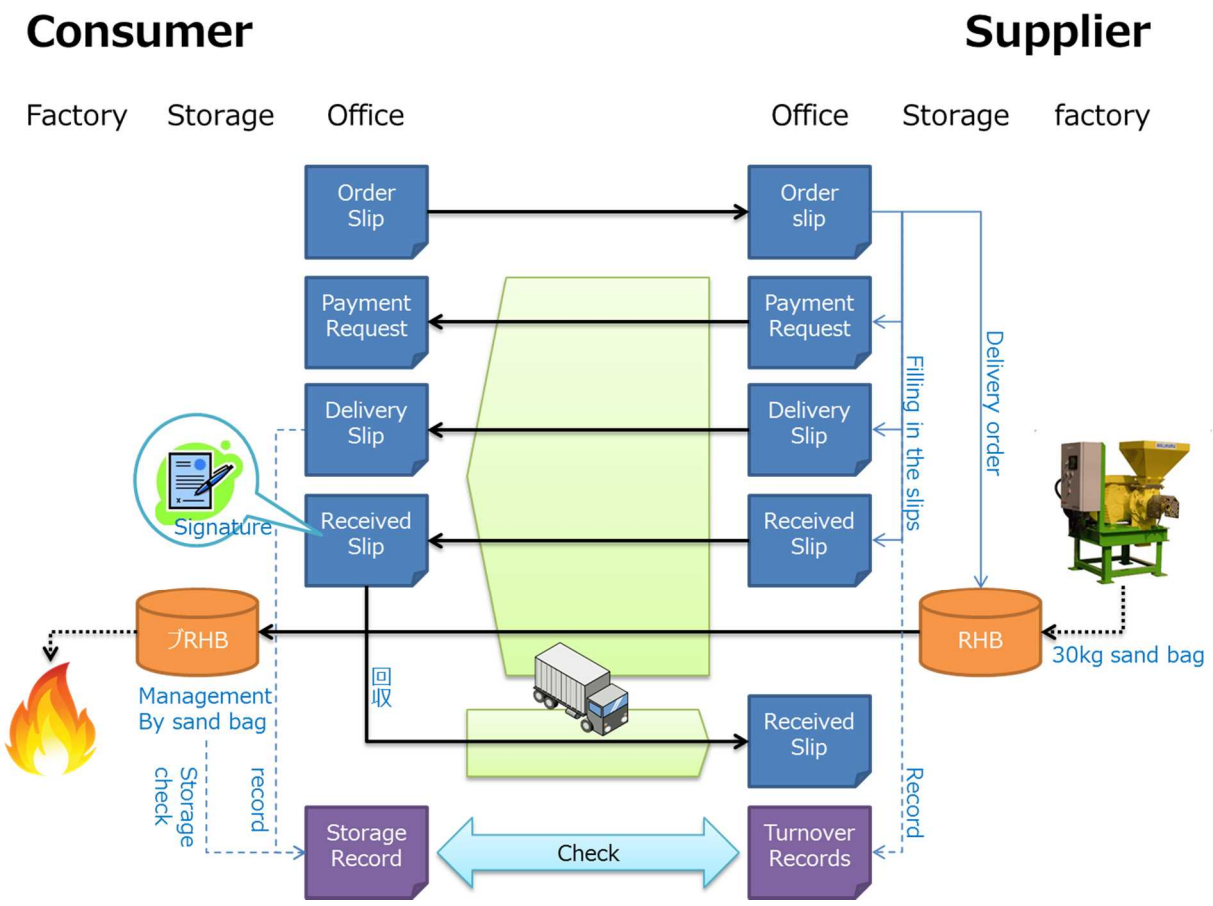


Figure Consumption management system idea (flow of product and slips)

Benefit of this system is that new investment is not required. It is usual workflow within both supplier and consumer side besides issuing/ collecting/ keeping the receipt and shipment volume of supplier and storage management of consumer side.

2) Control of unburned coal

About 120 Briquette coal is consumed per day at each furnace. Total weight is 108～132kgand thir is about ±10% allowance. There is also certain amount of unburned coal after the process.

If the weight of the new briquette coal is same, formula of (Total weight of briquette coal including unburned part) –(Totally burned briquette coal weight) enables to calculate the remained carbon weight. Although as the briquette coal itself has allowance in weight of ±10%, it requires detail weighing of briquette coal before firing and after the process to find the accurate burned carbon. As this method is too much difficult and annoying for the consumer (salt company) to implement, the project must consider another simple monitoring method to develop as JCM project

Picture Unburned coal

3.1.3.2 Company outline of rice mill factory and RHB production project outline

Most of the rice husks generated at rice mills located near Vientiane is thrown away. One of the plan on effective use of this unused energy source is to produce RHB and utilize as fuel for salt production.

1) Investment plan

- Initial investment for RHB production project

①V-Salt company: None

②KC-rice mill company

(A) Contents of initial investments

Material delivery equipment (Conveyers, pneumatic conveyance),raw material temporary storage + volumetric feeder, briquette production machine, measurement equipment, packing equipment, storage warehouse, computers, installation works, electricity works

* Fork lifts and trucks will be rented from rice mill factory.

(B) Expected investment: 93,600 thousand yen

(C) Financial arrangement: Own fund + JCM subsidy

- Maintenance cost (including MRV cost) financing

①V-salt company: basically none

②KC-rice mill company

(A) Maintenance cost items

Labor, education, fuel, consumables/parts, equipment maintenance, electricity, waste treatment, MRV cost

(B) Expected cost: 37,080 thousand yen/ year (when 100% operation)

(C) Financial arrangement:

Cost will be basically paid from the turnover of RHB sales, but initially will be own fund of KC.

- Creditability of KC-rice mill company

Financial report of KC company is obtained. KC has enough financial backgrounds to invest and operate the project. Documents will be submitted later to the JCM subsidy arrangement organization for their evaluation.

2) Legal survey

・Idea of operation entity

As mentioned at 3.1.1.5, the operation entity will be developed based on business cooperation contract.

3） Business plan

Business plan will be developed based on following information;

Table 2-2-1-2: Outline of business planning

Business	RHB production and sales
Operator	BCC contract based on investment law of Laos.
Product, service	RHB（3,600kcal/kg, moisture content around 8% ） ・Efficient transportation and material comparing to rice husk at it is. ・Does not burn at once as non-solid rice husk. Easy to control combustion. ・Using local rice husk by Japanese technology ・Sole in 15kg package ・Price includes transportation near to KC factory
Market analysis	Coal: Bad working environment, corrosion, CO2 emission Charcoal: Cost and time consumption Wood chips: Chopping and drying required which will be higher cost. Decreasing raw material since government is restricting wood for fuel use. Noon briquetted rice husk: Bad transportation efficiency, difficulties instable combustion.
Strategy and implementation	Long-term procurement contract, diffusion to other V company related factories. Development of new customers through KC business.
Operation outline	New client finding, capital and labor of KC: RHB long term using contract by V. Technical assistance and financing support by Japanese side.
Financial plan	・RHB sales price:　XVND/kg ・No loan ・Realization of 100％ operation（300 日/年）

	Calorific value Kcal/kg	Consumption t/year	Unit price LAK/kg (JPY/kg)
Coal	6,000	2,400	1,240 (18.5)
RHB	3,600	4,000	See below

Product cost	No subsidy			795.27	LAK/kg
	50% subsidy for Initial cost			708.19	LAK/kg
CO2 reduction amount	CO2 emission factor of coal			0.10	tCO2/GJ
	calorific value of coal			26.7	GJ/t
	Annual CO2 reduction amount			6,299.06	tCO2/y
	Co2 reduction amount 9 years			56,691.58	tCO2
Subsidy				3,134,882,143	LAK
CO2 reduction unit cost				55,297	LAK/t
V-Co. cost	Coal	1239.5	LAK/kg	2,974,800,000	LAK/y
	Rice husk without subsidy	795.2662074	LAK/kg	3,181,064,830	LAK/y
	Rice husk with subsidy	708.1861479	LAK/kg	2,832,744,592	LAK/y

Profit will be 4.7% when selling at equal calorific value to coal

4) Cost estimations

- Cost of briquetting machine which is the main equipment of this business will be chosen among 3 Japanese manufacturers.
- Transportation and insurance cost will be collected from Japan-based forwarder
- Other equipment cost such as pneumatic conveyance will be collected in Japan,
- Local cost such as installation and electricity works will be interviewed to the local companies and add certain ratio of contingency.

5) Construction plan

12.5 month is necessary from the start of the project.

- Detail planning：2 months
- Major equipment selection：1 month
- Major equipment manufacturing period：～6 months
- Transportation of equipment from Japan：2 months
- Installation：1 month
- Test operation：0.5 month

3.1.3.2.1 Present status of the rice mill company

1） Company outline of Kheamphengphet Chengsawang（KC）

KC is a private company 100% owned by Lao citizen. Besides rice mill, they operate agriculture such as rice, animal breeding (chicken pig). KC is also the chairing company of association of rice mill companies. They now own two factories in Vientiane.

Picture KC No.1 factory

【No. 1 factory】

Input volume of rice in No.1 factory is 83.3t per day in maximum. Milled rice volume is 50 t per day. 16.7t per day is rice bran and consumed as animal feedings and remained 16.7 t per day is rice husk. It is about 20% of the input volume and it has no big difference in general cases. No.1 factory generates 6,000t per year in maximum.

200 ton per year of rice husk is sold to CP-company which is animal feeding factory by 1million KIP per 4ton truck. Most of the rice husk is delivered to farmland for fertilizers. Some part is used for boiler fuel inside the factory to dry the rice.

Produced rice are sold mainly to Bialao (beer company), Police and Army. KC is the largest rice mill factory in Laos.

【No. 2 factory (under construction)】

KC is now constructing No.2 Factory 1okm in north west direction from N.1 factory. It will be completed on mid of 2016. The capacity of this rice mill is 200 t per day. The rice mill facility is supplied by Satake Co. of Japan. The price is around 900 million JPY. Rice husk generation volume will increase from 16.7 t per day to 66.7 t per day in maximum of both No1 and No.2 factories.

The reason of expansion is that Lao government decided to export their rice.

Rice mill owned by the association is also planned to be build near the No2 factory of KC. The area will be large supplier of rice husk.

Figure Location of KC

2） Rice husk

80% of paddy rice becomes 80% of brown rice and 20% of rice husk in weight in general.

Following table shows the general characteristics of rice husk.

table Characteristics of rice husk

Contents	Content ratio(wt%)
Water	8.04
Fat	0.20
Hemi cellulose	16.00
Lignin	20.3
Cellulose	31.8
Silica	16.9
Others	5.96
Total	100%

Most cases to treat with rice husk is to bring it back to the paddy field for soil conditioning, but rice husk is not easy to use as soil conditioner or fertilizer because it includes certain amount of SiO2.

（Paddy Rice）

↓

（Rice mill）

↓

（Rice husk）

Figure:　Rice husk generation flow

3）Basic concept of this project

For better handling and use of rice husk as a fuel, it is better to shape it such as briquette for increasing calorific value per unit weight and minimize the volume for efficient transportation and storage. The briquette shape also must e suitable for good combustion. The project planned to shape the rice husk into briquette and supply to the salt producing company for substituting coal.

Rice husk becomes a bar-shaped briquette by using RHB manufacturing machine. Representative manufactures of this machine in Japan are Kitagawa Co., Kansai Industry Co., and Tromso Co.

4） Outline of RHB manufacturing machine

RHB will be produced by supplying the rice husk from the hopper located above of the machine. The machine can produce either coil-type or stick-type RHB by attaching the heater at the end of the forming part or not. The project is selecting stick-type as this type has more moderate combustion characteristics than the coil-type.

Rice husk is crushed in small particles by pressurizing and rubbing each other. Lignin which is in the rice husk will melt out by the friction heat and binds the rice husk particles together. There are no additives such as glue, and necessary utility is only electricity.

Table:

Supplier	Input (kg/hr)	Output (kg/hr)	Electricity consumption (kW)
Kitagawa	150	150	22.6
Tromso	120	120	20
Kansai	100	100	20.6
	250	250	42.9

＜Reference Formill（Type：GMG-200RD）”【Internal-use spec.】＞

Production capacity：	150kg/h
Power：	22kW／4kW（ヒーター）、220/200V、3 相 AC
Weight：	720kg
Required area for installation：	8,000 ㎜×8,000 ㎜
Attachments：	Overload protection device, Electricity current monitor, Cutter

Figure: RHB production machine

Figure: Picture of briquette production

5） Features of produced RHB

Kitagawa and Tromso has same core device as the 2 companies jointly developed this part. Usual mode can produce coil type production, and if the attachment is attached, stick type will be produced. Kansai industry product only produce stick type but has two types of capacity with different dimensions.

Coil type has less friction than stick type. It also does not require the heater which is necessary for making a stick type so it consume less electricity and can produce more briquettes comparing to stick type. Density is lower than stick type so it is easier to break and the fire is larger and fast burning.

On the other hand, stick type will have higher calorific value as it will be more heated and the moisture will evaporate, comparing to coil type. The stiffness will also increase and the burning characteristics will be more near to wood burning. Electricity consumption is bigger than coil type.

The project will plan based on stick type. It is to avoid ash to fly and also to have long time burning.

Table3-2-1-2：RHB Characteristics (Kitagawa Co, case)

Visual	Stick 	Coil 
Specific gravity （Transportation）	0.3～0.4	0.5
Shape	53mm ϕ （Center hole:15mm ϕ ）	49mm ϕ （Center hole23mm ϕ ） Width: 20mm、Pitch: 25mm

Density	1.3	1.2
Features	Surface is heated by heater. Moisture absorption is less. Less braking than coil type, during transportation.	Easy to break, moisture absorption will easily break the briquette.
Calorific value	3300kcal/kg	

＊Reference：Calorific value of the coal＝6000kcal/kg

6） Basic plan

【RHB production machine plan】

Important design parameter when comparing to coal is calorific value. RHB is about 60% of the calorific value of coal. Therefore, to substitute 2,400 ton per year of coal, 4,000t per year of RHB shall be produced. The following plan is to fulfill the demand of V-salt company (4,000t per year).

Table Basic Plan

Demand（production volume）	4,000t/ year	
Raw material volume	4,000t/年	
Operation hours	7h/day×300day/year	Machine operates 7h per day
RHB production capacity	150 ㎏/時間	
Area required per unit	64m2	8m×8m
Operation labor	7 person per shift	7 people

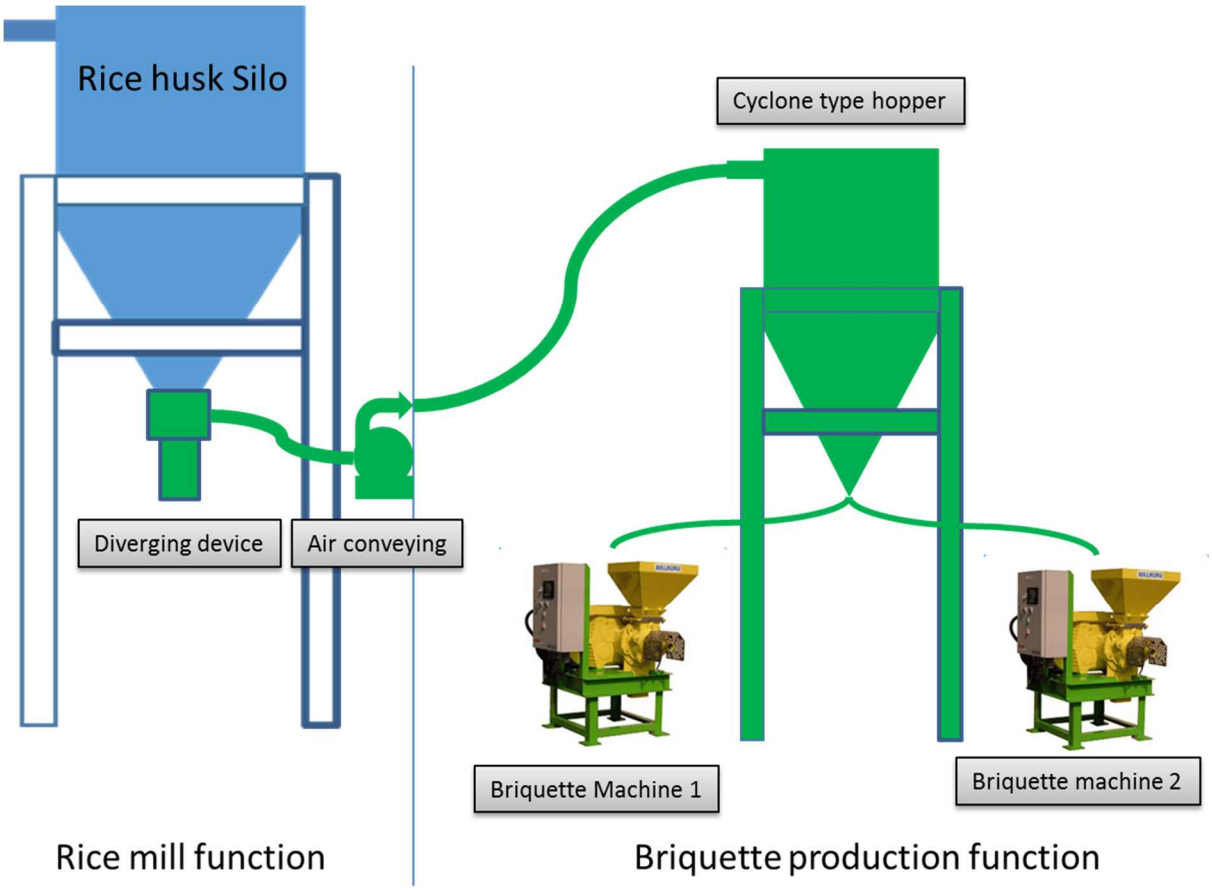
- Annual operation hours＝7 hours×300days＝2100hours/hear
- RHB production per hour＝4,000t/2,100 hour＝1.9t/hour
- Required number of RHB production machine＝1,900 ㎏÷150 ㎏＝12.7 units ≒13units
- Installation area ：64m2×13units ＝832m2

＊Minimum operation is 50% comparing to the high season (October – February). No.2 factory discharges maximum 50t per day of rice husk, and minimum is 25t per day. As the maximum requirement to fulfill the demand, 11t per day of rice husk is required. As a result No2. Factory will be able to supply enough raw material to fulfill the V-salt company demand.

【RHB production equipment installation plan】

4 rice husk storage hopper is planned to be installed at the KC No.2 factory. Dumper such as following figure is planned to be attached to the storage hopper. 1 storage hopper is planned to supply to 4 RHB production machine.

Figures: Dumper idea from rice husk storage hopper



Figures: System idea

3.1.4 JCM Methodology development survey

JCM methodology development has been conducted based on inception plan.

JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form	
Form for submitting the proposed methodology	
Host Country	Lao People's Democratic Republic
Name of the methodology proponents submitting this form	Japan Environmental Consultants, Ltd.
Sectoral scope(s) to which the Proposed Methodology applies	1. Energy industries (renewable - / non-renewable sources)
Title of the proposed methodology, and version number	Production and sales of rice husk briquette to replace fossil fuel, version.1.0
List of documents to be attached to this form (please check):	☒The attached draft JCM-PDD: ☐Additional information
Date of completion	2016.1.29

History of the proposed methodology

Version	Date	Contents revised
1.0	2016.1.29	First edition

A. Title of the methodology

Production and sales of rice husk briquette to replace fossil fuel

B. Terms and definitions

Terms	Definitions
Rice husk	The outermost layer of rice grain that is separated from brown rice during rice milling process.
Briquette	Compressed block of rice husk, saw dust, powdered coal or other dusts.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	The project produces rice husk briquette from unutilized rice husk, and sells it to the consumers to substitute fossil fuels combusted in boilers and other combustion facilities, thus reduces CO_2 emissions.
Calculation of reference emissions	Calculated by multiplying rice husk briquette consumption, net calorific value of the rice husk briquette and CO_2 emission factor of the reference fossil fuel. For this emission, take into account conservativeness and potential effects of fossil fuel consumption reductions through efficiency improvement of boiler and other combustion facilities, multiply "Energy efficiency improvement factor of the reference fossil fuel combustion machine" to the above emission.
Calculation of project emissions	Emission associated with electricity consumption of rice husk briquette production, and emissions with transportation of rice husk and rice husk briquette.
Monitoring parameters	・ Consumption of rice husk briquette ・ Electricity consumption of rice husk briquette production (if necessary) ・ Transportation distance of rice husk and rice husk briquette (if necessary)

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The project produces and sells rice husk briquette.
Criterion 2	The feedstock of rice husk briquette should be the rice husk which are currently not used as any materials or energy sources.
Criterion 3	The rice husk briquette produced in the project should be produced by the rice husk briquette machine with electricity and without any materials or additives other than rice husk.
Criterion 4	The rice husk briquette produced in the project substitutes fossil fuels which are used in boilers and other combustion facilities in demand sides.
Criterion 5	The producer and the consumer of the rice husk briquette are bound by a purchase and sales contract, and through sales/purchase documents of both companies, the producer can monitor the sales and consumptions of the rice husk briquette.
Criterion 6	The rice husk briquette produced should be certainly consumed by the consumer, and the consumer should not resale or export to other consumers.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Combustion of fossil fuel in boilers or other combustion facilities	CO_2
Project emissions	
Emission sources	GHG types
Electricity consumption of rice husk briquette production	CO_2
Transportation of rice husk	CO_2
Transportation of rice husk briquette	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emission in the methodology is defined as "CO_2 emission associated with combustion of fossil fuel that would have been used by the consumer in the absence of the rice husk briquette". Reference emission is calculated by multiplying rice husk briquette consumption, net calorific value of the rice husk briquette and CO_2 emission factor of the reference fossil fuel. For this emission, take into account conservativeness and potential effects of fossil fuel consumption reductions through efficiency improvement of boiler and other combustion facilities, multiply "Energy efficiency improvement factor of the reference fossil fuel combustion machine" to the above emission.

F.2. Calculation of reference emissions

$$RE_p = BC_p \times NCV_{biomass} \times EF_{CO2,i} \times (1 - EI)$$

BC_p Consumption of rice husk briquette during the period p [t/p]

$NCV_{biomass}$ Net calorific value of rice husk briquette [MJ/t]

$EF_{CO2,i}$ CO_2 emission factor of the reference fossil fuel i [tCO_2/MJ]

EI Energy efficiency improvement factor of the reference fossil fuel combustion machine

G. Calculation of project emissions

$$PE_p = PE_{elec,p} + PE_{tp1,p} + PE_{tp2,p}$$

1. Emission associated with electricity consumption of rice husk briquette production

$$PE_{elec,p} = EC_p \times EF_{CO2,elec}$$

EC_p Electricity consumption of rice husk briquette production during the period p [MWh/p]

$EF_{CO2,elec}$ CO_2 emission factor for electricity [tCO_2/MWh]

2. Emission associated with transportation of rice husk

Calculate emission associated with transportation of rice husk from the source of the rice husk to the rice husk briquette machine. The emission can be neglected if the source and the rice husk briquette machine are located in the same factory.

$$PE_{tp1,p} = \frac{DT_{tp1,p}}{FE_{tp1}} \times NCV_j \times EF_{CO2,j}$$

$DT_{tp1,p}$ Transportation distance of rice husk during the period p [km/p]

FE_{tp1} Fuel economy of motor vehicle for rice husk transportation [km/liter]

NCV_j Net calorific value of fossil fuel j of motor vehicle for rice husk transportation [MJ/liter]

$EF_{CO2,j}$ CO_2 emission factor of fossil fuel j of motor vehicle for rice husk transportation [tCO_2/MJ]

3. Emission associated with transportation of rice husk briquette
Calculate emission associated with transportation of rice husk briquette from the rice husk briquette machine to consumers. The emission can be neglected if the incremental transport distance compared with the reference fossil fuel transportation is equal or less than 200km. Only consumers with incremental transportation distance is over 200km should be counted.

$$PE_{tp2,p} = \sum_{i} \left(\frac{DT_{tp2,m,p}}{FE_{tp2,m}} \times NCV_{k,m} \times EF_{CO2,k,m} \right)$$

$DT_{tp2,m,p}$ Increment distance for rice husk briquette transportation to consumer m during the period p [km/p]
$FE_{tp2,m}$ Fuel economy of motor vehicle to transport rice husk briquette to consumer m [km/liter]
$NCV_{k,m}$ Net calorific value of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [MJ/liter]
$EF_{CO2,k,m}$ CO_2 emission factor of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [tCO_2/MJ]

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p$$

ER_p Emission reduction during the period p [tCO_2/p]
RE_p Reference emission during the period p [tCO_2/p]
PE_p Project emission during the period p [tCO_2/p]

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed ex ante is listed as below.

Parameter	Description of data	Source
$NCV_{biomass}$	Net calorific value of rice husk briquette [MJ/t]	Default value set through ex-ante measurement.
$EF_{CO2,i}$	CO_2 emission factor of the reference fossil fuel i [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
EI	Energy efficiency improvement factor of the existing fossil fuel combustion machine	Default value: 20% (=0.2)
$EF_{CO2,elec}$	CO_2 emission factor for electricity [tCO_2/MWh]	Grid electricity: i) The most recent official value in Laos or ii) average emission factor considering all power plants connected to the grid Captive electricity: The most recent default value available from CDM approved small scale methodology AMS-I.A.
FE_{tp1}	**In case, necessary to calculate $PE_{tp1,p}$* Fuel economy of motor vehicle for rice husk transportation [km/liter]	Default value set through ex-ante measurement.
NCV_j	**In case, necessary to calculate $PE_{tp1,p}$* Net calorific value of fossil fuel j of motor vehicle for rice husk transportation [MJ/liter]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.

$EF_{CO2,j}$	**In case, necessary to calculate $PE_{tp1,p}$* CO_2 emission factor of fossil fuel j of motor vehicle for rice husk transportation [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$FE_{tp2,m}$	**In case, necessary to calculate $PE_{tp2,p}$* Fuel economy of motor vehicle to transport rice husk briquette to consumer m [km/liter]	Default value set through ex-ante measurement.
$NCV_{k,m}$	**In case, necessary to calculate $PE_{tp2,p}$* Net calorific value of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [MJ/liter]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$EF_{CO2,k,m}$	**In case, necessary to calculate $PE_{tp2,p}$* CO_2 emission factor of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.

JCM Project Design Document Form

A. Project description

A.1. Title of the JCM project

Reduction of coal briquette consumption through production and sales of rice husk briquette in Vientiane

A.2. General description of project and applied technologies and/or measures

The purpose of the project is to produce rice husk briquette using unutilized rice husk in a rice milling company, Khamphengphet Chengsawang EXP-IMP Co., Ltd., and to replace coal briquettes that are used in the salt factory of Veukham Salt Co., Ltd. The project is implemented in Vientiane in Lao People's Democratic Republic.

The rice husk briquette machine to be installed in the project, is a machine to produce fuel briquette by grinding and compressing rice husk mechanically. In Laos, there is no manufacturer of the rice husk briquette machine, and the project will install the machines developed by Tromso Co., Ltd. from Japan. Since rice husk contains very rigid component (silica), generally, it is not easy to produce briquette from rice husk, and damages to briquette machines are significant. Tromso Co., Ltd. had developed parts of the machinery coated with special material, and make it possible to produce rice husk briquette efficiently. In the production processes, no materials or additives other than rice husk is added. Figure 1 and Table 1 show an image and major specifications of the rice husk briquette machine.

Figure 1 The rice husk briquette machine

Table 1 Major specifications of the rice husk briquette machine

Model	TRM-120F
Processing capacity	120kg/h
Size	W2800 xD1503 xH2283 (mm)
Weight	1300kg
Power	15.65kW
Heater	3.999kW

In the second rice mill factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd., 66 tons of rice husk are produced per day, and some of these are spread to farm land, while most of these are dumped without using effectively. Among these rice husks, the project uses 2,760 tons per year (11.5 tons per day) for production of rice husk briquette. 12 sets of the rice husk briquette machines are installed in the second factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd., and expected to produce 230 tons per year of briquette per 1 unit (operating 8 hours per day, 20 days per month, 12 month).

On the other hand, Veukham Salt Co., Ltd. produces salt from high concentration groundwater brine (25 to 26%) by concentrating it in open pans using coal briquette. 2,000 tons of coal briquette are consumed annually (in 2015), and the project is aiming to replace all coal briquette by rice husk briquette which are produced by Khamphengphet Chengsawang EXP-IMP Co., Ltd. The expected CO_2 emission reduction is 2,584 tons per year.

A.3. Location of project, including coordinates

Country	Lao People's Democratic Republic
Region/State/Province etc.:	Vientiane Capital
City/Town/Community etc:	The second rice mill factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd.: Naxaythong District Veukham Salt Co., Ltd.: Xaythany District
Latitude, longitude	The second rice mill factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd.: N18° 04' 03" and E102° 33' 12" Veukham Salt Co., Ltd.: N18° 08' 57" and E102° 35' 08"

A.4. Name of project participants

The Lao People's Democratic Republic	Khamphengphet Chengsawang EXP-IMP Co., Ltd.
Japan	

A.5. Duration

Starting date of project operation	01/09/2016
Expected operational lifetime of project	10 years

A.6. Contribution from developed countries

Japanese agricultural technologies, as a rice-producing country, have high applicability to Asian countries which have similar rice-food culture with Japan. Japan has been promoting development of agricultural technologies; therefore, Japan can provide more advanced technologies to Asian countries. Particularly for utilization of rice husk, Japanese companies have made efforts to utilize it and to produce rice husk briquette so that easy to handle and transport as a solid biofuel. In Laos, there is no manufacturer of rice husk briquette machine, therefore, the project which uses Japanese technologies can show a good and advanced practice of a new way of utilization of rice husk which has been treated as waste and has not utilized effectively in Laos.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	N.A.
Version number	N.A.

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	The project produces and sells rice husk briquette.	In the project, the rice milling company, Khamphengphet Chengsawang EXP-IMP Co., Ltd. produces rice husk briquette and sells these to the salt producer, Veukham Salt Co., Ltd.
Criterion 2	The feedstock of rice husk briquette should be the rice husk which are currently not used as any materials or energy sources.	In Khamphengphet Chengsawang EXP-IMP Co., Ltd., 66 tons of rice husk are produced per day, and among these, the project uses 2,760 tons per year (11.5 tons per day) for production of rice husk briquette.
Criterion 3	The rice husk briquette produced in the project should be produced by the rice husk briquette machine with electricity and without any materials or additives other than rice husk.	In the project, rice husk briquette is produced only by electricity as an energy source and without adding any materials or additives.

Criterion 4	The rice husk briquette produced in the project substitutes fossil fuels which are used in boilers and other combustion facilities in demand sides.	In the project, 2,000 tons/year of coal briquette are expected to be replaced by the rice husk produced by Khamphengphet Chengsawang EXP-IMP Co., Ltd.
Criterion 5	The producer and the consumer of the rice husk briquette are bound by a purchase and sales contract, and through sales/purchase documents of both companies, the producer can monitor the sales and consumptions of the rice husk briquette.	The purchase and sales contract is signed by Khamphengphet Chengsawang EXP-IMP Co., Ltd. and Veukham Salt Co., Ltd. Both companies prepare and exchange sales/purchase documents/slips that are necessary for the monitoring of the emission reductions.
Criterion 6	The rice husk briquette produced should be certainly consumed by the consumer, and the consumer should not resale or export to other consumers.	The purchase and sales contract between Khamphengphet Chengsawang EXP-IMP Co., Ltd. and Veukham Salt Co., Ltd. includes an article to prohibit resale or export to other consumers by Veukham Salt Co., Ltd.

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Combustion of coal briquette in open pans of the salt factory	CO_2
Project emissions	
Emission sources	GHG type
Electricity consumption of rice husk briquette production	CO_2
Transportation of rice husk	CO_2
Transportation of rice husk briquette	CO_2

C.2. Figure of all emission sources and monitoring points relevant to the JCM project

Emission sources of the project are the briquette machines of Khamphengphet Chengsawang EXP-IMP Co., Ltd. and open pans of Veukham Salt Co., Ltd. Monitoring points are shown in dark red square in the figure below.

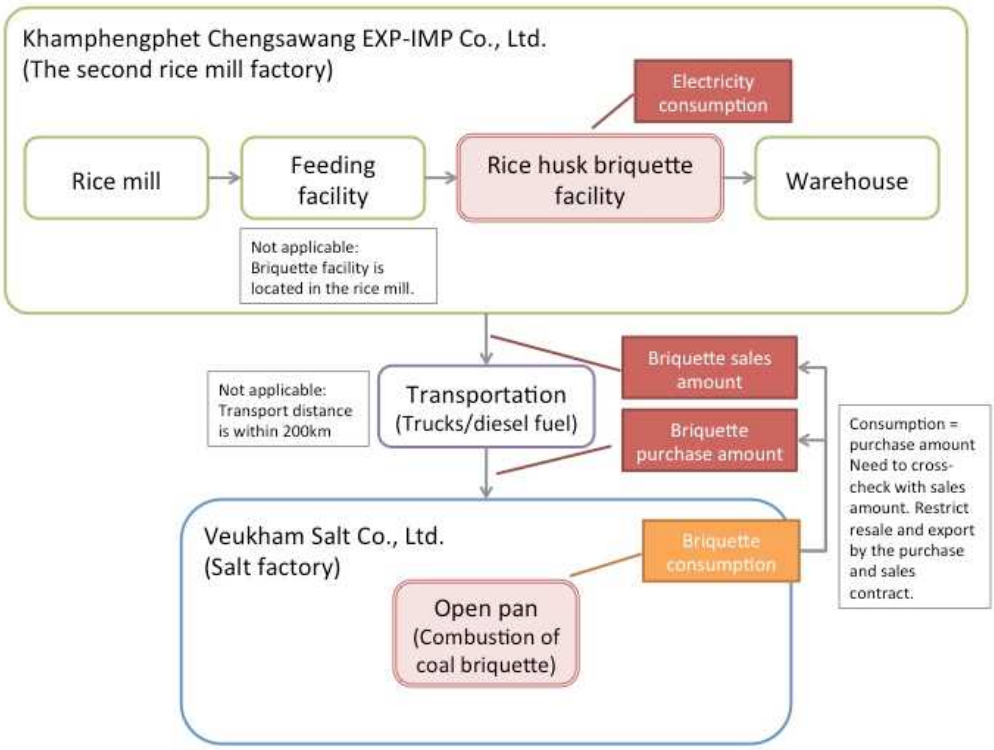


Figure 2 Emission sources and monitoring points for the project

C.3. Estimated emissions reductions in each year

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2016	863	2	861
2017	2,590	6	2,584
2018	2,590	6	2,584
2019	2,590	6	2,584
2020	2,590	6	2,584
2021	2,590	6	2,584
2022	2,590	6	2,584
2023	2,590	6	2,584
2024	2,590	6	2,584
2025	2,590	6	2,584
Total (tCO_{2e})	24,173	56	24,117

*As for 2016, the emissions/emission reduction from September to December are estimated.

D. Environmental impact assessment	
Legal requirement of environmental impact assessment for the proposed project	Not applicable.

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

To be implemented.

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
	To be implemented.	

F. References
N.A.

Reference lists to support descriptions in the PDD, if any.

Annex
(Following documents will be attached for the submission to JC.) 1. The purchase and sales contract between Khamphengphet Chengsawang EXP-IMP Co., Ltd. and Veukham Salt Co., Ltd. (**Confidential**) 2. Guideline for preparation and exchange of sales/purchase documents/slips (**Confidential**)

Revision history of PDD		
Version	Date	Contents revised
1.0	2016.1.22	First Edition

3.2 Generation and Use of Biogas from Sorted Organic Waste

3.2.1 Background of the study

3.2.1.1 Current status of waste management in Lao PDR

In Lao PDR, the amount of garbage generated is expected to increase (by about two- to threefold in the target areas from 2013 to 2020) as its population grows. Therefore, it has become imperative for the target cities of the project to not only resolve the existing issues but also increase their waste management capabilities by enhancing the efficiency of garbage collection and transport services. Regarding the amount of collected garbage by city, Vientiane collected 166.7 tons of garbage per day in 2013 (69.3 tons/day of which was collected by the Vientiane Urban Development Administration Authority (VUDAA) and 97.4 tons/day by private garbage collection services). In 2020, the amount of collected garbage is expected to increase substantially to reach 564.5 tons per day (259.7 tons/day of which will be collected by VUDAA and 304.8 tons/day by private garbage collection services). Moreover, Vientiane, having its final disposal landfill located some 32 km away from the city center, also needs to take measures to transport the collected garbage efficiently through building waste transfer stations.[2)]

3.2.2 Overview of the project

3.2.2.1 Background and objectives of the project

A field survey conducted for the JCM Feasibility Study of GHG Mitigation Project Contributing to Low-Carbon Historic City Based on City-to-City Cooperation between Vientiane and Kyoto (hereinafter referred to as 2014 study), a part of the Feasibility Studies in FY 2014 on large JCM Project for the realization of Low-Carbon Society in Asia, confirmed the following: the amount of garbage generated daily in Vientiane, Lao PDR's capital, is some 650 grams per person and about 300 tons for the entire city, and an estimated 40%–50% of the garbage is organic waste. These results are consistent with the findings of the *Report on Aerobic Intermediate Treatment of General Waste and Methane Gas Processing in Landfills* (study conducted by EX Research Institute Ltd.: http://gec.jp/main.nsf/jp/Activities-GHGmitimecha-FS2012_jcmfs-07), a feasibility study on the Joint Crediting Mechanism Project commissioned by Japan's Ministry of Environment in FY 2012. The so-called open dumping is practiced across Lao PDR, including its capital city Vientiane, as a way to dispose garbage. Garbage generated in Vientiane is dumped in the KM32 landfill located 32 km away from the city center. The garbage dumped at the site is neither covered with soil nor compacted, making the landfill's sanitary condition extremely poor. Since the management of garbage has been recognized as a major issue in Lao PDR as in other developing countries, Vientiane has expressed a strong need of collaboration in waste management measures in the 2014 study. In Vientiane today, the amount of garbage collected accounts for about 30% of the total waste generated in the city, and its garbage has not been collected separately by type. Even under these circumstances, the KM32 landfill site is expected to fill up to its maximum capacity in just a few years, which requires the city to promptly address the situation by taking measures including waste volume reduction processes. In fact, JICA Laos Office and the executing entity of "Laos Pilot Project: Environment Management Component (LPPE)," a JICA project, have been promoting efforts such as building intermediate transfer stations for garbage and composting of sorted waste in suburban villages. These efforts illustrate the fact that waste management is regarded as a pressing issue. In the interview of the 2014 study, the Vientiane Urban Development Administration

Authority (VUDAA), an organization that undertakes garbage management services for Vientiane and was surveyed for the FY 2014 feasibility study, has also shown interest in practicing the sorted disposal of garbage generated in the city center. If Vientiane responded to these developments and began the practice of separating garbage at source, increasing the ratio of collected garbage to the total amount of garbage produced in the city, and recycling the sorted organic waste for useful purposes, the rapidly growing capital would be able to prevent problems caused by inappropriate waste management that Vientiane is expected to face in the near future. Having said that, sorting garbage at source and improving the efficiency of waste transport can only be realized with the involvement of public administration, and, for this reason, projects based on public-private partnership will be needed. Therefore, Vientiane proceeding with the building of an appropriate waste management system under the intercity collaboration with Kyoto, a project has been set up to utilize the sorted organic waste, cut back on fossil fuel-related CO_2 emissions by processing the sorted organic waste in fermentation tanks to produce methane and supplying the generated methane (biogas) to hotels and restaurants to replace liquefied petroleum gas (LPG) now in use. This project is also expected to bring about co-benefits such as volume reduction of organic waste and extension of the final disposal landfill's life span. Moreover, when the sorted collection of waste is implemented as a governmental project, demonstrating ways to utilize the sorted waste will likely promote more practical efforts, resulting in the diffusion of similar projects.

3.2.2.2 Plan and details of the project

Hitachi Zosen Corporation (Hitz) aims to establish and operate businesses based on methane fermentation, an advanced energy technology of Japan, and expand its use. Figures 1 and 2 comprise the schematic view of the s envisioned B2B business in the project. Solid organic waste that is currently transported directly to the city's landfill from hotels and restaurants will be put in a food waste methane fermentation system (WTM system) for 12 days to be treated with a methane fermentation process. This process will enable capturing of 960 m^3 of biogas per day, and the captured gas will be supplied to a nearby hotel (Best Western Vientiane Hotel) and restaurants to be used in their kitchens. Fermentation residues from the fermentation process will be recycled as liquefied compost (liquid fertilizer) and used on farms and other soils. The organic waste that is now dumped in the landfill can be utilized through these measures, which will help prevent methane generated from dumping and rotting of organic waste, extend the life span of the landfill, and reduce environmental burdens such as seepage water from the landfill.

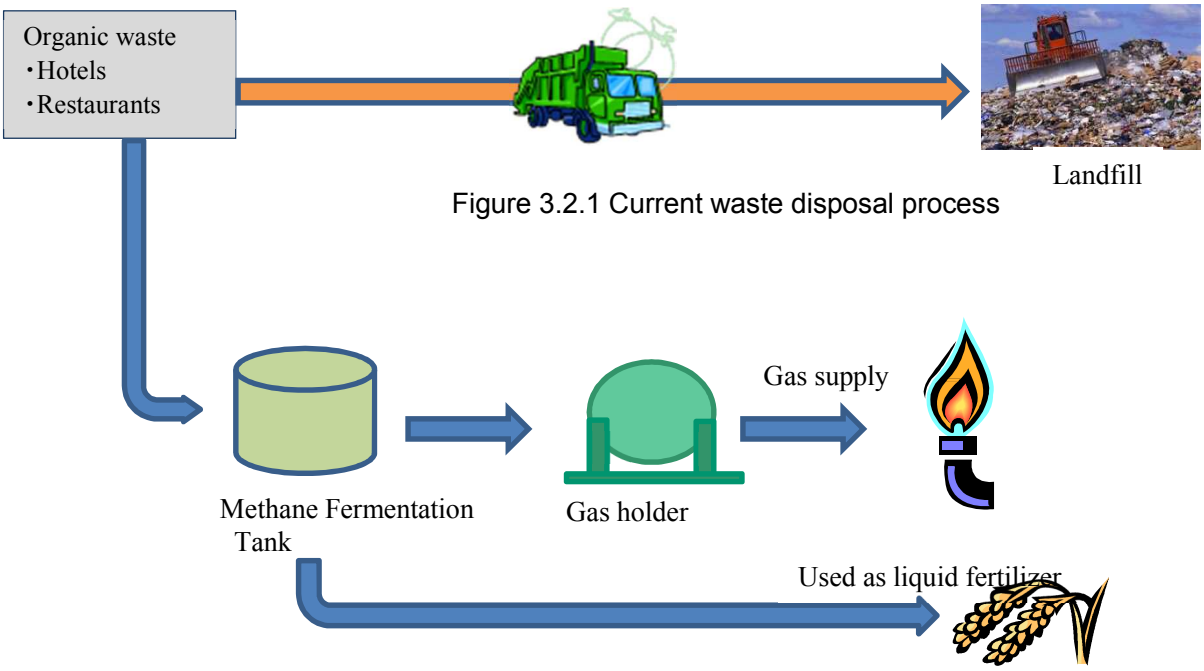


Figure 3.2.1 Current waste disposal process

Figure 3.2.2 Schematic view of the system to introduce in this project

1) Benefits and efficiency of the project

As described above, this is an effective project suitable for being implemented in Vientiane because it can contribute to objectives pursued by Vientiane, namely managing waste and ensuring future energy security. Moreover, although Lao PDR is the seventh signatory country to the JCM and, among ASEAN members that have close ties with Japan, the second country after Vietnam to sign up to the mechanism. However, as most of the country's electricity comes from hydroelectric generation, the development and formation of JCM projects in Lao PDR have been slow. This project is expected to produce major benefits by opening up the possibility of forming JCM projects.

The project aims to supply methane gas to the kitchen of a medium-sized hotel, Best Western Vientiane Hotel, and has already had a few meetings with the hotel owner to discuss the possibility. The owner has shown keen interest in the project, saying that he would like to have the project implemented in his hotel as soon as possible and promote the hotel as a green accommodation by advertising the project, which will also contribute to the betterment of environment in Vientiane. Thus, the conditions are ripe for conducting a feasibility study on the project in an effective manner. Based on the outcomes of the study, it will be aimed to turn this project into one funded by the FY 2016 JCM financing program for equipment.

2) Validity of the project

In Lao PDR, where the main source of energy is hydropower, this project can help further reduce fossil fuel energy consumption, which makes it suitable for becoming a JCM project. This project will not only help address waste-related issues that Vientiane faces but also turn the country's slogan, "Clean Green Lao," into practice in Vientiane, a city that attracts many foreign tourists for its various historic and cultural heritage sites, by promoting appropriate waste management. Specifically, the project is expected to provide momentum for starting the collection of garbage sorted at source.

3) Feasibility of the project

A main embodiment of the project is to generate biogas by the methane fermentation of solid organic waste from hotels and restaurants using a WTM system and supply the generated gas to Best Western Vientiane Hotel to be used as fuel in its kitchen. This project can allow the hotel to cut back on the consumption of LPG, currently used as cooking fuel in the kitchen, and reduce its fuel cost while promoting the hotel as an environmentally friendly accommodation as described above. Thus, the hotel has been keenly interested in the project. This strong interest on the part of the hotel will likely make the project come true.

4) Innovativeness of the project

This project will generate biogas by the methane fermentation of solid organic waste and utilize the generated gas. Projects similar to this have been implemented under Clean Development Mechanism (CDM) in the past, except that this project plans to apply WTM system as its technology. This technology, developed by Hitz, enables high-speed methane fermentation of solid organic waste with no water added by using an efficient circulating methane fermentation process. With the traditional methane fermentation process (es), COD_{Cr} volumetric load was lower than 13 kg ($m^3 \cdot d$), and food waste needed to be diluted with water before processing. Because of the added water, the methane fermentation tank needed increased amount of heat to be warmed up, which raises the expenses for waste disposal. Furthermore, the traditional system's decomposition rate of waste was about 70%. In contrast, the WTM system to be introduced in this project is an advanced technology characterized by (1) having capabilities for high-speed and high-load operations (1.5 times higher COD_{Cr} volumetric load than the traditional model, which is 20 kg ($m^3 \cdot d$)); (2) achieving the decomposition rate of 85% or more; (3) reducing the amount of energy needed to heat the methane fermentation tank and increasing the amount of captured energy; and (4) being capable of substantially cutting back on wastewater treatment cost.

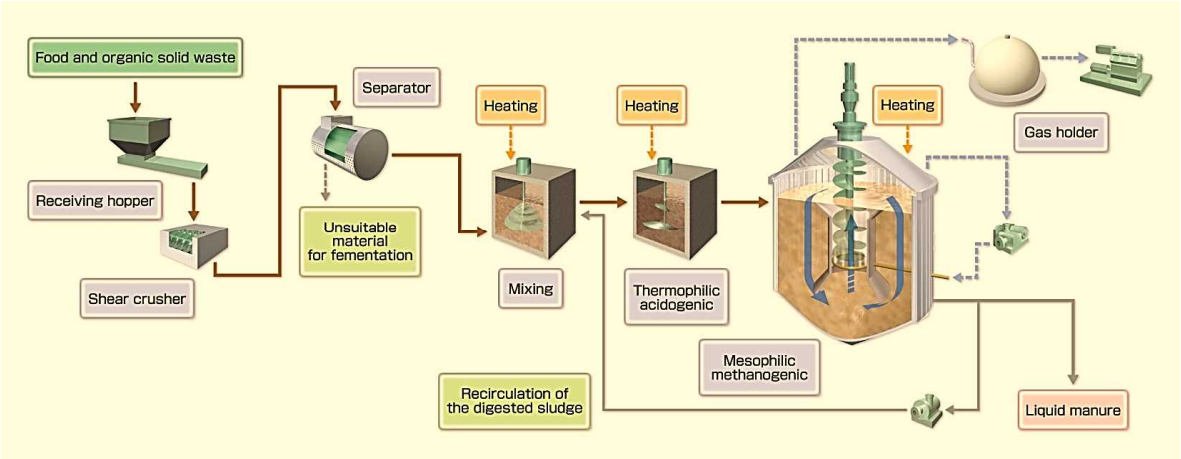


Figure 3.2.3 WTM System Flowchart

5) Possibility for area-wide deployment

This project is to use 12 tons per day of solid organic waste including food waste. However, an estimated amount of solid organic waste produced per day in Vientiane is about 150 tons or more (based on the assumption that about half of the Vientiane's total garbage output of 300 tons per day is organic). Considering

the country's expected economic development in the future, it is easy to forecast that the amount of generated garbage will increase at a rapid pace. In this situation, if the project succeeds and the utility of solid organic waste as an energy source is proved, this project could be deployed across the area.
If effective garbage collection and transport systems were established with the cooperation of Kyoto City and the collection rate was improved as a result, the usability of the technology would be further expanded. By aligning Kyoto City's assistance with Vientiane's demands and promoting the collection of garbage sorted at source, this project could open up the possibility of using solid organic waste for useful purposes. Furthermore, if the amount of usable solid organic waste collected reached a substantial amount, the project could not only deploy small-scale facilities on an area-wide basis but also raise the possibility of introducing intensive, large-scale facilities.

3.2.2.3 Implementation structure of the project

This project is based on the scheme involving Best Western Vientiane Hotel. Specifically, a business entity run by the owner of the hotel will operate the methane fermentation facility and supply the generated gas to the hotel located in the city center of Vientiane. The owner serves as the President of the Lao Hotel and Restaurant Association and runs multiple businesses including a joint venture with a Thai company. When the project is proposed the project to the owner, he showed keen interest and even offered a use of a piece of land he owns close to the hotel as a site to install the WTM system.
Hitz will offer its original high-efficiency methane fermentation system for food waste (WTM system) described above to help the project turn into a JCM project while developing necessary capabilities and human resources to operate the system.
The Vientiane Urban Development Administration Authority (VUDAA) will start collecting solid organic waste separately in its current garbage collection and transport services, and deliver the collected organic waste to the facility equipped with WTM system. In this study, payments for purchase of solid organic waste will be considered as a component of the project's financial plan.
Kyoto City, as a municipal government in Japan, will transfer its know-how on the collection and transport of garbage as part of the intercity collaboration. The notable initiative that Kyoto City has been carrying out with success is collecting waste cooking oil (used tempura oil) from households and turning it into biodiesel fuel for the municipal buses. Drawing from this experience, Kyoto City will provide Vientiane with the know-how and personnel trainings related to the operation of garbage collection system from restaurants and other places. Kyoto City will also help realize the project by providing Hitz with information related to Vientiane such as the improvement of its garbage collection status.

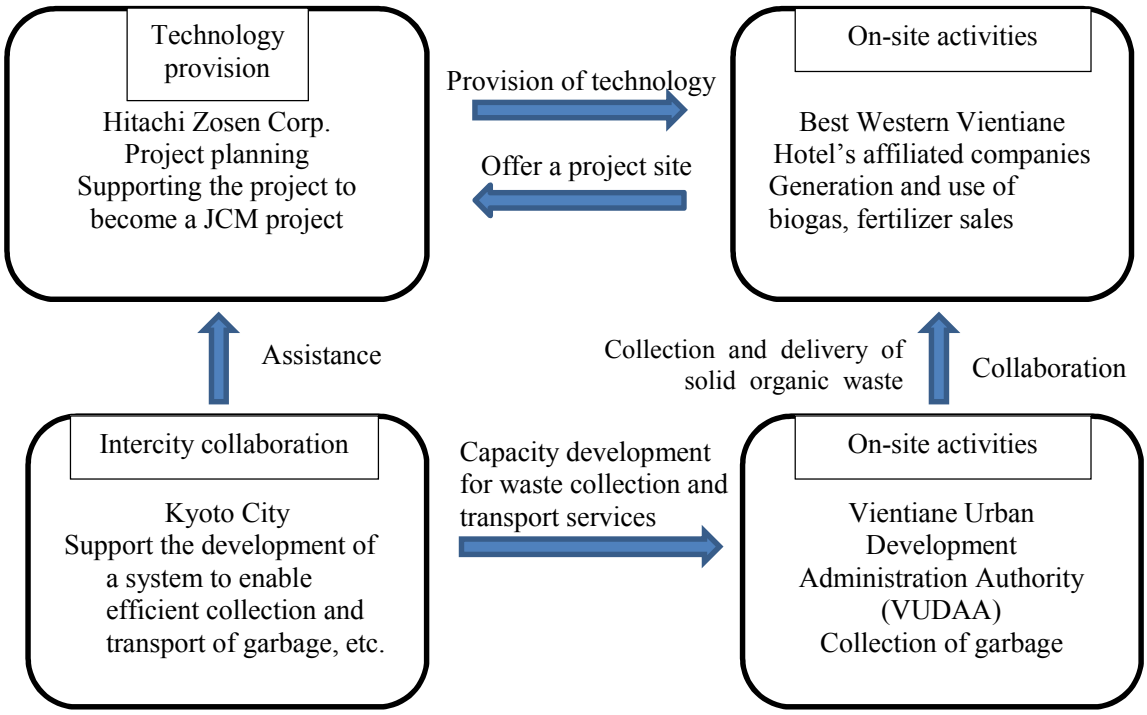


Figure 3.2.4 Implementation structure of the project

1) Past collaboration activities and discussions

As part of the 2014 study, the working team interviewed the owner of Best Western Vientiane Hotel on a few occasions to investigate the status of hotels and restaurants in Lao PDR and how the garbage produced by them was managed while discussing the applicability of the project.

Hitz has implemented a similar project in Ho Chi Minh City and collaborated in programs such as garbage sorting as part of that project. Drawing from this experience, Hitz has been holding discussions with VUDAA to find the status of garbage in Vientiane.

3.2.2.4 Expanding the use of the project

As described earlier, the WTM system developed by Hitz enables high-speed methane fermentation of solid organic waste with no water added by using an efficient circulating methane fermentation process. This technology is regarded as having a competitive advantage over other technologies. Considering the city's situation including the composition of its garbage, the system's technological advantage could be demonstrated in its capability of methane fermentation using solid organic waste as well.

Additionally, the technology can be applied to other solid organic waste than food waste. Therefore, as is discussed in the paragraph of the possibility for the area-wide deployment, the high potential of dissemination and general versatility in various other fields is expected.

3.2.3 Methodology and results of the study

3.2.3.1 Study-conducting agencies

Agencies in charge of conducting the study will be shown in the following list and figure:

- Hitachi Zosen Corporation (Hitz): Examines a business structure based on the findings of the field survey

- EX Research Institute Ltd. (Exri): Organizes the available information related to the status of Vientiane's garbage and conducts field surveys on the city's garbage; develops JCM methodologies and project design documents (PDDs)
- Vientiane Urban Development Administration Authority (VUDAA): Provides data/information related to garbage; supporting the project's surveys
- Department of Disaster Management and Climate Change, Ministry of Natural Resources and Environment (MONRE): Provides data/information related to climate change; supports the project-related surveys
- Best Western Vientiane Hotel's affiliated company: procures waste as raw materials for fermentation; conducts a survey on users of the resulting products (gas and liquid fertilizer)

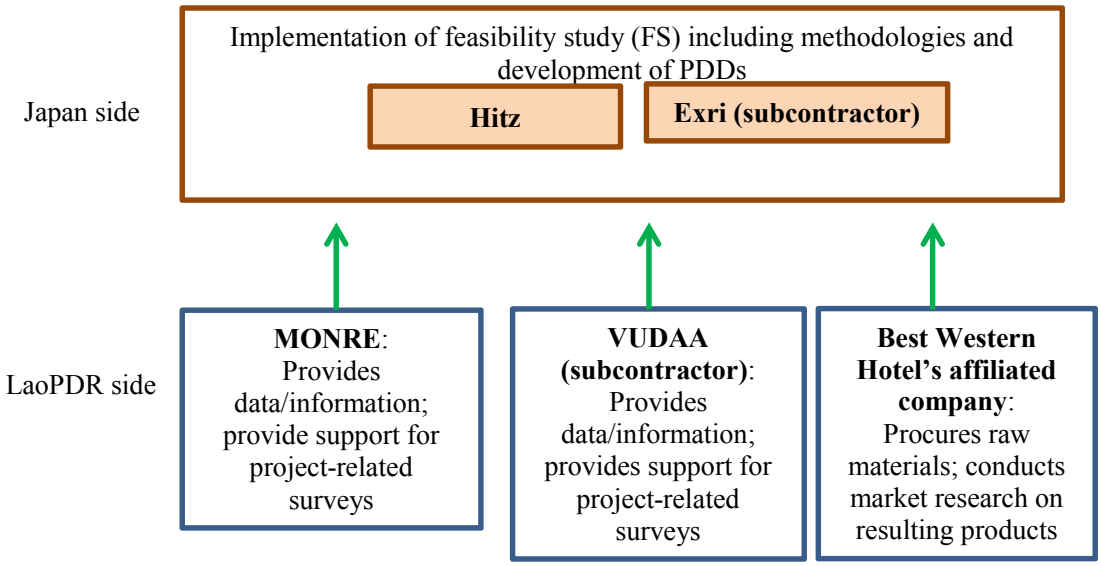


Figure 3.2.5 Implementation structure of the project

3.2.3.2 Details of the study

3.2.3.2.1 Survey on the amount and composition of general waste

Concerning the survey on garbage characteristics, the working team has asked Mr. A to select promising participants of the survey while trying to secure appointments with locally based consultants of EX Research Institute Ltd. For the former, selecting survey participants, the working team will first inform its preferred time to conduct the survey (end of August) on July 24, and, after securing appointments with the local consultants, reconfirm the feasibility of conducting the survey on its proposed date. To the message sent for this purpose, the working team will also attach a letter explaining the survey details to be sent to each participating hotel. The collected garbage from hotel and restaurant segments will not be aggregated but analyzed as two separate objects. The timing and sites of the survey will have to be informed to VUDAA by at least one week before the survey date. If requested by VUDAA, the working team may make arrangements for VUDAA staff to observe the survey. Regarding the estimated amount of collected garbage, the working team plans to calculate it based on the results of the garbage characteristics survey and the list of garbage collection service customers.*

*Mr. Khampiane, Deputy Director of VUDAA, stated in the meeting on July 17 that the list is disclosable upon request (or

application). Hotels and restaurants to be included in the survey will be selected from the list, and an estimated amount of garbage will be calculated based on the selected participants as well as the results of the garbage characteristics survey, though many of the items and details of the list are still unknown at the moment. If the list did not meet the required objectives, the working team would select hotels and restaurants from the garbage collection area served by VUDAA and calculate an estimated amount of the waste that can be used for Hitz' project. Furthermore, considering that the estimated amount of collected waste may be well below 10 tons, the required amount for the project, the working team is prepared to carry out a survey/inspection to investigate the possibility of expanding the number of survey participants. The candidate participants at the moment include a college cafeteria, a wedding reception venue, and a slaughterhouse.

3.2.3.2.2 Results of the surveys

1) Status of collected garbage: its amount and sorted collection practice

The working team visited nine sites (hotels and restaurants) in the city to conduct interviews on garbage characteristics and gas consumption. The interviews enabled the working team to grasp the scale-dependent trends in the amount of generated garbage and in the consumption of gas. Fees charged for garbage collection service and prices paid for gas were also investigated in the interviews.

- Kitchen garbage is kept in the dedicated bins and collected by VUDDA 6 days a week. For collection fees, one hotel pays 500,000 kip (approx. 7,500 yen) a month to have its garbage collected by VUDDA.
- The participating hotels/restaurants each produce one to five bags (90-liter garbage bag) of waste a day depending on their size.
- Plastic (PET) bottles, cans, and cardboards are sorted beforehand.
- The participating hotels/restaurants each consume two to six cylinders of gas (one cylinder contains 50 kg of gas) for kitchen use.

  Price for a cylinder of gas ＝ 650,000 kip (approx. 9,800 yen)

Photo 1: Kitchen garbage of a hotel

Kitchen garbage is collected in a bucket, which includes plastic and paper waste.
It is expected, however, that separating waste suitable for methane fermentation from unsuitable ones will be possible by providing guidance on the appropriate sorting of garbage.

Photo 2: Sorted garbage at a hotel
Kitchen staff collect cardboards, plastic bottles, and cans separately from other garbage, for they can be sold for money.

Photo 3: Liquefied petroleum gas (LPG)

Gas cylinders containing gas for cooking at a hotel (50 kg cylinder)

Photo 4: Cooking stoves

Cooking stoves used for cooking at a hotel

2) Information on final disposable landfill

Today, garbage produced in Vientiane (including waste collected from hotels and restaurants) is dumped in the final disposal landfill, KM32, located in the suburbs of the city.

Photo 5: Final disposal landfill (KM32)

In the landfill, people manually collect valuables that can be sold for money.

Photo 6: Final disposal landfill (KM32)

VUDDA (Vientiane Urban Development and Administration Authority) collects garbage from households and businesses in Vientiane City and transports them to the final disposal landfill.

3) Waste Amount and Composition Survey (WACS)

a) Purpose of the WACS

The waste amount and composition survey (WACS) was conducted to collect the baseline data of the composition of kitchen waste generated from hotels and restaurants in the City of Vientiane for the purpose of identifying its methane capture/collection potential with the gasification technology that is currently proposed in the Study.

b) Outline of the WACS

Considering the main purpose of identifying the biogas production potential of kitchen waste, the survey focused on collection of the three key data, i.e., the amount and composition of kitchen waste with attention to the ratio of the components suitable/unsuitable for gasifier and types of the waste components not suitable for gasifier.

Table 3.2.1 Outline of the WACS

Parameters	Descriptions	
Survey Period	4days	
Sampling Points	4 hotels 4 restaurants Total 8 facilities	
Outline of the Survey	Survey/analysis items	Methods
	Daily generation of kitchen waste at each each hotel and restaurant (kg/day).	Weigh the amount of daily waste per facility from consecutive 4days.
	Amount and ratio of the waste components unsuitable for gasifier. *Waste components unsuitable for gasifiers include: ※ Papers, Plastics, Textiles, egg shells, bones, Green waste, Cone core, Shells, peals of bamboo shoot, etc. Unsuitable waste components are defined based on waste acceptance criteria for the gasifiers proposed in the Project.	For each facility (hotel and restaurant), a 10 to 20kg sample of kitchen waste is taken for composition analysis every day. The above each sample is separated into each waste category for weighing and estimating the ratio (percentage by weight).

c) Facilities Surveyed

The following 4 (four) hotels and 4 (four) restaurants were selected for the WACS among the facilities that are to be the partners of the proposed project.

Table 3.2.2 Facilities to be conducted the WACS

Category	Name	Business hours	Number of rooms/seats*
Hotel	LEUXAY Hotel		37
	SOMERSET		116**
	Chanthapanya Hotel		75

	City Inn		40
Restaurant	Khop Chai Deu	8:00-23:30	360
	Kong View	11:00-23:30	Table (6 seats/chairs)×110
	Tamnak Lao Restaurant	9:00-14:00 17:00-21:00	100-120 seats/chairs
	Delhi Durbar	11:00-14:30 18:00-22:30	50 seats/chairs

*In accordance with the hearings and interviews

**Somerset: http://www.somerset.com/en/laos/vientiane/somerset_vientiane/apartment_types.html

d) Schedule

The WACS was conducted for the consecutive 4 days from 5 to 8 of October, 2015. One sample was daily collected from each facility for the composition analysis. Although some samples could not be collected due to handing over of the kitchen waste to municipal waste collection by several facilities before the arrival of survey team, the survey totally collected 15 samples from hotels and 10 samples from restaurants as summarized in the table below.

Table 3.2.3 Schedule

Unit:kg

Facility	Name	The day of sampling				Weight whole	No. of samples
		Oct-05	Oct-06	Oct-07	Oct-08		
Hotel	LEUXAY Hotel	66.00	20.00	19.60	19.60	125.20	4
	SOMERSET		15.50	15.20	2.83	33.53	3
	Chanthapanya Hotel	18.10	27.40	26.00	25.83	97.33	4
	City Inn	16.00	3.20	15.30	15.10	49.60	4
Total-Hotels		100.10	66.10	76.10	63.36	305.66	-
No. of samples		3	4	4	4	-	15
Restaurant	Khop Chai Deu			18.00	49.30	67.30	2
	Kong View			80.00	11.30	91.30	2
	Tamnak Lao Restaurant		2.40	3.70	2.92	9.02	3
	Delhi Durbar	17.80		12.00	16.00	45.80	3
Total- Restaurants		17.80	2.40	113.70	79.52	213.42	-
No. of samples		1	1	4	4	-	10

: No sample collected

e) Survey results

e)-1. Waste generation Weight

The results of the waste generation weight in the facilities are shown in below. The generation ration was calculated in accordance with the weight data,

Table 3.2.4 Results of the waste generation and calculation of the generation ratio

Items	The day of sampling				Weight whole period
	Oct-05	Oct-06	Oct-07	Oct-08	
Total Weight-Hotels(kg)	100.10	66.10	76.10	63.36	305.66
No. of hotel samples	3	4	4	4	15
Generation Ratio per hotel(kg/hotel)	33.37	16.53	19.03	15.84	20.38
Total Weight-Restaurants(kg)	17.80	2.40	113.70	79.52	213.42
No. of Restaurant samples	1	1	4	4	10
Generation Ratio per restaurant(kg/restaurant)	17.80	2.40	28.43	19.88	21.34

As the result, the generation of kitchen waste was estimated as 20.38kg/facility in hotel and 21.34kg/facility in restaurant respectively. Daily fluctuation and fluctuation by difference of business scale in each facilities were observed.

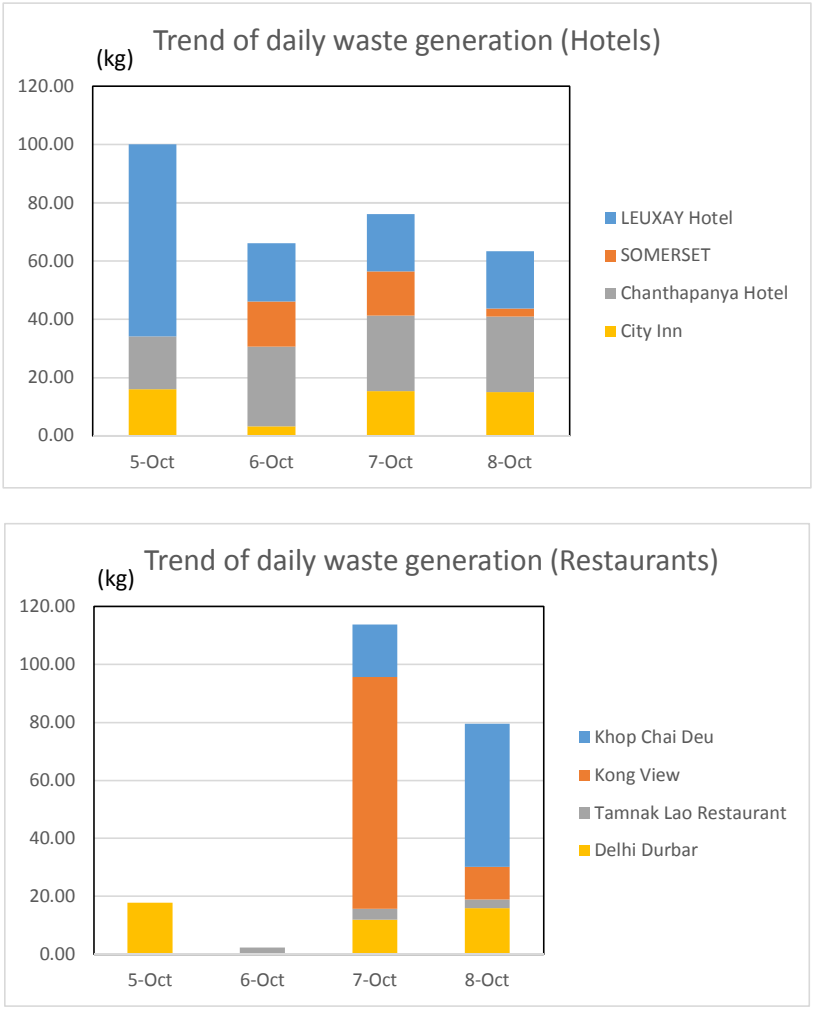


Figure 3.2.6 The trend of the daily generation of waste

As the result of considering the correlation, clear correlation between number of guests and waste generation was not able to estimate enough because number of samples was limited at this time.

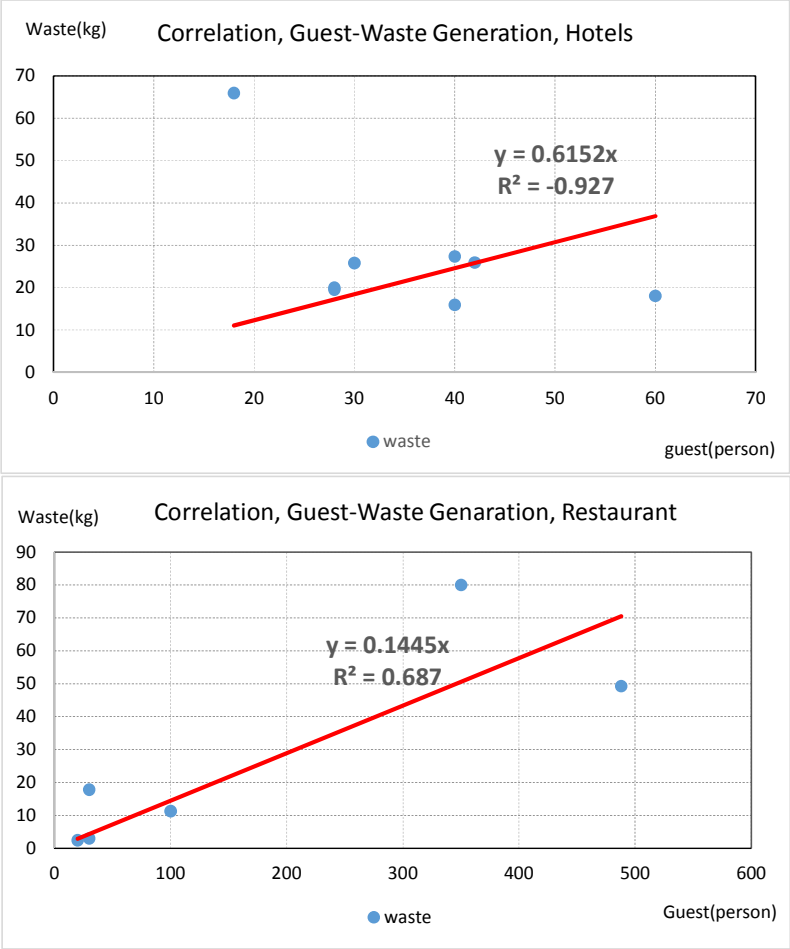


Figure 3.2.7 The correlation between waste generation and number of guest

The calculation results of the Waste Generation Rate (kg/person/day) were 0.7655 kg/person/day in Hotels and 0.1608 kg/person/day in Restaurants respectively. This data was calculated in accordance with the result of totally 8 hotels and 6 restaurants which answered the number of the guests in the interview survey.

Table 3.2.5 Waste Generation Rate

Hotel				Restaurant			
Sample	kg/day	Guest	kg/person/day	Sample	kg/day	Guest	kg/person/day
1	66	18	3.6667	1	17.8	30	0.5933
2	18.1	60	0.3017	2	2.4	20	0.1200
3	16	40	0.4000	3	80	350	0.2286
4	20	28	0.7143	4	49.3	488	0.1010
5	27.4	40	0.6850	5	11.3	100	0.1130
6	19.6	28	0.7000	6	2.92	30	0.0973
7	26	42	0.6190	SUM	163.72	1018	0.1608
8	25.83	30	0.8610				
SUM	218.93	286	0.7655				

e)-2. Waste Composition

The waste composition survey was conducted to the samples collected from each hotel and restaurant. The collected samples were respectively mixed, stirred, and divided several times to get the minimum required amount for composition analysis. The composition analysis was carried out for the consecutive 4 days for each sample taken from each facility with its focus on obtaining the weight-based percentage of the waste suitable and not suitable for gasifiers. The result was shown in the next table.

In many cases, kitchen waste was mixed with many other wastes such as plastics, papers, bottles, and so forth. It also contains the unopened packaged food and liquid food left over. All of them are properly separated to obtain the weight for each component. Each sample was put into a bucket to obtain the volume (cubic content) before its separation by components for the purpose of estimating the bulk specific gravity of the waste. The waste components to be defined as not suitable for gasifiers include plastics, papers, bottles, fruits peels, green waste, bones, and shells. They are all separately weighed to estimate their total ratio in kitchen waste. Table 6 and Figure 3 respectively shows the analysis results.

Table 3.2.6 The results of the waste composition

【Hotel】					Unit of Weight:kg
	5-Oct	6-Oct	7-Oct	8-Oct	Whole the term
# of Hotel	3	4	4	4	15
Total Amount of Sample	100.1	66.1	76.1	79.52	321.8
Liquide	0	0	0	0	0.0
Removed Large Plastics	15.5	10.5	11.4	8.5	45.9
Amount after volume reduction	14.7	11.2	11.7	12	49.6
No Suitable for Gasfiers					
Vinil, Plastics, Papers	0.57	0.7	0.62	0.38	2.3
Peals	1.85	2.1	2	1.63	7.6
Vesitables, Woods	1.12	1.56	2.48	2.9	8.1
Bones		0.39	0.085	0.165	0.6
Suitable for Gasfiers	11.3	6.1	7.5	6.79	31.7
Persentage					
Removed Large Plastics	15.48%	15.89%	14.98%	13.42%	14.26%
Liquide					
Others	84.52%	84.11%	85.02%	80.21%	85.74%
No suitable for Gasfiers					
Vinil, Plastics, Papers	3.88%	6.25%	5.30%	3.17%	4.58%
Peals	12.59%	18.75%	17.1%	13.6%	15.28%
Vesitables, Woods	7.62%	13.93%	21.2%	24.2%	16.25%
Bones			0.7%	1.4%	1.29%
Suitable for Gasfiers	76.87%	54.46%	59.58%	56.58%	63.89%
Removed Large Plastics	15.48%	15.89%	14.98%	13.42%	14.26%
Vinil, Plastics, Papers	3.28%	5.26%	4.51%	2.54%	3.92%
Peals	10.64%	15.77%	14.53%	10.90%	13.10%
Vesitables, Woods	6.44%	11.72%	18.02%	19.38%	13.93%
Bones			0.62%	1.10%	1.11%
Suitable for Gasfiers	64.97%	45.81%	50.66%	45.39%	53.67%

【Restaurant】					Unit of Weight:kg
	5-Oct	6-Oct	7-Oct	8-Oct	Whole the term
# of Restayrants	1	1	4	4	10
Total Amount of Sample	17.8	2.4	113.7	79.52	213.4
Liquide		0.57	13.6	2.35	16.5
Removed Large Plastics	6.45		8.9	12.2	27.6
Coconuts Shells				4.4	4.4
Amount after volume reduction	10.4	2.4	15.7	11.7	40.2
No suficient for Gasfiers					
Vinil, Plastics, Papers	1.35		0.59	1.61	3.6
Peals	1.38		0.33	0.48	2.2
Vesitables, Woods		0.24	4.6	1.72	6.6
Bones		0.115	0.515	0.66	1.3
Suficient for Gasfiers	6.1	1.43	10.5	7.2	25.2
Persentage					
Removed Large Plastics	36.24%	0.00%	11.96%	15.34%	12.91%
Liquide		23.75%	7.83%	2.96%	7.74%
Coconuts Shells				5.53%	2.06%
Others	63.76%	76.25%	80.21%	76.17%	79.35%
No suitable for Gasfiers					
Vinil, Plastics, Papers	12.98%		3.76%	13.76%	8.83%
Peals	13.27%		2.10%	4.10%	5.45%
Vesitables, Woods		10.00%	29.30%	14.70%	16.32%
Bones		4.79%	3.28%	5.64%	3.21%
Suitabl for Gasfiers	74.04%	59.58%	66.88%	61.54%	62.76%
Removed Large Plastics	36.24%	0.00%	11.96%	15.34%	12.91%
Vinil, Plastics, Papers	8.28%	0.00%	3.01%	10.48%	7.01%
Peals	8.46%	0.00%	1.69%	3.12%	4.32%
Vesitables, Woods		7.63%	23.50%	11.20%	12.95%
Bones		3.65%	2.63%	4.30%	2.55%
Liquide					7.74%
Coconuts Shells					2.06%
Suitabl for Gasfiers	47.21%	45.43%	53.64%	46.87%	50.46%

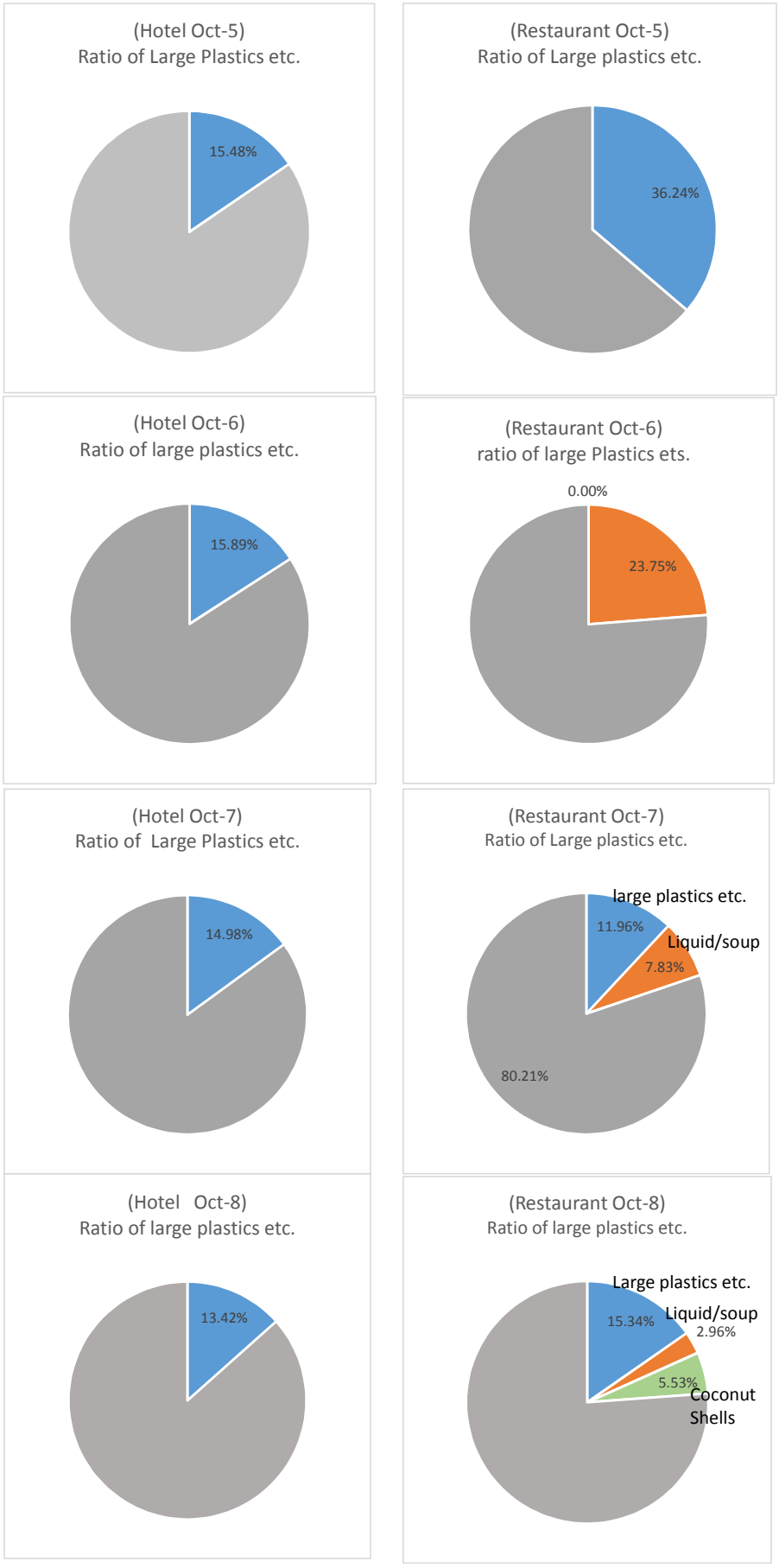


Figure 3.2.8 The results of waste composition(1)

The Percentage of plastics, liquid/soup and coconut shells in the sample before dividing process

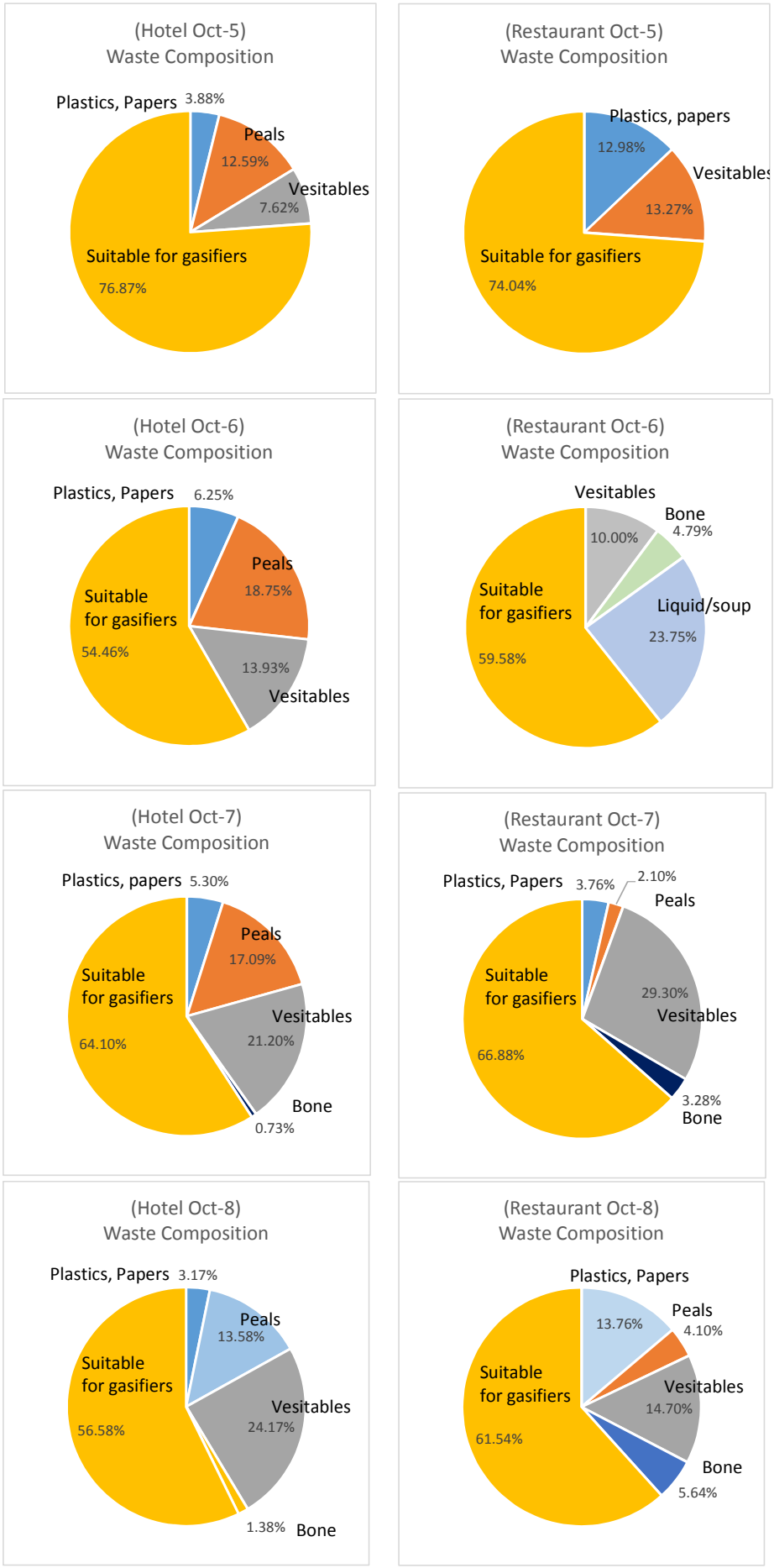
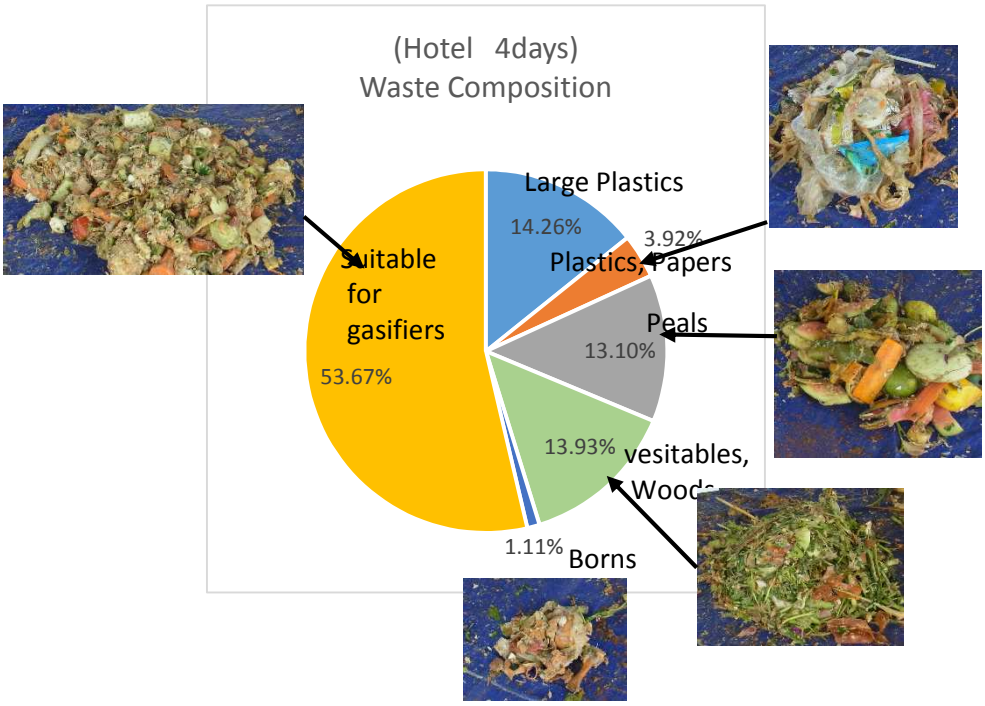
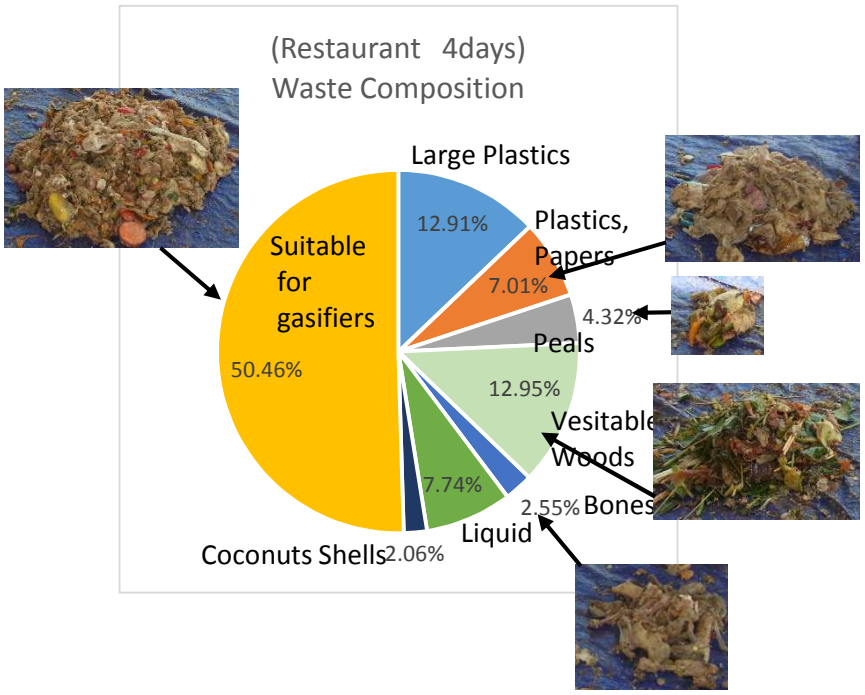


Figure 3.2.8 The results of waste composition (2)　Waste composition after dividing process



(Photo: Oct-8 After Composition Survey)



(Photo: Oct-8 After Composition Survey)

Figure 3.2.8 The result of the waste composition(3)

The waste composition whole the survey period

① Contamination ratio of the large plastics etc.

The contamination ratio of the large plastics and the likes in hotel samples were 15.48%, 15.89%, 14.98%, 13.42% in each respective day and 14.26% on average.

The contamination ratio of the large plastics and the likes in restaurant samples were 36.42%, 0.00%, 11.96%, 15.34% in each respective day and 12.91% on average.

The contamination ratio of the liquid food leftover in restaurant samples were 0.00%, 23.75%, 7.83%, 2.96% in each respective day and 7.74% on average.

The contamination ratio of the coconut shells in restaurant samples was the highest of 5.53% in the day 4 and 2.06% on average.

The large plastics and the likes mainly consists of plastic bags (containers) and food packages. It was also observed that the daily fluctuation of the ratio of liquid food leftover and some types of waste such as coconut shells were big probably because of difference in the types of the food served every day. The percentage of large plastics and the likes ranged between 14 and 15% in the sampled hotels while its average percentage in the sampled restaurants was 12.91%. Those percentages may be the good indicators to estimate the possible amount and percentage of kitchen waste suitable for gasifiers. The existence of liquid food leftover (7.74% on average) in kitchen waste in restaurants needs to be carefully considered in estimating the moisture content of the kitchen waste.

(Hotel, mixed 6th of October)

(Restaurant, mixed 8th of October)

Figure 3.2.9 Example of the large plastics etc.

② Bulk Specific Gravity (BSP) of the Kitchen Waste

The bulk specific gravity of kitchen waste was measured for hotels and restaurants respectively with the use of 20 litter buckets. As the result, the average BSP was 0.62kg/litter in hotel and 0.69kg/litter in restaurant respectively in whole 4 survey days.

Table 3.2.7 The BSP (Bulk Specific Gravity) of kitchen waste

Item	Day of sampling				Total
	Oct-05	Oct-06	Oct-07	Oct-08	
Weight afterdividing, Hotel(kg)	14.70	11.20	11.70	12.00	49.60
Weight per Unit Volume, Hotels(kg/L)	0.74	0.56	0.59	0.60	0.62
Weight after dividing, Restaurants (kg)	–	–	15.70	11.70	27.40
Weight per Unit Volume Restaurants (kg/L)	–	–	0.79	0.59	0.69
Capacity 0f the Bukket: 20L					
No dividing process because only one restaurants' sample at Oct-5 and Oct-6					

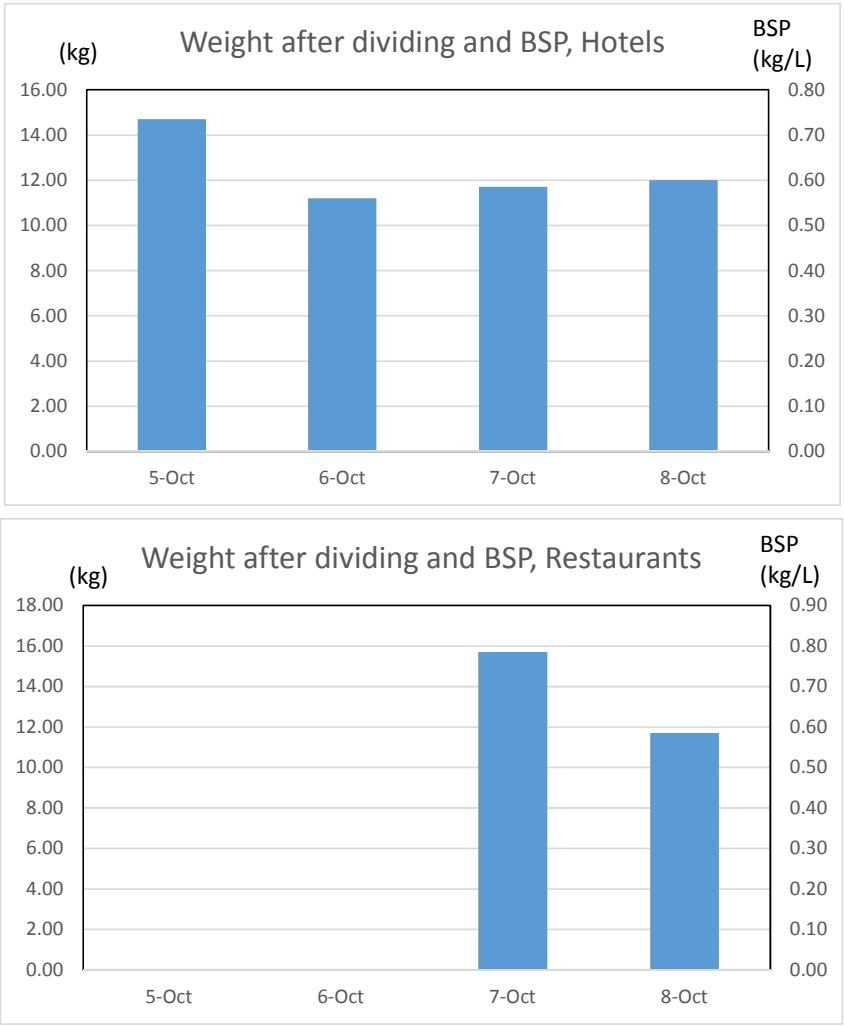


Figure 3.2.10 The results of the density

③ Waste components suitable for gasifiers

The percentage of the waste components suitable for gasifiers was 53.67% in the sampled hotels and 50.46% in the sampled restaurants respectively. It was estimated that about half of the kitchen waste can be utilized for biogas production. The waste components suitable for gasifiers include rice, bread, noodles, Indian naan and other carbohydrates, leftover of beef, chicken and fishes.

	
(Hotel 6th of October)	(Restaurant 6th of October)
	
(Restaurant 7th of October)	(Restaurant 8th of October)

Figure 3.2.11 Waste components suitable for gasifiers

④ Waste components not suitable for gasifiers

○Plastics/Papers

Packages of spices, paper napkins, decorations, disposable plastic cutleries were categorized as "Plastics/Papers". The ratio of this category was 3.92% in hotels and 7.01% in restaurants. Some restaurants consumed many paper napkins that may increase the contamination of waste papers.

○Peels

Fruits (Water melons, Pineapples, dragon fruits) peels, pieces of fruit, seeds, and pomaces of lemon were categorized as "Peels". The ratio of this category was 13.01% in hotels and 4.32% in restaurants.

○Vegetables

Vegetables, leaves and herbs, lemon grasses, stalks, peels of cucumber, Onions, leaves for decoration, bamboos, trees, bamboo skewers, and chop sticks were categorized as "Vegetables". The ratio of this category was 13.93% in hotels and 12.95% in restaurants.

○Bones/Shells

Bones of Cow, Pig, Chicken, and fish, shells and egg shells were categorized as "Bones/Shelsl". The ratio of this category was 1.11% in hotels and 2.55% in restaurants.

f) Findings

Although the elemental composition analysis was not conducted this time, the results of waste composition survey indicated that the characteristics of kitchen waste in Vientiane would be similar to that in Japan. The gasifier to be applied to the proposed project in this Study can be designed in accordance with the available data of kitchen waste in Japan.

The percentage of the waste components suitable for gasifiers in kitchen waste was estimated to be around 50%. Considering the high mixture of waste components not suitable for gasifiers in kitchen waste, the

proper separation of waste at sources is of great importance to obtain good quality waste for gasifiers as well as to increase transport efficiency.

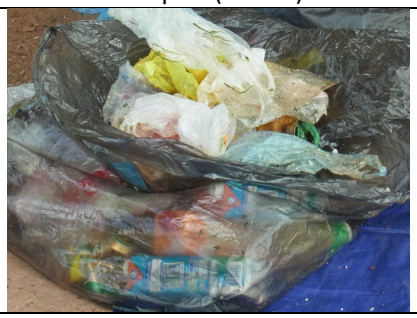
Photo

The Day 1 (5th of October)

	
Sampling at LEUXAY Hotel	Sample of hotel waste
	
Expansion of the sanple	Dividing process (Hotel)

	
Sampling at Delhi Durbar	Expanded sample (Restaurant)
	
Segregating the large plastics	Waste Composition Survey (Restaurant)
	
Scaling weight	

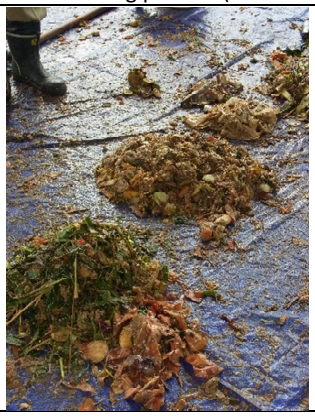
The Day 2: 6th of October

	
Sampling at SOMERSET	Samples (Hotels)
	
Expanding the samples (Hotel)	Segregating the large plastics
	
Dividing process (Hotels)	After the dividing process (Hotel)
	
Waste Composition Survey (Hotel)	After the Waste Composition Survey (hotels)

	
Sample (Tamnak)	Expanding the samples (restaurants)
	
Waste Composition Survey (restaurants)	After the Waste Composition Survey (restaurants)

The day 3: 7th of October

	
Sampling in City INN	Samples (hotels)
	
Expanding the samples (Hotels)	
	
Dividing process (hotel)	After the Dividing process (hotel)
	
Waste Composition Survey (hotel)	After the Waste Composition Survey (hotel)

	
Sampling at Kong View	Samples (restaurants)
	
Expanding the samples (restaurants)	Segregating the large plastics
	
Dividing process (restaurants)	After the Dividing process (restaurants)
	
Waste Composition Survey (restaurants)	After the Waste Composition Survey (restaurants)

The Day 4: 8th of October

	
Sampling at Somerset	Samples (hotels)
	
Expanding the samples (Hotels)	After Expanding the samples (Hotels)
	
Dividing process (hotel)	After the Dividing process (hotel)
	
Waste Composition Survey (hotel)	After the Waste Composition Survey (hotel)

	
Sampling at Tamnak	Samples (restaurants)
	
Expanding the samples (restaurants)	Segregating the large plastics
	
Dividing process (restaurants)	After the Dividing process (restaurants)
	
Waste Composition Survey (restaurants)	After the Waste Composition Survey (restaurants)

3.2.3.2.3 Organizing the system to receive the generated organic waste on a continuous basis

On July 15, 2015, the working team held a meeting with the project owner (Mr. A) to discuss the scheme for gas/liquid fertilizer projects. The products are intended to be sold under the owner's own brand name, but the need to verify and assess the project's profitability as a business was mentioned in the discussion. It is projected that the liquid fertilizer business will be realized without much difficulty, for liquid fertilizer demand is high in Lao PDR.

The following points were made by the project owner:

- The owner prefers that the Vientiane Urban Development and Administration Authority (VUDDA) continue to undertake garbage collection service. Incentives (T/P) to be paid by the project owner,

however, shall be agreed upon between the owner and VUDDA. As such, specifics of the incentives (T/P) paid to VUDDA by the project owner based on the amount of collected waste shall be decided after the memorandum of understanding (MOU) is concluded.

- The owner wants to launch the Green Award project in the future. Specifically, the award will aim to raise the environmental awareness of hotels and restaurants by grading them based on their environmental and energy conservation practices. For example, points will be given to preferable practices such as using vegetables grown with the liquid fertilizer and cooking with biogas, and the hotels and restaurants will be evaluated based on the total points earned.
- Unlike gasoline, gas prices are determined by free competition among businesses.
- The owner will help conduct the garbage characteristics survey on hotels and restaurants.

Photo 7: Discussion with VUDDA

The working team asked VUDDA to undertake collection of food waste. (Profitability of the project will be influenced by the amount of food waste collected from sources other than hotels and restaurants.)

Photo 8: Discussion on the signing of MOU between VUDDA and the project owner

The project owner asked VUDDA to undertake collection of food waste to secure the supply of the raw materials for methane fermentation. The details of incentives for the collection of food waste will be determined after the signing of MOU.

3.2.3.2.4 Survey on sales outlets of biogas

By searching the Internet, the team has found that, in Vientiane, the following 18 companies are engaged in gas supply business (whether or not they have filling equipment is unknown):

1. Gas Service Center, 2. Sunday Gas Supply, 3. Pasarnsak Gas Co Ltd., 4. Kham being Kham menu Gas Supply, 5. Phosay Gas Supply, 6. Vientiane Industrial Gas Co Ltd., 7. Khamsay Khoualuang Gas, 8. Phengta KT Gas Shop, 9. Khamsay Savang Gas, 10. Baide Lighter Industry (Lao) Co. Ltd., 11. Khamphoui Gas Supply, 12. Bounma Gas Supply, 13. Manivone Gas Shop, 14. Phetsamone Industry Gas Supply, 15. Bounnam Gas Supply, 16. Dong Gas Supply, 17. Tunsamy Gas, 18. Dongpalane Gas

Sales of gas may be conducted by an affiliated company of SCL, a corporation run by Mr. A, for gas sales are not regulated by any authority and prices of gas are determined by free competition among businesses. In any case, if the operation base is to be established at a site between Vientiane City center and KM32 landfill and a gas retailing business is to be launched from the base, a gas-filling equipment would have to be installed, operated, and managed on its premises. Therefore, details of expense items required for the evaluation of the project's profitability such as construction cost (including/excluding gas-filling equipment and purification equipment), maintenance cost, distribution cost, and selling and administrative expenses will have to be grasped, together with their evidences. The following are rough estimated figures based on the currently available costs and prices.

Apparently, the size of gas cylinder widely used in hotels and restaurants in Laos is 50 kg (volume: 25 m^3). It is estimated that 800 m^3 (60 vol%, 80 m^3/ton) of methane (CH_4) will be generated from 10 tons of input organic waste, which equals to 25 of 50 kg gas cylinder units. The amount of methane after separating CO_2 will be equivalent of some 19 cylinders. Estimating it simply, if one 50 kg cylinder of gas was sold for 9,000 yen (FYI: the market price of methane gas is 9,750 yen per cylinder), sales of the refined gas would generate 171,000 yen in daily revenue (5.13 million yen in monthly revenue, provided that the number of effective operating days of the business is 30 days a month). Assuming that three to five people are needed for the operation, and their monthly wages range from 16,000 to 133,000 yen per person, labor costs will come to be three to five times the above amounts, in the wide range of 48,000 yen to 665,000 yen a month. (Refer to the table below. Information on labor charges in private corporations is not available. The estimated figures were calculated assuming that most operators receive wages in the range of 30,000 to 50,000 yen a month.) Furthermore, 1.5 million yen per month would be required as incentive payment for purchasing the waste, provided that the incentive payment for 10 tons of the waste was set at 75,000 yen per day, the price likely to be accepted by VUDAA (according to the information provided by Leuxai Hotel: T/F = 15,000 kip/30 kg).

Table 3.2.8 Labor Costs of ASEAN countries and China (2013)

	Country	Myanmar	Cambodia	Laos	Vietnam	Thailand
	City / Unit	Yangon	Phnom Penh	Vientiane	Ho Chi Minh City	Bangkok
Country's population (2012)	Million	63.7	15.3	6.6	88.8	67.9
Per capita GDP (2012)	Dollars	868	926	1,380	1,753	5,390
Manufacturing industry: general factory worker	Dollars/month	53	74	132	148	345
Manufacturing industry: mid-level technician	Dollars/month	138	298	336	297	698
Manufacturing industry: section chief-level manager	Dollars/month	433	563	410	653	1,574
Nonmanufacturing industry: general staff	Dollars/month	236	297	321	440	664
Nonmanufacturing industry: section chief-level manager	Dollars/month	668	1,088	1,109	1,222	1,602
Legal minimum wage	Dollars/month	N/A	80	78	113	197

	Country	Philippines	Malaysia	Indonesia	China	
	City / Unit	Manila	Kuala Lumpur	Jakarta	Shanghai	Guangzhou
Country's population (2012)	Million	96	30	245	1,345	
Per capita GDP (2012)	Dollars	2,612	10,345	3,594	6,071	
Manufacturing industry: general factory worker	Dollars/month	301	344	239	449	395
Manufacturing industry: mid-level technician	Dollars/month	452	944	433	835	704
Manufacturing industry: section chief-level manager	Dollars/month	1,070	1,966	1,057	1,456	1,274
Nonmanufacturing industry: general staff	Dollars/month	493	858	423	824	848
Nonmanufacturing industry: section chief-level manager	Dollars/month	1,194	1,986	1,245	1,891	1,886
Legal minimum wage	Dollars/month	220	296	226	231	247

(Sources: The 23rd Survey of Investment Related Costs in Asia and Oceania issued in May 2013 by JETRO. The data on population and per capita GDP are taken from the IMF World Economic Outlook 2013 database.

3.2.3.2.5 Survey on sales outlets of liquid fertilizers

By searching the Internet, the team has so far found that the following companies are selling liquid fertilizers: 1. BIO FER, 2. Birla Lao Pulp and Plantation, 3. Soukhin Trading Sole Co. Ltd., and 4. Chanthanom Agricultural Promotion & Import Export Co. Ltd. The project's liquid fertilizer may be sold by an affiliated company of SCL Corporation (5.) run by Mr. A, carrying the brand name of A. However, in order to sell the liquid fertilizer under the A brand name, it will be necessary to secure enough outlets to sell at least 10 tons of the fertilizer per day, the expected minimum amount of production. Furthermore, there are some existing facts that need to be considered. First, Laos has been dependent on Thailand to meet its fertilizer demand, for the quality of fertilizers produced by companies in Laos is low, but the fertilizers made in Thailand are expensive. Second, the above-mentioned Chanthanom Agricultural Promotion & Import Export Co. Ltd. (4.) has concluded a business cooperation agreement with Pakhoom, a major fertilizer company in Thai (daily production: 1500 tons), to create a joint venture company. Considering these, it is expected that entering the fertilizer market in Lao PDR will be easier than in other countries. At the moment, the working team still considers it possible to pursue the option of selling the fertilizer by an affiliated company of SCL Corporation (5.) as long as an appropriate business model and an action plan are in place. The joint venture company mentioned above plans to produce regular, organic, and liquid fertilizers. Bracing for the launch of the ASEAN Economic Community (AEC) in 2015, Lao PDR is now focusing on the potential of organic agricultural products as exports to the regional market. According to Lao PDR's National Export Strategy for the period of 2011–2015, the government called on farmers to grow export-bound grains without using chemical fertilizers in response to the growing demand for organically grown vegetables and fruits in the region and in the world. (The amount of chemical fertilizers used in Lao PDR is 12 kg per hectare on average.) In September 2014, the newspaper *Nikkei* reported that the largest agricultural corporation in Laos is Paksong Development, with the number of its member farms reaching 10,000 and its total area of farmlands 7,500 hectares. The corporation also calls for pesticide- and chemical fertilizer-free agricultural production and can thus be regarded as a prospective customer of the project (with its expected demand for fertilizer being some 90 tons based on the corporation's total planted area).

Regarding the regional collaboration structure for the business, the Department of Agricultural and Forestry

Planning and Cooperation Section and the National University of Laos (NUOL), Faculty of Agriculture, have agreed to collaborate in conducting field tests of the liquid fertilizer and in expanding its use.

3.2.3.2.6 Formulating systems and design specifications suited to local needs

1) Methods to collect methane fermentation materials and waste

[Proposed structure of collection/sorting/transportation of waste usable for methane fermentation]

Collected from:	Collected by:	Sorting of waste—how and by whom:	Transportation of waste—how and by whom:
Hotels/restaurants belonging to the consortium	A company managed by the project owner (a newly established company)	Boxes dedicated to collection of the subjected waste are installed. Sorting work is done by hotels/restaurants, following guidance provided by the association.	The collected waste is transported directory to the processing plant, by employees of the project company.
General households not belonging to the consortium	VUDAA's garbage collection service	The facility dedicated to sorting work is built on the premises of KM32 (Vientiane's final disposal landfill),[1)] and the project company's employees sort the waste manually.[2)]	The sorted waste is transported from KM32 to the processing plant[3)] by employees of the project company.

1) VUDAA has agreed to the plan of building a waste-sorting facility on the premises of KM32. Details such as the actual site of the facility need to be discussed separately.

2) This method has been implemented in a facility for methane fermentation in Japan (in Minamisanriku town, with output of some 10 tons) and in a composting facility outside Japan (in Thailand, by Loxley).

3) The planned construction site of the processing plant and KM32 are about 8 km apart.

2) Amount of sorted waste to be received

Agoda-/TripAdvisor-registered hotels and restaurants in the subjected area are about 250. Based on this number and the aforementioned garbage characteristics survey results, the expected yield of waste that can be used to produce gas is 6,215 kg per day.

Based on the figure, the working team decided to receive 5 tons of sorted food waste per day in its methane fermentation facility.

3) Amount of the generated gas (sales output of the gas)

An estimated amount of generated biogas per unit by using WTM, a non-dilution methane fermentation process, is 150 m^3/ton.

Using this figure, the **total amount of biogas generated** can be calculated by the following formula: 5 ton/day × 150 m^3/ton ＝ 750 m^3/day. Therefore, the expected amount of biogas generated in total will be 750 m^3 per day.

When this biogas is refined to make the **gas comprised of 90% methane**, the total amount of the gas generated can be calculated by 750 m^3/day × 0.6 × 0.9 = 400 m^3/day. In this case, the expected amount of the gas will be 400 m^3 per day.

4) Amount of the liquid fertilizer (sales output of the fertilizer)

The amount of produced liquid fertilizer (fermentation residue) will be 5 m^3 per day, equal to the amount of food waste to be received.

5) Project owners (in charge of operation and management)

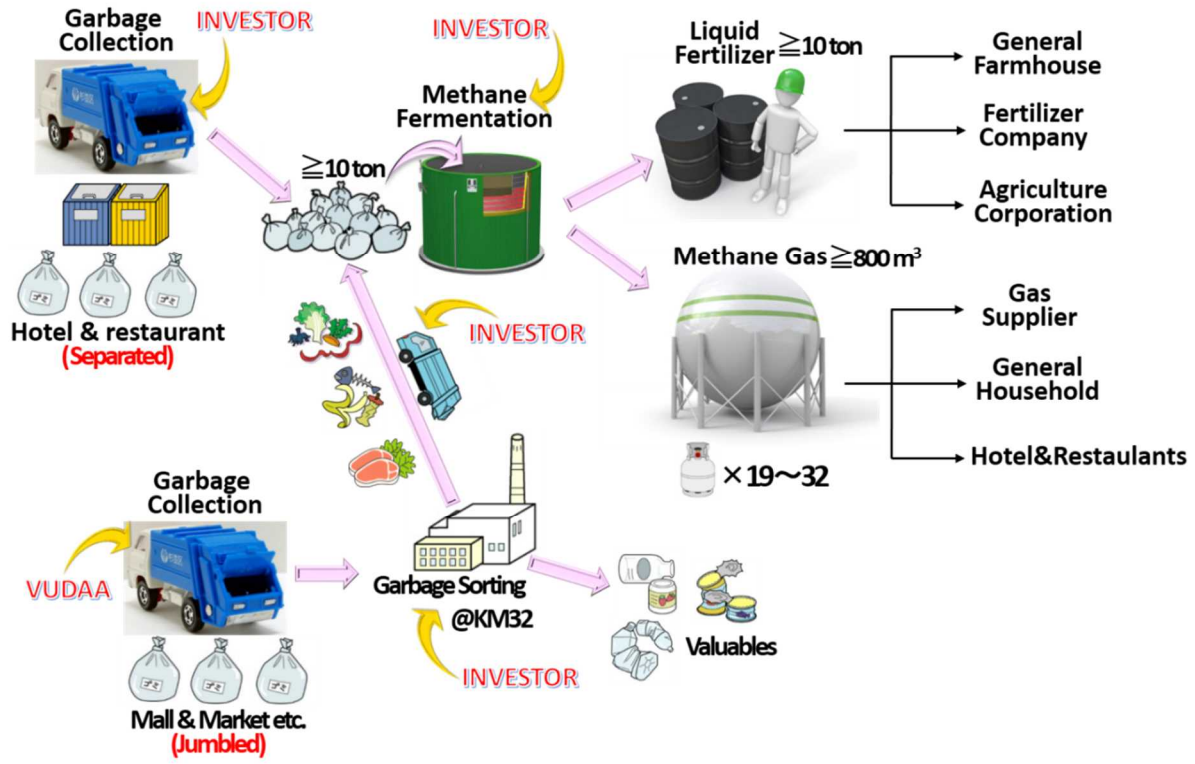
Mr. A, President of Societe Commerciale Lao Ltd. (SCL), a locally based corporation (also the serving

President of the Lao Hotel and Restaurant Association), and Mr. B of L Co.

6) Local contractor

One of the above-mentioned project owners, Mr. B, will be the project's contractor. He runs construction and many other businesses including trading companies, hydroelectric power plants, and staffing agencies in Lao PDR/Myanmar. His company has undertaken construction works of government facilities, large-scale projects in Lao PDR, and JICA projects; is Sumitomo Mitsui Construction Co., Ltd.'s (SMC) partner in Lao PDR; and has been certified by the Asian Development Bank and World Bank. He said that his company could undertake all the works required for building the plant, including conducting a geological survey prior to construction and environmental impact assessment; implementing ground improvement; completing applications for ministries and authorities; and procuring necessary materials (mostly from Thailand).

7） Schematic diagram of the project



8) Project site

Site for the project will be provided by the project owners.

(Photos of the site)

3.2.4 JCM Methodology

3.2.4.1 Proposed JCM Project and the Expected GHGs Reductions

The proposed JCM Project aims at reducing GHGs emissions through biogas production from organic kitchen waste and its utilization as the alternative fuel of liquefied petroleum gas (LPG), which was currently used for cooking in hotels and restaurants. The Project plans to collect separated organic kitchen waste from hotels and restaurants and put them into gasifier to accelerate the anaerobic fermentation process to capture the methane and produce biogas. The produced biogas will be injected into gas cylinders for the use by hotels and restaurants.

The expected GHGs emission reductions from the proposed JCM project is summarized as shown in the table below.

Proposed JCM Project	The Expected GHGs Emission Reductions
Methane capture and biogas production from kitchen waste and its utilization as the alternative fuel of LPG for cooking in hotels and restaurants	**(GHGs emission reduction from non-energy sources)** ▪ Collection and utilization of biogas from kitchen waste through the proposed project will reduce methane emission from kitchen waste that will otherwise be disposed at the existing landfill and generate landfill gas in the reference/BAU scenario.
	(GHGs emission reduction from energy sources) ▪ Substitution of the currently used LPG for cooking in hotels and restaurants by the carbon-neutral biogas produced under the proposed Project will reduce the amount of GHGs emission from LPG consumption.

3.2.4.2 Outline of JCM Methodology

The JCM methodology for the proposed project mainly consists of two components, i.e.

①The methodology for estimating and monitoring methane (CH_4) emission reduction from final disposal landfill where the kitchen waste will be brought if the proposed project is not carried out in the reference/BAU scenario.

②The methodology for estimating and monitoring carbon dioxide (CO_2) emission reduction by substituting the LPG used in hotels and restaurants for cooking purpose to carbon-neutral biogas produced by the project

In formulating the JCM methodology, the Study reviewed the IPCC's GHGs inventory guidelines (2006) on waste sector, the relevant approved CDM methodologies (e.g. AMS-III.F Version 11.0、AMS-III.G Version 7.0 and other related tools), and other relevant JCM methodologies developed in prior studies.

3.2.4.3 Boundary of the Proposed JCM Project

The boundary of the proposed JCM project includes collection and transportation of kitchen waste from generation sources as well as final disposal landfills to the biogas production facility, biogas production process (anaerobic fermentation, methane capture, biogas production and injection to gas cylinders), transportation of biogas cylinders to the final users (hotels and restaurants), and consumption of biogas as the substitute of LPG in hotels and restaurants for cooking purpose.

The Project GHGs emission includes:

- CO_2 emission from electricity consumption by the biogas production facility of the propose project and
- CO_2 emission from fossil fuel consumption by the transportation vehicles of gas cylinders from the biogas production facility to final users (hotels and restaurants).

As to the CO_2 emission from fossil fuel consumption by the transportation vehicles of kitchen waste from the generation sources and final disposal landfills, CO_2 emission also arises in the reference scenario when the kitchen waste is transported from the generation sources to the existing final disposal landfill while the project scenario plans to build/install biogas production facility nearer to the generation sources in terms of its distance than the existing landfill or within the existing landfill. Therefore, the CO_2 emission arising from transporting the kitchen waste from the sources to the biogas production facility will be equal or less than the reference emission in relation to this transport. Thus, the Project CO_2 emission by the transportation of kitchen waste from the generation sources to the biogas production facility is not estimated on the basis of the principle of simplicity of JCM methodology and conservativeness in estimating the GHGs emission reduction.

3.2.4.4 Establishment of the Reference Scenario

The reference scenario of GHGs emission in relation to the propose project consists of two components as described in the table below.

Reference scenario components	Contents
Treatment of kitchen waste	In the absence of the proposed project, all the kitchen waste will be collected under the current municipal solid waste collection system and disposed at the existing final disposal landfill of KM25.
Energy utilization in hotels and restaurants for cooking purpose	In the absence of the proposed project, all the hotels and restaurants, to which the proposed project will provide biogas cylinders as alternative fuel, will continue using LPG for cooking purpose.

3.2.4.5 Methodology for Estimating GHGs Emission Reduction

The methodology for estimating GHGs emission reduction by the proposed project is described as below.

3.2.4.5.1 Basic equation for estimating GHGs emission reduction

Basic equation for estimating GHGs emission reduction is as follows.

$$ER_y = RE_y - PE_y$$

ER_y	Emission reduction in the year y ($tonCO_2$)
RE_y	Reference emission in the year y ($tonCO_2$)
PE_y	Project emission in the year y ($tonCO_2$)

3.2.4.5.2 Methodology for estimating reference emission

The GHGs emission in the reference scenario is to be calculated in accordance with the equation shown below.

$$RE_y = RE_{CH4,y} + RE_{HC,y}$$

RE_y	Reference emission in the year y ($tonCO_2e$/year)
$RE_{CH4,y}$	Reference emission from the existing final disposal landfill in the year y ($tonCO_2e$/year)
$RE_{HC,y}$	Reference emission from the consumption of LPG for energy purpose that is substituted by biogas by the proposed project in the year y ($tonCO_2$/year)

Where $RE_{CH4,y}$ is defined as:

$$RE_{CH4,y} = RE_{CH4,SWDS,y}$$

$RE_{CH4,y}$	Reference emission from the existing final disposal landfill in the year y ($tonCO_2e$/year)
$RE_{CH4,SWDS,y}$	Methane emission potential of the kitchen waste collected for biogas production by the proposed project if it is disposed at the existing final disposal landfill ($tonCO_{2e}$)

Where $RE_{CH4,SWDS,y}$ is estimated by the equation below:

$$RE_{CH4,SWDS,y} = \varphi_y * GWP_{CH4} * (1 - OX) * \frac{16}{12} * F * DOC_{f,y} * MCF_y * \sum_{x=1}^{y} \sum_{j} W_{j,x} * DOC_j * e^{-k_j(y-x)} * (1 - e^{-k_j})$$

$RE_{CH4,SWDS,y}$	Methane emission potential of the kitchen waste collected for biogas production by the proposed project if it is disposed at the existing final disposal landfill ($tonCO_{2e}$)
φ_y	Correction factor ▪ Default value (0.9:IPCC)
GWP_{CH4}	Global warming potential of methane ($tonCO_2e/tonCH_4$) ▪ Default value (21 : IPCC)
OX	Oxidization factor (Percentage of methane oxidized on the surface layer of landfill) ▪ Default value (0.1: IPCC)
F	Ratio of methane in landfill gas ▪ Default value (0.5: IPCC)
$DOC_{f,y}$	Ratio of degradable organic carbon at the landfill in the year y ▪ Default value (0.5: IPCC)
MCF_y	Methane correction factor in the year y ▪ Default value (IPCC)

$W_{j,x}$	Amount waste type j in the year y (ton/year)
DOC_j	Ratio by weight of the degradable organic carbon in waste type j ▪ Default value (IPCC Guidelines)
k_j	Decay factor of waste j ▪ Default value (IPCC Guidelines)
J	Waste type
X	Credit year (from 1 to y)
Y	Credit period

(Remarks on estimation of $RE_{CH4,SWDS,y}$)

The reference emission to be estimated in accordance with the equation above may be higher or lower than the actual methane capture and collected by the proposed project through biogas production. In such a case, the Project will take the lower one as the reference emission on the basis of the principle of the conservative estimation of GHGs emission reduction.

On the other hand, $RE_{HC,y}$ is estimated in accordance with the equation shown below.

$$RE_{HC,y} = HC_{displace,PJ,y} * EF_{CO2,displace,LPG,y}$$

$RE_{HC,y}$	Reference emission from the consumption of LPG for energy purpose that is substituted by biogas by the proposed project in the year y ($tonCO_2$/year)
$HC_{displace,PJ,y}$	The amount of energy to be substituted by biogas under the proposed project in the year y (TJ/year) ▪ Measurement by monitoring
$EF_{CO2,displace,LPG,y}$	Emission factor of LPG to be substituted by biogas under the proposed project in the year y ($tonCO_2$/TJ) ▪ Default value (IPCC)

3.2.4.5.3 Methodology for estimating project emission

The GHGs emission in the project scenario is estimated in accordance with the equation below.

$$PE_y = PE_{FC,transport,y} + PE_{EC,facility,y}$$

PE_y	Project emission in the year y ($tonCO_2$/year)
$PE_{FC,transport,y}$	CO_2 emission from the fossil fuels consumption by the transportation vehicles of biogas cylinders from the biogas production facility to the final users in the year y ($tonCO_2$/year)
$PE_{EC,facility,y}$	CO_2 emission from electricity consumption by the biogas production facility in the year y ($tonCO_2$/year)

Where $PE_{FC,transport,y}$:

$$PE_{FC,transport,y} = FC_{transport,PJ,y} * EF_{CO2,fuel,y}$$

$PE_{FC,transport,y}$	CO_2 emission from electricity consumption by the biogas production facility in the year y ($tonCO_2$/year)
$PE_{FC,transport,y}$	The amount of fossil fuels consumption by the transportation vehicles of biogas cylinders from the biogas production facilities to the final users in the year y (TJ/year) ▪ Measurement by Monitoring
$EF_{CO2,fuel,y}$	Emission factor of the fossil fuels used by the transportation vehicles of biogas cylinder ($tonCO_2$/TJ) ▪ Default value (IPCC)

On the other hand, $PE_{EC,facility,y}$:

$$PE_{EC,facility,y} = EC_{facility,PJ,y} * EF_{CO2,grid\ electricity,y}$$

$PE_{EC,facility,y}$	CO_2 emission from electricity consumption by the biogas production facility in the year y (tonCO_2/year)
$EC_{facility,PJ,y}$	Electricity consumption by the biogas production facility in the year y (kwh/year) ▪ Measurement by monitoring
$EF_{CO2,grid\ electricity,y}$	Grid emission factor in the year y (tonCO_2/kwh) ▪ National grid emission factor of Lao

3.2.4.6 Monitoring Methodology

3.2.4.6.1 Default Value Applied

The propose project set the following default values in estimating the GHGs emission reduction by the proposed project.

Items	Unit	Default value
Global warming potential of methane (GWP_{CH4})	tonCO_2e/tonCH_4	21
Oxidization factor (Percentage of methane oxidized on the surface layer of landfill) (OX)	-	0.1
Ratio of methane in landfill gas (F)	-	0.5
Ratio of degradable organic carbon at the landfill ($DOC_{f,y}$)	-	0.5
Methane correction factor in the year y (MCF_y)	-	Default value is set by type of landfill in IPCC guidelines.
Ratio by weight of the degradable organic carbon in waste type j (DOC_j)	-	Default value is set by type of waste in IPCC guidelines.
Decay factor of waste j (k_j)	-	Default value is set by types of waste and type of climate in IPCC guidelines.
Emission factor of LPG ($EF_{CO2,displace,LPG,y}$)	tonCO_2/TJ	63.1
Emission factor of the fossil fuels used by the transportation vehicles of biogas cylinder ($EF_{CO2,fuel,y}$)	tonCO_2/TJ	Default value is set by types of fossil fuels in IPCC guidelines.
Grid emission factor ($EF_{CO2,grid\ electricity,y}$)	tonCO_2/kwh	National grid emission factor is available in Lao.

3.2.4.6.2 Monitoring items and monitoring methods

The monitoring items and methods to be applied in the proposed project is as shown in the table below.

Monitoring items	Monitoring methods	Frequency
Mount of kitchen waste collected by the proposed project	Weight scale	At every collection
Composition of the collected kitchen waste	Waste composition analysis	Yearly
Amount of methane capture and collected from kitchen waste	Flow meter, methane meter	Consecutive
Electricity consumption by the project facilities	Meter reading	Monthly
Amount of LPG substituted by biogas (TJ)	Sales records (invoices, receipts) of biogas cylinders	Quarterly
Amount of fossil fuels consumption by the transportation vehicles of biogas cylinders	Records of fuel purchase (receipts), trip meter readings of transportation vehicles.	Quarterly

3.2.4.7 Amount of GHG emission reductions

Estimated amount of CO2 reductions is below CO2-ton/y

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	amount
Avoided methane gas	541	904	1,148	1,311	1,420	1,493	1,543	1,576	1,598	1,612	1,622	1,629	1,633	1,636	1,638	21,306
Replace of LPG	263	263	263	263	263	263	263	263	263	263	263	263	263	263	263	3,945
Amount of CO2 reductions	**804**	**1,167**	**1,411**	**1,574**	**1,683**	**1,756**	**1,806**	**1,839**	**1,861**	**1,875**	**1,885**	**1,892**	**1,896**	**1,899**	**1,901**	**25,251**

Amount of GHG emission reductions is 25,251t-CO_2 which is 15years.

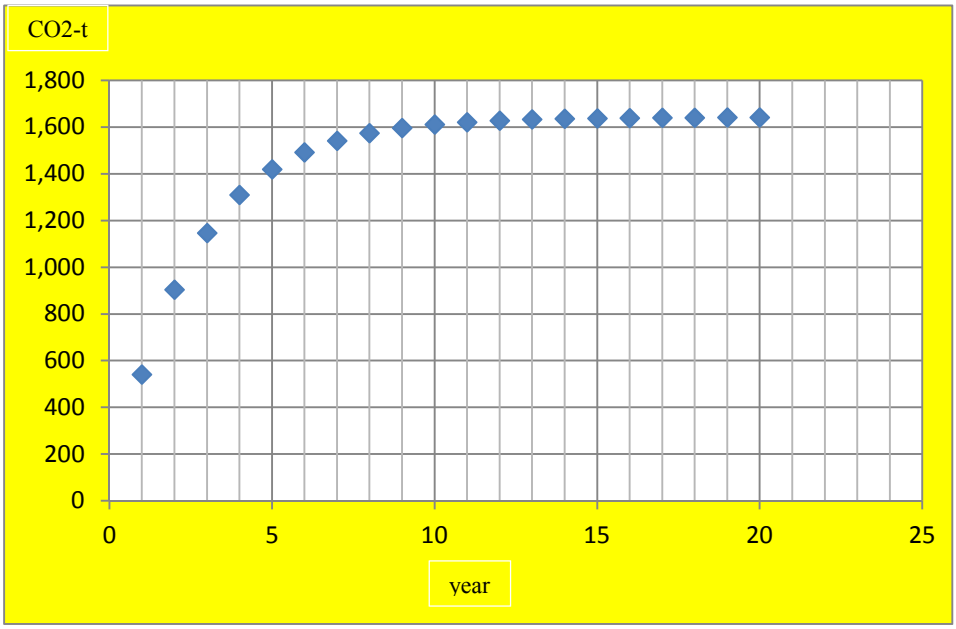


Fig. Secular change of methane gas from landfill

3.2.5 Survey for developing JCM project design documents

3.2.5.1 Implementation structure of the survey project for developing a JCM project design document (PDD) and its participants

The following figure illustrates the implementation structure of this project:

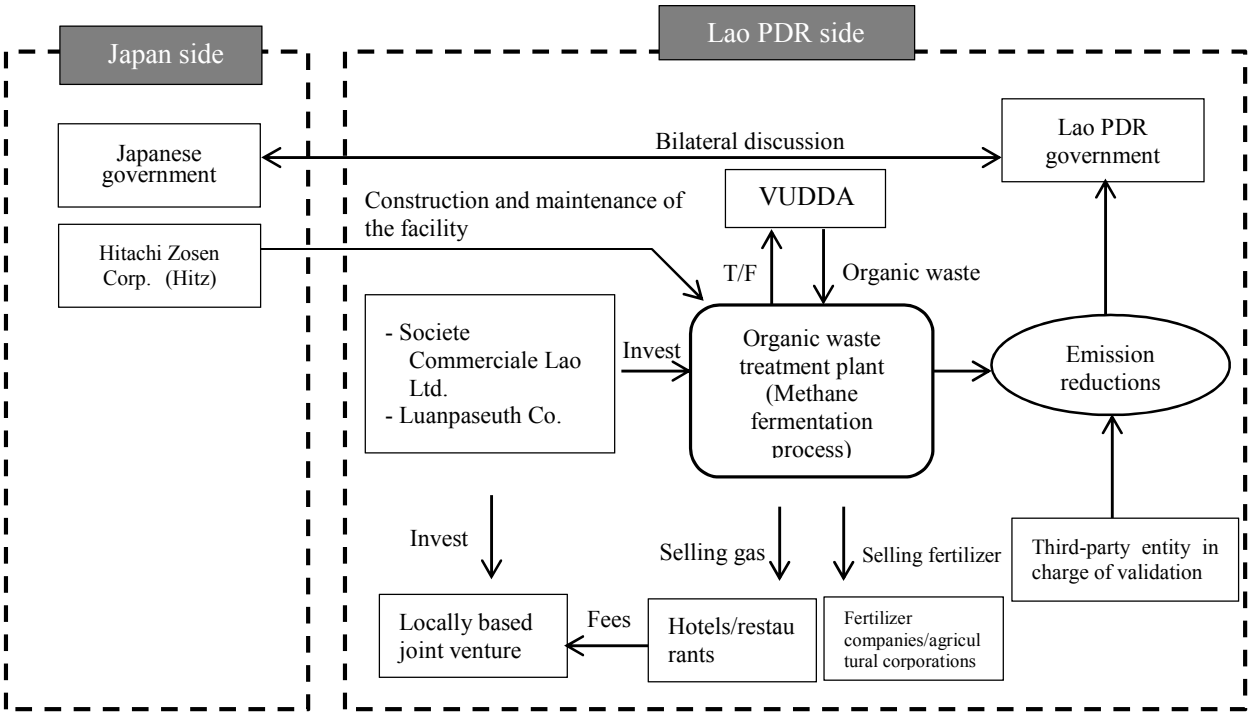


Figure: Project implementation structure

・Hitachi Zosen Corporation (Hitz) will perform designing, material procurement, construction, and maintenance works for the organic waste treatment plant.

・Societe Commerciale Lao Ltd. and Luanpaseuth Co. in Vientiane will launch a locally based joint venture and invest in the organic waste treatment plant (using methane fermentation process). The joint venture will receive proceeds from selling the generated gas and fertilizer while paying T/F to VUDDA for organic waste collected thereby.e

3.2.5.2 Implementation schedule and executing entity of the project

The planned schedule for the project is as follows:

4, 2016 Discuss the submission of a proposal for JCM's financing program for model project.

We need correct more 15ton/d separated garbage to construct methane fermentation plant.

3.2.5.3 Ensuring compliance with the project's eligibility criteria

The working team will ensure that the project's methodology meets JCM project eligibility criteria as below:

Criterion 1	Methane fermentation equipment and gas purifier are installed.
Criterion 2	A facility maintenance plan is developed in a format widely used in Japan.
Criterion 3	The organic waste currently transported to the landfill KM32 is used as raw materials to put into the methane fermentation equipment.
Criterion 4	Following the installation of the methane fermentation equipment, equipment verification testing is conducted, whose results are validated by a third-party credential service provider authorized for ISO certification, etc. The validation documents are submitted to the screening session for validating the qualifications of the project.
Criterion 5	After installing the methane fermentation equipment, an air tightness testing of the equipment is conducted to make sure there is no leak.
Criterion 6	The methane fermentation equipment has the capacity to process five tons or more of waste per day.
Criterion 7	Desulfurization equipment is installed between the methane fermentation tank and gas holder(s).

3.2.5.4 The project's GHG emission sources and monitoring points

The following figure illustrates the GHG emission sources and monitoring points of the project:

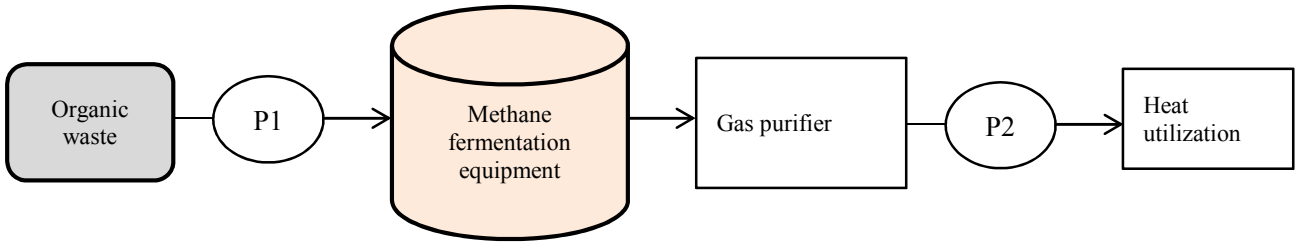


Figure: Monitoring points

P1: Amount of the avoided emission of the methane gas from the organic waste when it is disposed in the KM32 landfill

P2: Amount of CO_2 generated by LPG fuels that have traditionally been used in the hotels and restaurants

3.2.5.5 Monitoring plan

The monitoring required for this project will be conducted by the joint venture company. The project manager of the joint venture company will be in charge of overseeing the monitoring processes and storing data while on-site operators will carry out practical work processes such as collecting necessary data.

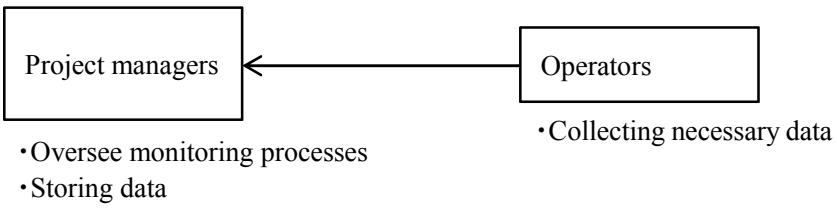


Figure: Monitoring structure

3.2.6 Results of surveys (on the project's profitability and financing) concerning the realization of the project (to be conducted)

3.2.6.1 Financing plan

The following tables show a breakdown of the estimated initial investment and maintenance costs.

Table 1: Initial investment costs

Item	Subitem	Subtotal(in JPY)	Total (in JPY)
Ⅰ Construction expenses	1. Civil engineering and construction cost	82,570,000	
	2. Machinery and equipment installation cost	72,900,000 16,900,000	
	3. Plumbing and pipe-fitting cost	100,620,000	
	4. Electrical instrumentation engineering expense	2,880,000	
	5. Logistics cost		275,870,000
Ⅱ Temporary construction facility and other expenses	1. Site management expenses	50,950,000 35,450,000	
	2. Engineering cost		86,400,000
Ⅲ General Administrative expenses		50,770,000	50,770,000
		Grand total	413,040,000

Table 2. Maintenance costs

Item	Amount (in JPY)	Remarks
Maintenance cost	5,000,000	
Labor cost	1,500,000	150 $ /M×7people
Total	6,500,000	

The site to be used for the project will also be provided by the project owners on the Lao PDR side.

3.2.6.2 Measuring, reporting, and verification (MRV) structure

Monitoring will be conducted by a joint venture company to be established by the project owners. Measuring, reporting, and verification (MRV) on the project will be done by a contracted third-party agency with a proven track record in conducting validation and verification works for CDM projects in Lao PDR.

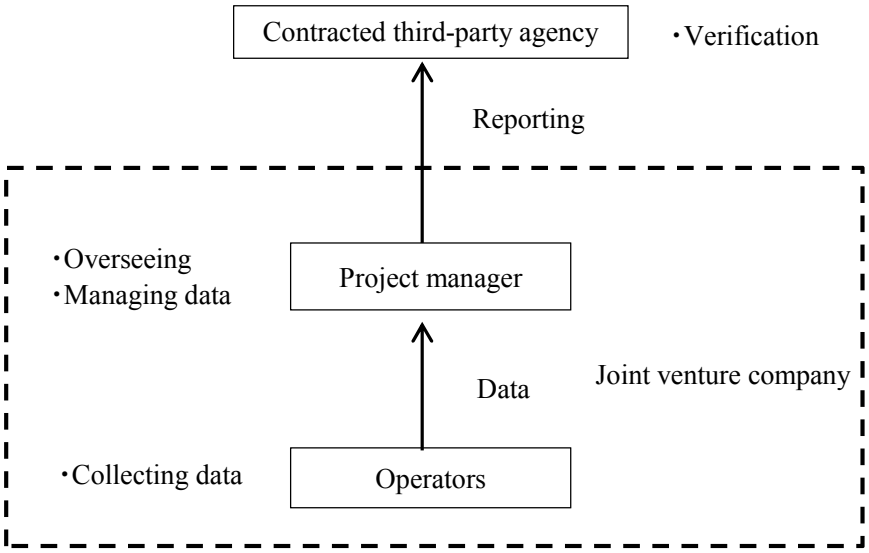


Figure: MRV structure

3.2.6.3 MRV structure

The following table shows the permits that need to be obtained from relevant local authorities in order to implement the project.

Table: Approvals to be obtained for the project

No.	Permit
1	Setting up a joint venture company
2	Environmental impact assessment
3	Construction permit
4	License of producing and selling liquid fertilizers

3.2.6.4 Introduction of Japanese technology

The Japanese technology to be introduced to the project has the following characteristics:

1. By putting the wastewater generated back to the methane fermentation process in the fermentation tank, the food garbage and organic waste can be fermented to produce methane as they are, without having to dilute the materials in the tank to adjust its density to an appropriate level. As a result, the amount of moisture in the tank will only be the amount originally contained in the materials, which will minimize generation of wastewater by the plant facility.
2. The speed of methane generation can be doubled by carrying out solubilization and methane generation processes separately. Through this, the capacity of a reaction tank will be reduced to less

than half of the one used for the traditional technology and, therefore, the facility can be downsized. The cost for this technology will also be reduced to the half or less of that for the traditional technology.

3. By having the materials solubilized under a high-temperature condition and then go through high-speed methane fermentation under mesophilic condition, ammonia inhibition can be prevented.
4. Regarding fat and oil waste, over 90% or more of their fat and oil contents can be transformed into methane through installing a unique device specialized in dispersing oil and fat contents by using food waste or high-concentration sludge as a dispersing agent.
5. By combining the above-mentioned technology with the patented methane fermentation accelerating technology, a stable operation of methane fermentation fitting to the composition of food waste can be ensured.

Through the implementation of the project, Japan is expected to make the following contributions to the host country:

- Transferring its know-how for comprehensive waste management, including the sorting of garbage at source and the promotion of reduce, reuse, recycle (3R) practices.
- Transferring its techniques for maintaining the facilities.
- Providing the area's residents with employment and training opportunities.

In the meantime, it is important that the deployment of methane fermentation equipment as in this project shall not end in treating of organic waste alone, but shall be planned and implemented as part of a comprehensive waste management initiative of the project's subjected area (Vientiane City) that involves governmental agencies as well. To introduce and expand the use of methane fermentation equipment like the one to be deployed in this project, the target city has to have a policy and plan for comprehensive waste management. For this reason, Kyoto City is expected to provide guidance on waste management methods (garbage sorting, promotion of 3R practices) going forward.

3.2.6.5 Contributions to the host country

The project is expected to not only help reducing GHG emissions, but also make the following contributions to enable sustainable development in Lao PDR.

1. Help facilitate the use of renewable energy and resolve energy supply issues

The project will reduce the amount of methane released into atmosphere from the landfill by having the organic waste currently disposed in the landfill treated in the methane fermentation equipment, and supply heat as a replacement for LPG traditionally used as fuels by capturing biogas in the methane fermentation equipment and purifying it. Through this, the project aims to reduce GHG emissions.

2. Enhance waste management practices in cities and reduce the amount of solid waste

By implementing this project, it is possible to demonstrate a model of alternative waste management to the existing practice of transporting the generated waste and disposing in a landfill, thereby contributing to the enhancement of waste management and reduction in the amount of solid waste in cities.

3. Reduce the amount of waste transported and extend the landfill's life span

Through this project, organic waste that is currently disposed in KM32 will be treated in a methane fermentation facility to be installed within Vientiane City. This will shorten the distance of garbage transportation and reduce the amount of garbage disposed in the landfill, thereby helping to extend the life span of the landfill.

4. Introduce the new technology

In Lao PDR, equipment for treating solid waste using methane fermentation process like the one in this project have yet to take root. At present, most of the country's solid waste is disposed in landfills. In view of promoting waste reduction, the project's technology is expected to attract demand from many prospective customers.

5. Utilize financing provided by JCM

This project will generate energy from the waste currently disposed in a landfill and is also expected to contribute to reducing environmental impact on various fronts. In addition, the project is also likely to generate demand for the technology it uses. Considering these advantages, if the subsidy is awarded to the project through the JCM financing programme for equipment and thereby the financial plan becomes workable with reduced financial burden to the project owners in Lao PDR, the technologies used in the project will find greater demands.

3.2.6.6 Environmental contributions

By implementing the project, organic waste currently transported and disposed in a landfill will be treated in the methane fermentation facility located in Vientiane City. This will make it likely to reduce the generation of CO_2, NO_x, PM, and the like, compared with the amounts generated in the current practice of transporting and disposing the waste into the KM32 landfill. Other environmental contributions can be expected, such as cutting back on the amount of methane released into atmosphere and reducing the odor of decaying waste from the landfill.

3.2.6.7 Expected future actions and issues

1. Concerning the amount of collected organic waste

The survey was conducted this time for the sorted food waste collected mostly from businesses such as hotels and restaurants. However, the expected amount of waste from these sources is only about 5 tons per day, which will make it difficult to turn the project into a profitable business. Therefore, the working team will ask VUDDA, the agency in charge of garbage collection and transportation, to widen the area of collection. The project owners and VUDDA will conclude an MOU in this regard.

When the prospect of securing the required amount of resources (organic waste) becomes likely, the working team will consider starting discussions with the project owners again regarding the commercialization of the project.

Table: Profitability of the project as business (in JPY)

Item	Supply of biogas (purified)	Remarks
Initial investment cost	213,000,000 JPY	JCM Subsidy is 200,000,000 JPY
Maintenance cost	6,500,000JPY/year	Please show P38
Waste management cost	－	
Sales of liquid fertilizer	216,000 JPY/year	5 m^3/d×360d/y=1,800 m^3/y Liquid fertilizer sale unit ：1USD/ m^3=120 JPY/m^3 1,800 m^3/y×120 JPY / m^3＝216,000 JPY/y
Sales of biogas	25,110,000 JPY/year	5ton/d×150m^3/d=750 m^3/d （purified gas amount =750 m^3/d×0.6=450 m^3/d ） Gas sale unit：155 円/m^3（Please show※1） 450 m^3/d×155 円/m^3×360d/y=25,110,000 JPY/y
Annual revenue	25,326,000 JPY/year	
Amount of GHG emission reductions	263t-CO_2/year	➢ **Amount of GHG emission reductions from avoided landfill methane gas** Please show FOD model of p41 figure . ➢ **Replace fuel of LPG as Biogas** Because of using 15% biogas as plant heating, amount of biogas is 750m^3/d×0.85=637m^3/d Calorie of Biogas is 5,130kcal/m^3, on the other hands, Calorie of LPG is 26,493kcal/m^3. 637 m^3/d×5,130kcal/m^3÷26,493kcal/m^3 ＝123m^3/d CO_2 emission factor of LPG is 3.00kg-CO_2/L, Amount of CO_2 emission is 123m^3/d × 2.183kg/m^3 × 3.00kg-CO_2/L × 365d/y=294t-CO_2/y ➢ **Power consumption of methane fermentation facility** Power consumption of methane fermentation facility is 150 kWh/d, grid emission factor of Laos is 0.5764kg-CO_2/ kWh/d, Amount of CO_2 emission of power is 150kWh/d×0.5764kg-CO_2/ kWh/d×365d/y＝31t-CO_2/y ➢ **Amount of GHG emission reductions** is 294t-CO_2/y－31t-CO_2/y＝263t-CO_2/y

※1 Sales performance of LPG in Vientiane is 10,000JPY/50kg

Specific gravity of LPG is 1.55 kg/m^3

Sales unit of LPG : 10,000 JPY ÷ (50kg ÷ 1.55 kg/m3) = 310 JPY / m^3

Calories of methane gas is 11,000Kcal/ m^3, on the other hands, Calories of LPG is 23,673Kcal/ m^3. So, we assumed that sales unit of methane gas is a half of LPG.

2. Discussing ways to utilize the liquid fertilizer

Discussions will be held regarding the mechanism to utilize the digestive fluid generated after the methane fermentation process in this project as liquid fertilizer to be used in farms.

Since Lao PDR has no experience in using digestive fluids generated from methane fermentation as liquid fertilize in the past, personnel from the Japan side will provide instruction on how to use it. On the Lao PDR side, the Department of Agricultural and Forestry Planning and Cooperation Section and National University of Laos (NUOL), Faculty of Agriculture, have agreed to collaborate in conducting field tests of the liquid fertilizer and in expanding its use.

References (sources)
1) Source : Website of Embassy of Japan in the Lao PDR
www.la.emb-japan.go.jp/jp/content_news_from_the_embassy/shomei250807.html
2) Source : Japan International Cooperation Agency (JICA), Kokusai Kogyo Co., Ltd. (2014)
(*Report on Feasibility Study on Collaboration for Planning Waste Management Improvement in Environmentally Sustainable Cities in Laos*)

4. Promotion of intercity collaboration and government–private sector collaboration

Through the studies on the building of a low-carbon historical city by Vientiane Capital, we endeavoured to identify the requirements for realising a low-carbon historical city and sustainable development by Vientiane Capital. To promote the transfer of Kyoto City's experience, knowledge, know-how, technology, and systems relating to urban development, we considered establishing a basic system in Vientiane Capital. We sought the participation of additional private companies in JCM projects and new JCM projects for subsequent fiscal years by expediting the sharing of information with private companies, etc. having an interest in the implementation of JCM projects in Vientiane Capital.

4.1 Conclusion of the Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City

Concurrently with the "Special partner city tie-up ceremony between Kyoto City and Vientiane Capital" which was held on the occasion of the visit to Japan and to Kyoto by the mayor of Vientiane, the signing ceremony of the Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City was held at the Kyoto City Zoo on November 3, 2015. The signed MOU contains matters relating to the project and is therefore expected to help expedite intercity collaboration and government–private sector collaboration.

Signing ceremony of the Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City

Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City

Vientiane Capital and Kyoto City, hereinafter referred to as the 'Parties',

Desiring to promote cooperation between both cities to avoid environmental problems that may occur in Vientiane Capital and to achieve sustainable and low-carbon development in Vientiane Capital,

On the basis of equality and mutual benefit,

In compliance with laws and regulations adopted in Lao People's Democratic Republic and Japan,

Bearing in mind the purpose of the Memorandum of Understanding (MoU) entered into by both Parties to establish the cooperative partnership between the Parties for solving environmental problems and for developing the sustainable and low-carbon historic city in Vientiane Capital,

Have agreed setting forth below:

1. **Objectives:**
   The Parties establish an effective cooperative partnership, to support and promote the activities for the environmental protection and the sustainable and low-carbon development in Vientiane Capital, as a historic city in Lao People's Democratic Republic.

2. **Goals:**
   The Parties aim at following goals in order to achieve the objectives of this MoU, by March 2018:
   (i) Vientiane Capital gains their personnel and institutional capacities for the environmental management, in particular, for the appropriate and effective solid waste management; and
   (ii) Climate change mitigation projects contributing to the reduction of greenhouse gas emissions are developed in Vientiane Capital to be realised and implemented.

3. **Duties of the Parties:**
   - Kyoto City:
     - Dispatches their human resources as trainers, who own technical expertise and experiences, to promote the environmental technologies and the environmental management techniques, financing by Kyoto City, and
     - Makes best efforts to obtain necessary personnel and financial resources, provided from governmental and relevant public organisations and/or private sectors.
   - Vientiane Capital:
     - Provides cooperative support comprehensively to relevant activities by Kyoto City, Global Environment Centre Foundation, and private companies working for the programme to achieve the purpose of this MoU,
     - Coordinates the cooperative linkage among governmental authorities, relevant public organisations, and private sectors, and

4. **Contents of Activities:**

- Through the JICA Partnership Program's Project for Assistance to Develop an Effective Waste Utilization System with Citizen Cooperation in Vientiane Capital (under the commission and funds of JICA),
  - The training courses for the Vientiane Capital personnel are implemented, by sending the officials of Kyoto City to Vientiane Capital;
  - The training courses on the appropriate solid waste management, including the field visits, are implemented, by accepting the Vientiane Capital personnel to be sent to Kyoto City; and
  - The awareness-raising campaign is implemented in Vientiane Capital, for public relations to get wider citizen participation.
- Through the Feasibility Study Programme on Joint Crediting Mechanism (JCM) Projects towards Environmentally Sustainable Cities in Asia (under the commission and funds of the Ministry of the Environment, Japan),
  - The 'Fundamental Action Plan for the Sustainable and Low-Carbon Historic City in Vientiane Capital' will be discussed and developed under both Parties' cooperation, which will be drafted on a sectoral basis seriatim, and
  - The climate change mitigation projects contributing to the reduction of greenhouse gas emissions including JCM projects are to be developed and implemented by private entities with the private-public partnership, if applicable, to avoid and remove the obstacles for the projects, which will be further promoted.
- In relation to these activities, the Parties make efforts to hold environmental cooperative policy dialogues, to share the visions and the progress of the effective cooperative partnership.

Signed in Kyoto on 3 November 2015 in English Language. In case of any divergence in interpreted documents in Lao or Japanese, the original text in English shall prevail.

For Vientiane Capital

Sinlavong Khoutphaythoune
Governor
Vientiane Capital

For Kyoto City

Daisaku Kadokawa
Mayor
Kyoto City

Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City

5. Holding of local workshop

5.1 FY2015 Kick-off meeting

[Date and time] Wednesday, June 3, 9:10–11:30

[Place] Office of the Vientiane Urban Development Administration Authority

[Attendants of local counterpart] DONRE, VUDAA

[Attendants of Japan] Kyoto City, Hitachi Zosen Corporation, GEC

[Description]

We held a kick-off meeting with DONRE and VUDAA to share information and exchange views on projects, policy, and schedule of FY2015.

We explained a general overview of the project to Mr. Bounhom, director of DONRE, reported the results of the events of FY2014, and confirmed the matters agreed upon (Co-chairs' Summary: February).

Following an explanation and confirmation of the project policy and plan for FY2015, we exchanged views about two specific objectives set by the Japanese delegation: (1) the formulation of a the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital and (2) a joint action programme between Vientiane Capital and Kyoto City ("Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City" described later (hereinafter referred to as "MOU environmental cooperation") relating to the building of a low-carbon historical city.

Regarding (1), we decided to focus on waste management in FY2015, and confirmed that the working processes would be carried out in the following order: Selection of items (framework) of the fundamental action plan, drafting of the fundamental action plan, and drafting of items relating to waste.

Regarding (2), we also agreed to establish it as a three-year plan ending in 2018, and explained that the plan would deal with waste management like the fundamental action plan of (1). We confirmed the following schedule up to formulation of the specific action programme: Completion of the first draft in August and agreement in November.

DONRE said that it would be necessary to exchange and harmonise views on the abovementioned plans with VUDAA because both of them focused on waste management. DONRE also requested us to confirm the specific steps of drafting. Mr. Phoudone, deputy director of VUDAA, stated that verification and coordination of consistency with the national strategy of Laos would be necessary within VUDAA before everything, and confirmed that Vientiane Capital would be committed to drafting and Japan would support it. We explained to the counterpart's attendants Kyoto City's actual plans, the "Basic Plan for Establishing a Sound Material-Cycle Society" and the "Action Plan for General Waste Treatment" (only the tables of contents were translated into English and provided) as reference materials for drafting.

In addition, we presented JICA Grass Roots Project. We explained that this project would offer technical assistance for the efficient recovery and separate collection of waste in the centre of Vientiane Capital and the utilisation of separate refuse, and requested smooth cooperation from DONRE and VUDAA if the project was adopted. The counterpart expressed a strong interest in this project.

5.2 International Workshop

[Date and time] Thursday, February 4, 9:00-12:00

[Place] Vientiane City Hall

[Attendants of local counterpart] MONRE, DONRE, VUDAA, and others

[Attendants of Japan] Kyoto City, Japan Environmental Consultants, Ltd., Hitachi Zosen Corporation, GEC

[Program]

9:00	Opening speech (Mr. Bounhom, director of DONRE) (Mr. Imai, manager of Environmental General Affairs Section, Kyoto City)
	<Photo session>
9:30	Introduction of attendants
9:50	Study for assisting in building a low-carbon historical city through collaboration between Vientiane Capital and Kyoto City (Mr. Tabo, Senior Program Officer of Global Environment Centre Foundation)
10:10	Project for the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory (Mr. Kurasawa, Director of Japan Environmental Consultants, Ltd.)
10:30	Project for the generation and use of biogas from sorted organic waste (Mr. Ushida, Senior Manager of Hitachi Zosen Corporation)
10:50	Formulation of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital (Ms. Rotchana, chief of Environmental Section, DONRE)
11:20	Discussions
11:50	Wrap-up
12:00	Closing

[Overview]

We held an international committee in Vientiane Capital on Thursday, February 4, 2016 for the building of a low-carbon historical city by Vientiane Capital. This was intended to report the progress of the formulation of the fundamental action plan for the building of a sustainable low-carbon historical city by Vientiane Capital and the implementation status of the JCM projects, as well as having discussions on promoting transfer of Kyoto City's experience, knowledge, know-how, technology, and systems concerning urban development and training staff members of Vientiane Capital.

Mr. Bounhom, director of DONRE, and Mr. Imai, manager of Environmental General Affairs Section, Kyoto

City, addressed the committee as co-chairs, starting with their opening speech. Mr. Bounhom said that he wished to make Vientiane Capital a low-carbon city with cooperation of Kyoto City and utilisation of the JCM. After the secretariat GEC explained the project overview, Japan Environmental Consultants, Ltd. and Hitachi Zosen Corporation, showed the implementation status of the JCM projects of FY2015. Then, Ms. Rotchana, chief of Environmental Section, DONRE, introduced the basic idea of the fundamental action plan for the sustainable and low-carbon historic city /for waste by Vientiane Capital. After these announcements, Vientiane Capital and Kyoto City talked over their future partnership for the building of a low-carbon historical city by Vientiane Capital and confirmed that the two cities would continue to cooperate with each other.

[Major announcements and minutes]

1) Overview of DONRE announcements

- As the population grew, Vientiane Capital has seen more environmental impacts, such as shortage of infrastructure, air pollution, water contamination, and increase in waste. Cooperation from citizens is vital for solving these problems, which requires to improve their awareness of the environment.
- To improve citizens' awareness of the environment, enlightenment activities are important. With the aim of promoting the activities, DONRE wishes to formulate the fundamental action plan for the sustainable and low-carbon historic city and develop knowledge and technology on climate change mitigation for involving citizens in sustainable environmental protection, efficiently utilising and reducing waste, and developing a low-carbon city.
- The goals are developing a clean and green city, improving the environment and citizens' life, and making citizens know their duties of environmental conservation.
- The specific actions for formulating and implementing plans are as follows: (1) Collecting information about laws and manuals with cooperation from MONRE, (2) Selecting a target village, farm, or factory, promoting 3Rs, improving the awareness of climate change mitigation, and promoting pesticide-free farming, and (3) Monitoring and assessment for three years.

2) Discussion

- Based on our experience in "Environmental Management Component of the Laos Pilot Project for Narrowing the Development Gap towards ASEAN Integration (LPPE)", we think that improving the laws is essential to raising citizens' and vendors' awareness of the environment and getting cooperation from them. (MONRE)
- There is a shortage of engineers specialized in the field of environment in Vientiane Capital to create plans and conduct the JCM-FS projects. Vientiane Capital should consider training engineers, as well. We would also like the central government or Japan to consider providing financial assistance. (MONRE)

⇒ A project is comprised of good and bad points. It is important to know these points, and then connect them as a line and deploy it to other projects. To receive financial support from the central government or JICA, the projects currently in progress need to ensure the best results. So we really want to make the projects successful. (Kyoto City)

- We are studying 3Rs but have not yet implemented them fully. As separating waste produced from households is important, we want to cooperate but need some advice and suggestion how we can get cooperation from residents. If separate collection is successfully conducted, it would lead to a contribution to a biogas project in the future. (VUDAA)
- Cooperation of residents is vital for waste separation and 3Rs, but they are less interested. Under the circumstances, we need capacity developing by district staff members, who live near the residents and manage the village.
- Vientiane Capital is promoting a project where garbage is composted into fertilizer. For example, the ministry is conducting a pilot project for selected model households in the JICA project. We hope that Hitachi Zosen joins this project. Or, we want to make it bigger, like accepting a project proposed by Laos and carrying it out together.

⇒ The JCM set a big goal of reducing GHG. However, not only do we focus on the reduction of GHG but need to develop using low-carbon solutions and carry out only profitable projects. In other words, projects should have an advantage environmentally and economically. Thus, you should propose projects from the viewpoint of developing private projects. We hope that Vientiane Capital makes a sustainable low-carbon society based on the partnership between Kyoto City and Vientiane Capital and using the JCM and other schemes. (GEC)

3) Summary

- Kyoto City wishes to promote activities regarding environmental protection and sustainable low-carbon development based on the MOU concluded between Kyoto City and Vientiane Capital for the building of a low-carbon historical city by Vientiane Capital. That is why it is the most important to successfully complete the projects currently in progress. In addition, we request Vientiane Capital to provide more information and proposals for future project development. Kyoto City will cooperate as much as possible for transferring technology and obtaining funding for proposed requests. (Kyoto City)
- Based on the city management conducted by Kyoto City, we have proceeded with building a low-carbon historical city in Vientiane Capital with the aim of promoting economic growth, historic and cultural conservation, and environmental conservation. We will continue to be committed to it. (GEC)
- We thank that many people from Japan and Laos participated in this meeting and had animated discussions. We will keep working hard together to realise a low-carbon historical city in Vientiane Capital, and with cooperation of the two cities, we are sure that it would be highly possible. (DONRE)

<Group photo>

6. Public relations activities

To introduce this project and to promote the deepening and expansion of the understanding of JCM, we conducted public relations activities by using opportunities at local workshops, etc.

7. Reporting the output of this city to city cooperation project

7.1 Working Group in Japan before workshops, etc. in Vientiane Capital

A meeting for mutually introducing personnel involved in the study for the project in FY2015 was held, and they shared and discussed information and an overview of the studies for FY2015 and their schedules.
The personnel concerned also shared the latest information for the first field study, confirmed the matters to be discussed with the counterparts of Vientiane Capital, and confirmed the finalised local schedule.

[Date and time] Friday, May 15, 2015, 13:30–16:15
[Place] Teramachi meeting room No. 6 of Kyoto City Hall
[Attendants] Kyoto City, Hitachi Zosen, GEC
[Main subjects discussed]
We confirmed the achievements of the project in FY2014, reported the process for the project in FY2015, and confirmed it with the personnel concerned. We confirmed that the project of disseminating electric automobiles, which had been an FS project in FY2014, was suspended because it was not adopted in FY2015, that the project of utilising chaff briquettes as alternative fuel to coal would be commenced in place of the electric automobile project, and that the project of producing biogas from waste, for which a preliminary study had been performed since FY2014, would be officially launched. We also confirmed the specific policy and schedule for the formulation of the building of a low-carbon city by Vientiane Capital.
With regard to the project of producing biogas from waste, it was reported that judging from the results of the preliminary study conducted in FY2014, improvement of the current garbage collection system was indispensable for securing the required amount of organic waste, which is effective for producing biogas, for commercialisation, and that focusing on collecting industrial refuse was also under consideration. It was also reported that Kyoto City and GEC were applying for the JICA Grass Roots Project to assist Vientiane Capital in establishing these frameworks, and that the project, if adopted, would be a powerful tool for supporting the FS project. We confirmed that the action plan for the JICA Grass Roots Project needed to be coordinated with the project because assistance by Kyoto City in establishing a garbage administration framework in Vientiane Capital was the key to the success of the project. In addition, it was confirmed that in-depth consultation and coordination were required for compatibility with the project, including the JICA Grass Roots Project.
In addition to the above, since a visit by the mayor of Vientiane Capital is scheduled for the coming autumn and a partner city relationship is expected to be concluded between Kyoto City and Vientiane Capital, the conclusion of an MOU concerning cooperation in the field of the environment, including the activities of the project, at that timing was considered. If an MOU can also be concluded in the field of the environment concurrently with the partner city relationship, this would increase name recognition of the project, strengthen the cooperative system within Kyoto City, and thus boost the project.

7.2 Attendance and reporting at the progress briefing sessions in Japan

(1) Kick-off meeting (May 2015)

We attended the kick-off meeting held at the Ministry of the Environment on May 12, 2015, explained an overview of the whole project and of the studies for supporting the formulation of the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital through intercity collaboration based on the proposals for the project, and an overview of the two FS subjects, and held a question-and-answer session.

1) Support for the whole project and the formulation of the fundamental action plan

- Confirming the formulation of the action plan by the end of FY2015

⇒ Vientiane Capital already has an Urban Development Master Plan and strongly desires support for specific activities and projects. It is therefore necessary to formulate the fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital focusing on specific activities and projects. We confirmed that it is important to exchange views on this matter with the local counterparts. Taking into account the results of the studies conducted in FY2014 (including the results of consultations with Vientiane Capital), it is conceivable that an action plan focusing on measures against waste will be formulated. Kyoto City believes that the intercity collaboration should not be terminated upon completion of a single project, and assumes that the planning will be based on collaboration for many years.

Kyoto City thinks it is difficult to complete the formulation of the fundamental action plan for the building of a low-carbon historical city by the end of FY2015, considering the needs of Vientiane Capital and the feasibility of the measures. In view of the fact that Vientiane Capital particularly demanded “measures against waste” in the studies conducted in FY2014 and that “measures against waste” is an area that Kyoto City can support as a municipality and is related to the JCM study subject of Hitachi Zosen, we are focusing on formulating a plan that ensures the effective utilisation of organic waste, including waste separation. Through planning for waste, we intend to help improve the expertise of the local counterpart (Department of Natural Resources and Environment (DONRE) of Vientiane Capital) in formulating the whole action plan, and also formulating medium- and long-term action plans.

- Confirming the overall concept, including the JICA Grass Roots Project (When we were asked by JICA, we replied that the project was not related to JCM. However, it seems that the project is closely related to a JCM project.)

⇒ In principle, the JICA Grass Roots Project is intended to develop the expertise of the Vientiane Urban Development Administration Authority (VUDAA), which is in charge of the collection and transportation of waste, and DONRE in the efficient separation, collection, and transportation of waste and to establish a system for the collection and transportation of organic waste in cooperation with Kyoto City. Thus, the project is expected to contribute not only to the dissemination and development of the biogas project of Hitachi Zosen but also to the realisation of proper waste management and 3R in Vientiane Capital.

2) FS of “the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing

factory”

- Confirming whether chaff briquettes can be secured

⇒ This project started with consultation by a rice milling plant, and chaff exceeding the coal consumption by the saltery assumed in this project exists.

- Confirming upgrading the oven of the saltery. Does upgrading the oven fall under JCM projects?

⇒ The project initially planned to use biomass fuel as the only alternative to coal, but it was found that the oven needed to be upgraded. In the study to be conducted in FY2015, we will carefully check whether upgrading the oven falls under JCM projects.

⇒ There is equipment that is defined as a requirement for a JCM equipment subsidy project and must contribute to the reduction of energy-induced CO_2 emissions. However, equipment for producing briquettes alone does not meet this requirement. For this reason, we asked the counterparts to include the upgrading of the oven in the project.

- Is it appropriate to calculate the reduction of CO_2 emissions by subtracting the amount of CO_2 emissions estimated in the project based on the use of biomass fuel by the upgraded oven from the reference amount of CO_2 emissions based on the consumption of coal by the oven before the upgrade?

⇒ The value calculated by this approach would be the baseline. Thus, how to set a conservative reference amount of CO_2 emissions also needs to be studied. It is necessary to investigate the effect of upgrading the oven to set a conservative reference amount of CO_2 emissions.

3) FS of “the generation and use of biogas from sorted organic waste”

- It is estimated that the project will treat 10% of organic waste produced in the whole of Vientiane Capital. However, is it possible to collect such an amount of waste?

⇒ We have already talked with hotel and restaurant owners about the project, and will conduct field studies on how much garbage can be actually collected, as well as the composition of produced waste. However, we are estimating the amount of garbage based on a certain amount required for commercialisation (amount of treated garbage: at least 10 tonnes/day). If the composition and amount of garbage can be determined, the reduction of GHG is not difficult to calculate, and technical specifications can also be considered.

The project assumes that garbage will be collected from the kitchens of hotels and restaurants, not from individual hotels, because the chairperson of the Laos Hotel and Restaurant Association owns a hotel. In this context, we also discussed a tie-up with the Green Hotel Award campaign. In addition, the project considers market garbage in Vientiane Capital as the target garbage.

- Since the success of the project depends on the willingness of the counterparts and the commercial feasibility of the project, they should consider the project bearing these points in mind. We understand that EX Research Institute, a contractor, can deal with the composition of garbage, etc.
- We desire the counterparts to carry out the FS so that the project can be applied for as an equipment subsidy project or PS in FY2016.

(2) 2nd work progress briefing session (August 2015)

On August 5, 2015, Kyoto City/GEC and two FS vendors reported the progress of the project after the kick-

off meeting held in May based on their own materials and data as follows.

1) Support for the whole project and the formulation of the fundamental action plan

- We confirmed the goals for FY2015, and reported the contents of the fundamental action plan to be formulated in particular, and the result of schedule coordination. We explained that a fundamental action plan for waste management would be preferentially formulated, that field drafting would be completed by November (when the first international committee meeting is scheduled to take place), and that we were endeavouring to complete the local approval procedures in February 2016 (when the second international committee meeting is scheduled to take place).
- We confirmed support for drafting (plan for waste management) by the counterparts. The Japanese delegate will propose a draft, and the counterparts will formulate a plan under the guidance of Kyoto City after they have gained an understanding of the draft. We additionally explained that the case of Kyoto City was introduced in the field study conducted in June and that a plan linked to the JICA Grass Roots Project would be carried out so that comprehensive support would be provided for waste management in Vientiane Capital.
- In addition, we expressed our gratitude for the adoption of the JICA Grass Roots Project. We heard that a similar JICA project proposed by Kitakyushu City was finally adopted after the Ministry of the Environment submitted a written opinion to the Ministry of Foreign Affairs of Japan.
- As of today, the mayor of Kyoto City does not intend to participate in COP21 (due to dealing with the city council before the election, etc.). At present, it is intended that a staff member of the Kyoto City Government (adjusting the schedule) and a staff member of GEC will participate. We heard that the participation of the counterparts (DONRE, VUDAA, etc.) was exactly what the Ministry of the Environment desires but the participation of MONRE alone would be enough. However, we confirmed that it is necessary to share information in advance so that the details of specific activities and other matters of the JCM project in Vientiane Capital can be fully conveyed and communicated in COP21.
- We are further coordinating on the early conclusion of the partnership agreement between Kyoto City and Vientiane Capital, preferably at the time of the visit of Prime Minister Thongsing Thammavong to Japan scheduled for October or November.
- The Ministry of the Environment will provide an opportunity to introduce JCM on October 19, the day before the Asia Smart City Conference (in Yokohama) scheduled for October 20. Cities that started any project in FY2015 are expected to participate in the conference, and Vientiane Capital will be welcomed if the city (a high-ranked staff member in particular) participates in it.
- With regard to conferences designated by the Ministry of the Environment, we are considering participating in the Environmentally Sustainable Cities Seminar (in Hanoi VN) scheduled for early March in addition to COP21. Kyoto City is expected to participate in the seminar.
- In addition, we are checking the current situation of the project of disseminating electric automobiles (by Mitsubishi Motors Corporation), which was not adopted in 2015. We have been requested to continue collecting information in view of future needs in Vientiane Capital unless the company completely withdraws from the project.

2) FS of "the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory"

We reported the progress of the project from May to June. As of today, arrangements for procuring briquette machines for rice milling plants have been completed with three Japanese manufacturers.

- Compliance issue of the saltery (currently using fossil fuel, or coal)

⇒ There is no obvious progress in oven upgrade technology. It is necessary to examine further the current situation of the saltery.

- Confirming setting up a consortium

⇒ We have already acquired the consent of the rice mill. For the saltery, we will make arrangements in the future (target month of acquiring consent: September).

- The second subscription for equipment subsidy projects for 2015 is scheduled for around September. We will consider applying for the subscription after acquiring the consent of the saltery.

3) FS of "the generation and use of biogas from sorted organic waste"

- We reported the result of coordination with Mr.A (LHRA), which would be a main counterpart of the project, the plan to investigate the local situation, etc.
- Question about the likelihood of collecting the required amount of waste from hotels and restaurants

⇒ It will be determined based on future detailed field studies. It is best to start by collecting industrial refuse.

- Question about the required level of separation

⇒ The inclusion of paper and plastic refuse is a concern.

- Confirming the specific plan for the supply of biogas

⇒ It will be difficult to supply biogas if charging equipment is required (*excluded from equipment subsidy programmes). A study on this will be conducted in the future.

- Advice from the Ministry of the Environment: It is not necessary to compare projects in Laos with projects in other countries in terms of cost and other aspects (preferential treatment available) because the project must be registered as soon as possible.
- Confirmation of ensuring compliance with local regulations, etc.

⇒ Under investigation.

(3) 3rd work progress briefing session (December 2015)

Kyoto City/GEC and two FS vendors reported the progress of the project after the previous, 2nd work progress briefing session held in August.

1) Support for the whole project and the formulation of the fundamental action plan

- When the mayor of Vientiane Capital came to Japan and visited Kyoto on November 3, 2015, the mayor of Vientiane Capital and the mayor of Kyoto City concluded the Memorandum of Understanding on Environmental Area in Cooperation between Vientiane Capital and Kyoto City. The main target is the

implementation of the following by March 2018: Proper and efficient waste management; and the creation of countermeasures against climate change to be realised and executed in Vientiane Capital.

- Regarding the international committee meeting, we are coordinating with the local counterpart with a plan to hold it in early February. We plan to report on the achievements of the intercity collaboration project this year and the study results of two FS projects.
- Regarding the "Project for Assistance to Develop an Effective Waste Utilization System with Citizen Cooperation in Vientiane Capital, Lao PDR," promoted this year as part of the JICA Grass Roots Technical Cooperation Project, we held a kick-off seminar last week, on December 17, and reported that we had started the project on a full scale.
- Kyoto City reported on the presentations made at the ICLEI conference and Japan Pavilion at COP21 (Paris) and other activities.

2) FS of "the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory"

- As issues, we need to consider the following in the future: There are wishes to sell chaff briquettes outside the consortium; the ratio of consumables to the total legal durable years cost has increased; and the eligibility of the company as the representative vendor.

⇒ From the viewpoint of the system, it is possible to sell chaff briquettes outside the consortium, and we need to develop methodology based on this and conduct a survey on the eligibility of the representative vendor (such as credit) on the Vientiane side. Consumables are ineligible for subsidies.

3) FS of "the generation and use of biogas from sorted organic waste"

- Collection of ten tonnes of garbage per day for the production of biogas has become an issue. We coordinated with the administrative organization for local garbage collection, VUDAA, and conducted a study for solving the issue.
- At present, the CO2 reduction cost effectiveness is estimated about 17,000 yen/tCO2.

⇒ For some recent projects adopted for equipment subsidies, the CO2 reduction cost effectiveness is 3,000 to 4,000 yen/tCO2, so we need to examine the cost effectiveness more closely. The biogas refiner is recorded in the section of equipment eligible for equipment subsidies, but it is considered ineligible, and we must conform this. In addition, we must collect information about the eligibility (such as credit) of the local representative vendor.

(4) Final briefing session (February 2016)

Koto City/GEC and two FS vendors reported the progress of the project after the previous, kick-off meeting held in December based on their own materials and data as follows.

1) Support for the whole project and the formulation of the fundamental action plan

- We reported that the FY2015 last international committee meeting was held on February 4, that the Vientiane side made an announcement about the fundamental action plan for the sustainable and

low-carbon historic city /for waste management, and that in discussions, high needs and expectations for matters related to waste management, such as 3R and compost, were confirmed again on the whole. We also confirmed that there were high expectations for biogas and Hitachi Zosen, which promotes it. We also reported that the director of DONRE in Vientiane requested the continuation of this intercity collaboration project.

- Regarding the comment by the local side that legislation would be important, we do hope that the Ministry of the Environment proceeds with legislation in such a way to meet the needs of the local people, because matters related to legislation will be a strength of intercity collaboration. Concurrently with legislation, it is important to create a master plan and an action plan.
- There have been requests about legislation and human resource development, but we need to grasp the specific fields and details.

⇒ Kyoto City requested the Vientiane side to propose specific matters, but at the discussion on that day, the Vientiane side did not make any remarks. We would like to follow up on this.

2) FS of "the reduction of fossil fuel consumption involving biomass fuel conversion at salt producing factory"

- We reported that talks were being held with the saltery and the rice mill steadily for the realisation of the project. Regarding the sale to customers other than those of the saltery, we made a study about coping with this by creating JCM methodology.
- Because we consider this to be promising as a JCM project, we must properly understand the procedure for the subscription for equipment subsidy projects and proceed with coordination with the local side. In particular, we hope that the financial situation of the local side is checked.

⇒ We plan to consult with the local side again in mid-March and organize the documents necessary for a subscription for equipment subsidy projects.

- Expensive consumables have been an obstacle to investment, and we will consult about whether they will be eligible for subsidies.

⇒ Consumables are ineligible for subsidies. We hope that this is coped with by, for example, negotiating on price with consumables suppliers

3) FS of "the generation and use of biogas from sorted organic waste"

- Regarding waste collection, the business plan is such that vendors pay garbage treatment expenses to VUDAA, but for the realisation of the project, it is important to reduce the financial burden of vendors. Is it not possible to consult in the direction of decreasing the garbage treatment expense to zero? Is it not the strength of intercity collaboration to realise this?

⇒ If vendors implement garbage collection by themselves, this will incur cost, and vendors understand that they will pay garbage treatment expenses to VUDAA instead. VUDAA reported that the separation of kitchen garbage was time-consuming, and required the expenses for this.

7.3 Presentations at conferences designated by the Ministry of the Environment

(1) COP21 (December 2015)

At the 21st United Nations Climate Change Conference (COP21) (November 30 to December 13), held in Paris, France, Kyoto City made presentations about the environmental policies implemented by the City and efforts to international cooperation in side events such as Japan Pavilion, established by the Japanese government, and ICLEI, which is an international association of local governments in the area of global environment issues. As an example, this project was presented. Also introduced in the events were some of the environmental policies characteristics of Kyoto City, the birthplace of the Kyoto Protocol, such as the "project of producing biodiesel using tempura oil," which Kyoto City is promoting jointly with citizens, and the "DO YOU KYOTO?" promotion project.

(2) Creation of a leaflet

We created a leaflet about this study, and by distributing it at various conferences, we conducted public relations activities for this study.

7.4 Presentations at related conferences

(1) ADB JCM workshop (February 2016)

The "A Workshop on the Joint Crediting Mechanism - Promoting Bilateral Mechanisms in Asia and the Pacific -," hosted by the Asian Development Bank (ADB), was held on February 2nd and 3rd in Vientiane Capital, where GEC and Hitachi Zosen Corporation, made a presentation about this project. The main results of the workshop are as described below.

MONRE gave an introduction to the system related to JCM in Laos (relevant ministries being MONRE and DMCC) and potential JCM projects. In this presentation, an introduction was given to the JCM project FS (project for using bio briquettes at a saltery) and the JCM Project Planning Study (PS) (project for using chaff at a cement factory) under Vientiane Capital and Kyoto City collaborative projects.

To introduce a specific example, GEC presented this project. It first emphasized the roles that cities play in climate control, and stated that the two cities, which have a common characteristic as a historical city, would cooperate with the target of achieving three elements at once: preservation of historical and cultural heritages, economic development (including the fostering of the tourism industry), and environmental protection (including climate control and the development and implementation of JCM projects). Also introduced were the implementation of the two JCM project feasibility studies promoted under the project and the support of the formulation of a draft "fundamental action plan for the sustainable and low-carbon historic city in Vientiane Capital " by Vientiane Capital, among others.

Subsequently, Hitachi Zosen Corporation gave an introduction to the technology for producing biogas using organic waste and examples of introducing it, as well as efforts for projects in Ho Chi Minh and Vientiane.

In the question-and-answer session, GEC was asked questions about the points of the contribution of Vientiane Capital and Kyoto City collaboration to sustainability and about the differences between Vientiane Capital and Kyoto City. As for sustainability, it was replied that implementing JCM projects would exactly be one means for being able to make contribution. As for the differences between Vientiane Capital and Kyoto City, the following was indicated: They are the same in that they both contain historical heritages. Kyoto City is accelerating the efforts for climate control in keeping with the holding of COP3, and because infrastructures have been developed, Kyoto City is in an environment where it is easy to promote various efforts. In Vientiane, however, infrastructures have not been developed adequately, and it must promote environmental protection and climate control in keeping with infrastructure development. Hitachi Zosen Corporation was asked questions about the project of organic waste biogas in Vientiane Capital, more specifically, about the amount of waste to collect and the cost. The following was indicated: They aim for ten tonnes per day for only organic waste after separation, and the estimate of the cost of introducing equipment varies with the scale of the amount of organic waste to treat.

Kyoto City indicated the magnitude of the role that cities play on climate control, and stated that sharing through intercity collaboration the facts that Japanese cities had learned from past experiences and the know-how for implementing climate control, promoting climate control in cities in collaboration, and building friendly relations through intercity collaboration would be advantageous in that projects at the private level

could be implemented smoothly.

In the individual counselling session held after the workshop, we interviewed with Hello Laos Sole, shared issues with cultivating JCM projects, and obtained information about facilities using fossil fuel, such as vegetable factories and pho factories.

Ⅲ. Presentation Materials

— Table of contents —

1. International Workshop

Global Environment Centre Foundation

MOEJ "Project Development for Greenhouse Gas Reduction Projects in Asia" 2015

Programme for the Establishment of Low-Carbon Historic City in Vientiane, based on City-to-City Cooperation between Vientiane Capital and Kyoto City

Report of Programme JFY2015

Final Reporting Workshop JFY2015
on 4 February 2016,
at Vientiane Capital, Lao PDR

Global Environment Centre Foundation (GEC)

GEC

Background

Global Environment Centre Foundation

Under consultation for conclusion of Partner City Agreements between Vientiane and Kyoto

Kyoto City

Birth place of Kyoto Protocol, and World famous historic and environmental city with the sustainable development practice

- Continuous conservation of cultural and historic heritage
- Practice of advanced and unique environmental preservation
- Continuous development in urban plan and economic aspects, with lots of tourist visitors from all over the world

Take leadership as the Chairman of "League of historic Cities"

support

Vientiane Capital

- **historic city with plenty of historic and cultural heritage**
- **Emerging urban problems** (disordered urban exploitation, traffic jams, waste increase) due to economic growth and increased tourists with lack of infrastructures
  → Supports should be important for solving these problems
- **Request Kyoto City Mayor to provide support** to tackle similar challenges experienced in Kyoto

☆Support from MOEJ☆

- "MoU on JCM implementation" signed by Laos and Japan in Aug. 2013
- Adopted this study (2014-)

Kyoto mayor visited Vientiane Capital in April 2014
(source: Mayor's blog)

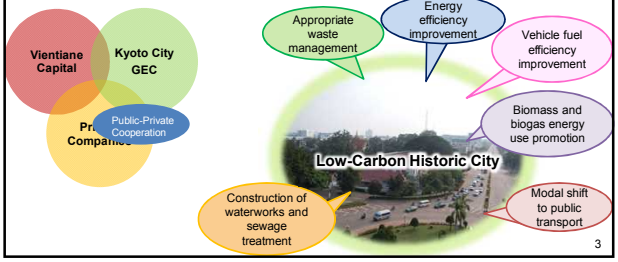
2

Objectives

Global Environment Centre Foundation

Objectives of the study

- To provide advanced Japanese and/or Kyoto's environmental sound technology and environmental administration, as a packaged system
- To establish an operation and management scheme to formulate Low Carbon Historic City Vientiane Capital, as the centre of low-carbon historic city
- To utilize financial resources for JCM project development and implementation, to realize the technology transfer and diffusion in Vientiane Capital



3

Expected outputs

Global Environment Centre Foundation

- Reduction of GHG and air pollutants emissions
- Appropriate waste management and waste recycling, etc.
- Conservation of cultural and historic heritages
- Preservation of landscape, etc.
- Establishment of urban and transportation infrastructures
- Promotion of tourisms development, etc.

Formulation of **Low-Carbon Historic City Vientiane** with integrated sustainable development, through the utilization of Kyoto's and Japan's experiences and institutions and the implementation of large-scale JCM projects

Information transmission widely through League of historic Cities to other historic cities facing at challenges for economic development and heritage conservation

4

Global Environment Centre Foundation

Activities in FY2014

<Courtesy Visit>

<International WS>

<Individual Interview>

<Co-Chair Signature>

<Japan Embassy / JICA Meeting>

<JETRO Meeting>

【Main Counter Part】
DONRE, VUDAA, MONRE, MPWT, DPWT, DOFA, DOPI, etc.

5

Global Environment Centre Foundation

Co-Chairs' Summary in 2nd International Workshop FY2014

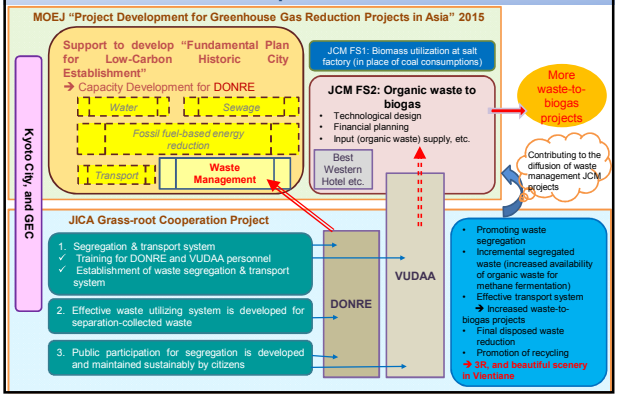
- Developing Vientiane's fundamental plan toward low-carbon historic city
  ⇒ (1) solid waste management
  (2) transportation system
  (3) fossil fuel-based energy
  (4) water resource management
  (5) wastewater and sewage treatment
- Proposed capacity building programme for Vientiane Capital officials, focusing on the appropriate management of municipal solid waste, including effective collection and transport and 3R (reduce/reuse/recycle) of solid waste.
- Further development of new JCM projects with the closer public-private cooperation among Vientiane Capital, Lao PDR, and Kyoto City, Japan.

6

City-to-City Cooperation

Global Environment Centre Foundation

Overall Cooperation Structure



Global Environment Centre Foundation

Signed the MoU between Vientiane Capital and Kyoto City

[Date] : 3rd November 2015

[Place] : Kyoto City Zoo

[Signatures] :
Mr. Sinlavong Khoutphaythoune
(Governor, Vientiane Capital)
Mr. Daisaku Kadokawa
(Mayor, Kyoto City)

[Term] : by March 2018

8

Global Environment Centre Foundation

Signed the MoU between Vientiane Capital and Kyoto City

Objectives

The Parties establish an effective cooperative partnership, to support and promote the activities for **the environmental protection and the sustainable and low-carbon development** in Vientiane Capital, **as a historic city** in Lao People's Democratic Republic.

Goals

(i) Vientiane Capital gains their personnel and institutional capacities for the environmental management, in particular, for **the appropriate and effective solid waste management**

(ii) **Climate change mitigation projects** contributing to the reduction of greenhouse gas emissions are developed in Vientiane Capital to be realised and implemented.

9

Contents of the study in FY2015

Global Environment Centre Foundation

Based on the experiences of Kyoto City, following activities will be conducted:

- Support promoting appropriate urban development and making effective environmental policy to realize a Low Carbon Historic City.
- Provide comprehensively institutional and technological supports for sustainable development
- Capacity development for human resources thru training / workshop
- Finding possible JCM projects (wide-spread and/or packaged types)

Establishment of operation and management scheme for low-carbon historic city

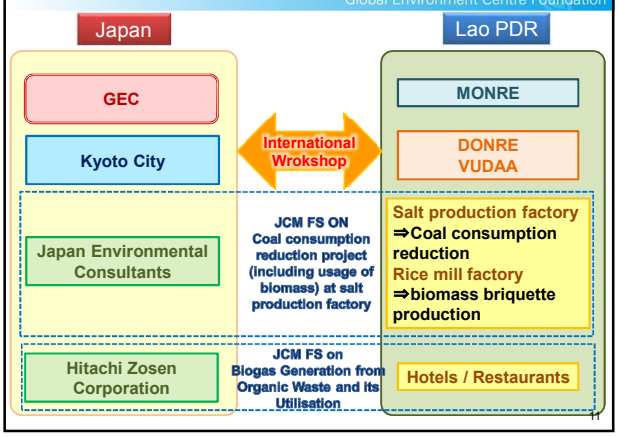
FS for JCM project candidates (including development of JCM methodologies and project design documents (PDDs))

Promising JCM project candidate, with high local needs and high expectation for widespread and early implementation

- **"Coal consumption reduction project (including usage of biomass) at salt production factory" (Japan Environmental Consultants, CO., LTD.)**
- **"Biogas Generation from Organic Waste and its Utilisation" (Hitachi Zosen Corporation)**

10

Global Environment Centre Foundation



11

Global Environment Centre Foundation

Japanese implementers

Representative entity: GEC
Total coordination

GEC	Kyoto City Government	Japan Environmental Consultants	Hitachi Zosen Corporation
- Coordinating the entire study - Developing low-carbon city plan - Investing local needs - Finding new JCM project candidate - Managing FS progress - Promoting city-to-city cooperation - Promoting public-private cooperation	- Promoting city-to-city cooperation - Developing low-carbon city plan - Investing local needs - Promoting public-private cooperation - Providing how to develop capacity and human resources	**Implementing JCM FS of biomass project** ✓investing project feasibility ✓developing applicable JCM methodology ✓drafting PDD ✓establishing project financial plan etc.	**Implementing JCM FS of Biogas project** ✓investing project feasibility ✓developing applicable JCM methodology ✓drafting PDD ✓establishing project financial plan etc.

12

Fundamental Plan for Low-Carbon Historic City

Global Environment Centre Foundation

Structure of Fundamental Plan (under developing)

Introduction	✓ on the basis of urban development master plan (MP) (developed by JICA project); ✓ Fundamental plan for low-carbon urban development securing historic/cultural heritage conservation and economic development
Background	• Background situation (national, international, city levels) • Objectives: City-level application of national stategy
Summary	• Progress of implementation of MP • Current situation of Vientiane: environmental/urban problems, social problems (such as transport, waste management, etc.) • Closer linkage among historic/cultural heritage conservation and tourism
Basic information	• Overall direction • Duration of the plan • Geographical range of plan application (whole Vientiane, (+ sub-area level?)) • Current GHG emissions (city-level GHG inventory) • GHG reduction/limitation target • Institutional arrangement
Points of plan	• Future vision • Role of 'Low-carbon Vientiane Committee' (?)
Actions/ Strategies	• Sectoral actions/measures, and/or strategies: Agriculture & food security; Forestry & land use change; Water resources; Energy & transport; Industry; Urban development; Public health
Implementation management	• Institutionalization of PDCA (Plan – Do – Check – Action) cycle

Reference

- Strategy on Climate Change of the Lao PDR
- DONRE Presentation in 2nd International Workshop, held on 4 Feb. 2015
- Vientiane Urban Development Master Plan (MP) (developed by JICA project)
- Kyoto City Program of Global Warming Countermeasure

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Global Environment Centre Foundation

Activities in FY2015

<Meeting with DONRE Director>

<Meeting with MONRE>

<Visit salt factory>

<Consultation with biogas project proponent>

14

Global Environment Centre Foundation

Activities in FY2015

Signed MoU Of JICA Glassroots

JICA Glassroots Kick Off WS

JICA Glassroots Project Team Meeting

Site Visit KM32

Site Visit KM7

Site Visit Transfer Station

15

Global Environment Centre Foundation

ຂໍຂອບໃຈທ່ານຫຼາຍຫຼາຍ!

KYOTO

VIENTIANE

Global Environment Centre Foundation (GEC)
International Cooperation Division
(Contact person: Mr. Masaaki Tabo, tabo@gec.jp)
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Fax: +81-6-6915-0181
Email: vcc-lc@gec.jp
Web: http://gec.jp

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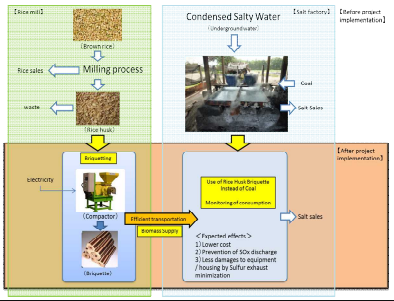
Feasibility Study on JCM Project
"Coal consumption reduction project (including usage of biomass) at salt production factory"

Workshop Presentation Material
February 4th, 2016
(Japan Environmental Consultants C., LTD.)

【Outline of the project】
The project is proposing to use biomass instead of coal at salt production process at the factory near Vientiane Capital, Laos. Target biomass is rice husk which is generated at rice mill factory in Vientiane. Rice husk will be compacted by briquetting machine.

【Outline】

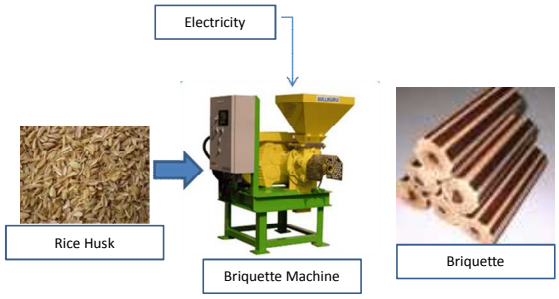


【Cost effectiveness】(67LAK/YEN)

Items	Amount
1.Initial investment (Mill LAK)	6,271
2.Depreciation (tentative, years)	9
3.Project Operation cost (Mill LAK/year)	3,181
4.Reference scenario cost (Mill LAK/year)	2,975
5.Operation cost difference per year	206
6.Operation cost difference in 9 years	1,854
7.Annual CO2 reduction (tCO2/ year)	6,299
8.9 years CO2 reduction	56,691
9.CO2 reduction unit cost (LAK/tCO2) ((1+6)/8)	**143,321**

Briquette production from Rice Husk

- Rice husk is generated at rice milling process, and it is very bulky. It has about 3,600 kcal/kg.
- Rice husk is supplied to "Briquetting machine" and pressurized and compacted. Specific gravity will be from 0.1 (when raw material) to more than 0.5 (when compacted).
- Rice husk shall be compacted beside rice mill factory for efficient transportation of the product.
- Rice husk consists rich amount of "Silica", which is a hard material that worn even metal. Rice husk compacting requires proper selection of machine itself (anti- abrasion processed parts), periodical maintenance by considering cost balance.



Project Participant and their Roles

1) KC-Company (Laos company: Largest rice mill factory)
   - Rice husk supplier
   - Main player of rice husk briquette production and sales activity
   - Investment (Major investment)

2) V-Company (Laos Company: Salt production factory)
   - Rice husk consumer

3) I-Company (Laos Company: Business supporting consultant)
   - Survey support
   - Briquette sales planning, customer development
   - Contract basis or Investment (Minor investment)

4) C-Company (Japanese Company: Business consultant)
   - Survey
   - Briquette sales planning, Technical planning
   - Contract basis
   - If possible, investment (Minor investment)

Upper Goal and Target of this proposal

- Upper goal: **Apply to FY2016 JCM subsidy**

- Target of this survey:

1) Establishment of "International Consortium" required for JCM subsidy application
2) Adequate business plan development and financing planning
3) Adequate technology/system selection and operation structure development for stable production.
4) Confirmation of quality, price and suitability as fuel for salt production process.

History

- 2013：JCM Bilateral agreement signed by Laos
- 2013・2014：Organization under MOEJ found this project idea through their survey and was Introduced to CUES.
- 2014：Promotion of the project by CUES.
- 2015：Taken up as one of the component of MOEJ survey (Kyoto-City+GEC+HITZ+CUES)

Common Challenge in Laos < CO2 reduction by what?>

● *Energy in Laos*

Main source is Hydro-power = Low CO2 emission

● *CO2 reduction method in our proposal*

Replacing Biomass to Fossil fuel (Coal)

Challenges of this project <Business feasibility>

● *Product Competitiveness*
＝Evaluation as competing product to coal (Under evaluation at V-Co. site)

1）Effects to Final Product (Salt)
→ Shall satisfy quality standards of V-Co.

2）Unit cost of RHB
→ Break-even point is 744 LAK/kg (11.1 JPY/kg)
= Obtaining subsidy by JCM will realize 719 LAK(10.73 JPY/kg)
* Price will be decided after test use at V-Co.

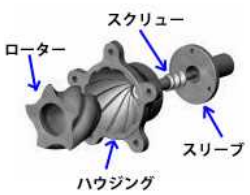
● *Divergence of RHB customers*
– Find potential customers, sell RHB to them by designing adequate MRV under JCM rule

Material Balance

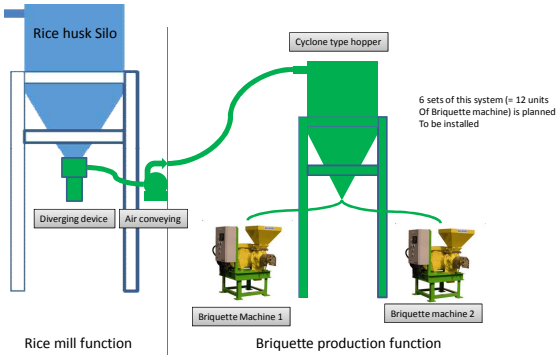
Supplier	Input (kg/hr)	Output (kg/hr)	Electricity consumption (kW)
Kitagawa	150	150	22.6
Tromso	120	120	20
Kansai	100	100	20.6
	250	250	42.9

Prepotency of Japanese technology

- Anti-abrasion countermeasures
  – Resistance to abrasion is upgraded by using special alloy at the wearing section.
  – All listed companies introduced it.



System flow (tentative)



Result of Feasibility Study

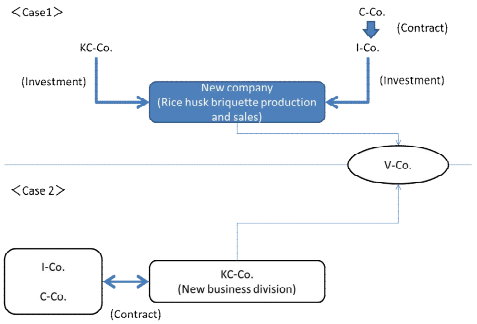
【Preconditions】

	Calorific value Kcal/kg	Consumption t/year	Unit price LAK/kg (JPY/kg)
Coal	6,000	2,400	1,240 (18.5)
RHB	3,600	4,000	See below

Product cost	No subsidy			795.27	LAK/kg
	50% subsidy for Initial cost			708.19	LAK/kg
CO2 reduction amount	CO2 emission factor of coal			0.10	tCO2/GJ
	calorific value of coal			26.7	GJ/t
	Annual CO2 reduction amount			6,299.06	tCO2/y
	Co2 reduction amount 9 years			56,691.58	tCO2
Subsidy				3,134,882,143	LAK
CO2 reduction unit cost				55,297	LAK/t
V-Co. cost	Coal	1239.5	LAK/kg	2,974,800,000	LAK/y
	Rice husk without subsidy	795.2662074	LAK/kg	3,181,064,830	LAK/y
	Rice husk with subsidy	708.1861479	LAK/kg	2,832,744,592	LAK/y

Profit will be 4.7% when selling at equal calorific value to coal

Basic Business Operation Structure



Remaining issues

- Adoptability to V-Co.'s salt production process
- Customer diversity for business stability
- Cost reduction
  - Quick wearing out of material at compression section
    - Low cost procurement of anti-abrasion parts or anti-abrasion processing work

Programme for the Establishment of Low-Carbon Historic City in Vientiane, based on City-to-City Cooperation between Vientiane Capital and Kyoto City

International Workshop JFY2015

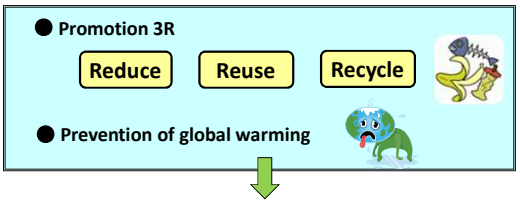
Bio-Gas Generation from Organic Waste and its Utilization

+ Waste to Energy project using WTM System©
+ JCM project Feasibility Study

Feb. 2016
Hitachi Zosen Corporation

1. Social Background

Vientiane Capital requested to Kyoto City for the support to appropriate waste management.

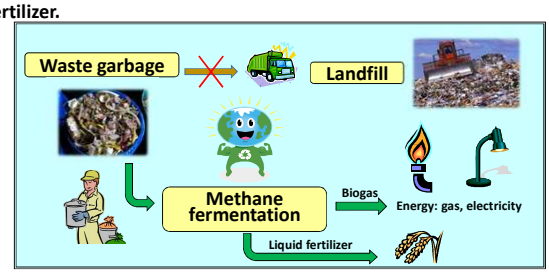


We contribute to create pleasant environments in Vientiane.

2. What is Waste to Energy?

Under the JCM, the organic waste is to be fermented to generate biogas (mainly composed of methane), which is to be supplied to kitchen as an alternative fuel for cooking to replace LPG.

And, we can use digestive liquid after methane fermentation as a fertilizer.



3. What is Methane Fermentation?

✓ **Methane fermentation**

We produce a biogas consisting mainly of methane gas, by the fermentation of anaerobic microorganisms organic waste such as garbage.

$$C_6H_{10}O_5+H_2O \rightarrow 3CH_4+3CO_2$$

✓ **Gas utilization**

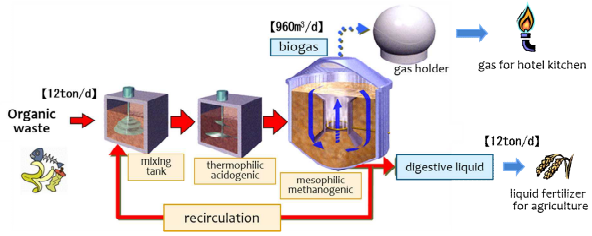
We can use the gas as a heat source or power, or directly methane gas generated.

✓ **Reduction of CO_2**

It will prevent the release of methane, a greenhouse gas that occurs in landfills . As a result, it is possible to contribute to the reduction of CO_2 emissions as measures to prevent global warming.

4. Flow of the WTM System

The WTM system recycles organic waste such as kitchen waste from ordinary households, restaurants and food factory, to get biogas through fermentation.
Meaning of WTM is Water- needless Two-phase Methanation system.
The WTM System developed by Hitachi Zosen.



5. Feature of the WTM System

Feature

- **Uunnecessary dilution water**
  Compact fermenter, Less energy required for heating
- **High efficient two-phase circulation**
  Increased degradation rate of the solids by the high temperature
  Achieve high organic matter decomposition rate(85%)
- **Mesophilic methane fermentation**
  A variety of garbage can be treated because mesophilic methane fermentation have tolerability for ammonia inhibition.

6. Main Terms of Our Feasibility Study

1. Target Feedstock
Waste garbage suitable for WTM system discarded hotel and restaurant.

2. Target Quantity
10 ton/day (Account for approximately 10% of MSW in Vientiane)

3. Investor for WTM System
Societe Commerciale Lao Ltd and Luanpaseuth Co.

4. Bio-Gas User
Hotel and Restaurant in Vientiane city

5. Liquid Fertilizer User
Fertilizer selling corporations

7. Result of the Waste Survey

The more proper waste we correct, the more profitable we get

- The waste survey had been implemented for Hotel and Restaurant so as to confirm amount and component under the cooperation of VUDAA.

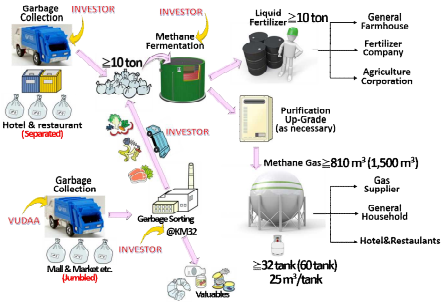
	Hotels (4 locations, 4 days)	Restaurants (4 locations, 4 days)
Results	Total collection quantity: 321.8 kg Applicable for gasifying: 172.8 kg (53.7%)	Total collection quantity：213.4 kg Applicable for gasifying：107.8 kg (50.5%)

Potential amount of suitable waste at Hotel&Restaurant in Vientiane city → **7.5 ton (Maximum)**
Unfortunately, Far from an assumed amount

Solid supports of VUDAA is indispensable to promote this project.

8. Business Framework with VUDAA

Under the cooperation of VUDAA, We have to construct the scheme below



The negotiations are under way.
Before long, we will enter into this request for cooperation with VUDAA.

9. The Profitability of the Project

Based on the data which we have already acquired …

Accepting amount of waste	10 ton/day (Separated)
Bio-Gas generation amount	10 ton/day × 150 m^3/ton=1500 m^3/day (Unpurified) 1500 m^3/day × 0.6 × 0.9=810 m^3/day (Purified)
Business revenue	**Gas Selling** (Assuming the Bio-gas unit price is 1.43 USD/m^3) 810 m^3/day × 1.43 USD/m^3 × 365day/year=422,780USD/year
	Liquid Fertilizer Selling (Assuming the fertilizer unit price is 1.00 USD/ton) 10 ton/day × 1.00 USD/ton × 365day/year=3,650USD/year
	Total Revenue: 426,430 USD/year
Construction cost	330 MUSD (ball-park estimate)
Maintenance costs	50,000 USD (ball-park estimate)
Amount of CO_2 reduction	690 ton/year
statutory useful life	15 years

The cost of capital investment may be mostly recovered in 8 years.

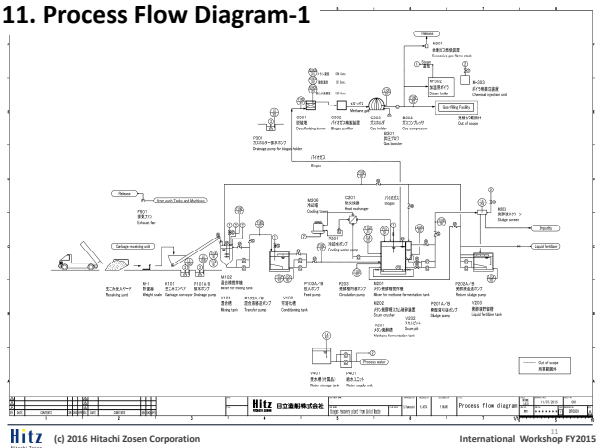
10. Conclusion

WTM System would deliver multiple benefits in respect of sustainable development for Vientiane City

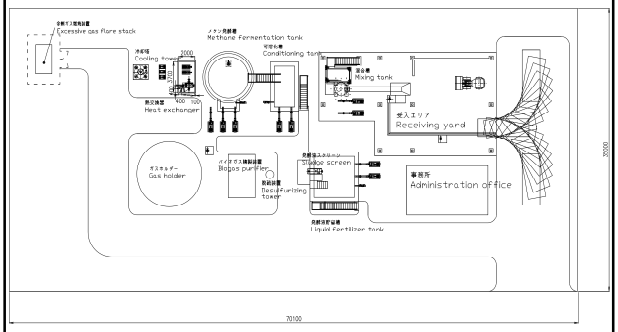
- Potential amount of suitable waste at Hotel&Restaurant in Vientiane city is 7.5 ton.
- The negotiation regarding waste collection with VUDAA are under way.
- 10 ton of suitable waste for WTM generate 1,500 m^3/day of Bio-Gas.
- Annual revenue of this project is 426,430 USD. Subsequent to execution of feasibility study successfully, we would like to establish a plan to install facility as next step.

Social Benefits	✓ Promoting the best practices of waste management in the Vientiane city ✓ Improving environmental awareness among the people in the community
Environment Benefits	✓ Leading to reduction of greenhouse gas emission ✓ Leading to prolonging the life of landfill KM32
Economic Benefits	✓ Getting environmentally friendlier alternative energy ✓ Enhancing product competitiveness of agricultural products which is currently facing a lot of competitive pressure in the global market

11. Process Flow Diagram-1



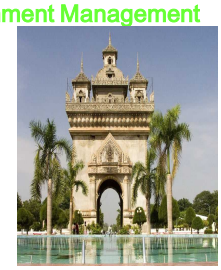
11. Process Flow Diagram-2



Thank you for your attention

Hitz 日立造船株式会社
Hitachi Zosen

plan on Awareness people to Participate on Low - carbon to Sustainable Environment Management



Name: Ms ROTCHANA PHOUANGMANIVONG
chief of environment section

Natural Resources and Environment
Department Vientiane Capital City Lao PDR

Background

In general, The urban environment is in good condition, peace and safety. However, urban cities are in rapid growth trends causing some environmental concerns such as increased migration from rural areas into cities, lack of public utilities to meet the demands, many forms of pollutants in the air, water, soil and distractions , So to solve all of these Public awareness is very important to educate awareness people to participate on environment to preservation the environment .

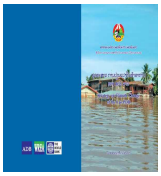
Purpose

- ❖Develop positive attitudes by participating in sustainable environment management .
- ❖ to reduce and develop an effective waste Utilization .
- ❖To awareness campaign and transfer knowledge and technologies in formulation of greenhouse gas Mitigation to Low-Carbon and sustainable development .

Regulation and Law

- Environment protection Law (revised version)was approved by National Assembly in December 2012.

- Strategy on Climate change of the Lao PDR .



Goals

- To make the urban city Clean, Green and beauty
- To protect the environment and improve the livelihood of the people
- To active campaigns to raise public awareness obligation for people toward the protection of environment

Implementation

- ❖promote 3 Rs principle (reduce, reuse, recycle) to the public people
- ❖ focus and Combine the villages , farm , factory
- ❖Awareness : 3R, climate change and greenhouse gas mitigation
- ❖Enhance the agricultural without chemical

Benefit

- ❖ the solid waste and the Green house gas emission will reduce

- ❖People will understand and have more participate actively on Environment management

Action Plan

- **The steps to achieve the Action Plan's goals**

STEP 1

Prepare the regulation-law and manual for Campaign on the program

STEP 2

Communicated with the village administration authority ,farm, factory

Promote 3 Rs principle and training normal composting , climate change ,green house gas

Enhance the people for agricultural without chemical and use solid waste effective

STEP 3

Monitor, evaluate and report

Action Plan Time Table

- **Duration: (3 Year) First Year Work Plan: 2016**

No	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Prepare the regulation –law and manual for Campaign on the program												
2	Communicated with the villages administration authority ,farm, factory for implementation (9 districts)												
3	Using 3 Rs principle and training normal composting , climate change , greenhouse gas												
4	Training for agricultural without chemical using composting (9 districts)												
5	Monitor, evaluate and report												

Outline of the Action Plan–Budget

Activity	TOTAL	Year (Cost US$)	Responsibility
Awareness	80,000	80,000	Vientiane Capital
Equipment and facility Domestic fund	20,000	20,000	Vientiane Capital
Foreign Fund (need support)	100,000	100,000	
TOTAL AMOUNT	100,000	100,000	-

Thank You

Ⅳ. JCM Proposed Methodology・Project Design Document

—Table of Contents —

1. Production and sales of rice husk briquette to replace fossil fuel

JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form	
Form for submitting the proposed methodology	
Host Country	Lao People's Democratic Republic
Name of the methodology proponents submitting this form	Japan Environmental Consultants, Ltd.
Sectoral scope(s) to which the Proposed Methodology applies	1. Energy industries (renewable - / non-renewable sources)
Title of the proposed methodology, and version number	Production and sales of rice husk briquette to replace fossil fuel, version.1.0
List of documents to be attached to this form (please check):	☒The attached draft JCM-PDD: ☐Additional information
Date of completion	2016.1.29

History of the proposed methodology

Version	Date	Contents revised
1.0	2016.1.29	First edition

A. Title of the methodology

Production and sales of rice husk briquette to replace fossil fuel

B. Terms and definitions

Terms	Definitions
Rice husk	The outermost layer of rice grain that is separated from brown rice during rice milling process.
Briquette	Compressed block of rice husk, saw dust, powdered coal or other dusts.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	The project produces rice husk briquette from unutilized rice husk, and sells it to the consumers to substitute fossil fuels combusted in boilers and other combustion facilities, thus reduces CO_2 emissions.
Calculation of reference emissions	Calculated by multiplying rice husk briquette consumption, net calorific value of the rice husk briquette and CO_2 emission factor of the reference fossil fuel. For this emission, take into account conservativeness and potential effects of fossil fuel consumption reductions through efficiency improvement of boiler and other combustion facilities, multiply "Energy efficiency improvement factor of the reference fossil fuel combustion machine" to the above emission.
Calculation of project emissions	Emission associated with electricity consumption of rice husk briquette production, and emissions with transportation of rice husk and rice husk briquette.
Monitoring parameters	・ Consumption of rice husk briquette ・ Electricity consumption of rice husk briquette production (if necessary) ・ Transportation distance of rice husk and rice husk briquette (if necessary)

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The project produces and sells rice husk briquette.
Criterion 2	The feedstock of rice husk briquette should be the rice husk which are currently not used as any materials or energy sources.
Criterion 3	The rice husk briquette produced in the project should be produced by the rice husk briquette machine with electricity and without any materials or additives other than rice husk.
Criterion 4	The rice husk briquette produced in the project substitutes fossil fuels which are used in boilers and other combustion facilities in demand sides.
Criterion 5	The producer and the consumer of the rice husk briquette are bound by a purchase and sales contract, and through sales/purchase documents of both companies, the producer can monitor the sales and consumptions of the rice husk briquette.
Criterion 6	The rice husk briquette produced should be certainly consumed by the consumer, and the consumer should not resale or export to other consumers.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Combustion of fossil fuel in boilers or other combustion facilities	CO_2
Project emissions	
Emission sources	GHG types
Electricity consumption of rice husk briquette production	CO_2
Transportation of rice husk	CO_2
Transportation of rice husk briquette	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emission in the methodology is defined as "CO_2 emission associated with combustion of fossil fuel that would have been used by the consumer in the absence of the rice husk briquette". Reference emission is calculated by multiplying rice husk briquette consumption, net calorific value of the rice husk briquette and CO_2 emission factor of the reference fossil fuel. For this emission, take into account conservativeness and potential effects of fossil fuel consumption reductions through efficiency improvement of boiler and other combustion facilities, multiply "Energy efficiency improvement factor of the reference fossil fuel combustion machine" to the above emission.

F.2. Calculation of reference emissions

$$RE_p = BC_p \times NCV_{biomass} \times EF_{CO2,i} \times (1 - EI)$$

BC_p Consumption of rice husk briquette during the period p [t/p]
$NCV_{biomass}$ Net calorific value of rice husk briquette [MJ/t]
$EF_{CO2,i}$ CO_2 emission factor of the reference fossil fuel i [tCO_2/MJ]
EI Energy efficiency improvement factor of the reference fossil fuel combustion machine

G. Calculation of project emissions

$$PE_p = PE_{elec,p} + PE_{tp1,p} + PE_{tp2,p}$$

1. Emission associated with electricity consumption of rice husk briquette production

$$PE_{elec,p} = EC_p \times EF_{CO2,elec}$$

EC_p Electricity consumption of rice husk briquette production during the period p [MWh/p]
$EF_{CO2,elec}$ CO_2 emission factor for electricity [tCO_2/MWh]

2. Emission associated with transportation of rice husk
Calculate emission associated with transportation of rice husk from the source of the rice husk to the rice husk briquette machine. The emission can be neglected if the source and the rice husk briquette machine are located in the same factory.

$$PE_{tp1,p} = \frac{DT_{tp1,p}}{FE_{tp1}} \times NCV_j \times EF_{CO2,j}$$

$DT_{tp1,p}$ Transportation distance of rice husk during the period p [km/p]
FE_{tp1} Fuel economy of motor vehicle for rice husk transportation [km/liter]
NCV_j Net calorific value of fossil fuel j of motor vehicle for rice husk transportation

[MJ/liter]
$EF_{CO2,j}$ CO_2 emission factor of fossil fuel j of motor vehicle for rice husk transportation [tCO_2/MJ]

3. Emission associated with transportation of rice husk briquette
Calculate emission associated with transportation of rice husk briquette from the rice husk briquette machine to consumers. The emission can be neglected if the incremental transport distance compared with the reference fossil fuel transportation is equal or less than 200km. Only consumers with incremental transportation distance is over 200km should be counted.

$$PE_{tp2,p} = \sum_{i} \left(\frac{DT_{tp2,m,p}}{FE_{tp2,m}} \times NCV_{k,m} \times EF_{CO2,k,m} \right)$$

$DT_{tp2,m,p}$ Increment distance for rice husk briquette transportation to consumer m during the period p [km/p]
$FE_{tp2,m}$ Fuel economy of motor vehicle to transport rice husk briquette to consumer m [km/liter]
$NCV_{k,m}$ Net calorific value of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [MJ/liter]
$EF_{CO2,k,m}$ CO_2 emission factor of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [tCO_2/MJ]

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p$$

ER_p Emission reduction during the period p [tCO_2/p]
RE_p Reference emission during the period p [tCO_2/p]
PE_p Project emission during the period p [tCO_2/p]

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed ex ante is listed as below.

Parameter	Description of data	Source
$NCV_{biomass}$	Net calorific value of rice husk briquette [MJ/t]	Default value set through ex-ante measurement.
$EF_{CO2,i}$	CO_2 emission factor of the reference fossil fuel i [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
EI	Energy efficiency improvement factor of the existing fossil fuel combustion machine	Default value: 20% (=0.2)
$EF_{CO2,elec}$	CO_2 emission factor for electricity [tCO_2/MWh]	Grid electricity: i) The most recent official value in Laos or ii) average emission factor considering all power plants connected to the grid Captive electricity: The most recent default value available from CDM approved small scale methodology AMS-I.A.
FE_{tp1}	**In case, necessary to calculate*	Default value set through ex-ante

	$PE_{tp1,p}$ Fuel economy of motor vehicle for rice husk transportation [km/liter]	measurement.
NCV_j	**In case, necessary to calculate* $PE_{tp1,p}$ Net calorific value of fossil fuel j of motor vehicle for rice husk transportation [MJ/liter]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$EF_{CO2,j}$	**In case, necessary to calculate* $PE_{tp1,p}$ CO_2 emission factor of fossil fuel j of motor vehicle for rice husk transportation [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$FE_{tp2,m}$	**In case, necessary to calculate* $PE_{tp2,p}$ Fuel economy of motor vehicle to transport rice husk briquette to consumer m [km/liter]	Default value set through ex-ante measurement.
$NCV_{k,m}$	**In case, necessary to calculate* $PE_{tp2,p}$ Net calorific value of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [MJ/liter]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.
$EF_{CO2,k,m}$	**In case, necessary to calculate* $PE_{tp2,p}$ CO_2 emission factor of fossil fuel k of motor vehicle to transport rice husk briquette to consumer m [tCO_2/MJ]	Country specific data or IPCC default value from "2006 IPCC Guidelines for National Greenhouse Gas Inventory". Lower limit value is applied.

JCM Project Design Document Form

A. Project description

A.1. Title of the JCM project

Reduction of coal briquette consumption through production and sales of rice husk briquette in Vientiane

A.2. General description of project and applied technologies and/or measures

The purpose of the project is to produce rice husk briquette using unutilized rice husk in a rice milling company, Khamphengphet Chengsawang EXP-IMP Co., Ltd., and to replace coal briquettes that are used in the salt factory of Veukham Salt Co., Ltd. The project is implemented in Vientiane in Lao People's Democratic Republic.

The rice husk briquette machine to be installed in the project, is a machine to produce fuel briquette by grinding and compressing rice husk mechanically. In Laos, there is no manufacturer of the rice husk briquette machine, and the project will install the machines developed by Tromso Co., Ltd. from Japan. Since rice husk contains very rigid component (silica), generally, it is not easy to produce briquette from rice husk, and damages to briquette machines are significant. Tromso Co., Ltd. had developed parts of the machinery coated with special material, and make it possible to produce rice husk briquette efficiently. In the production processes, no materials or additives other than rice husk is added. Figure 1 and Table 1 show an image and major specifications of the rice husk briquette machine.

Figure 1 The rice husk briquette machine

Table 1 Major specifications of the rice husk briquette machine

Model	TRM-120F
Processing capacity	120kg/h
Size	W2800 xD1503 xH2283 (mm)
Weight	1300kg
Power	15.65kW
Heater	3.999kW

In the second rice mill factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd., 66 tons of rice husk are produced per day, and some of these are spread to farm land, while most of these are dumped without using effectively. Among these rice husks, the project uses 2,760 tons per year (11.5 tons per day) for production of rice husk briquette. 12 sets of the rice husk briquette machines are installed in the second factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd., and expected to produce 230 tons per year of briquette per 1 unit (operating 8 hours per day, 20 days per month, 12 month).

On the other hand, Veukham Salt Co., Ltd. produces salt from high concentration groundwater brine (25 to 26%) by concentrating it in open pans using coal briquette. 2,000 tons of coal briquette are consumed annually (in 2015), and the project is aiming to replace all coal briquette by rice husk briquette which are produced by Khamphengphet Chengsawang EXP-IMP Co., Ltd. The expected CO_2 emission reduction is 2,584 tons per year.

A.3. Location of project, including coordinates

Country	Lao People's Democratic Republic
Region/State/Province etc.:	Vientiane Capital
City/Town/Community etc:	The second rice mill factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd.: Naxaythong District Veukham Salt Co., Ltd. : Xaythany District
Latitude, longitude	The second rice mill factory of Khamphengphet Chengsawang EXP-IMP Co., Ltd.: N18° 04' 03" and E102° 33' 12" Veukham Salt Co., Ltd.: N18° 08' 57" and E102° 35' 08"

A.4. Name of project participants

The Lao People's Democratic Republic	Khamphengphet Chengsawang EXP-IMP Co., Ltd.
Japan	

A.5. Duration

Starting date of project operation	01/09/2016
Expected operational lifetime of project	10 years

A.6. Contribution from developed countries

Japanese agricultural technologies, as a rice-producing country, have high applicability to Asian countries which have similar rice-food culture with Japan. Japan has been promoting development of agricultural technologies; therefore, Japan can provide more advanced technologies to Asian countries. Particularly for utilization of rice husk, Japanese companies have made efforts to utilize it and to produce rice husk briquette so that easy to handle and transport as a solid biofuel. In Laos, there is no manufacturer of rice husk briquette machine, therefore, the project which uses Japanese technologies can show a good and advanced practice of a new way of utilization of rice husk which has been treated as waste and has not utilized effectively in Laos.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	N.A.
Version number	N.A.

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	The project produces and sells rice husk briquette.	In the project, the rice milling company, Khamphengphet Chengsawang EXP-IMP Co., Ltd. produces rice husk briquette and sells

		these to the salt producer, Veukham Salt Co., Ltd.
Criterion 2	The feedstock of rice husk briquette should be the rice husk which are currently not used as any materials or energy sources.	In Khamphengphet Chengsawang EXP-IMP Co., Ltd., 66 tons of rice husk are produced per day, and among these, the project uses 2,760 tons per year (11.5 tons per day) for production of rice husk briquette.
Criterion 3	The rice husk briquette produced in the project should be produced by the rice husk briquette machine with electricity and without any materials or additives other than rice husk.	In the project, rice husk briquette is produced only by electricity as an energy source and without adding any materials or additives.
Criterion 4	The rice husk briquette produced in the project substitutes fossil fuels which are used in boilers and other combustion facilities in demand sides.	In the project, 2,000 tons/year of coal briquette are expected to be replaced by the rice husk produced by Khamphengphet Chengsawang EXP-IMP Co., Ltd.
Criterion 5	The producer and the consumer of the rice husk briquette are bound by a purchase and sales contract, and through sales/purchase documents of both companies, the producer can monitor the sales and consumptions of the rice husk briquette.	The purchase and sales contract is signed by Khamphengphet Chengsawang EXP-IMP Co., Ltd. and Veukham Salt Co., Ltd. Both companies prepare and exchange sales/purchase documents/slips that are necessary for the monitoring of the emission reductions.
Criterion 6	The rice husk briquette produced should be certainly consumed by the consumer, and the consumer should not resale or export to other consumers.	The purchase and sales contract between Khamphengphet Chengsawang EXP-IMP Co., Ltd. and Veukham Salt Co., Ltd. includes an article to prohibit resale or export to other consumers by Veukham Salt Co., Ltd.

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Combustion of coal briquette in open pans of the salt factory	CO_2
Project emissions	
Emission sources	GHG type
Electricity consumption of rice husk briquette production	CO_2
Transportation of rice husk	CO_2
Transportation of rice husk briquette	CO_2

C.2. Figure of all emission sources and monitoring points relevant to the JCM project

Emission sources of the project are the briquette machines of Khamphengphet Chengsawang EXP-IMP Co., Ltd. and open pans of Veukham Salt Co., Ltd. Monitoring points are shown in dark red square in the figure below.

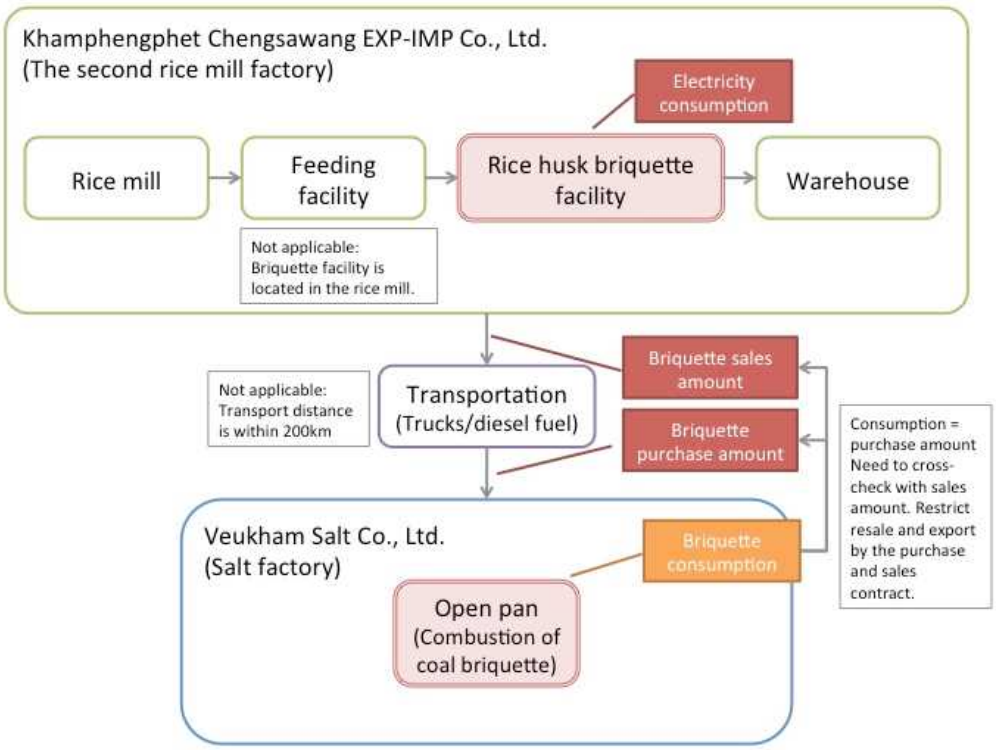


Figure 2 Emission sources and monitoring points for the project

C.3. Estimated emissions reductions in each year

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2016	863	2	861
2017	2,590	6	2,584
2018	2,590	6	2,584
2019	2,590	6	2,584
2020	2,590	6	2,584
2021	2,590	6	2,584
2022	2,590	6	2,584
2023	2,590	6	2,584
2024	2,590	6	2,584
2025	2,590	6	2,584
Total (tCO_{2e})	24,173	56	24,117

*As for 2016, the emissions/emission reduction from September to December are estimated.

D. Environmental impact assessment

Legal requirement of environmental impact assessment for the proposed project	Not applicable.

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

To be implemented.

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
	To be implemented.	

F. References
N.A.

Reference lists to support descriptions in the PDD, if any.

Annex
(Following documents will be attached for the submission to JC.) 1. The purchase and sales contract between Khamphengphet Chengsawang EXP-IMP Co., Ltd. and Veukham Salt Co., Ltd. (**Confidential**) 2. Guideline for preparation and exchange of sales/purchase documents/slips (**Confidential**)

Revision history of PDD		
Version	Date	Contents revised
1.0	2016.1.22	First Edition

2. Methane capture and biogas production from kitchen waste and its utilization as the alternative fuel of LPG for cooking in hotels and restaurants

1 JCM Methodology

1.1 Proposed JCM Project and the Expected GHGs Reductions

The proposed JCM Project aims at reducing GHGs emissions through biogas production from organic kitchen waste and its utilization as the alternative fuel of liquefied petroleum gas (LPG), which was currently used for cooking in hotels and restaurants. The Project plans to collect separated organic kitchen waste from hotels and restaurants and put them into gasifier to accelerate the anaerobic fermentation process to capture the methane and produce biogas. The produced biogas will be injected into gas cylinders for the use by hotels and restaurants.

The expected GHGs emission reductions from the proposed JCM project is summarized as shown in the table below.

Proposed JCM Project	The Expected GHGs Emission Reductions
Methane capture and biogas production from kitchen waste and its utilization as the alternative fuel of LPG for cooking in hotels and restaurants	(GHGs emission reduction from non-energy sources) ▪ Collection and utilization of biogas from kitchen waste through the proposed project will reduce methane emission from kitchen waste that will otherwise be disposed at the existing landfill and generate landfill gas in the reference/BAU scenario.
	(GHGs emission reduction from energy sources) ▪ Substitution of the currently used LPG for cooking in hotels and restaurants by the carbon-neutral biogas produced under the proposed Project will reduce the amount of GHGs emission from LPG consumption.

1.2 Outline of JCM Methodology

The JCM methodology for the proposed project mainly consists of two components, i.e.,

(1) The methodology for estimating and monitoring methane (CH_4) emission reduction from final disposal landfill where the kitchen waste will be brought if the proposed project is not carried out in the reference/BAU scenario.
(2) The methodology for estimating and monitoring carbon dioxide (CO_2) emission reduction by substituting the LPG used in hotels and restaurants for cooking purpose to carbon-neutral biogas produced by the project

In formulating the JCM methodology, the Study reviewed the IPCC's GHGs inventory guidelines (2006) on waste sector, the relevant approved CDM methodologies (e.g. AMS-III.F Version 11.0、AMS-III.G Version 7.0 and other related tools), and other relevant JCM methodologies developed in prior studies.

1.3 Boundary of the Proposed JCM Project

The boundary of the proposed JCM project includes collection and transportation of kitchen waste from generation sources as well as final disposal landfills to the biogas production facility, biogas production process (anaerobic fermentation, methane capture, biogas production and injection to gas cylinders), transportation of biogas cylinders to the final users (hotels and restaurants), and consumption of biogas as the substitute of LPG in hotels and restaurants for cooking purpose.

The Project GHGs emission includes:

▪ CO_2 emission from electricity consumption by the biogas production facility of the propose project and

- CO_2 emission from fossil fuel consumption by the transportation vehicles of gas cylinders from the biogas production facility to final users (hotels and restaurants).

As to the CO_2 emission from fossil fuel consumption by the transportation vehicles of kitchen waste from the generation sources and final disposal landfills, CO_2 emission also arises in the reference scenario when the kitchen waste is transported from the generation sources to the existing final disposal landfill while the project scenario plans to build/install biogas production facility nearer to the generation sources in terms of its distance than the existing landfill or within the existing landfill. Therefore, the CO_2 emission arising from transporting the kitchen waste from the sources to the biogas production facility will be equal or less than the reference emission in relation to this transport. Thus, the Project CO_2 emission by the transportation of kitchen waste from the generation sources to the biogas production facility is not estimated on the basis of the principle of simplicity of JCM methodology and conservativeness in estimating the GHGs emission reduction.

1.4 Establishment of the Reference Scenario

The reference scenario of GHGs emission in relation to the propose project consists of two components as described in the table below.

Reference scenario components	Contents
Treatment of kitchen waste	In the absence of the proposed project, all the kitchen waste will be collected under the current municipal solid waste collection system and disposed at the existing final disposal landfill of KM25.
Energy utilization in hotels and restaurants for cooking purpose	- In the absence of the proposed project, all the hotels and restaurants, to which the proposed project will provide biogas cylinders as alternative fuel, will continue using LPG for cooking purpose.

1.5 Methodology for Estimating GHGs Emission Reduction

The methodology for estimating GHGs emission reduction by the proposed project is described as below.

1.5.1 Basic equation for estimating GHGs emission reduction

Basic equation for estimating GHGs emission reduction is as follows.

$ER_y = RE_y - PE_y$

ER_y	Emission reduction in the year y ($tonCO_2$)
RE_y	Reference emission in the year y ($tonCO_2$)
PE_y	Project emission in the year y ($tonCO_2$)

1.5.2 Methodology for estimating reference emission

The GHGs emission in the reference scenario is to be calculated in accordance with the equation shown below.

$RE_y = RE_{CH4,y} + RE_{HC,y}$

RE_y	Reference emission in the year y ($tonCO_2e$/year)
$RE_{CH4,y}$	Reference emission from the existing final disposal landfill in the year y ($tonCO_2e$/year)
$RE_{HC,y}$	Reference emission from the consumption of LPG for energy purpose that

	is substituted by biogas by the proposed project in the year y ($tonCO_2$/year)

Where $RE_{CH4,y}$ is defined as:

$$RE_{CH4,y} = RE_{CH4,SWDS,y}$$

$RE_{CH4,y}$	Reference emission from the existing final disposal landfill in the year y ($tonCO_2e$/year)
$RE_{CH4,SWDS,y}$	Methane emission potential of the kitchen waste collected for biogas production by the proposed project if it is disposed at the existing final disposal landfill ($tonCO_{2e}$)

Where $RE_{CH4,SWDS,y}$ is estimated by the equation below:

$$RE_{CH4,SWDS,y} = \varphi_y * GWP_{CH4} * (1 - OX) * \frac{16}{12} * F * DOC_{f,y} * MCF_y * \sum_{x=1}^{y} \sum_{j} W_{j,x} * DOC_j * e^{-k_j(y-x)} * (1 - e^{-k_j})$$

$RE_{CH4,SWDS,y}$	Methane emission potential of the kitchen waste collected for biogas production by the proposed project if it is disposed at the existing final disposal landfill ($tonCO_{2e}$)
φ_y	Correction factor ▪ Default value (0.9:IPCC)
GWP_{CH4}	Global warming potential of methane ($tonCO_2e/tonCH_4$) ▪ Default value (21 : IPCC)
OX	Oxidization factor (Percentage of methane oxidized on the surface layer of landfill) ▪ Default value (0.1: IPCC)
F	Ratio of methane in landfill gas ▪ Default value (0.5: IPCC)
$DOC_{f,y}$	Ratio of degradable organic carbon at the landfill in the year y ▪ Default value (0.5: IPCC)
MCF_y	Methane correction factor in the year y ▪ Default value (IPCC)
$W_{j,x}$	Amount waste type j in the year y (ton/year)
DOC_j	Ratio by weight of the degradable organic carbon in waste type j ▪ Default value (IPCC Guidelines)
k_j	Decay factor of waste j ▪ Default value (IPCC Guidelines)
J	Waste type
X	Credit year (from 1 to y)
Y	Credit period

(Remarks on estimation of $RE_{CH4,SWDS,y}$)

The reference emission to be estimated in accordance with the equation above may be higher or lower than the actual methane capture and collected by the proposed project through biogas production. In such a case, the Project will take the lower one as the reference emission on the basis of the principle of the conservative estimation of GHGs emission reduction.

On the other hand, $RE_{HC,y}$ is estimated in accordance with the equation shown below.

$$RE_{HC,y} = HC_{displace,PJ,y} * EF_{CO2,displace,LPG,y}$$

$RE_{HC,y}$	Reference emission from the consumption of LPG for energy purpose that is substituted by biogas by the proposed project in the year y ($tonCO_2$/year)
$HC_{displace,PJ,y}$	The amount of energy to be substituted by biogas under the proposed project in the year y (TJ/year) ▪ Measurement by monitoring
$EF_{CO2,displace,LPG,y}$	Emission factor of LPG to be substituted by biogas under the proposed project in the year y ($tonCO_2$/TJ) ▪ Default value (IPCC)

1.5.3 Methodology for estimating project emission

The GHGs emission in the project scenario is estimated in accordance with the equation below.

$$PE_y = PE_{FC,transport,y} + PE_{EC,facility,y}$$

PE_y	Project emission in the year y ($tonCO_2$/year)
$PE_{FC,transport,y}$	CO_2 emission from the fossil fuels consumption by the transportation vehicles of biogas cylinders from the biogas production facility to the final users in the year y ($tonCO_2$/year)
$PE_{EC,facility,y}$	CO_2 emission from electricity consumption by the biogas production facility in the year y ($tonCO_2$/year)

Where $PE_{FC,transport,y}$:

$$PE_{FC,transport,y} = FC_{transport,PJ,y} * EF_{CO2,fuel,y}$$

$PE_{FC,transport,y}$	CO_2 emission from electricity consumption by the biogas production facility in the year y ($tonCO_2$/year)
$PE_{FC,transport,y}$	The amount of fossil fuels consumption by the transportation vehicles of biogas cylinders from the biogas production facilities to the final users in the year y (TJ/year) ▪ Measurement by Monitoring
$EF_{CO2,fuel,y}$	Emission factor of the fossil fuels used by the transportation vehicles of biogas cylinder ($tonCO_2$/TJ) ▪ Default value (IPCC)

On the other hand, $PE_{EC,facility,y}$:

$$PE_{EC,facility,y} = EC_{facility,PJ,y} * EF_{CO2,grid\ electricity,y}$$

$PE_{EC,facility,y}$	CO_2 emission from electricity consumption by the biogas production facility in the year y ($tonCO_2$/year)
$EC_{facility,PJ,y}$	Electricity consumption by the biogas production facility in the year y (kwh/year) ▪ Measurement by monitoring
$EF_{CO2,grid\ electricity,y}$	Grid emission factor in the year y ($tonCO_2$/kwh) ▪ National grid emission factor of Lao

1.6 Monitoring Methodology

1.6.1 Default Value Applied

The propose project set the following default values in estimating the GHGs emission reduction by the proposed project.

Items	Unit	Default value
Global warming potential of methane (GWP_{CH4})	$tonCO_2e/tonCH_4$	21
Oxidization factor (Percentage of methane oxidized on the surface layer of landfill) (OX)	-	0.1
Ratio of methane in landfill gas (F)	-	0.5
Ratio of degradable organic carbon at the landfill ($DOC_{f,y}$)	-	0.5
Methane correction factor in the year y (MCF_y)	-	Default value is set by type of landfill in IPCC guidelines.
Ratio by weight of the degradable organic carbon in waste type j (DOC_j)	-	Default value is set by type of waste in IPCC guidelines.
Decay factor of waste j (k_j)	-	Default value is set by types of waste and type of climate in IPCC guidelines.
Emission factor of LPG ($EF_{CO2,displace,LPG,y}$)	$tonCO_2/TJ$	63.1
Emission factor of the fossil fuels used by the transportation vehicles of biogas cylinder ($EF_{CO2,fuel,y}$)	$tonCO_2/TJ$	Default value is set by types of fossil fuels in IPCC guidelines.
Grid emission factor ($EF_{CO2,grid\ electricity,y}$)	$tonCO_2/kwh$	National grid emission factor is available in Lao.

1.6.2 Monitoring items and monitoring methods

The monitoring items and methods to be applied in the proposed project is as shown in the table below.

Monitoring items	Monitoring methods	Frequency
Mount of kitchen waste collected by the proposed project	Weight scale	At every collection
Composition of the collected kitchen waste	Waste composition analysis	Yearly
Amount of methane capture and collected from kitchen waste	Flow meter, methane meter	Consecutive
Electricity consumption by the project facilities	Meter reading	Monthly
Amount of LPG substituted by biogas (TJ)	Sales records (invoices, receipts) of biogas cylinders	Quarterly
Amount of fossil fuels consumption by the transportation vehicles of biogas cylinders	Records of fuel purchase (receipts), trip meter readings of transportation vehicles.	Quarterly

JCM Project Design Document

1. Survey for developing JCM project design documents

1.1 Implementation structure of the survey project for developing a JCM project design document (PDD) and its participants

The following figure illustrates the implementation structure of this project:

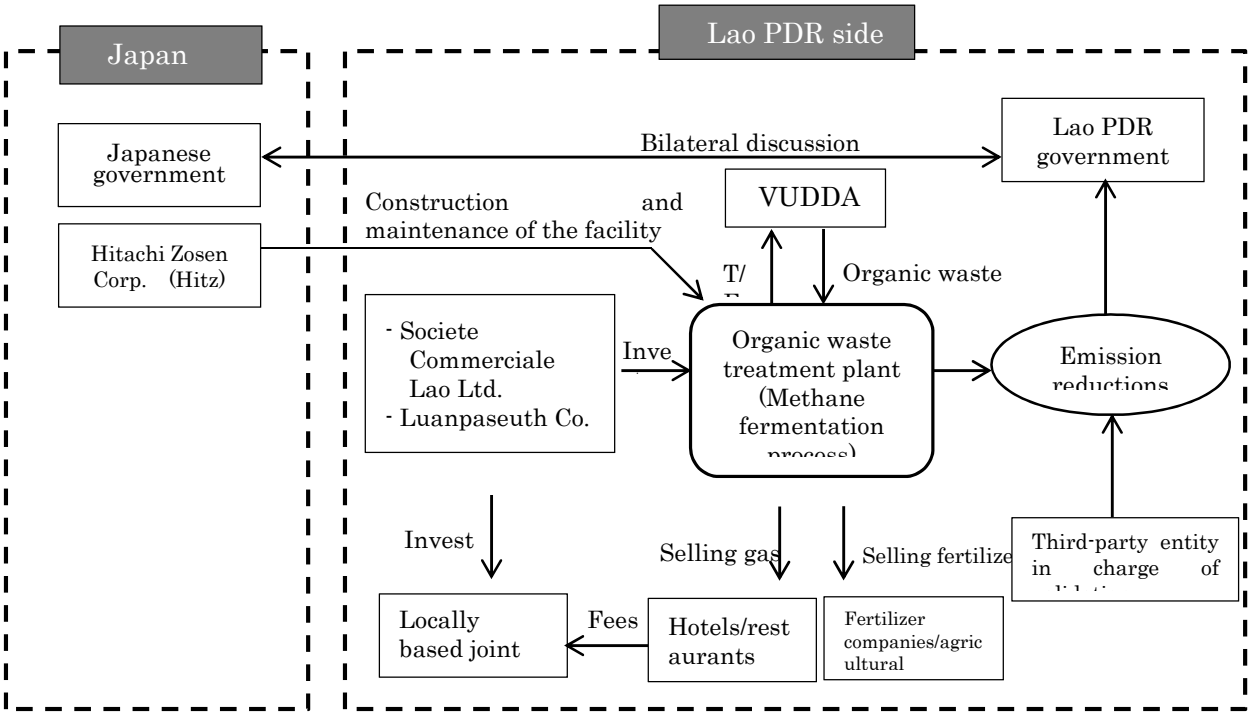


Figure: Project implementation structure

・Hitachi Zosen Corporation (Hitz) will perform designing, material procurement, construction, and maintenance works for the organic waste treatment plant.

・Societe Commerciale Lao Ltd. and Luanpaseuth Co. in Vientiane will launch a locally based joint venture and invest in the organic waste treatment plant (using methane fermentation process). The joint venture will receive proceeds from selling the generated gas and fertilizer while paying T/F to VUDDA for organic waste collected thereby.e

1.2 Implementation schedule and executing entity of the project

The planned schedule for the project is as follows:

4, 2016 Discuss the submission of a proposal for JCM's financing program for model project

We need correct more 15ton/d separated garbage to construct methane fermentation plant.

1.3 Ensuring compliance with the project's eligibility criteria

The working team will ensure that the project's methodology meets JCM project eligibility criteria as below:

Criterion 1	Methane fermentation equipment and gas purifier are installed.
Criterion 2	A facility maintenance plan is developed in a format widely used in Japan.
Criterion 3	The organic waste currently transported to the landfill KM32 is used as raw materials to put into the methane fermentation equipment.
Criterion 4	Following the installation of the methane fermentation equipment, equipment verification testing is conducted, whose results are validated by a third-party credential service provider authorized for ISO certification, etc. The validation documents are submitted to the screening session for validating the qualifications of the project.
Criterion 5	After installing the methane fermentation equipment, an air tightness testing of the equipment is conducted to make sure there is no leak.
Criterion 6	The methane fermentation equipment has the capacity to process five tons or more of waste per day.
Criterion 7	Desulfurization equipment is installed between the methane fermentation tank and gas holder(s).

1.4 The project's GHG emission sources and monitoring points

The following figure illustrates the GHG emission sources and monitoring points of the project:

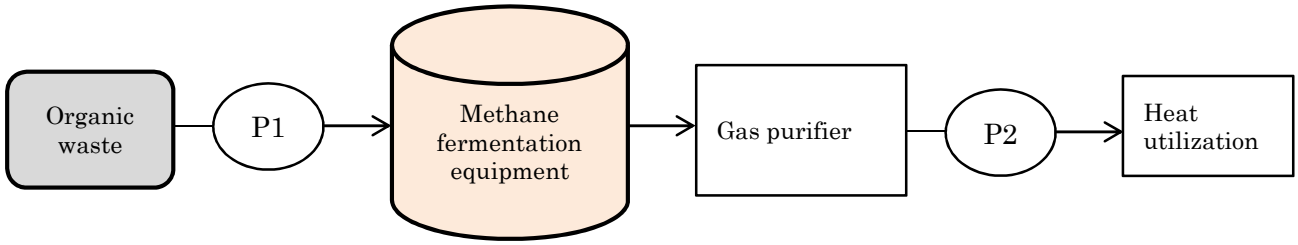


Figure: Monitoring points

P1: Amount of the avoided emission of the methane gas from the organic waste when it is disposed in the KM32 landfill

P2: Amount of CO_2 generated by LPG fuels that have traditionally been used in the hotels and restaurants

1.5 Monitoring plan

The monitoring required for this project will be conducted by the joint venture company. The project manager of the joint venture company will be in charge of overseeing the monitoring processes and storing data while on-site operators will carry out practical work processes such as collecting necessary data.

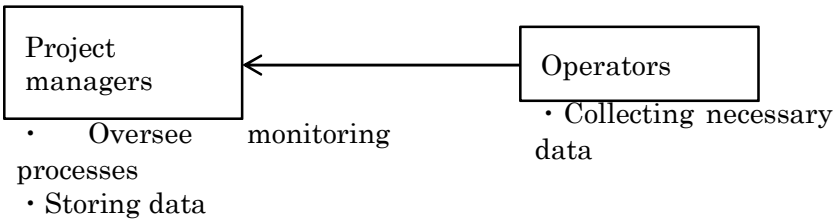


Figure: Monitoring structure

2. Results of surveys (on the project's profitability and financing) concerning the realization of the project (to be conducted)

2.1 Financing plan

The following tables show a breakdown of the estimated initial investment and maintenance costs.

Table 1: Initial investment costs

Item	Subitem	Subtotal(in JPY)	Total (in JPY)
Ⅰ Construction expenses	1. Civil engineering and construction cost	82,570,000	
	2. Machinery and equipment installation cost	72,900,000	
	3. Plumbing and pipe-fitting cost	16,900,000	
	4. Electrical instrumentation engineering expense	100,620,000	
	5. Logistics cost	2,880,000	
			275,870,000
Ⅱ Temporary construction facility and other expenses	1. Site management expenses	50,950,000	
	2. Engineering cost	35,450,000	
			86,400,000
Ⅲ General Administrative expenses		50,770,000	50,770,000
		Grand total	413,040,000

Table 2. Maintenance costs

Item	Amount (in JPY)	Remarks
Maintenance cost	5,000,000	
Labor cost	1,500,000	150 $ /M×7people
Total	6,500,000	

The site to be used for the project will also be provided by the project owners on the Lao PDR side.

2.2 Measuring, reporting, and verification (MRV) structure

Monitoring will be conducted by a joint venture company to be established by the project owners. Measuring, reporting, and verification (MRV) on the project will be done by a contracted third-party agency with a proven track record in conducting validation and verification works for CDM projects in Lao PDR.

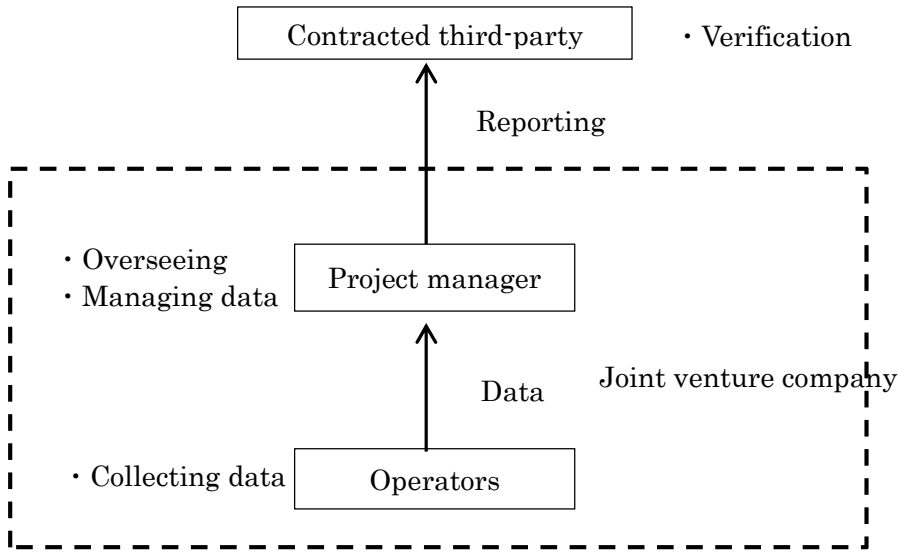


Figure: MRV structure

2.3 MRV structure

The following table shows the permits that need to be obtained from relevant local authorities in order to implement the project.

Table: Approvals to be obtained for the project

No.	Permit
1	Setting up a joint venture company
2	Environmental impact assessment
3	Construction permit
4	License of producing and selling liquid fertilizers

2.4 Introduction of Japanese technology

The Japanese technology to be introduced to the project has the following characteristics:

1. By putting the wastewater generated back to the methane fermentation process in the fermentation tank, the food garbage and organic waste can be fermented to produce methane as they are, without having to dilute the materials in the tank to adjust its density to an appropriate level. As a result, the amount of moisture in the tank will only be the amount originally contained in the materials, which will minimize generation of wastewater by the plant facility.
2. The speed of methane generation can be doubled by carrying out solubilization and methane generation processes separately. Through this, the capacity of a reaction tank will be reduced to less than half of the one used for the traditional technology and, therefore, the facility can be downsized. The cost for this technology will also be reduced to the half or less of that for the traditional technology.
3. By having the materials solubilized under a high-temperature condition and then go through high-speed methane fermentation under mesophilic condition, ammonia inhibition can be prevented.
4. Regarding fat and oil waste, over 90% or more of their fat and oil contents can be transformed into methane through installing a unique device specialized in dispersing oil and fat contents by using food waste or high-concentration sludge as a dispersing agent.
5. By combining the above-mentioned technology with the patented methane fermentation accelerating technology, a stable operation of methane fermentation fitting to the composition of food waste can be ensured.

Through the implementation of the project, Japan is expected to make the following contributions to the host country:

- Transferring its know-how for comprehensive waste management, including the sorting of garbage at source and the promotion of reduce, reuse, recycle (3R) practices.
- Transferring its techniques for maintaining the facilities.
- Providing the area's residents with employment and training opportunities.

In the meantime, it is important that the deployment of methane fermentation equipment as in this project shall not end in treating of organic waste alone, but shall be planned and implemented as part of a comprehensive waste management initiative of the project's subjected area (Vientiane City) that involves governmental agencies as well. To introduce and expand the use of methane fermentation equipment like the one to be deployed in this project, the target city has to have a policy and plan for comprehensive waste management. For this reason, Kyoto City is expected to provide guidance on waste management methods (garbage sorting, promotion of 3R practices) going forward.

2.5 Contributions to the host country

The project is expected to not only help reducing GHG emissions, but also make the following contributions to enable sustainable development in Lao PDR.

1. Help facilitate the use of renewable energy and resolve energy supply issues

The project will reduce the amount of methane released into atmosphere from the landfill by having the organic waste currently disposed in the landfill treated in the methane fermentation equipment, and supply heat as a replacement for LPG traditionally used as fuels by capturing biogas in the methane fermentation equipment and purifying it. Through this, the project aims to reduce GHG emissions.

2. Enhance waste management practices in cities and reduce the amount of solid waste

By implementing this project, it is possible to demonstrate a model of alternative waste management to the existing practice of transporting the generated waste and disposing in a landfill, thereby contributing to the enhancement of waste management and reduction in the amount of solid waste in cities.

3. Reduce the amount of waste transported and extend the landfill's life span

Through this project, organic waste that is currently disposed in KM32 will be treated in a methane fermentation facility to be installed within Vientiane City. This will shorten the distance of garbage transportation and reduce the amount of garbage disposed in the landfill, thereby helping to extend the life span of the landfill.

4. Introduce the new technology

In Lao PDR, equipment for treating solid waste using methane fermentation process like the one in this project have yet to take root. At present, most of the country's solid waste is disposed in landfills. In view of promoting waste reduction, the project's technology is expected to attract demand from many prospective customers.

5. Utilize financing provided by JCM

This project will generate energy from the waste currently disposed in a landfill and is also expected to contribute to reducing environmental impact on various fronts. In addition, the project is also likely to generate demand for the technology it uses. Considering these advantages, if the subsidy is awarded to the project through the JCM financing programme for equipment and thereby the financial plan becomes workable with reduced financial burden to the project owners in Lao PDR, the technologies used in the project will find greater demands.

2.6 Environmental contributions

By implementing the project, organic waste currently transported and disposed in a landfill will be treated in the methane fermentation facility located in Vientiane City. This will make it likely to reduce the generation of CO_2, NO_x, PM, and the like, compared with the amounts generated in the current practice of transporting and disposing the waste into the KM32 landfill. Other environmental contributions can be expected, such as cutting back on the amount of methane released into atmosphere and reducing the odor of decaying waste from the landfill.

2.7 Expected future actions and issues

1. Concerning the amount of collected organic waste

The survey was conducted this time for the sorted food waste collected mostly from businesses such as hotels and restaurants. However, the expected amount of waste from these sources is only about 5 tons per day, which will make it difficult to turn the project into a profitable business. Therefore, the working team will ask VUDDA, the agency in charge of garbage collection and transportation, to widen the area of collection. The project owners and VUDDA will conclude an MOU in this regard.

When the prospect of securing the required amount of resources (organic waste) becomes likely, the working team will consider starting discussions with the project owners again regarding the commercialization of the project.

Table: Profitability of the project as business (in JPY)

Item	Supply of biogas (purified)	Remarks
Initial investment cost	213,000,000 JPY	JCM Subsidy is 200,000,000 JPY
Maintenance cost	6,500,000JPY/year	Please show P38
Waste management cost	―	
Sales of liquid fertilizer	216,000 JPY/year	5 m^3/d×360d/y=1,800 m^3/y Liquid fertilizer sale unit ：1USD/ m^3=120 JPY/m^3 1,800 m^3/y×120 JPY / m^3＝216,000 JPY/y
Sales of biogas	25,110,000 JPY/year	5ton/d×150m^3/d=750 m^3/d （purified gas amount =750 m^3/d×0.6=450 m^3/d ） Gas sale unit：155 円/m^3（Please show※1） 450 m^3/d×155 円/m^3×360d/y=25,110,000 JPY/y
Annual revenue	25,326,000 JPY/year	
Amount of GHG emission reductions	263t-CO_2/year	➢ **Amount of GHG emission reductions from avoided landfill methane gas** Please show FOD model of p41 figure . ➢ **Replace fuel of LPG as Biogas** Because of using 15% biogas as plant heating, amount of biogas is 750m^3/d×0.85=637m^3/d Calorie of Biogas is 5,130kcal/m^3, on the other hands, Calorie of LPG is 26,493kcal/m^3. 637 m^3/d×5,130kcal/m^3÷26,493kcal/m^3 ＝123m^3/d CO_2 emission factor of LPG is 3.00kg-CO_2/L, Amount of CO_2 emission is 123m^3/d × 2.183kg/m^3 × 3.00kg-CO_2/L × 365d/y=294t-CO_2/y ➢ **Power consumption of methane fermentation facility**

		Power consumption of methane fermentation facility is 150 kWh/d, grid emission factor of Laos is 0.5764kg-CO_2/ kWh/d, Amount of CO_2 emission of power is 150kWh/d×0.5764kg-CO_2/ kWh/d×365d/y＝31t-CO_2/y ➢ **Amount of GHG emission reductions** is 294t-CO_2/y－31t-CO_2/y＝263t-CO_2/y

※1 Sales performance of LPG in Vientiane is 10,000JPY/50kg
Specific gravity of LPG is 1.55 kg/m^3
Sales unit of LPG :10,000 JPY÷(50kg÷1.55 kg/m3)＝310 JPY / m^3
Calories of methane gas is 11,000Kcal/ m^3, on the other hands, Calories of LPG is 23,673Kcal/ m^3.
So, we assumed that sales unit of methane gas is a half of LPG.

2. Discussing ways to utilize the liquid fertilizer

Discussions will be held regarding the mechanism to utilize the digestive fluid generated after the methane fermentation process in this project as liquid fertilizer to be used in farms.

Since Lao PDR has no experience in using digestive fluids generated from methane fermentation as liquid fertilize in the past, personnel from the Japan side will provide instruction on how to use it. On the Lao PDR side, the Department of Agricultural and Forestry Planning and Cooperation Section and National University of Laos (NUOL), Faculty of Agriculture, have agreed to collaborate in conducting field tests of the liquid fertilizer and in expanding its use.