FY 2019 Project for Ministry of the Environment, Japan

FY2019

City-to-City Collaboration Program for Low Carbon Society

Promotion Project of Low-carbon Regional Development in Sagaing Region

Project Report

March 2020

Mitsubishi Research Institute, Inc.

Fujita Corporation

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List of units and abbreviations

This report uses the following standardized units and abbreviations.

Units

t	Ton
kg	Kilogram
MW	Megawatt
kW	Kilowatt
kWh	Kilowatt hour
MPa	Megapascal
ha	Hectare
Km	Kilometers
m^2	Square meter
m^3	Cubic meter
t-CO_2	Carbon dioxide emissions (t)
kg-CO_2	Carbon dioxide emissions (kg)
MMK	Myanmar kyat
JPY	Japanese Yen

Abbreviations

ADB	Asian Development Bank
BTG	Boiler, Turbine, Generator
CDM	Clean Development Mechanism
COP	International Conference of the Parties
EIA	Environmental Impact Assessment
EIAP	Environmental Impact Assessment Procedure
EMP	Environmental Management Plan
EPC	Engineering, Procurement, Construction
FY	Fiscal Year
GHG	Greenhouse Gas
IEE	Initial Environment Examination
IFC	International Finance Corporation
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contributions
JCM	Joint Crediting Mechanism
JICA	Japan International Cooperation Agency
LDC	Least Developed Country
MALI	Ministry of Agriculture, Livestock and Irrigation
MAPCO	Myanmar Agribusiness Public Corporation
MIC	Myanmar Investment Commission
MIMU	Myanmar Information Management Unit
MRV	Measurement, Reporting and Verification
PV	Photovoltaics
SDGs	Sustainable Development Goals
SPC	Special Purpose Company

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Executive Summary

Through city-to-city cooperation, a sustainable, low carbon-generating city will be built using a new waste management system that will be developed in the Sagaing Region. In particular, institutional development (i.e., the development of a master plan, proposal of related institutional systems, and awareness building of the project) will be carried out. Correspondingly, the planning of a low-carbon waste management system using locally available materials will also take place. In addition, a step-by-step approach to improve the regional waste management system, such as a rice husk power generation system, separation of urban waste, and an appropriate waste treatment system will be considered.

Challenges and basic policies discussed through policy dialogue

Challenges:

In the state capital of Monywa, the disposal of municipal solid waste has become a major issue, as waste has been increasing in parallel with economic development. Currently, solid waste is disposed of in a landfill. More sites are needed to accommodate an increasing amount of solid waste. However, the local community opposes an increase in the number of landfill sites.

The Japanese government has the necessary experience and knowledge about solving this issue of increasing urban waste. It advocates the method of incineration for waste disposal as opposed to dumping it in a landfill. It also promotes the 3Rs (reduce, reuse, and recycle) to reduce the amount of waste. Segregation of waste is one of the most important elements for the promotion of the 3Rs. Raising awareness about recycling among citizens and environmental education at schools play an important role in waste reduction. The project is expected to draw on the experience, technology, and knowledge of local governments and waste disposal companies in Japan.

Basic policy:

The Monywa Development Committee is taking a progressive approach to garbage collection in urban areas in the form of periodic collections by patrolling collection vehicles, collections at home bases, collections at markets, etc. In addition, based on the knowledge obtained through the city-to-city cooperation and waste separation projects at Fukushima, pilot projects for waste separation were launched, and an educational pamphlet designed for environmental education at elementary schools in the city.

First, the pilot projects for volume reduction of the waste at the final disposal sites and biomass gasification in the market will be implemented. Successful examples of efforts to make projects sustainable and test the introduction of related policies will be conceived. Simultaneously, we will expand our efforts to raise awareness about the importance of waste segregation and promote environmental education at homes and

businesses. Over the medium to long term, the government will take drastic measures regarding recycling and incineration. It will aim to solve the issue of securing funds and will create a system for effective waste treatment. The government will promote recycling as a business and introduce the principle of an individual emitter's duty.

As the district is one of the largest agricultural areas in Myanmar, it is necessary to concretize the project of rice husk power generation that is being promoted in the Ayeyarwady region.

Implementation of basic policies:

A. It was decided that the formulation of a master plan for city-to-city cooperation would be carried out in the near future.

Key components of the plan:

1) Securing funds for solving issues regarding the implementation of different waste disposal techniques like volume reduction in existing landfills, biomass gasification at markets, and incineration treatments.

2) Raising awareness about the importance of waste segregation by households and businesses by distributing educational pamphlets in addition to developing measures for further expanding the aims of the project.

3) Environmental education of the citizens (work is underway on the regional side, and cooperation with the Fukushima side is sought).

B. For the rice husk power generation system, the basic plan for the project (3.6 MW) was formulated and candidate sites were selected in the Shwebo district. The project scheme will be implemented in the near future. For the procurement of rice husks, a new company will be formed by rice milling companies in the vicinity of the candidate sites of a power generation project. The new company will manage the procurement of the necessary amount of rice husks. Regarding the project entities, a plan to form an SPC between Myanmar and Japanese companies will be carried out.

1. Objectives and outline of implementation

1.1 Project objective

All countries attended the 21st International Conference of the Parties (COP21) on the United Nations Framework Convention on Climate Change held in December 2015 in Paris, France. They adopted the Paris Agreement, a legal framework of equitable and effective measures against climate change from 2020 onward. Subsequently, at the COP 24 held in Katowice, Poland, in December 2018, a rulebook was adopted setting out specific obligations of each country from 2020.

COP21 decided that the activities of non-state entities including cities must be grasped, and that the efforts of all nongovernmental entities (cities and other local public bodies) are appreciated and their scale-up must be promoted.

A city is the place of activities that support the development of society and economy. Many people live there. About 50% of the world population live in cities, the area of which is less than 2% of that of all lands in the world. The ratio is anticipated to increase up to 70% by 2050. As it is estimated that more than 70% of CO2 emissions in the world were from cities in 2006, the role that cities play in mitigating climate change is great. For achieving the goal of Paris Agreement, it is important to implement measures against climate change steadily in urban areas to reduce emissions of greenhouse gas.

In this project, Japanese research institutes, private companies and universities as well as Japanese municipalities having experience regarding the formation of a low-carbon society supported such formation of circulating and ecological economy in Sagaing based on city-to-city cooperation.

1.2 Study items

Based on the background and objective, institutional development (e.g. development of master plan, proposal of related institutional system, and awareness building), step-by-step approach of regional waste management such as rice husks power generation system, separation of urban waste, and appropriate waste treatment system were examined for building the Low-Carbon and Sustainable City using a new waste management system in Sagaing Region. In particular. This research surveyed the following items.

(1) Overview of the area and finding regional issues in waste management

(2) Examination of project feasibility and deployment measures

(3) Examination of concrete support measures through city-to-city cooperation

(4) Local surveys, workshops and other meetings

1.3 Outline of implementation

The research was conducted by Mitsubishi Research Institute (MRI) as the representative, cooperating with Fujita, its research partner, Fukushima City, and Fukushima Chamber of Commerce and Industry Companies. The research was conducted in coordination with Sagaing Region government.

<Roles of entities from Japan>

Mitsubishi Research Institute, with its rich experiences in policy implementation, planning, and JCM research for the Japanese national and municipal government, collected relevant information, managed workshops, considered measures for forming JCM projects, and supported policy dialogue between Fukushima City and the local government (Sagaing Region), in addition to its role of the overall project management.

Fujita Corporation, with its knowledge and experiences in industrial, urban, and regional development, considered possibilities for specific project formulation (rice husk power plant).

Fukushima City had policy dialogue with the officials of the local government to discuss policy-side approach for low-carbon, environmentally friendly regional development, introducing its experiences in establishing waste treatment plans, renewable promotion plans, and raising environmental consciousness (e.g. educational programs at school). Department of environment served as the main counterpart from Fukushima City.

Fukushima Chamber of Commerce and Industry Companies cooperated with its member companies to introduce their technologies and know-how in businesses, and to investigate possibilities in transferring technologies of companies from Fukushima City.

<Roles of entities from Myanmar >

The Sagaing Regional government contributed, including the Minister in charge of the environment issue as the head and with the participation of officials from relevant departments. In the study of municipal waste in Monywa, the state capital, the study was carried out with the cooperation of the Monywa Development Committee.

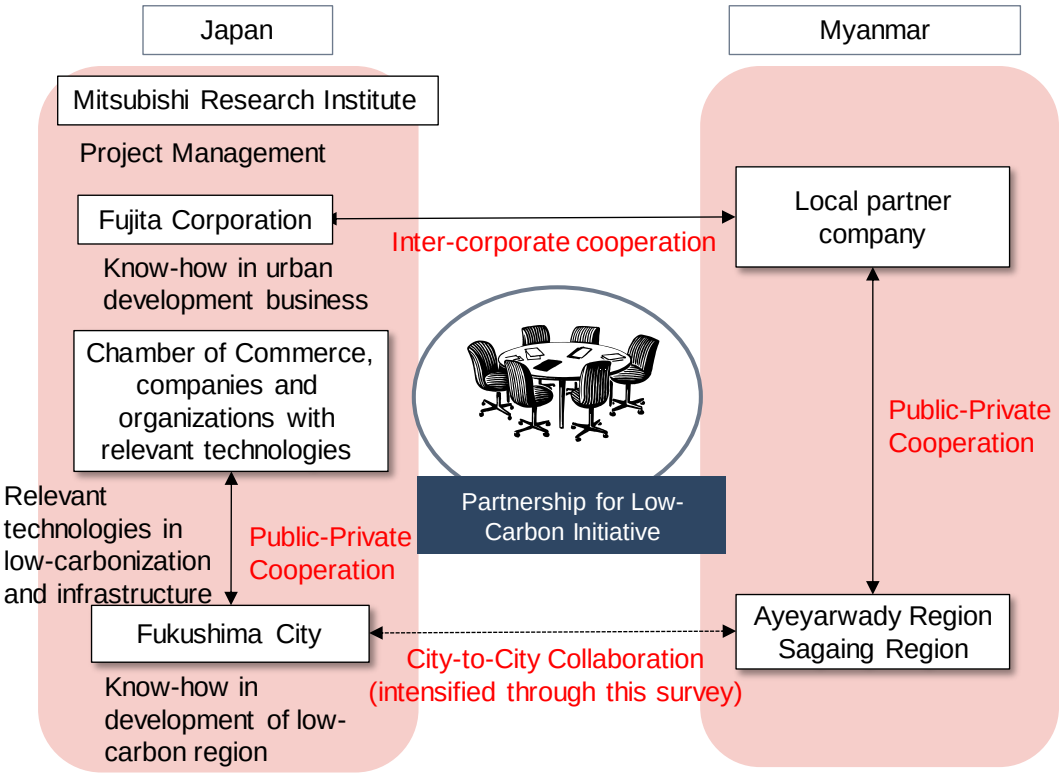


Figure 1-1 Organizational structure

1.4 Overview of city-to-city cooperation

Ayeyarwady Region, which is the main product region of rice, is concerned with work of clearing off large amounts of rice husks (in rice cropping districts, the largest amount of waste is rice husks).

As economy grows, addressing power shortages and emerging environment problems (waste, water preservation, etc.) became the most important issue in local cities in Myanmar.

Establishment of low-carbon, environmentally-friendly industrial zone is expected by applying the experiences of Japanese municipalities and companies. Additionally, such unique regional development is important for attracting businesses and promoting the industrial sector.

Myanmar has high expectations for Japanese experiences and technologies which have undergone rapid economic growth in the past. When the Chief Minister of Ayeyarwady Region visited Japan towards the end of April 2015, he learned about the activities related to energy efficiency and renewable energy in Fukushima City. Then, in June of the same year, the Chief Minister sent an official letter of intent to the Mayor of Fukushima City asking for support and cooperation in the development of Pathein Industrial City (letter asking for support and cooperation for the creation of a sustainable low-carbon city under an inter-city cooperation scheme).

In response to such a request for support and cooperation, Fukushima City, the Fukushima Chamber of Commerce and Industry, Mitsubishi Research Institute, and Fujita Corporation jointly established a partnership called the “Partnership for a Low-Carbon Initiative in Ayeyarwady” as a platform for city-to-city collaboration, and decided to perform activities for such purpose. In FY 2015, the Partnership held workshops in Pathein City in Ayeyarwady Region as well as in Fukushima City, conducted field surveys and made policy dialogues, and examined the possibilities of developing a project applicable to the subsidies under JCM Scheme. And furthermore in February 2016, when government officials of Fukushima City visited the site in Ayeyarwady Region, they handed the Chief Minister of the Region a letter from the Mayor of Fukushima City responding to the request for support and cooperation, and expressed Fukushima City’s willingness to cooperate with Ayeyarwady Region not only in the sectors of renewable energy and waste treatment but also in various important matters such as the formulation of a master plan, based on Fukushima City’s experience hitherto so as to achieve a sustainable, resilient, and low-carbon society in Pathein City.

<Past Activities>

June 2015	Chief Executive of Ayeyarwady Region made a request to Mayor of Fukushima City for cooperation.
October 2015	Relevant parties of Ayeyarwady Region visited Fukushima City.
February 2016	Relevant parties of Fukushima City (Deputy Director of Environment Division, etc.) visited Ayeyarwady and hand over a reply letter of Mayor of Fukushima City regarding the request to the responsible Minister of Ayeyarwady Region.
September 2016	Workshop in Ayeyarwady (attendance of Chief Executive of the region)
October 2016	Director of Urban Development Bureau of Ayeyarwady Region, etc., visited Fukushima City.
January 2017	Discussion on the direction of project expansion at WS in Ayeyarwady (attendee: responsible Minister of Ayeyarwady Region, Chief of Environment Section of Fukushima City, etc.)

With such background, central government officials, in discussions for policy development regarding local distributed power supply system, asked MAPCO to consider expanding the first JCM project in Myanmar for rice husk power plant (Myaung Mya project, by Fujita and MAPCO) in other areas from Ayeyarwady Region; Sagaing Region (Shwebo District in particular) was proposed as a specific candidate project site.

MAPCO conducted its own local survey, and Fujita Corporation conducted preparatory survey in June. Afterwards, request for constructive development support under collaboration between Sagaing Region and Ayeyarwady Region was proposed (as an official letter from the regional minister to mayor of Fukushima City). The letter consisted of following requests:

- Promoting measures for waste treatment system (including local rice husk power plant project)
- Promoting micro-grid systems utilizing local renewable energy sources

As a result of discussion between Fukushima City and Fukushima Chamber of Commerce, it was decided that activities under Partnership for Low-Carbon Initiative in Ayeyarwady would be expanded to inter-regional collaboration between Sagaing Region as well.

FY2017

July 2017	Responsible Minister of Ayeyarwady Region made a request to Mayor of Fukushima City for cooperation for development under collaboration of Sagaing and Ayeyarwady Regions.
September 2017	Workshop in Sagaing Region (in Monywa City, Sagaing Region with attendance of the Chief Minister of the region)
February 2018	Workshop in Ayeyarwady
February 2018	Discussions in Fukushima City
March 2018	Reporting of city-to-city collaboration activities (Nay Pyi Taw)

FY2018

July 2018,	The first meeting to share the year's activities among concerned parties and to start this project in Fukushima.
October 2018	Fukushima Program with officials in Ayeyarwady region and Sagaing region. We also participated the city-to-city seminar in Tokyo.
January 2019	Local workshops and field surveys in Yangon, Myanmar.
February 2019	The second meeting to share the year's activities among concerned parties and discussed further activity of city-to-city collaboration.

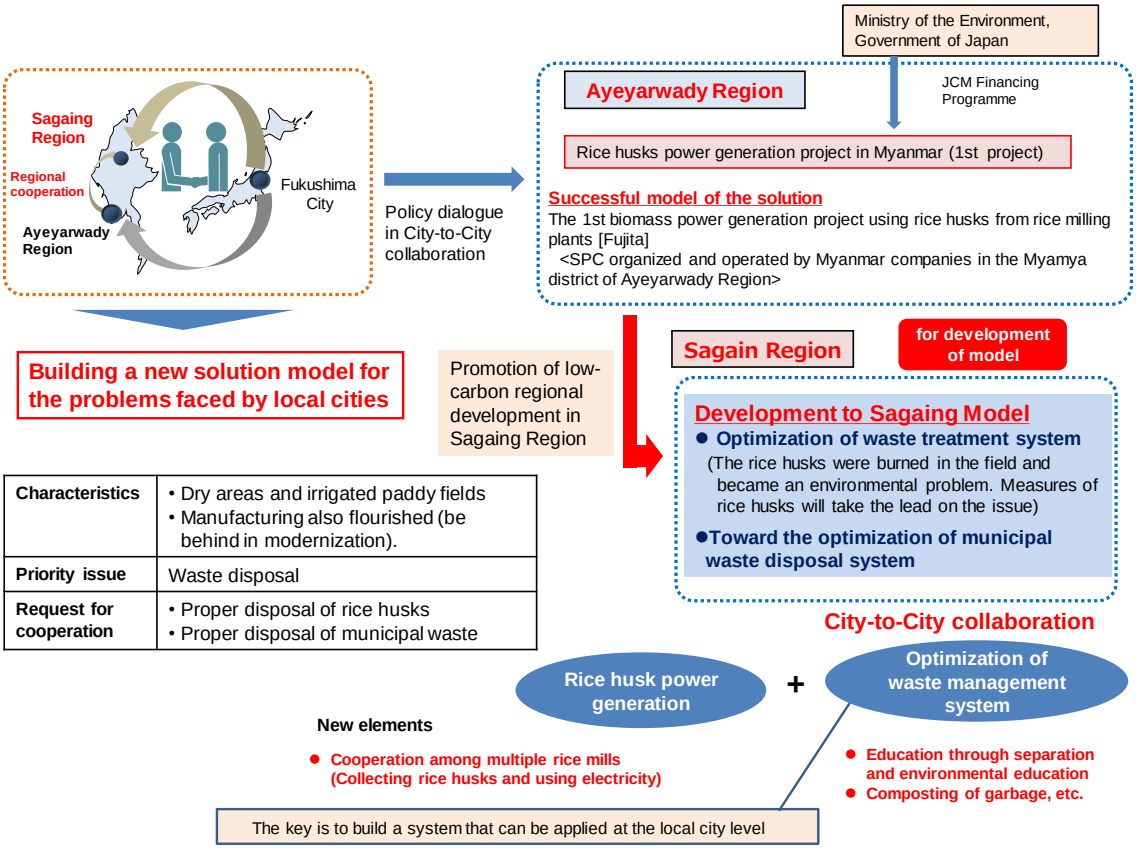
<Activities conducted this year>

- July 2019: Field survey, and workshop (in Monywa)
- July 2019: Meeting in Fukushima City
- November 2019: Field survey, and workshop (in Monywa)
- January, 2020: Invitation Program in Fukushima City

  (Joint implementation with studies of Ayeyarwady and Sagaing Regions)
- February 2020: Field survey and Workshop (in Nay Pyi Taw)

  (Joint implementation with studies of Ayeyarwady and Sagaing Regions)
- February, 2020: Review meeting (in Fukushima city)

  (Joint implementation with studies of Ayeyarwady and Sagaing Regions)



Characteristics	• Dry areas and irrigated paddy fields • Manufacturing also flourished (be behind in modernization).
Priority issue	Waste disposal
Request for cooperation	• Proper disposal of rice husks • Proper disposal of municipal waste

Figure 1-2 Overall of study

Table 1-1 Overall of study plan

<table>
<tr><td>Future direction of development</td><td colspan="3">・ Sagaing Region has major rice-growing areas in Myanmar and has the same problems dealing with rice husks as Ayeyarwady Region (Burned in the open, even more serious).

・ Support will be provided for the first project, the rice husk power generation project in Myaung Mya (Opened in April 2019), to be implemented in Sagaing Region (1st project at Sagaing Region).

・ There was a limit to how much can be dealt with at the final disposal site of municipal solid waste, and there was a strong desire to find a solution through intercity cooperation with Japan. There was a great interest in the fields of sorting, environmental education, and disposal technology, where short-term efforts could be made. In addition, based on the fact that there was a great deal of interest in the medium- to long-term direction of development (development direction based on the characteristics of local cities). It was intended to draw on its experience as a regional city in Fukushima City), and to support the creation of a framework for urban waste countermeasures (Example: Roadmap development).</td></tr>
<tr><td rowspan="2">Concrete plan for future development</td><td>Feasibility study</td><td colspan="2">Study of implementation of rice husk power generation project in district (Consideration of commercialization, prioritization, reorganization of rice mills, enhancement of competitiveness of rice industry, development roadmap, etc.)</td></tr>
<tr><td>Discussions utilizing dialogue and exchange through city-to-city cooperation</td><td colspan="2">•Support will be provided for the creation of a framework for urban waste measures (Ex. Roadmap development), with a focus on the promotion of sorting and disposal within reach (Ex. Composting, etc.).

•Recognizing the importance of raising awareness of waste in local communities, we will collaborate on environmental education as a first step to firmly establish waste separation (Cooperation in environmental education between Myanmar and Fukushima City, etc.).</td></tr>
<tr><td rowspan="4">Annual plan</td><td>Year</td><td>Rice hull power generation project</td><td>Establishment of waste management and systems</td></tr>
<tr><td>FY2019</td><td>Consideration of roadmap (identify business modes)

Materialization of the project</td><td>• Consideration of roadmap for waste disposal (finding of key components)
• Awareness raising (utilization of school education)</td></tr>
<tr><td>FY2020</td><td>Implementation of projects (detailed examination)</td><td>• Trial sorting and problem extraction
• Planning and examination of treatment business
• Awareness raising (Expansion to citizens and businesses)</td></tr>
<tr><td>FY2021</td><td>・JCM Application

・Consideration of measures for further lateral deployment</td><td>• Improvement and expansion of sorting
• Implementation of the treatment business
• Awareness raising (Expansion to citizens and businesses)</td></tr>
</table>

2. Overview of the area and finding the regional issues

2.1 Overview of the area

In this section, the socio-economic situation of Sagaing Region and Monywa and Shwebo Districts is described.

Sagaing Region is the second largest region in Myanmar (the largest is Shan). The regional capital is located along the Ayeyarwady River. According to “The 2014 Myanmar Housing and Population Census, Sagaing Region”, the region has an area of approximately 93,700 km^2, with 9 districts, 45 townships. The population is a little more than 5 million; its composition does not differ much from that of the whole country, and an increasing trend in population can be seen.

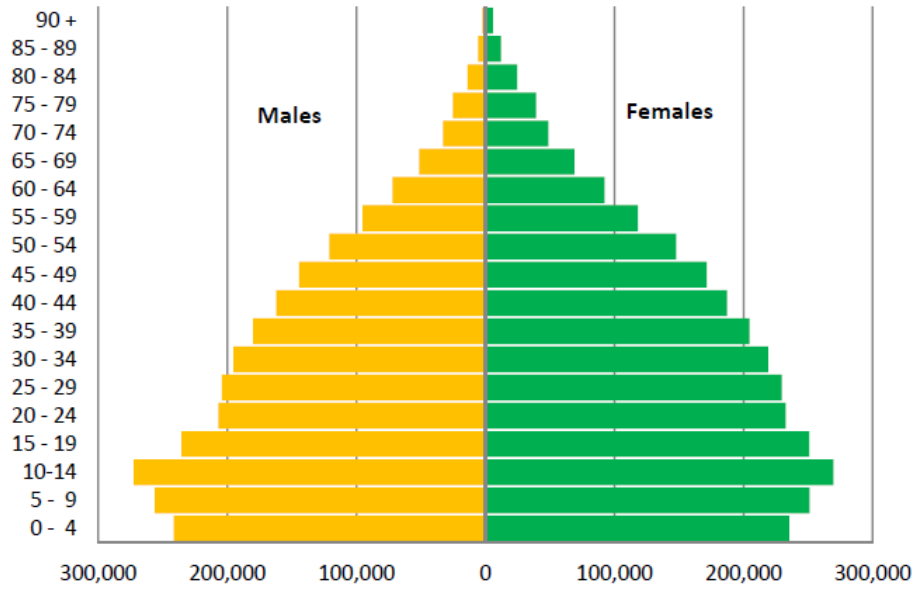


Figure 2-1 Population pyramid in Sagaing Region

Source) Department of Population, Ministry of Immigration and Population “The 2014 Myanmar Housing and Population Census: Sagaing Region”, (p12)

https://themimu.info/node/54035
(Last accessed: 28 February 2020)

As there are two main rivers in the region (Ayeyarwady River and Chindwin River), the main industry of the region is rice milling, but production of other grain products is rich as well. Aside from agriculture, the region is blessed with natural resources such as gold, coal, and oil; therefore, the living standard of the region is relatively high compared with the whole country. However, it is important to note that a large difference in living standards remains in the region; the southern part with plain field is more developed, while the mountainous northern region faces serious poverty issues.

The total popuration of Monywa District is about 757 thousand. Monywa city which in main city in Monywa District has about 372 thousand population. Shwebo District, which is the candidate district for the project (rice husk power generation), is the most populated district within the region, with population of approximately 1.4 million population (refer to the table below).

Table 2-1 Population of Sagaing (Region and districts)

Region/District	Population (thousand)
Sagaing (Overall)	5,325
Sagaing	521
Shwebo	**1,433**
Monywa	**757**
Katha	861
Kalay	509
Tamu	115
Mawlaik	164
Hkamti	423
Yinmarpin	542

Source) Department of Population, Ministry of Immigration and Population “The 2014 Myanmar Housing and Population Census: Sagaing Region”

https://themimu.info/node/54035
(Last accessed: 28 February 2020)

Monywa and Shwebo districts within Sagaing Region

Figure 2-2 Map of Sagaing Region

Source) Department of Population, Ministry of Immigration and Population “The 2014 Myanmar Housing and Population Census: Sagaing Region”

https://themimu.info/node/54035
(Last accessed: 28 February 2020)

Shwebo District is one of the foremost areas in Sagaing Region for rice production; agriculture with a focus on grain production is popular. The district focuses on its high-brand rice, “Shwebo Paw San”, in particular. The production of agricultural product in Shwebo is shown below.

(Reference) Overview of Saging Region

Number of Districts	9
Number of Townships/Sub-Townships	45
Total Population	5,325,347
Population Male	2,516,949 (47.26%)
Population Female	2,808,398 (52.74%)
Percentage of urban population	17%
Area (Km2)	93,702.48
Population density (per Km2)	56.8
Median age	27.4
Number of private households	1,096,857
Percentage of households urban	16.8%
Percentage of female headed households	24.8%
Mean household size	4.6

Source) Department of Population, Ministry of Immigration and Population “The 2014 Myanmar Housing and Population Census: Sagaing Region”

https://themimu.info/node/54035

(Last accessed: 28 February 2020)

2.2 Regional trend

There are two major environmental issues in Sagaing Region. One is the problem of proper disposal of large amounts of rice husks, which have been generated in the past, and the other is the problem of proper disposal of municipal waste, which is rapidly increasing with economic development. These two challenges are common to many Myanmar cities and regions, although of some severity.

The problem of municipal solid waste in Myanmar is also a serious problem in Yangon. The capital of Sagaing Province, Monywa, is a provincial city of about 370,000 people and is the 6th city in Myanmar, which accounts for less than 1/10 of Yangon's population.

Monywa is not a big city like Yangon, and the daily amount of municipal waste generated is less than 300 tons, which is the profit base for incineration power generation facilities, which are generally said to generate daily amounts of municipal waste. However, in Southeast Asia, all countries except the capital seem to be of a similar size, and it is hoped that if measures can be established to properly dispose and dispose of municipal solid waste in Monywa, it will be possible to spread the concept to other cities in Myanmar as well as Southeast Asia.

Regarding the issue of municipal solid waste in Monywa, the following directions have been arranged through policy dialogues to date.

The issue of municipal solid waste was largely divided into the issue of municipal solid waste and the issue of rice husks, and the issue of municipal solid waste was divided into the issue of the present final landfill and the issue of the introduction of waste incineration facilities in the future, and goals for three years were set for each of these issues.

Table 2-2 Challenges and direction

2019			2020			2021		
1st year			**2nd year**			**3rd year**		
Research the amount of household waste generated Research the composition of household waste	⇒	Idea	・Trial production of composter ・Experimental operation	⇒	Examination of securing of budget and spread method	Spread	⇒	Deploy to other areas
Research the amount of market waste generated Research the composition of market waste generated	⇒	Idea	Design & Planning for Composting equipment	⇒	Examination of securing of budget	Construction	⇒	Deploy to other areas
Research the amount of landfill waste Research the composition of landfill waste	⇒	Idea	Design & Planning for Screening equipment	⇒	Examination of securing of budget	Phased implementation	⇒	Deploy to other areas
							⇒	Basic plan of waste power generation facility
Rice Husk Power Generation (Basic Plan)			Basic Design			JCM entry		

Basic approach to municipal waste management

(Challenges in Monywa)

Currently, a major environmental issue is that the municipal waste will not be properly disposed of.

Municipal waste in administrative districts is collected by the government and transported to five final disposal sites via intermediate treatment plants. The disposal method is not landfill but so-called " waste heap". Therefore, the claims of the residents in the surrounding area are increasing day by day due to "odr", "fire", etc. Due in part to this, it has become impossible to secure new disposal sites in administrative districts.

(Basic policy for problem solving)

It was decided to devise a three-year plan by dividing it into two methods of treatment and disposal of newly generated municipal waste and life extension and regeneration of existing final disposal sites. Monywa aims to be a top model for municipal waste management in Myanmar. Therefore, the plan was made to adapt the experience of Japan, especially Fukushima, to the actual situation of Monywa.

Activities of separation of waste at the market in Monywa

Activities of environmental education in basic primary school

Source) Presentation by Sagaing Region development affairs committee at the workshop (Feb. 2020)

3. Project feasibility study

3.1 Urban waste treatment in Monywa

(1) Treatment and disposal of newly generated municipal waste

The plan is based on the premise that the city will eventually introduce a power generation system using municipal waste incineration. Therefore, in order to increase calories as much as possible, it is planned to treat garbage separately. There are two types of garbage generated in administrative districts: household and market.

Household Kitchen Garbage: Urban areas Divides the method into areas where households do not have gardens and peripheral areas where there are gardens or small fields nearby.

Neighborhood area households: Use plastic or wooden composters for in-house treatment. In Japan, local governments provide subsidies for the purchase of land. This not only increases the calories of the waste put into the incinerator, but also reduces collection costs. The problem lies in the enlightenment activity to the inhabitant including the proper usage of the poster.

Urban area households: collect only food waste separately and treat it with organic waste from the market. The biggest challenge is to educate local residents. The establishment of a specific collection system, including collection vehicles, will also be an issue.

1) Organic waste in the market

It seems relatively easy to separate and discharge only organic wastes. There are two types of garbage disposal methods: "composting" and "methane fermentation treatment". Although both are microbial reactions, the composting process is aerobic and the methane fermentation process is anaerobic, both of which require a sufficient amount of oxygen. In addition, the composting process and the methane fermentation process are aerobic and anaerobic, respectively, and there are differences in the direction in which fertilizer components are actively produced and in the method in which heat and electricity are produced and the residue is used as fertilizer.

(Basic direction)

For households in urban areas where composters cannot be used, food waste from restaurants and markets should be collected by the government as before. It is considered that a certain charge should be made as a principle of cost burden of the emitter.

(Consideration of treatment methods)

Two methods can be considered roughly. One is composting by aerobic fermentation

and the other is treatment by anaerobic fermentation.

<Composting>

Types of Composting Facilities by Aerobic Fermentation are four methods. In the case of the region, "Non-Ventilation type Composting facility" is considered appropriate in view of low personnel costs and costs. However, if the initial fermentation is not successful, there is a high possibility that a bad smell will be generated, so sufficient consideration should be given to the construction site.

<Biogas power generation>

The principle of biogas power generation is that organic matter is produced under anaerobic conditions (Circumstances where air is blocked) to generate combustible methane gas, which is used as fuel for power generation. There are three methods of methane fermentation. It is divided into two types according to the difference in organic matter concentration. One is the wet fermentation method, in which the solid content is adjusted to around 10%, and the other is the dry fermentation method, in which the solid content is adjusted to around 15 ~ 40%. The dry fermentation system has a higher solid content and therefore a smaller reactor capacity. However, fermentation at high temperature (Around 55 degree Celsius is necessary, and cost-effectiveness must be examined.

There are two types of fermentation methods depending on the reaction temperature, a medium temperature fermentation method at around 35 degree Celsius and a high temperature fermentation method at around 55 degree Celsius. The high-temperature fermentation method has the advantage that the reaction time is shorter and the volume of the fermenter is smaller because the reaction activity is higher. On the other hand, energy is required to maintain high temperatures, and cost-effectiveness must be determined.

Since the wet medium temperature fermentation method is the most widely used method, medium temperature fermentation will be used in this project.

Table 3-1 Classification of methane fermentation

Type of fermentation	Wet type fermentation		Dry type fermentation
	middle-temperature fermentation	high-temperature fermentation	
Overview	Solid content: about 10% Fermentation temperature: About 35 degree Celsius	Solid content: about 10% Fermentation temperature: About 55 degree Celsius	Solid content: about 15 ~ 40% Fermentation temperature: About 55 degree Celsius

Methane fermentation is a method to decompose organic matter into methane, carbon

dioxide, etc., in an atmosphere where air is shut off. Methane generated in this process occupies about 60% of generated gas, and it is possible to generate electricity by gas turbine.

The decomposition residue can be directly sprayed on farmland as a slurry or can be returned to farmland by solid-liquid separation. If farmland cannot be returned to farmland, processing and disposal of slurry requires additional costs.

<Comparison of composting and methane fermentation>

In general, methane fermentation is expensive to build, although it depends on the type of organic material being treated and the conditions at which it is built. Therefore, it is generally unsuitable for small-scale treatment.

The biggest difference is that methane fermentation can produce electricity and heat. Both composting and methane fermentation produce fertilizers. It is necessary to consider business feasibility by taking into account local needs, local users, price levels, etc.

> The electrification rate of Sagaing Region is higher than that of the south part of Myanmar, such as Ayeyarwady Region. It is pointed out that the treatment and disposal of municipal waste is an issue of concern rather than increasing the current electrification rate.

There is another fundamental difference in facility planning. There is no significant difference between the facility planning stage and the actual operation of composting facilities, as long as the type and amount of organic matter to be treated are roughly known. It is also relatively easy to follow changes in the quality and quantity of organic matter.

However, when methane fermentation is carried out at the facility planning stage without sufficient understanding of the amount and calories of organic substances to be treated, it often becomes trouble at the operation stage. Although the gas holder serves as a buffer to some extent, the amount of organic matter that can be treated is relatively often varied depending on the capacity of the fermenter and the capacity of the generator.

In this FS, however, we decided to study methane fermentation. This is due to the following reasons.

- Construction and operation of the composting facility was determined to be possible by engineers from the current Sagaing Region and City Development Department.
- There is no well-conducted methane fermentation in Myanmar.

(Biogas power generation specifications)

The specifications of biogas power generation are shown in the table below. Operation

is relatively simple and controlled by pH and temperature. In most cases, except for raw materials with very low pH, the pH is within the specified range. The temperature can be easily kept constant by installing hot water pipes inside or outside the fermenter. In Myanmar, temperatures are relatively high, so adjusting temperatures before adding raw materials to the fermenter may keep the temperature within the specified range.

The biogas generated contains H_2S, which damages the gas engine and must be removed. There are wet desulfurization (biological desulphurisation) using sulfur bacteria and dry desulfurization using iron oxide. Wet desulfurization is cheaper, but there are some unstable parts.

Area of land required

Land area	300	m2

Raw materials required

Input requirement

Food waste	12	tons/day
Ferric oxide	2.5	kg/day
DM water	10	L/day

Methane Fermentation Conditions

Fermenter Condition

Solid content	12-15	%
pH	7-8	
Temperature	37	Degree C

Composition of fermentation gas

Raw biogas

Biogas	1,440	m3/day
CH4	55-60	%
CO2	40-35	%
O2	0.1-5	%
H2S	1.5	%
Temperature	30-35	Degree C
Outlet pressure	100	mbar

Gas composition after desulfurization

Treated biogas

H2S	<100	ppm
Pressure	150-200	mbar

Scale of power generation

Generation of power

Pawer generation	100	kW
Self use	10	kW
Selling pawer	90	kW

Byproducts

Production

Manure	10.5	m3/day
Pure Sulphur	50	kg/day

(Waste composition in Monywa market)

The composition of municipal waste in Monywa is shown.

Table 3-2 Waste composition in Monywa

	Rate	t/day
Kitchen rubbish	40%	
Plant rubbish	10%	
Tin and bottle rubbish	5%	
Paper rubbish	6%	
Zinc, aluminum rubbish	5%	
Cork rubbish	2%	
Unused clothes	2%	
Plastic rubbish	20%	
Meat and fish rubbish	6%	10.11
Basket rubbish	3%	
Piece of wood	1%	

Monywa's markets are generating about 10 tonnes of meat and fish waste, according to Monywa City Development Committee. The remaining 2 tons of household food waste will cover the necessary amount of raw materials. Current data, however, do not provide sufficient numbers of calories for microbial fermentation. Since it is not possible to measure the calories of raw materials in Myanmar, further analysis of the composition of each waste will be conducted and databases from Japan and neighboring countries will be used.

The rated output of the generator is 100 kW. Excluding 10 kW of on-site power consumption, 90 kW can be sold, and 2,160 kWh/day can be sold in 1 day. If the unit price of electricity sold is 100 MMK/kWh, a revenue of 216,000 MMK/day can be obtained.

In the detailed planning stage, it is necessary to investigate the composition of waste in more detail. It is also necessary to develop a plan that includes the municipal solid waste management policy and the emitters' share of the processing costs.

2) Separate collection of incombustible waste

The first priority is to create a system to collect incombustible materials separately from combustible materials, and to separate items with "taker" and “without taker”. At present, those “without taker" are rubble, brick scrap, china waste, and scrap glass cullet. Of these, debris, brick waste, and ceramic waste are crushed and used for roadbed.

(2) Method for extending life and regenerating existing final disposal site

Since new disposal sites cannot be secured, the basic policy is to reduce the volume. The principle of volume reduction is separation. Of the five disposal sites, some have been covered with soil and now have shrubs and grasses. Various types of municipal solid waste are brought to disposal sites, but biodegradation of organic waste, mainly household garbage, seems to be progressing.

First, they should be separated and used as farmland soil. The natural soil around Monywa is not always fertile. Fractional soils, which decompose organic matter and are rich in plant nutrients, are highly beneficial both as potted soil for seedling production and as direct farmland reduction.

After the fractionated soil is separated, "plastics" and "incombustible" such as glass, metal, and pottery are left. These are also separated. Classification is based on the principle that only items "with taker" exist. If there is no one to take care of it, there is no point in discriminating.

The basic equipment that can do this is large sieving equipment such as a trommel and a sorting conveyor. Separate the soil with a trommel. In this case, the plastics can be sorted by installing a wind sorting facility. The material "with taker" on the conveyor is then separated by hand. Metals of steel can be separated by installing magnetic separation equipment. The following items are considered to be hand-sorted on a conveyor and "with taker" is assumed.

- Steels: as raw materials for steel
- Glasses: as raw material for bottles (Bottles are basically reused.)
- Aluminum: as raw material
- Large wood: as household fuel
- Plastics wind-sorted by a trommel are compressed and packed by a baler to be used as fuel for boilers and the like.

Those "without taker" are returned to their original disposal sites. In this way, the five disposal sites are regenerated sequentially. For this purpose, a small-scale prior component survey is essential. What and how much waste is included? Based on the results, it is possible to predict the scale of equipment and the regeneration period.

(Challenges)

In Myanmar, there is almost no equipment necessary for the above separation work. We have to depend on imports. Some can be adapted by processing existing equipment, but most must rely on imports. It would be too expensive to equip cities with these large machines. There are also financial challenges.

This issue is common to all cities in Myanmar, and there are plans to share it among neighboring cities as a federal government issue.

(Consideration of treatment methods)

Facilities and equipment necessary for the regeneration of final disposal sites include trommel, wind separator, magnetic separator, etc. These facilities and equipment shall be portable.

Regeneration process of municipal solid waste final disposal site (Proposed)

The work will be carried out in chronological order.

Process plan

1) Use a shovel to loosen up

2) Filter landfilled waste with trommel

3) The fraction that passes through the sieve (soil) is reduced to agricultural land

4) The residue on the trommel is sorted by wind sorting, magnetic sorting, and manual sorting.

The sorted waste is disposed of as follows.

Plastics are packaged with a baler (compression packing machine), stored temporarily, and incinerated after completion of an incineration power generation facility.

Steel and aluminum products are sold to dealers.

Glass products will be sold to glass factories.

The rubble will be used as road infrastructure or landfilled as final waste.

3.2 JCM project formulation

Promising technology for low-carbon waste treatment system would be rice husk power generation technology. As already mentioned, Shwebo District in Sagaing Region is an agricultural area, with rich generation of rice husks. In fact, the largest waste generated in Shwebo District is rice husks, and their inappropriate treatment is leading to environmental pollution, raising needs for their utilization. Even compared with Ayeyarwady Region, rice husks are burnt open-air on a large scale, posing more serious problems in Sagaing Region in particular.

Feasible JCM project for low-carbon waste treatment system (rice husk power plant) in Shwebo District, Sagaing Region, along with its candidate site and applied technology, is considered.

3.2.1 Project overview

A Japanese company and a Myanmar company will form an SPC as a power generation facility to be constructed at an industrial park and a rice milling plant in the Shwebo district of Sagaing Region, with the aim of early commencement of a 3.6 MW biomass power generation project using rice husks as a raw material.

3.2.2 Project site

The industrial zone complex in the Shwebo District was examined as an execution place of this project.

(Industrial zone in Shwebo District)

Of the 357 sections in the industrial zone, 80% are already occupied with factories, of which half are rice mills (rice mills accumulation area). There is a large amount of unused rice husks generated in the area. Power is supplied from the grid, but in times of shortage, diesel generators are used; stable supply of power is an important issue.

From such perspectives, potential amount of rice husks was considered as follows:

Total amount of generated rice husks

Industrial Zone in Shwebo: estimated amount from rice production is 85,700 ton/year (357 sections*80%*50%*20t/day*50%*20%*300days/year=85,700t/y)

Amount of rice husks that can be utilized

Unlike in Ayeyarwady Region, rice mills using gasification power plant as self-power supply facility are limited in Shwebo District.

Assuming that 50% of the rice millers participate in the project, 42,900 ton of rice husks can be collected each year, which is enough for a power plant larger than 4 MW.

(Key outcomes in site study)

Regulations on environmental problems caused by open fires have become stricter than in the previous survey.

Another reason was that, through the mediation of the Sagaing Regional Government, they were able to exchange opinions with large rice-milling companies who could organize rice-milling companies in the industrial park. The business owner of this rice mill has diversified into the effective use of rice flour bread, rice bran oil, and rice husks, and wants to establish an efficient rice husk power generation system. In addition, he has devoted himself to the development of local economies and industries by holding important positions such as development committees in the region. With the support of the regional government led by this business owner, it was fully possible to summarize land procurement, rice husk procurement, and electricity demand.

3.2.3 Applied technology

Technology to be applied in the proposed project is considered from the perspectives to sustainably operate the project, collectable amount of rice husks, generation system.

(1) Power generation system

The power generation method is being used for the 1st project between Fujita and MAPCO (JCM) in the Myaungmya Township of Ayeyarwady Division. The plan is to build a more optimal system that meets the actual conditions of the area through partial modifications based on the system.

Build an optimal system (From both equipment cost and power generation efficiency) based on the experience in the 1st project.

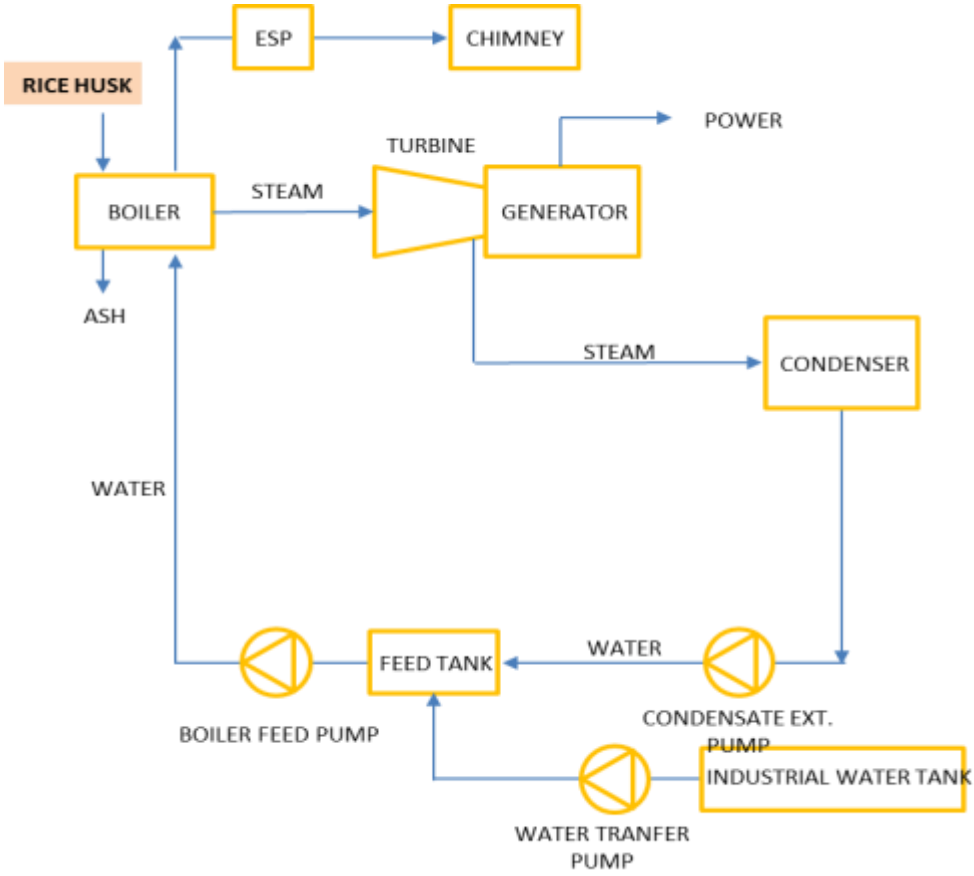


Figure 3-1 Flow of Boiler turbine generator (BTG)

Differences between the first JCM project in Myaungmya District in Ayeyarwady Region are shown below:

<Common Features (Shwebo District and Wetlet District)>

There are no large nearby rivers, so there is concern that pumping up groundwater could affect rice cultivation. The reduction of groundwater will be carried out after sufficient consultation with the agricultural authorities, but depending on the situation, the cooling of steam will be changed to an air-cooled system.

The initial cost will increase, but the company will consider reducing the initial cost by reviewing the equipment in the first project.

Since the ground is assumed to be better than that of the first project, the increase in construction costs is assumed to be restrained.

To reduce operation management costs, the scale should be doubled.

In order to secure the necessary amount of rice husks in a stable manner, small and medium-sized rice milling companies will be organized as rice husks supply companies.

(2) Project scheme

The scheme of this project is as follows.

Table 3-3 Project scheme

Implementation Site	Industrial Zone in Shwebo
Size	3.6 MW Scale:
Fuel	Rice Husk
Applied Technology	Boiler Turbine (Biomass Power Generation)
Power Supply	Rice mills and surrounding facilities
Project Scheme	Assumption: Establishment of SPC (e.g. Japanese company and local partner) Utilization of JCM Subsidy

(3) Equipment size and main specifications

The specifications are shown below.

Table 3-4 Specifications of the rice husk power plant

	3.6 MW	
Installed capacity	3,600	kW
Self-consumption	360	kW
Sold electricity	3,240	kW
Availability	24	hrs/day
	330	days/year
Generated electricity	77,760	kWh/day
	25,660,800	kWh/year
Rice husk (approximate)	4.6	t/h
	110	t/day
	36	1,000 t/year

(4) Financial consideration

The plan is to plan funds for business investment in proportion to the equity interest of SPC.

(5) Examination of implementation system

Considering the possibility of utilizing the JCM scheme, we are planning to establish an SPC between Japanese and Myanmar companies.

3.3 Condition of local related regulations

The following shows the expected investment approval and environmental measures for the implementation of the rice husk power generation project.

Table 3-5 Expected investment approval and procedures for environmental measures

Item	Main content
investment authorization procedure	In accordance with the Myanmar Investment Act, investment approval procedures by the Myanmar Investment Commission (MIC: Myanmar Investment Committee) are required.
Procedures for environmental measures	・In order to be approved for investment by MIC, an environmental impact assessment (EIA) or initial environmental assessment (IEE), or an environmental management plan (EMP) must be established and approved for projects that meet the industry and scale requirements specified in the environmental impact assessment procedure (EIAP: Environmental Impact Assessment Procedures). ・The EIAP specifies the industries in which IEE or EIA is required, and specifies nine industries including energy and waste treatment. ・The 3.6 MW rice husk power generation project proposed in this study falls under the category of "Power generation plants using waste materials (Power Plants from Waste Products)" among the specific industries of EIAP. Plants with capacity of 50 MW or more are subject to IEE, and this project is not considered to be subject to IEE or EIA.

Compliance with individual environmental standards	・Currently, there is no enforceable environmental value referred to in the EIA. Although the National Environmental (discharge) Guidelines (National Environmental Quality (Emission) Guidelines) were prepared at the end of 2015 with reference to the Environmental Health and Safety Guidelines issued by the International Finance Corporation (IFC: International Finance Corporation), they are treated as reference only. Therefore, at present, it is necessary to examine it in accordance with international standards (JICA Guidelines for Environmental and Social Considerations, IFC Performance Standards, ADB Safeguard Policy Statements 2009, etc.). ・Respective environmental standards such as ambient air quality, air emissions, industrial wastewater, wastewater, and noise shall be in accordance with the small-scale combustion facility exhaust emission guidelines of the IFC EHS (International Finance Corporation Environmental Health and Safety) Guidelines (thermal power generation) and the IFC EHS Guidelines (General).

Environmental measures to be taken at power plants are shown below.

At present, there are no regulations concerning the landfill of incinerated ash from rice husk power generation. However, it is important to cooperate with regional organizations, if necessary, by considering landfill standards that do not cause environmental impact, such as measures against heavy metals. The application for connection to the National Grid requires the submission of an appropriate disposal plan for incinerated ash, although it is not stipulated in the law.

Rice husk incineration ash contains silica (Silica accounts for about 90% of the total, and carbides) derived from rice husks, and it is considered necessary to extract purified silica and use it as a high value-added raw material. As a result, there is a possibility of business development, including the recycling of silica resources, and we believe that this will contribute to the formation of a regional recycling symbiosis zone based on the rice industry.

Table 3-6 Main environmental measures at rice husk power plants

Exhaust emission	Particulate matter	Cyclone dust collector
	NOx and Sox	Since nitrogen and sulfur component of rice husk is small, special processing is unnecessary
	Dioxin	Although rice husk hardly contain chlorine, it is assumed that it is shifted to rice hulls by absorbing dioxin of soil (no guideline value)
Rice husk incineration ash	Fly ash	Considering the introduction of bag filter or electrostatic precipitator. About 90% is fly ash.
	Main ash	Purified silica was extracted together with fly ash for use as a high value-added material (Rice hull incineration ash contains approximately 90% silica).

Up until about two years ago, Myanmar was rather lax about the formulation and approval of EIA, IEE or EMP, but recently it has been required to submit EIA, IEE or EMP in accordance with the rules.

In order to operate a chaff power plant, it is necessary to submit a construction completion notice, fire inspection, etc., which are carried out in general construction. In addition, boiler inspection and electric safety inspection are somewhat special for boilers, turbines, and power generation facilities. In particular, boiler inspections shall be carried out every six months.

3.4 Examination of GHG emission reduction

3.4.1 Methods of GHG emission reduction

Methods of emission reduction of CO_2 from fuel combustion and greenhouse gas of the rice husk biomass power plant project were examined. Based on this, reduction volume of such energy-derived CO_2 was calculated. We also examined the effect of the project other than GHG reduction such as economic effect (direct and indirect) and social effect (direct and indirect).

The outline of the examination is described below.

(1) Reference

Generated electricity will fulfill electricity demand. The industrial city is connected to the grid; therefore, reference value will be assumed as power supply from the grid.

(2) Project emission

1）CO_2 emission from transport

CO_2 emission from fuel use for transporting rice husks and plastic waste used for power generation is estimated. Most of them will be transported by human power, but for conservativeness, default value of CDM tool (for light vehicles), 245g-CO_2/t-km may be applied.

Based on the idea of the materiality (The threshold of materiality for verification is set at five (5) percent of emission reductions. etc.), small amount of emission resource will not be considered.

2）Electricity consumption within the power plant

When the electricity is supplied for equipment in the rice husk biomass power plant as backup power, the amount of emission from fuel consumption must be considered. Monitoring is done according to the sales receipt of fuel.

(3) Other sources of emission

Methane generated from rice husk disposal:

Methane emissions arising from disposal of rice husk under anaerobic condition may be considered as part of the reduction in this project by utilizing these rice husks. However, rice husk disposals in Myanmar are not always under anaerobic condition; therefore for conservativeness, they are not part of emission reduction in this project.

3.4.2 Estimated results of emission reductions

Assuming the above, emission reduction is calculated as follows.

List of CO2 emission factors for electricity in the guidelines for submitting proposals of financing programme for JCM model projects from FY2019 to FY2021 (Global Environment Centre Foundation, April 5, 2019 and Revised on June 19, 2019)[1,2], in the case of renewable energy (PV, wind power, hydropower, etc.) in Myanmar, 0.533 t CO2/MWh (for displacement of on-site generation only); and 0.319 t CO2/MWh (for other). In this trial calculation, the grid emission intensity was set based on this figure and the calculation was carried out.

Table 3-7 Result of emission reductions calculation (Biomass power plant project)

Capacity (Net)	3.6	MW
Annual power generation (Net)	25,660	MWh/year
Grid emission factor	0.319	kg-CO2/kWh
Reference emission	8,186	t-CO2/year
Fuel transport (approximate)	36	1,000 t/year
Project emission	0 *	t-CO2/year
Emission reductions (planned)	8,186	t-CO2/year

Note) Regarding project emissions, about half of rice hulls are procured from adjacent rice mills and the remaining half are contracts to procure from nearby rice mills, which are considered small amount of emissions resource and are not taken into consideration in calculating reductions

[1] Global Environment Centre Foundation website, the guidelines for submitting proposals of financing programme for JCM model projects in FY 2019 (in Japanse version)
http://gec.jp/jcm/jp/kobo/h31/mp/jcmsbsd31_koboyoryo.pdf
(Last access: 28 Febrary 2020)

[2] It is noted that "This list is used for the examination of the JCM financial program"

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4. Examination of concrete support measures through city-to-city cooperation

4.1 Study team meeting in Fukushima City

4.1.1 1st study team meeting (July 2019)

On July 16, a meeting of relevant parties was held in Fukushima City for the implementation policy of inter-city cooperation and the holding of a workshop in Fukushima City.

Date: Wednesday, July 16, 2019 14: 00 ~ 15: 30

Venue: Fukushima Chamber of Commerce and Industry Conference Room (Corasse Fukushima 8th floor)

Attendees: Fukushima City (Deputy Environment Department Manager, Environment Section Manager, Environmental Section Staff, Deputy Manager, Industry Creation Promotion Office, Industry-Academia Collaboration Coordinator), Fukushima Chamber of Commerce and Industry (Deputy General Manager of Business Promotion Department, Manager of Management Support Department, and Deputy General Manager), Representatives of Fukushima Myanmar Economic Exchange Association, Fujita, Mitsubishi Research Institute

Items of considerations:

- Implementation plan/status of implementation for the current fiscal year (July 1-3)
- Business exchange with Myanmar
- Implementation of the program with local invitees

4.1.2 2nd study team meeting (February 2020)

Based on the results of the on-site WS and the on-site investigation, a meeting of relevant parties was held in Fukushima City as follows, and opinions were exchanged on future developments in addition to the compilation for this fiscal year.

(Photo) A review meeting in Fukushima City

4.2 Implementation of policy dialogue and business dialogue

4.2.1 Program with Myanmar officials in Fukushima City in January

From Monday, January 13, 2020 to 15 (4 persons in total), officials from Ayeyarwady Region and Sagaing Region were invited to Fukushima City, where they made courtesy calls to the Fukushima Deputy Mayor and the Chairman of the Chamber of Commerce and Industry, made on-site studies (Industrial waste intermediate treatment facilities, etc.), held inter-city collaborative workshops, and held exchange meetings with business people, including members of the Chamber of Commerce and Industry.

The following two people from Sagaing Region participated.

- Director of Sagaing Regional Government
- Director of Sagaing Region development affairs committee

This program was implemented jointly with the city-to-city cooperation project in Ayeyarwady Region with the aim of promoting cooperation between the two regions.

Entire schedule

Date	Schedule	Venue
1/13 (Mon)	1/12 leaving Yangon 1/13 Morning: Arrive at Narita	
	PM: Move (Tokyo - Fukushima)	
1/14 (Tue)	[site visits] Fukushima Municipal Local Wholesale Market	Fukushima City
	Iitate Electric Power Co., Inc.	In Iitate Village
	Environmental education program with schoolchildren	Shinmachi Children's Club
	Exchange meetings with district officials Meeting with Regional Officials	City conference facility
1/15 (Wed)	Courtesy call on Deputy Mayor	Office Assembly Room
	Courtesy call on the president of the Fukushima Chamber of Commerce and Industry City-to-city Collaboration Workshop	Conference room
	[site visits] Food processing plants (Jurakuri Plant); Industrial waste intermediate treatment facilities (Keiwa Recycling Center Fukushima);	Fukushima City
	Move (Fukushima to Tokyo)	

- **About the courtesy call**

Courtesy Call on Fukushima Deputy Mayor	・Date: January 15, 2020 10: 00 ~ 10: 20 ・Venue: Fukushima City Hall ・Attendees: Deputy Mayor of Fukushima City, Director and Deputy Director of the Environment Department, Director of the Environment Department, and others of the Environment Department
Courtesy Call on the Chairman of the Fukushima Chamber of Commerce and Industry	・Date: January 15, 2020 10: 40 ~ 11: 00 ・Venue: Fukushima Chamber of Commerce and Industry ・Participants: [Fukushima Chamber of commerce and Industry]: Chairman of the Fukushima Chamber of Commerce and Industry, Manager of the Business Promotion Department, Manager of the Business Support Department, Manager of the Business Support Department [Fukushima City] Environment Section Manager, Environment Section Environment Planning Section Manager

Visit by Deputy Mayor (Photo)

(Photo) Visit to the President of the Fukushima Chamber of Commerce and Industry

- **City-to-City collaboration workshop**

Date	Wednesday, January 15, 2020 11: 00 ~ 12: 00
Venue	Fukushima Chamber of Commerce and Industry Conference Room
Attendee	[Fukushima City] General Manager of Environment Department, Deputy General Manager of Environment Department, Manager of Environment Department, others in Environment Department, etc. [Fukushima Chamber of Commerce and Industry] Business Promotion Department Manager, Business Support Department Manager, Business Support Department Manager [Other concerned parties] Fukushima Myanmar Economic Exchange Association official

(Photo) Workshop

(Workshop overview)

- Opening Remarks (Japan side: Fukushima City, Myanmar side)
- Attendee introduction (self introduction)
- Overview of the study, key binding, discussion note Introduction to the survey overview and past discussions (Mitsubishi Research Institute, Fujita)
- Introduction of Activities in Fukushima City (Fukushima City)
- Presentation from Myanmar
- Discussion (Questions and Answers/Exchange of Opinions)
- Closing Remark
- Group Photo

The officials from Sagaing Region shared the current issues concerning Monywa City .

They shared the view that the Sagaing Region had started separating garbage since June 2019, and that it had started investigating the volume of garbage per day, and that it would consider a disposal system depending on the results of the survey.

(Visits and exchanges of views)

Site visits of relevant facilities in Fukushima City and Iitate Village and exchanges of views with relevant parties were conducted.

- Field trip to Fukushima Municipal Local Wholesale Market

  (Status of waste treatment, etc.)

- Field Visit and Exchange of Opinions on Iitate Electric Power's Efforts (site of Iitate Village)

- Meeting with Fukushima Chamber of Commerce and Industry

food processing facility

Intermediate treatment facility for industrial waste

(Photo) Visit to relevant facilities in Fukushima City and exchange of opinions

We also visited a school children's club in Fukushima City to exchange information on environmental education. In addition, in collaboration with the Fukushima Chamber of Commerce and Industry, a business dialogue was held with visiting managers of Myanmar District.

4.2.2 Field workshop and field survey

In July and November 2019, we conducted a field workshop and a field survey with officials of the Regional government to understand the current state of waste treatment.

In January 2020, local joint workshops were held with the participation of officials from both Regions (The schedule of the local program in Myanmar is as follows).

In addition to the participants from Fujita and Mitsubishi Research Institute, the chief of

the Environment Section and the chief of the Environment Section from Fukushima City participated. Participants from the Myanmar side are as follows.

<Participants from Ayeyarwady Region>

Minister of Electricity, Energy, and Industry of the Government of Ayeyarwady Region: * Visitor to Fukushima City in December

Director, Ayeyarwady Regional Environmental Protection Bureau

<Participants from Sagaing Region>

Sagaing Regional Government Director: * Invited to Fukushima City in January

Government officials from Monywa, the provincial capital of the district: * Invited people from Fukushima City in January

Entire schedule

Date	Schedule
February 4	Fukushima City officials: Travel from Fukushima to Narita
February 5	Narita - Yangon
February 6	Site visits (Industrial parks, waste disposal, etc.) (Yangon City and its vicinity)
February 7	Travel to Yangon and Nay Pyi Taw AM: Attending policy dialogue with Japan (Only Ayeyarwady Minister), preparing for Workshop Afternoon: Joint workshop between Ayeyawady Region and Sagaing Region (MAPCO Conference Room) Departure from Nay Pyi Taw
February 8	Yangon - Narita

- **Workshop overview**

Date	Friday, February 7, 2020 12: 40 ~ 16: 00
Venue	Conference room in MAPCO Nay Pyi Taw Office
Attendee	[Japanese side] ・ Fukushima City: Manager of Environment Division, Manager of Environment Planning in Environment Division; ・ Mitsubishi Research Institute: ・ Fujita: [Myanmar government officials] ・ Ayeyarwady Regional Government: Minister of Electricity, Energy and Industry and one other person ・ Sagaing Regional Government: Director and two others

(Workshop agenda)

Joint Workshop of Partnership for Low Carbon Initiative
with Fukushima City, Ayeyarwady Region and Sagaing Region

7th (Friday) February 2020, Nay Pyi Taw, Myanmar

Background and Objective

Partnership for Low Carbon Initiative between Fukushima City (Japan) and Myanmar Region Governments (with Ayeyarwady region: starting from in 2015, and with Sagaing Region: starting from 2017) aims to follow;

- Accelerating action for low-carbonization and SDGs localization of cities, by formulating the Joint Crediting Mechanism (JCM) projects (feasibility study) and institutional building.
- Facilitating regulation of institutional mechanisms (e. trials and pilot projects) by policy dialogue under city-to-city cooperation with Fukushima City, Ayeyarwady Region and Sagaing Region governments.

Under the Partnership for Low Carbon Initiative between Fukushima City, Ayeyarwady Region and Sagaing Region governments, various workshops were implemented in both of Fukushima city, Pathein city, Monywa city etc., and we are sharing future goals.

One of key outcomes of our partnership is development of Rice Husk Power Generation project in Myaung Mya Township (The plant facility has been constructed in MAPCO's industrial area). This project is one of the JCM projects in Myanmar. This

JCM project is the pilot project as the new problem-solving approach for solving energy access and waste management in Ayeyarwady Region, also in Myanmar. This approach is expected to spread in many rural communities in Myanmar.

In this year (FY 2019), we are challenging following key topics:

- Promotion project for formulation of Circulating and Ecological Economy in Ayeyarwady Region: i.e. Supporting formula of local distributed power system (e. biomass power projects), the concept of a regional circular and ecological sphere.
- Promotion project of low-carbon regional development in Sagaing Region: i.e. Supporting formula of waste management system of urban waste (e. separation and waste treatment systems, environmental education) and rice husks power generation system.

The workshop will facilitate city-to-city cooperation for each topic through sharing experiences of policy planning in Fukushima city, key binding of previous Japan program (in Dec. and Jan.) and discussion on pathways for regulation of project formation, institutional mechanisms (e. key strategy for actions, idea of roadmap).

Program

Opening remarks

Mr. Win Htay, Minister for Electricity, Energy and Industry (Ayeyarwady Region)

Mr. Kato Naoki, Manager of Environment, Environment Division, Fukushima City

Attendee introduction (self introduction)

Presentations from Japanese side

Overview of the activities, summary of previous workshops in Fukushima City (in Dec. and Jan.); Research Director, Environment and Energy Division, Mitsubishi Research Institute

Lessons of Policy Planning in Fukushima City; Manager of Environment, Environment Division, Fukushima City

Idea of new solution model (i.e. power generation system in Ayeyarwady region, waste management in Monywa city); Senior Manager Project Planning Office, Overseas Development Division, Fujita Corporation

Coffee break

Presentations from Myanmar side:

from Ayeyarwady region

- Key binding of Japan program in Dec.

- Expectation to our partnership and idea of further collaboration

Minister for Electricity, Energy and Industry (Ayeyarwady Region)

from Sagaing region

- Key binding of Japan program in Jan.

- Expectation to our partnership idea of further collaboration

Director, Sagaing Region Development Affairs Committee

Discussion:

Q & A, exchanging ideas and comments, wrap up

Closing Remarks:

Minister for Electricity, Energy and Industry (Ayeyarwady Region)

The Ministry of the Environment of Japan and the Ministry of Natural Resources and Environmental Conservation of the Republic of the Union of Myanmar held the "Third Japan-Myanmar Environmental Policy Dialogue" in Nay Pyi Taw on Friday, February 7.

The Parliamentary Vice-Minister of the Environment (Japan), who visited Nay Pyi Taw for policy dialogue, delivered a speech during the workshop.

(Photo) Local Workshop

(Comments from Myanmar side at the workshop)

Explanation of the current situation at the February workshop and proposals from the district side

The biggest problem is the problem of waste incinerators. This is a problem not only for Sagaing, but for Myanmar as a whole, and if Sagaing succeeds, it can be expanded to the whole country.

There are 37 districts in Sagaing, and we would like to see concrete measures taken for a final disposal site in Monywa.

- There are 31 townships in Monywa where 43 garbage trucks collect garbage.
- Garbage from homes (ring up), hospitals (have a special collection of) and markets (Monywa has eight markets.).
- There are places to throw away garbage, but they don't have the know-how to incinerate it, so there is a risk of fire. We want to establish a sustainable waste disposal system that includes financial services.
- We have been providing environmental education to schools since we started cooperating with Fukushima City regarding recycling and sorting.
- They started separating garbage for townships from half a year ago. The government has started to provide garbage bins to dispose of food waste and ordinary garbage. They also hold explanatory meetings at the community level. He translated materials from Fukushima City into Myanmar and used them with ingenuity.
- We would also like to refer to the Ayeyarwady Region's efforts for rice husk power generation.

4.3 Summary of results of intercity collaboration

Points (Exchange of opinions with invited participants in Fukushima City and arrangement based on local workshop) in terms of city-o-city cooperation (policy dialogue) are shown below.

Recognition

・In Sagaing Region, the amount of waste has been increasing along with economic development, and the disposal of municipal waste has become a major issue. However, it is difficult to secure sufficient land for final disposal sites. The city is still littered with garbage, and the citizens' proper understanding of garbage disposal and awareness of the environment are low.

・In Japan, after the period of rapid economic growth, local governments have taken the initiative in switching from landfill to incineration and in strengthening 3R (Reduce, reuse and recycle) initiatives. Separation activities are one of the most important elements for the promotion of the 3Rs. In Sagaing Region, education and awareness-raising activities for children and local residents have been started little by little, such as providing guidance on garbage separation in environmental education at elementary schools.

・In addition, as Sagaing Region is one of the major agricultural areas in Myanmar, it is necessary to promote the appropriate treatment and effective use (Biomass power generation, etc.) of agricultural waste such as rice husks.

Direction of development to solve problems

・Based on Japan's experience and local conditions, it is necessary to consider a master plan for waste separation and appropriate treatment planning, and to steadily promote the effective use of biomass wastes such as rice husks in the future.

・In order to promote the 3Rs, it is necessary to gradually combine several measures such as the establishment of a clear division of roles among the national government, local governments, and local citizens, the establishment of appropriate sorting practices, the penetration of "polluter pays principle" in the industrial sector, and the effective utilization of waste biomass (Fertilization, heat utilization, methane gasification, etc.). An activity that is easy to undertake in the short term is to promote appropriate separation at home and in the business sector.

・Reforming the awareness of waste in local communities is also an important element, and in order to firmly establish waste separation, it is necessary to continue to strengthen environmental education efforts (Utilizing school education

opportunities, etc.).

Master plan for city-to-city collaboration (Draft)

As a master plan for the promotion of waste countermeasures corresponding to the economic development of Sagaing Region, it is important to 1) establish a separation system in the business division such as the market, 2) examine the commercialization (Conversion of waste into energy through rice husk power generation business) of appropriate treatment (effective utilization) of biomass wastes such as rice husks, 3) strengthening of countermeasures and awareness-raising activities in the policy side.

1) Establishment of separation systems in markets and other business divisions (including raising awareness)

・Garbage is sorted on the market and composted

・Environmental education to establish waste separation (Reference: Part of elementary school education)

・Sorting and recycling activities through participation by governments, businesses, citizens (home), schools, and local communities

2) Commercialization of appropriate treatment (effective utilization) of biomass waste such as rice husks

・Development of rice chaff power generation business using JCM

・Establishment of a system for the procurement of rice husks (Coordination among government, businesses, and industry associations)

3) Strengthening policy measures

・Clarification of vision for local waste treatment (Reference: Basic Plan of Fukushima City)

・Reforming Awareness of Regulatory Compliance (Reference: Study meetings and educational activities at the Chamber of Commerce and Industry in Japan)

・Activities to disseminate the Polluter Pays Principle (PPP) (Collection of waste disposal costs from businesses on a trial basis)

5. Toward future development

The future development was examined based on the point of the result of the examination.

(Field of policy dialogue)

<Extract key components to include>

1) Implementation of waste disposal business (Securing funds is the biggest challenge)

1. Volume reduction in existing landfills,
2. biogasification in the market,
3. incineration treatment

2) Separation by household and business (The regional government prepared a pamphlet and is now working on raising awareness)

Regarding the above two issues, discussions were held on the direction of the resolution of issues and further development, while sharing the progress made on the regional side.

3) Environmental education (Work is underway on the regional side, cooperation with Fukushima side)

・Development of roadmap for urban waste measures

・Approach within the region

・Review and improvement of activities in Monywa

・Cooperation with efforts at Fukushima

Table 5-1 Summary of results and future plans (Field of policy dialogue)

<table>
<tr><th>Item</th><th>Results for the current fiscal year</th><th>From April to June</th><th>From July to October</th><th>From November to February</th></tr>
<tr><td rowspan="2">Creating a master plan for inter-city cooperation</td><td rowspan="2">・Master Plan Formulation Agreement
・ Identification of countermeasure technologies</td><td colspan="2">Reduction of final disposal site volume and commercialization of biogas
Realization of the future development
Direction of creating a foundation for realization (Funding, awareness building, human resource development, etc.)</td><td>[Approach within the region]</td></tr>
<tr><td>Create a draft</td><td>Draft (Working with Regional Government)</td><td>Discussions for development and implementation to relevant parties</td></tr>
<tr><td rowspan="2">Supporting the implementation of initiatives</td><td rowspan="2"></td><td colspan="3">Review of activities in Monywa</td></tr>
<tr><td colspan="3">Collaboration with activities in Fukushima</td></tr>
</table>

(Field of project)

Table 5-2 Summary of results and future plans (Field of project)

Items	Achievements and Issues in FY 2019	Plans for FY 2020	Plans for FY 2021
Rice husk power generation business	**[Outcomes]** ・Understanding the scale of business ・Grasp of local business entities ・Model Plant Basic Plan (3.6 MW) **[Challenges]** ・Electric power sales route not yet considered	・Formation of local business entities ・Review of project participants (Japanese descent) ・Determination of power sales method ・Brushing up plant plans ・Apply for JCM financing programme (latter half of the fiscal year)	・Rice husk power plant construction (3.6 MW)
Municipal waste (Volume reduction at final disposal sites, incineration facilities, etc.)	**[Outcomes]** ・grasp of the current situation ・Proposal of volume reduction methods ・Grasp of municipal waste generation **[Challenges]** ・Accuracy of the amount generated	・Preparation of using the JICA support programe for SMEs and SDGs businesses (with waste treatment companies in Fukushima City (in Volume reduction field) ・Finance consideration ・Examination of project implementation structure ・Reinvestigation of the amount of waste generated ・Basic Plan for Incineration Facilities	・Installation of volume reduction equipment ・Volume reduction started ・JCM entry for incinerator (latter half of the fiscal year)
Municipal waste (Garbage disposal in the market)	**[Outcomes]** ・Grasp of emission volumes ・Proposal of biogas system (100 kW scale) **[Challenges]** ・The composition of garbage in the market is unclear.	・Grasping the composition of market garbage (estimation of generated gas) ・Business entity and finance review ・Apply for JCM financing programme (latter half of the fiscal year)	・Biogas plant construction
Household garbage	**[Outcomes]** ・Introduction to the use of posters ・Introduction of Business Development Law **[Challenges]** ・Nothing special.	・Creation of manual for use of computer posters ・Implementation of composter model	・Horizontal expansion

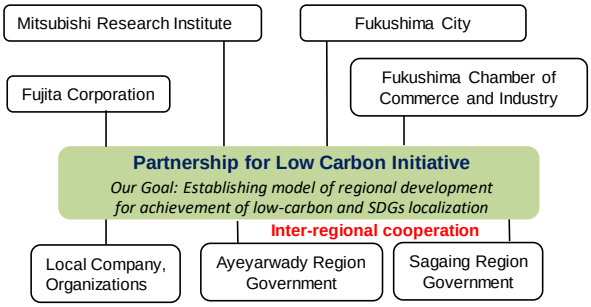
Appendix

Overview of project

City-to-City Collaboration for Low Carbon Initiative
with Fukushima City (Japan), Ayeyarwady Region and Sagaing Region (Myanmar)

Policy dialogue between Fukushima City and Region Governments
(Supporting through knowledge of Japan's institutional aspects)

"Partnership for Low Carbon Initiative" between Fukushima City (Japan) and Region Governments in Myanmar (with Ayeyarwady Region: starting from 2015, and with Sagaing Region: starting from 2017)



Workshops and site visits for facilitating policy formulation


Dec. 2019, Fukushima City


Dec. 2019, Tokyo

Key topics

Promotion project for formulation of Circulating and Ecological Economy in Ayeyarwady Region

i.e. Supporting formulation of local distributed power system (e.g. biomass power projects), the concept of a regional circular and ecological sphere

Promotion project of low-carbon regional development in Sagaing Region

i.e. Supporting formulation of waste management system of urban waste (e.g. separation and waste treatment systems, environmental education) and rice husks power generation system

Feasibility study of JCM project

Example of achievement;

Rice husk power generation PJ (JCM) in Myaung Mya Township

Project Title：Promotion project of low-carbon regional development in Sagaing Region

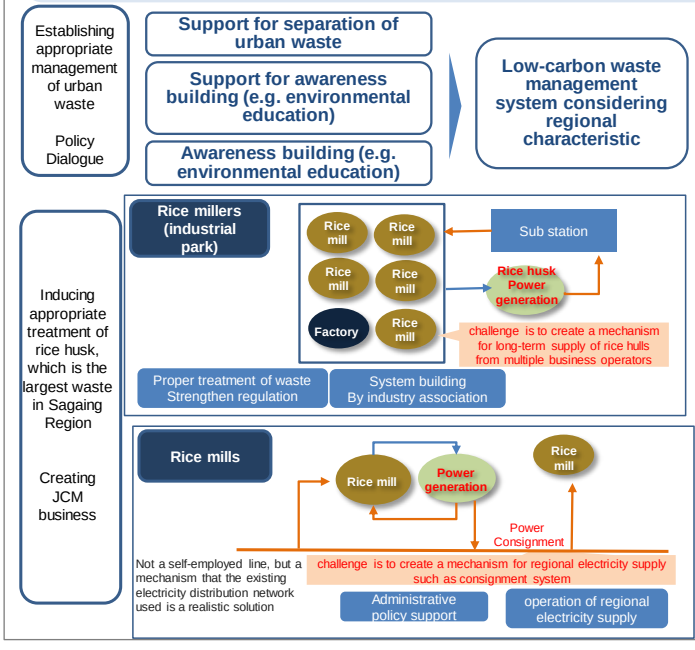
Project Overview

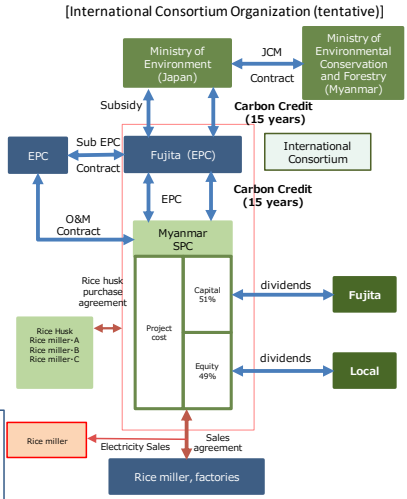
Establishing appropriate management of urban waste
Biomass power generation business such as rice husk + electric power supply business around milling(3.6MW scale)

a large amount of rice husks are generated, and most of them are discarded. Example) Field burning etc. at the airport site

Not only the regional government, but also the central government is struggling to respond, and I expect it to be solved by rice husk power generation

Construction of a business model that responds to the needs of the Region
· Multi-milling center model
· Rice mills





Materials of the workshop

Joint Workshop of Partnership for Low Carbon Initiative

7 February 2020

Overview of our collaborative activity

City-to-City Collaboration for Low Carbon Initiative with Ayeyarwady Region and Sagaing Region (Myanmar)

1

Partnership for Low Carbon Initiative

Our Goal: Establishing model of regional development for achievement of low-carbon & SDGs with solving key challenges of **achievement of universal energy access, and creation of a circulating and ecological economy**

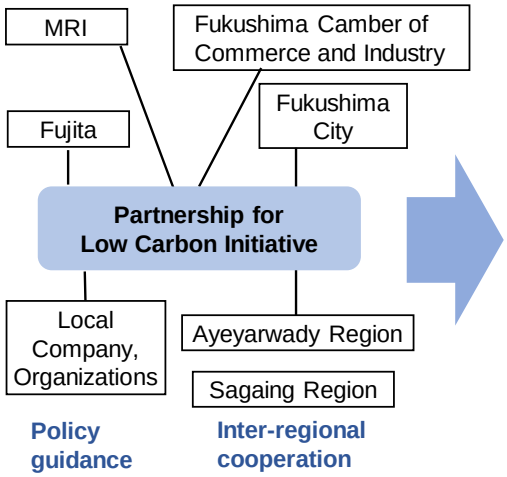
	JAPAN	Myanmar
Policy dialogue	Fukushima City	Ayeyarwady Region Sagaing Region
Business dialogue	Fukushima Chamber of Commerce & Industry Mitsubishi Research Institute	Business organizations
Development of project	Fujita Corporation	Myanmar companies

Workshops and site visits for facilitating policy formulation

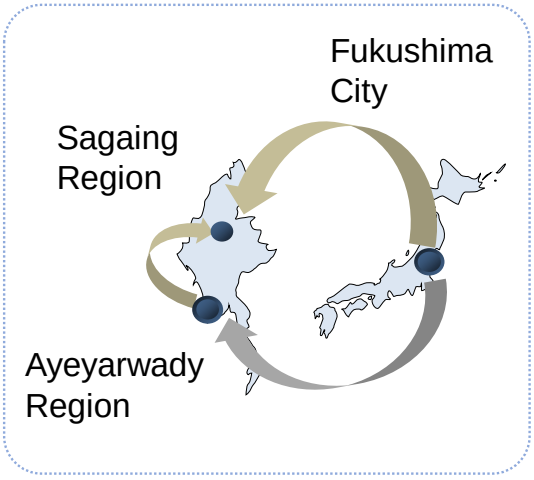
Feasibility study:
Example of achievement;
Rice husk power generation PJ in Myaung Mya Township

2

Policy dialogue between Fukushima City and Regional governments
(Support through knowledge of Japan's institutional aspects)



Expansion in Myanmar through inter-regional cooperation
(approach of promotion in Myanmar)



3

Partnership for Low Carbon Initiative

Horizontal Cooperation

Workshop in Sagaing Region
Nov. 2019, Monywa

Joint Workshop in Fukushima City
December. 2019, Fukushima

Workshop in Ayeyarwady Region
Dec. 2019, Pathein

Networking meeting with business organizations
December. 2019, Fukushima

4

Partnership for Low Carbon Initiative

Vertical Cooperation

With city development committee
Nov. 2019,

With region government officials

Dec. 2019, Pathein

Meeting in MOEJ
Dec. 2019, Tokyo

Minister for Electricity, Energy and Industry (Ayeyarwady Region) and Vice Minister for Global Environmental Affairs (MOJ)

With site manager
Nov. 2019, Monywa

With school principal
Nov. 2019, Monywa

5

Reference 1

Overview of Key Achievements

6

1 Key achievements of city-to-city collaboration : Enlightenment by environmental education

Ayeyarwady Region

Sagaing Region

Introducing environmental education activities in Fukushima City at a local elementary school

Introducing video letter from students at an elementary school in Fukushima City to Elementary school in Ayeyarwady Region

Receiving return video letter from students in Ayeyarwady Region to students in Fukushima

Introducing exchange activity between elementary school students in Ayeyarwady Region and Fukushima City

7

2 Key achievements of city-to-city collaboration

Waste landfill site in Pathein (Ayeyarwady Region)

Waste is treated by landfill in Pathein City.

After the city-to-city dialogue, segregation of waste has been started in the treatment site .

Waste landfill site in Monywa (Ayeyarwady Region)

The problem of waste disposal is a common issue in other regional cities.

We are currently discussing measures to deal with waste disposal in Monywa City during policy dialogue.

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3 Key achievements of city-to-city collaboration : Expansion to cities

Joint Workshop with Ayeyarwady Region & Sagaing Region (Feb. 2018, Yangon)

Courtesy visit to the Minister of Agriculture, Livestock and Irrigation(Feb. 2018)

Booth presentation of City-to-City Collaboration activities in Naypyidaw (Mar. 2018. Conference of Myanmar Rice Federation)

State Counsellor Dew Aung San Suu Kyi visited the booth, and we had a chance to explain the activity.

9

Reference 2

Overview of Current Discussion

in Policy Dialogues

10

Sharing Key Concepts for Low Carbon Society

Key global trends towards to sustainable development

Policy Goals

Sustainable Development

Circular Economy
Circular and Ecological Sphere

Low-carbon Society

Key Challenges

- Facilitating policy formulation for achievement of **universal energy access**.
- Facilitating policy formulation for regional development for achievement of **low-carbon & Sustainable Development Goals (SDGs), circular economy in rural development**.

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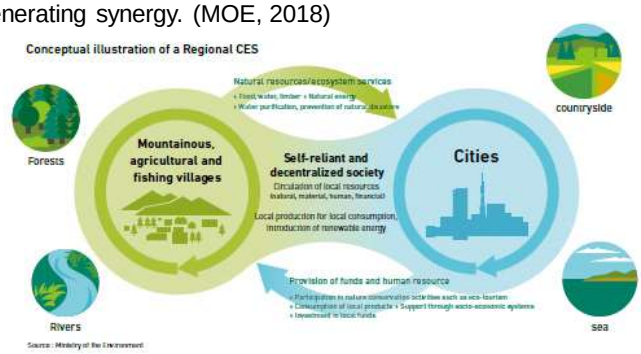
Sharing Key Concepts for Low Carbon Society

Circular and Ecological Sphere (CES)

Reference

- **Regional CES that complements and supports regional resources by building broader networks**, which is composed of natural connections (forests, the countryside, rivers and the sea) and, economic connections (human resources, funds, and others), thus complementing each other and generating synergy. (MOE, 2018)

- In order to form Regional CES, it is important to **circulate resources that can be circulated in the region as much as possible**, and the same applies to waste treatment.



Source) MOEJ (2018) Annual report on the environment in Japan 2018

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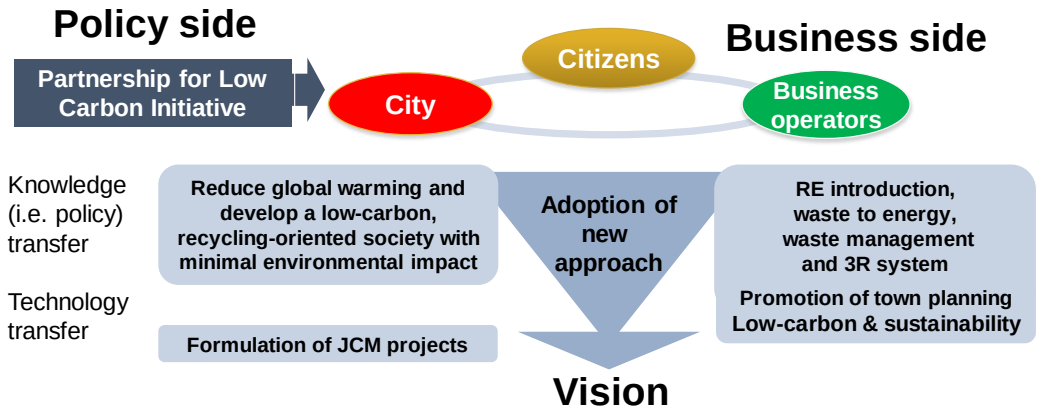
Partnership for Low Carbon Initiative

Key approach for Low-Carbon City

Promoting a low-carbon city and building a sustainable low carbon city (Local city model)



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Partnership for Low Carbon Initiative

Idea note of policy roadmap for decarbonization and SDGs localization

Key strategy for actions in local level

- **Business model** for realizing a low-carbon, resilient and sustainable rural city: using renewable energy technologies, such as power plant and heat utilization using biomass resources (e.g. rice husks)
- **Social model (institutional mechanism development)** for smooth project implementation
- **Capacity building** for low-carbonization of industrial park

New industrial park model (Rice complex)

Rural community model (Biomass to energy)

To formulate a master plan (i.e. vision, regional model, approaches)

Leading the a circulating and ecological economy in Myanmar and Asia rural areas

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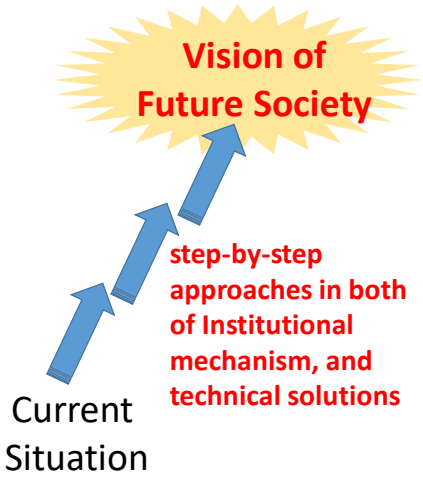
Key Items of Institutional Mechanisms in Communities

1. **Setting the policy targets (Short-term and Long-term)**
   - Sharing visions
   - Identify actions
   - Check and reviews
2. **Enhancing the success stories**
3. **Role (Partnerships) and responsibility**



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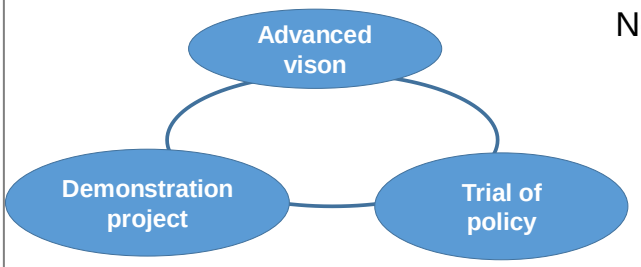
Approach for Setting of Policy Target

Short-term → **Long-term**



- Environmental education in schools
- Activities in industry associations
- Cultivation of human resources development
- Incentive to investment for demonstration project

Next 10 years:Y2030

Setting target
- Electrification rate %
- RE rate %

Taking action (step-by-step)

Model city of sustainable rural development
- Making vision
- Enhancing partnerships

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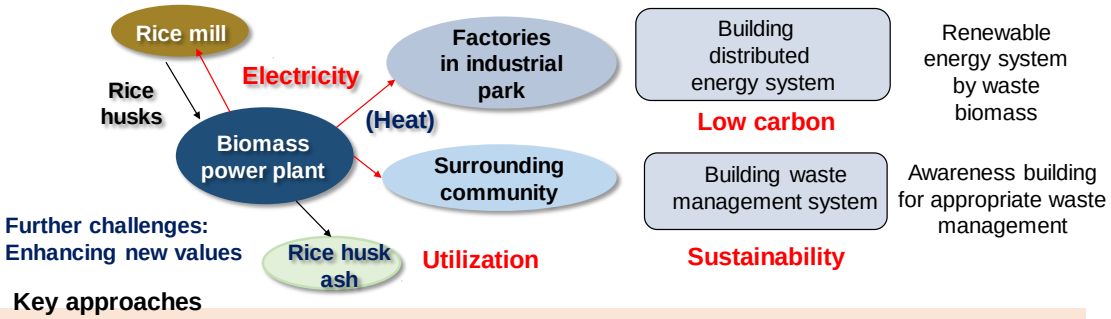
Idea Note of Policy Roadmap: Low-carbon energy

Regional model — **Creating new regional electric power supply system by biomass power plant using rice husks**

Combination of business model & social model



Key approaches

Project by collaboration of Japanese companies and local companies, not only focusing of Japanese technology and products.

- Combination of appropriate technologies (Cost and performance through the project life cycle)
- O&M system (by localization, training)
- Project management

Idea Note of Policy Roadmap: Steps in Building Circular Economy

Changing Mind

STEP 1
Education Awareness building
Appropriate sorting system

Showing win-win approach

STEP 2
Waste to energy etc. (Power + Heat)

Enhancing partnerships Promotion & Regulation

STEP 3
Creating venous industry
PPP principles, especially for business sector

18

Reference

Support for initiatives of environmental measures

In order to contribute to the further development of environmental measures in the regions, we introduce Fukushima City's plans for environmental measures and the future vision of Fukushima City in the "Fukushima City Promotion Plan for Renewable Energy Introduction".