

**FY2017**  
**Feasibility Study of Joint Crediting Mechanism**  
**Project by City to City Collaboration**

**Feasibility Study of Joint Crediting Mechanism Project**  
**by City to City Collaboration in Yangon city Phase-3**  
**(“Project for introduction of high-efficiency pumps into**  
**existing pumping station” and “Project for low carbonization of**  
**waste management”)**

**Final Report**

**February 2018**

**Nippon Koei Co., Ltd.**  
**Kawasaki City**

**FY2017**  
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**ABBREVIATION**

CPLA	City Planning and Land Administration Dept.
GHG	Greenhouse Gases
INDC	Intended Nationally Determined Contributions
JCM	Joint Crediting Mechanism
MEPE	Myanmar Electric Power Enterprise
MGD	Million Gallon per day
MMK	Myanmar Kyat
MOEJ	Ministry of the Environment, Japan
MOECAP	Ministry of the Environment Conservation and Forestry
MOU	Minutes of Understanding
MRV	Monitoring, Reporting and Verification
PCCD	Pollution Control and Cleansing Dept.
PV	Photovoltaics
USD	United States Dollars
YCDC	Yangon City Development Committee
EDWS	Engineering Department of Water and Sanitation
IoT	Internet of Things
IRR	Internal Rate of Return
CEO	Chief Executive Officer
ERS	Environmental Recycling System
ICT	Information and Communication Technology
Capex	Capital Expenditure
MAEX	Myanmar Agro Exchange Public Limited
EPC	Engineering, Procurement, Construction
iSGM	ICT Star Group Myanmar Co., Ltd
LNG	Liquefied Natural Gas

**UNITS**

A	–	Ampere
kWh	–	kilowatt-hour
kW	–	kilowatt
MW	–	Megawatt
V	–	Voltage

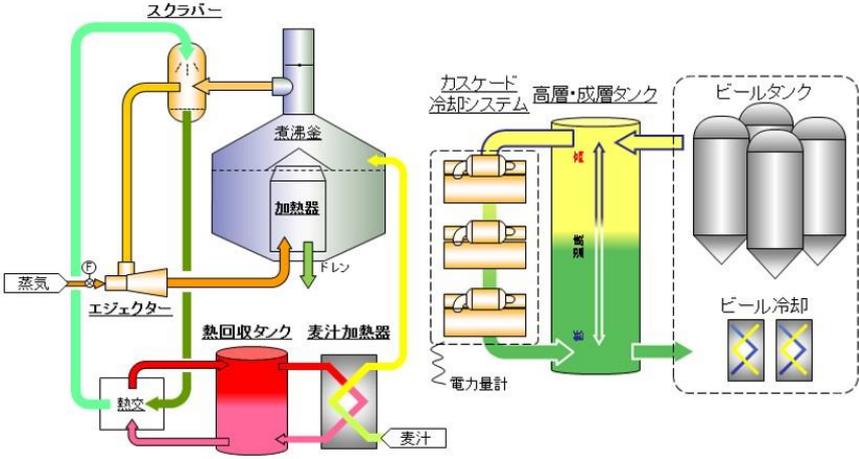
## **CHAPTER 1 BACKGROUND OF THE STUDY**

### **1.1 BACKGROUND**

Yangon City, the former capital of the Republic of the Union of Myanmar, is one of the largest commercial cities in the country which population is over 5 million. In response to the democratization in recent years, rapid urbanization of Yangon city is on-going through the inflow of foreign capital and development by private companies. However, the city faces the difficulties such as deterioration of infrastructure due to the limited investment, technical assistance and social development from foreign countries against the military government. More specifically, there are some problems to be considered, for example, the demand far exceeds the supply of electricity power with the urban development and infrastructure development, traffic congestion is caused by the poor road condition or lack of facilities, including signal, and the lower capacity of water supply and sewerage facilities by their aging. Considering such situation in Yangon city, the necessity of saving energy and low carbon development is needed and the study for the city to city collaboration between Yangon city and Kawasaki city is implemented since last year.

Yangon city and Kawasaki city started its cooperation through city to city collaboration study even though they do not have any official communication. The outcome of the city to city collaboration study in the previous year was i) conclusion of MOU for city to city collaboration between Yangon city and Kawasaki city, ii) Discussion based on MOU, and iii) Development of two JCM model projects which were adopted by Ministry of the Environment, Japan.

The 3<sup>rd</sup> year of the city to city collaboration project aims to conduct tangible projects under city to city collaboration between Yangon and Kawasaki city based on the previous results and relations of trust.

<p><b>Output I Conclusion of MOU</b></p> <p>The MOU between Kawasaki city and Yangon city was concluded on the end of March 2016.</p>	 <p>The MOU document outlines the collaboration for advancement of low carbon society in Yangon and contributes to the further prosperity of Kawasaki and Yangon cities. The MOU shall become effective on the signed date and remain valid for three years. The contents of the MOU can be amended in accordance with a written agreement of both parties.</p>
<p><b>Output II JCM model project</b></p> <p>Introduction of saving energy system into Beer factory</p> <p>Estimated GHG emission reduction <u>2,841 tCO<sub>2</sub>/year</u></p>	 <p>The diagram illustrates a complex energy recovery system for a beer factory. It includes a boiler (煮沸釜) with a heater (加熱器) and a steam ejector (エジェクター). A cascade cooling system (カスケード冷却システム) with high-stage and intermediate-stage tanks (高層・成層タンク) is used for beer cooling (ビール冷却). A heat recovery tank (熱回収タンク) and a wort heater (麦汁加熱器) are also shown, along with a power meter (電力量計) and a wort tank (麦汁).</p>
<p><b>Output III JCM model project</b></p> <p>Introduction of high efficiency boiler into food factory</p> <p>Estimated GHG emission reduction <u>674 tCO<sub>2</sub>/year</u></p>	 <p>High-efficiency once-through boiler with monitoring system</p>

Source: The Study Team

## 1.2 OBJECTIVE OF THE STUDY

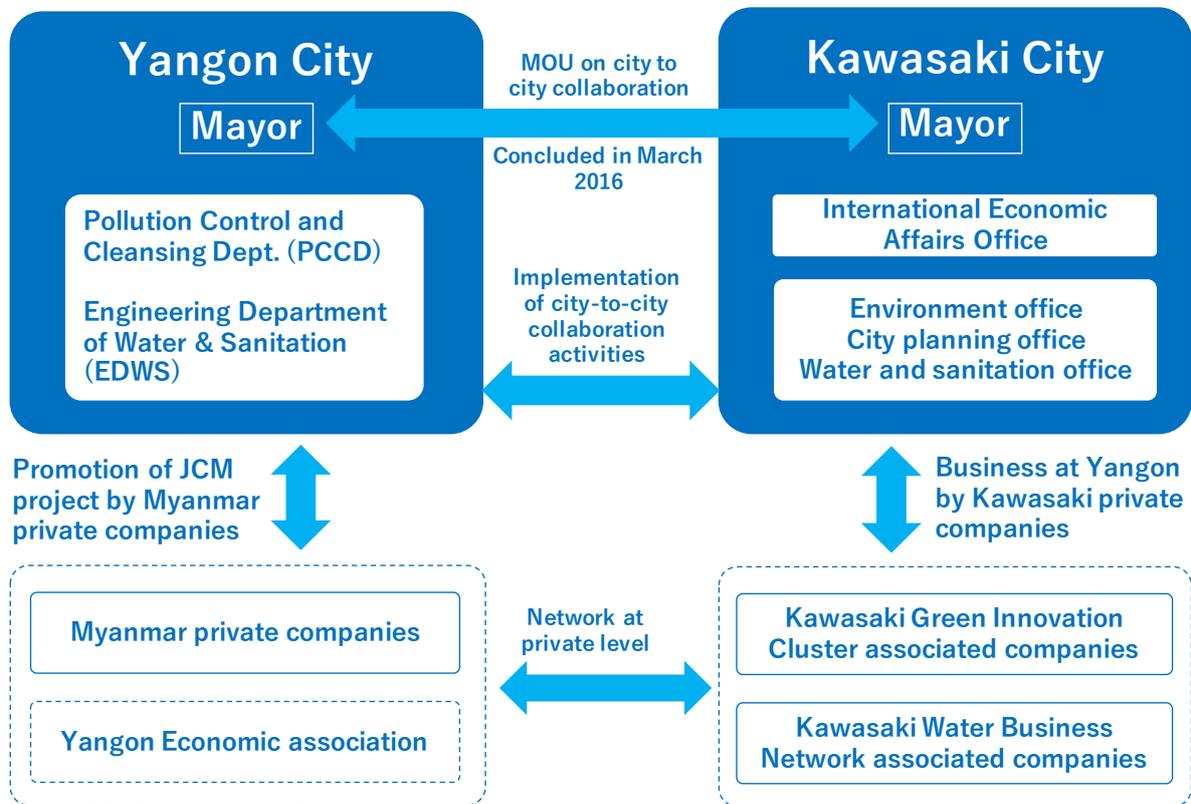
The study aims to contribute for solving issues which Yangon city has by utilizing Joint Crediting Mechanism (hereinafter as JCM) as well as considering approaches under the city to city collaboration with Kawasaki city which has rich experience and knowledge for low carbon society development.

### 1.3 IMPLEMENTATION FRAMEWORK

Nippon Koei Co., Ltd led the project in cooperation with Kawasaki city and proposed JCM projects from the view of technical and policy making to Yangon City Development Committee, hereinafter as YCDC.

The counterparts of local side were City Planning and Land Administration Department (CPLA) and Pollution Control and Cleansing Department (PCCD) continuously in the 1<sup>st</sup> and 2<sup>nd</sup> year. In the 3<sup>rd</sup> year, the counterparts are Pollution control and Cleansing department (PCCD) and Engineering Department of Water and Sanitation (EDWS).

The main implementation body of Kawasaki city is International Economic Affairs Office and conducted support of development of low carbon action plan in cooperation with other relevant departments such as Water and Sewer Department and Environmental Bureau.



Source: The Study Team

Figure 1-1 Implementation Scheme of the Project

## CHAPTER 2 OVERVIEW OF YANGON CITY

### 2.1 OVERVIEW

#### 2.1.1 General Information

Yangon city used to be a capital of the Republic of the Union of Myanmar so called as Rangoon until 2006. The current capital is Naypyidaw which locates in the north from Yangon.

Yangon city belongs to Yangon region as administrative area of Myanmar and has a border with Bago region in the north and east of Yangon and Ayeyarwady region in the west. The Yangon region is the most industrialized area in the country and major industry of the country concentrates in the region.

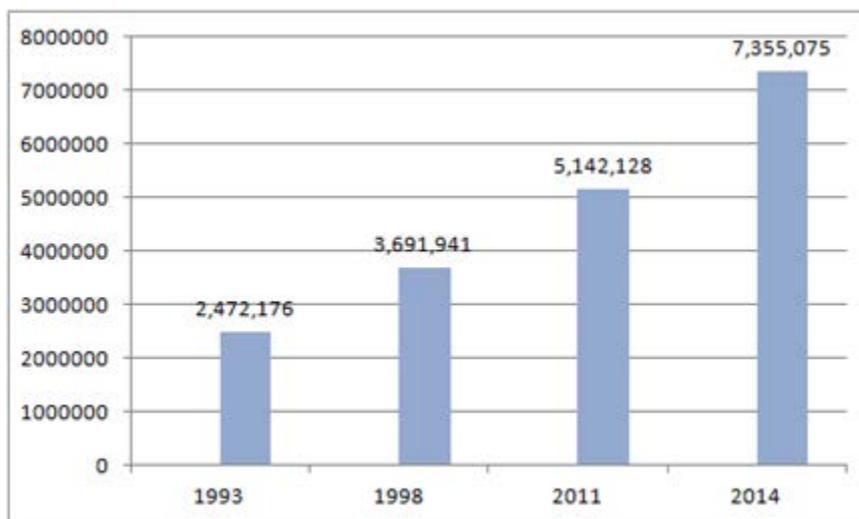
Basic information of Yangon city is indicated in the following table comparing to Kawasaki city.

**Table 2-1 Overview of Yangon City**

Item	Yangon city	Kawasaki city
Area [km <sup>2</sup> ]	598.8	143.0
Population [persons]	5.21 million [2014]	1.47 million [2015]
Average temperature [degree-C]	27.5	16.6

Source: The Study Team prepared based on several data

Yangon region including Yangon city increases population because of rapid urbanization at three times compared to population of 1998.



Source: JICA'' the Preparatory Study for Urban Development Programmed in the Greater Yangon in 2011'' and population census in 2014

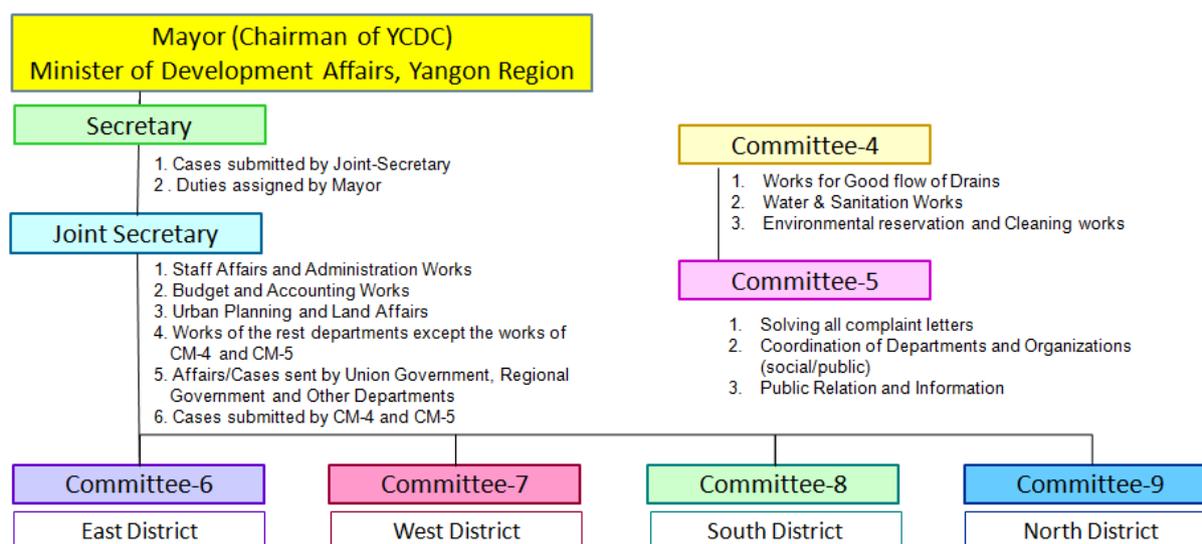
**Table 2-2 Trend of Yangon city's Population**

## 2.1.2 Yangon City Development Committee (YCDC)

Myanmar consists of seven regions, seven states, five autonomous areas and one autonomous region which are regulated by constitution. Also, under these areas, there are district and township as administrative unit.

Yangon City Development Committee (YCDC) which administrates Yangon city and provides government services is a development committee based on Yangon city development law.

In 2016 April, new government was established and the YCDC's framework was drastically changed as indicated in the following figure. The major points of this change are Joint Secretary was established under Secretary and City planning and land administration department which used to be independently set became a part of Joint Secretary. Also, Engineering Department of Water & Sanitation and Pollution Control and Cleansing Department were integrated into Committee-4. Four new Committees such as Committee-6 to Committee-9 were established to administrate four districts of Yangon city.



Source: YCDC

**Figure 2-1 YCDC's Administrative Framework**

## 2.2 CLIMATE CHANGE POLICY IN MYANMAR

The study focuses on Yangon city but climate change policy is handled by national government, so the climate change policy of Myanmar is summarized in the following as national policy including Yangon city.

### 2.2.1 Current situation of GHG emission

Myanmar submitted the first national report in 2012. According to the national report, the origin of GHG emission are dominated by land use and forest sector same as other Asian agricultural countries at 36.5%, agriculture at 17.1%, and waste materials at 4%. Also, regarding origin of emission and carbon sink, land use and forest sector are major share.

**Table 2-3 Amount of GHG emission in Myanmar (2000)**

Sector	CO <sub>2</sub> [Gg CO <sub>2</sub> -eq]		
	Carbon sink	GHG Emission	Total amount of GHG emission
Energy	0	786	786
Industry	0	463	463
Agriculture	0	22,843	22,843
Land use and forest sector	142,221	40,405	-101,816
Waste materials	0	2,826	2,826
Total	142,221	67,323	-74,898

Source: The 11<sup>th</sup> Workshop on GHG Inventories in Asia

### 2.2.2 Implementation body and National policy on global warming

Myanmar ratified UNFCCC in November 25<sup>th</sup>, 1994 and Kyoto protocol in August 13<sup>th</sup>, 2003. The national policy on global warming is summarized in the following table. In 2016, Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2016-2030 were formulated in order to precede action plan for global warming.

**Table 2-4 National Action for Global Warming**

Action	Year	Summary
National Environment Policy in Myanmar	1994	- Environmental protection and prevention of deterioration - Promotion of economic development - Achievement of sustainable development in priority of environmental protection - Harmony between environment and development
Myanmar• Agenda21	1997	- Use of natural resource for sustainable development - Development of society, economy, and institution
National Sustainable Development Strategy (NSDS)	2009	- Strategy for sustainable development in three sectors such as society, economy and environment
Environment Protection Law	2012	- Management of natural resource - Promotion of social awareness - Cooperation to environmental program
National Adaptation Plan for Action (NAPA)	2012	- Selection of 32 priority actions from 8 sectors - Implementation of adaptation action for global warming
Participation to Joint Crediting Mechanism	2015	- Conclusion of JCM
Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2016-2030	2016	- Target year is 2030 and plans to implement 6 priority projects for global warming policy

Source: prepared by the Study Team based on 11<sup>th</sup> Workshop on GHG inventories in Asia and the published Information by the UN prepared by the JICA Study Team

In the following, the Myanmar Climate Change Strategy and Action Plan 2016-2030 is summarized.

**Table 2-5 Summary of Myanmar Climate Change Strategy and Action Plan (MCCSAP)**

- Vision	The action plan aims to implement low carbon development in order to pursue sustainable development of Myanmar
- Goal	Goal of the plan is low carbon development and adaptation of climate change with the target year of 2030
- Priority Action Area	<p>Basic action plan</p> <ul style="list-style-type: none"> <li>a) Counter measure for climate change is reflected into development plan</li> <li>b) Development of organization and institution for climate change strategy</li> <li>c) Preparation of budget for climate change strategy</li> <li>d) Consideration of techniques for climate change strategy</li> <li>e) Development of knowledge and organization for climate change</li> <li>f) Promotion of cooperation with several organizations for project investment</li> </ul> <p>Priority action plan are selected from the following sectors.</p> <p>1) Agriculture and Fishery, 2) Environment, 3) Energy, Transportation and industry, 4) Urban city, 5) Welfare, 6) Education</p>

Source: Myanmar Climate Change Strategy and Action Plan 2016

## **CHAPTER 3 PROMOTION OF CITY TO CITY COLLABORATION FOR LOW CARBON DEVELOPMENT**

### **3.1 SUMMARY OF CITY TO CITY COLLABORATION**

Regarding basic policy for city to city collaboration between Yangon city and Kawasaki city, it is planned for three years term as indicated in the following table. In the first year of the plan in 2015, MOU was concluded by city mayors between Yangon city and Kawasaki city based on study and discussion for current condition and needs for city to city collaboration and basic policy.

In second year of the study, it prepared draft low carbon action plan and selection of pilot project based on the basic policy discussed in the first year.

The summary of menu for city to city collaboration through three years is indicated in the following table.

**Table 3-1 City to city Collaboration Implementation Menu**

<b>Fiscal year</b>	<b>Topics</b>	<b>Summary</b>
<b>FY2015</b>	1) To grasp and share the current situation for city-to-city collaboration	It was focused to build the deeper understanding of each other through the understanding of the current situation and information sharing by having several consultation meetings in Myanmar and Japan.
	2) To examine the menu for city-to-city collaboration	It was examined the menu for city-to-city collaboration by having the consultation of the issues and needs of Yangon city and possible supports to be offered from Kawasaki city.
	3) To examine the draft MOU	It was examined and prepared the draft MOU based on the above discussion for future city-to-city collaboration
		
<b>FY2016</b>	1) To prepare the low-carbon development action plan	To prepare low-carbon development action plan from middle and long terms point of view, based on the low-carbon development vision stated in Master Plan of the development of Yangon metropolitan area prepared in 2013
	2) To conduct WG meetings (including the meetings in Japan)	To implement WG meetings to promote the preparation of low-carbon action plan and implementation of the city-to-city collaboration. WG was hold in Myanmar and Japan.
	3) To prepare the draft menu for technical training	To prepare the technical training menu based on the possible support from Kawasaki city toward the technical assistance requested by Yangon city
	4) To prepare the draft pilot project	To select the sites for pilot projects which are feasible in the short term and prepare implementation plans in lo-carbon development action plan.
		
<b>FY2017</b>	1) To implement the pilot project based on the low-carbon development action plan	To support pilot project implementation based on the pilot project implementation plan prepared in 2016 fiscal year.

	2) To implement the technical training (including training in Japan)	To implement the technical training in Myanmar and Japan based on the technical training menu prepared in 2016 fiscal year.
	3) To implement WG meeting (including meeting in Japan)	To attempt close cooperation through the implementation of WG meetings.

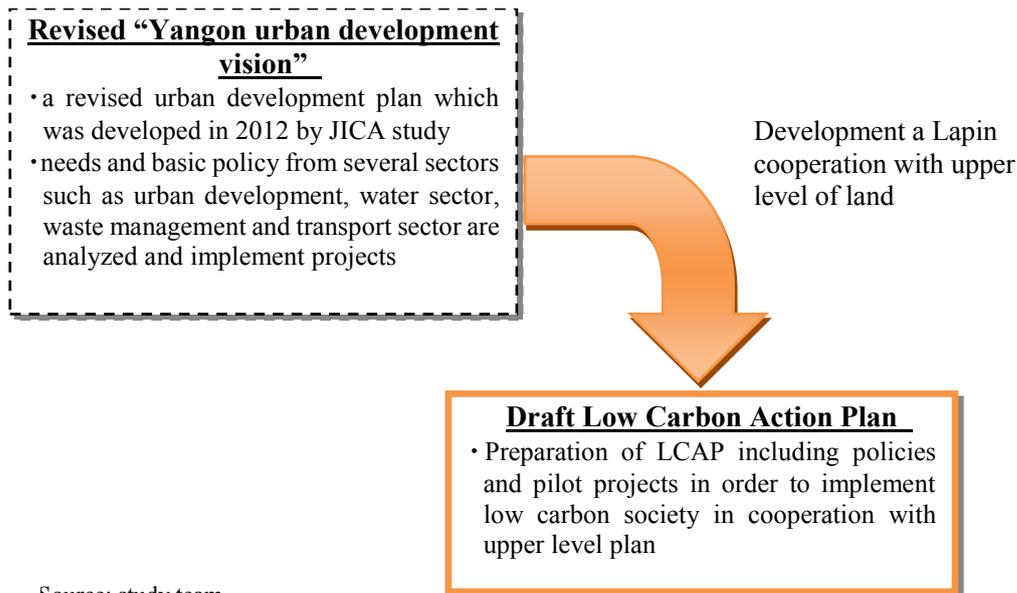
Source: The Study Team

### 3.2 PREPARATION OF LOW CARBON ACTION PLAN

#### 3.2.1 Low Carbon Action Plan

Draft Low Carbon Action Plan (LCAP) was prepared in cooperation with Kawasaki city which has knowledge and experiences for low carbon plan’s development and the basic policy. The implementation schedule of the plan is from 2017 up to 2040 and the scheme of the plan is set as three terms such as short, middle and long terms in order to conduct pilot projects for achieving low carbon society.

Also, the upper level plan of the LCAP is a revised “Yangon urban development vision” which is prepared by JICA study in 2016 to 2017. The LCAP aims to coordinate with basic policy and implementation schedule of the Yangon urban development plan.

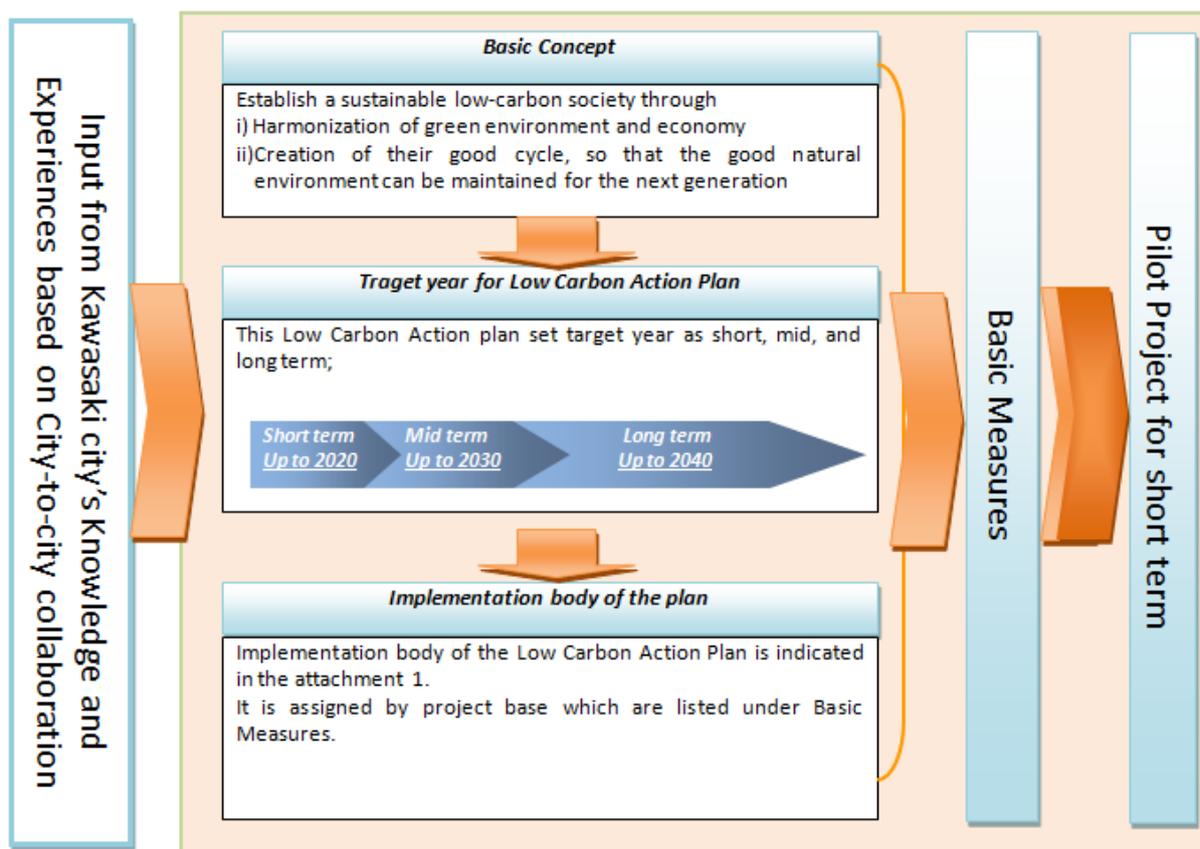


Source: study team

**Figure 3-1 Setting of Low Carbon Action Plan**

#### 3.2.2 Framework of Low Carbon Action Plan

Framework of Low Carbon Action Plan is indicated in the following figure which includes basic concept, implementation schedule, implementation body, basic policy by sectors and pilot projects.



Source: The Study Team

**Figure 3-2 Framework for Low Carbon Action Plan**

**【Basic Concept】**

The Low Carbon Action Plan aims to contribute for development of sustainable and low carbon society of Yangon city based on i) harmonization of green environment and economy and ii) creation of their good cycle, so that the good natural environment can be maintained for the next generation.

**【Implementation Schedule】**

The implementation schedule is set as from FY2017 to FY2040 and divided into three parts such as short, middle and long term. The basic policy and implementation of pilot project are planned by each three parts.

The implementation schedule is set as the same with SUDP, Sustainable Urban Development Plan which is upper level of plan to the LCAP.

**【Basic Policy】**

Basic policy of the plan was developed by sector considering needs of urban development of YCDC, on-going projects, and future development plan. The basic policy is indicated in the following table.

**Table 3-2 Needs and basic policy of Low Carbon Action Plan**

Sector	Needs and Basic policy
Industry	Yangon city has existing industrial parks and a plan of development of industrial parks in the city. Existing industrial parks have issues on renewal of aged facilities.

Energy	Population growth and development of industry cause increase of demand of electricity and frequent electric outage. It is important to provide stable electric supply.
Urban City	Urban development in the city center is increased because of private investment from domestic and international entities. It is expected that such commercial development will be more promoted since government also actively call for investment.
Transportation	Traffic congestion is one of issues to be solved in the city. It is necessary to consider counter measure for traffic congestion.
Waste Management	The main issue of waste management is increase of cost for garbage collection, needs for incineration facility and recycling system because of increase of waste materials. The total amount of wastes is exceeding 2000t per day and it is necessary to consider counter measure to the issue.
Education	It is necessary to improve understanding of citizens about recycling system and saving energy in order to archive low carbon society.
International Cooperation	Regarding low carbon and sustainable development, needs for introduction of leading technology from domestic and international courtiers is necessary.
MRV (Monitoring, reporting and verification)	It is important to introduce monitoring system for air pollution, and water contamination, and promotion of saving energy project.

Source: The Study Team

Based on the needs derived from issues, basic policy of LCAP was established as in the following table.

**Table 3-3 Basic Policy for Low Carbon Action Plan**

Sector	Basic policy
Industry	<b><i>I. Reduction of greenhouse gas emission from industrial activities</i></b> 1. Establishment of a business model towards "low-carbon Yangon City" 2. Fostering eco-friendly industries 3. Creation of eco-friendly model for industrial complexes
Energy	<b><i>II. Utilization of renewable energy resources</i></b> 1. Promotion of Solar-city Project 2. Creation of a system for making an effective use of energy 3. Making a wider use of renewable energy resources, considering the regional characteristics
Urban City	<b><i>III. Creation of low-carbon city</i></b> 1. Encourage construction of highly energy efficient buildings 2. Introduction of energy efficient technology into public sector 3. Promotion of energy efficient technology to private sector
Transportation	<b><i>VI. Introduction of Low carbon technique in the transportation Sector</i></b> 1. Establishment of eco-friendly transportation network 2. Enhance convenience of public transportation 3. Promotion of measures for greenhouse gas emitted from automobiles
Waste Management	<b><i>V. Creation of recycling-oriented society</i></b> 1. Promotion of 3R activities of non-industrial wastes and industrial wastes 2. Introduction of low-carbon waste incineration facility Reduction of greenhouse gas emission from collection and transportation of wastes
Education	<b><i>VI. Environmental education and study on global environmental issues</i></b> 1. Promotion of environmental education and study 2. Promotion of human resource development

Sector	Basic policy
International Cooperation	<b>VII. Introduction of international technology through city to city cooperation</b> 1. Contribution to reduction of global greenhouse gas emission by introducing international technology through city to city cooperation 2. Supporting and cooperating international environmental conservation activities
MRV (Monitoring, reporting and verification)	<b>VIII. Research and development of environmental technologies</b> 1. Research and development of environmental technologies, and promotion of scientific measures 2. Conducting MRV in order to promote introduction of saving energy technology

Source: The Study Team

### **【Pilot project】**

Based on basic policy which was set in above, several pilot projects which pursue to implement from short term to midterm in order to promote low carbon society were selected as in the following table.

**Table 3-4 List of Pilot Projects**

Sector	Proposed Pilot projects	Schedule
Industry	PP1: Introduction of high efficiency boilers into factory	Short term
Energy	PP2: Introduction of solar PV system into existing water pumping station	Short term
Urban City	PP3: Introduction of high efficiency pumps in to existing pumping station	Short term
Waste Management	PP4: Introduction of Waste to Energy Plant in Yangon City	Mid term

Source: The Study Team

### **【Implementation body】**

Implementation body in YCDC and its role were summarized in the following table. The implementation body is assigned by sector including its major roles. In the case the sector strides several implementation bodies such as education and dissemination to citizens for low carbon society, it is necessary to discuss which should be major body and how to coordinate among several bodies.

**Table 3-5 Major implementation body by basic policy**

Sector	Basic policy	Major implementation body
Industry	•Promotion of saving energy technology to private sector •Plan and development of eco-friendly industrial park	⇒ CPLA ⇒ CPLA
Energy	•Promotion of saving energy project >>>In case the public facility, management body in YCDC is major implementation body •Promotion of renewable energy project >>>In case the public facility, management body in YCDC is major implementation body	⇒ relevant body ⇒ relevant body

Sector	Basic policy	Major implementation body
Urban City	<ul style="list-style-type: none"> <li>•Low carbon urban development</li> <li>&gt;&gt;In case the public facility, management body in YCDC is major implementation body</li> <li>&gt;&gt;In case private facility, edification of low carbon development is conducted by CPLA</li> </ul>	⇒ CPLA
Transportation	<ul style="list-style-type: none"> <li>•Promotion of low carbon public transport</li> <li>•Promotion of low carbon transport in private sector</li> </ul>	⇒ CPLA
Waste Management	<ul style="list-style-type: none"> <li>•Promotion of 3R</li> <li>• Promotion of low carbon development for waste management facility</li> </ul>	⇒ PCCD
Education	<ul style="list-style-type: none"> <li>•Edification of recycling system to city staff and citizens</li> <li>•Promotion of introduction of renewable energy into private sector</li> </ul>	⇒ PCCD
International Cooperation	•Promotion of introduction of international high efficiency technology under city to city collaboration	⇒ Public relations
MRV	•Promotion of introduction of monitoring system for GHG emission reduction	⇒ PCCD, CPLA

Note: CPLA (City Planning and Land Administration Dept.), PCCD (Pollution Control and Cleansing Dept.),  
Source: The Study Team

The issues which need to be discussed continuously are summarized in the following table.

**Table 3-6 Issues to be discussed and policy for counter measure**

Issues	Policy
1)Proportion and dissemination of low carbon techniques to private sector	It is necessary to introduce low carbon technology to private sector for future development such as industrial park, commercial facility, hospitals and transport sector. It is difficult to handle by one unit of YCDC, so it is recommended that several units or new unit for the task shall take in part of the sector.
2)Edification of YCDC staff and citizens for low carbon development	As for low carbon technology, staffs of YCDC has gap in understanding. In order to implement low carbon society in the future, it is necessary to expand the understanding among YCDC. Also, for recycling activities, it is necessary to have cooperation with citizens and disseminate information.
3)Preparation of institution for low carbon development	As for implementation of low carbon and sustainable society, development of institution and system is needed to develop as well as implementation of pilot projects.

Source: The Study Team

### 3.2.3 Summary of Proposed Pilot Projects

Summary of proposed pilot projects are indicated in the following table.

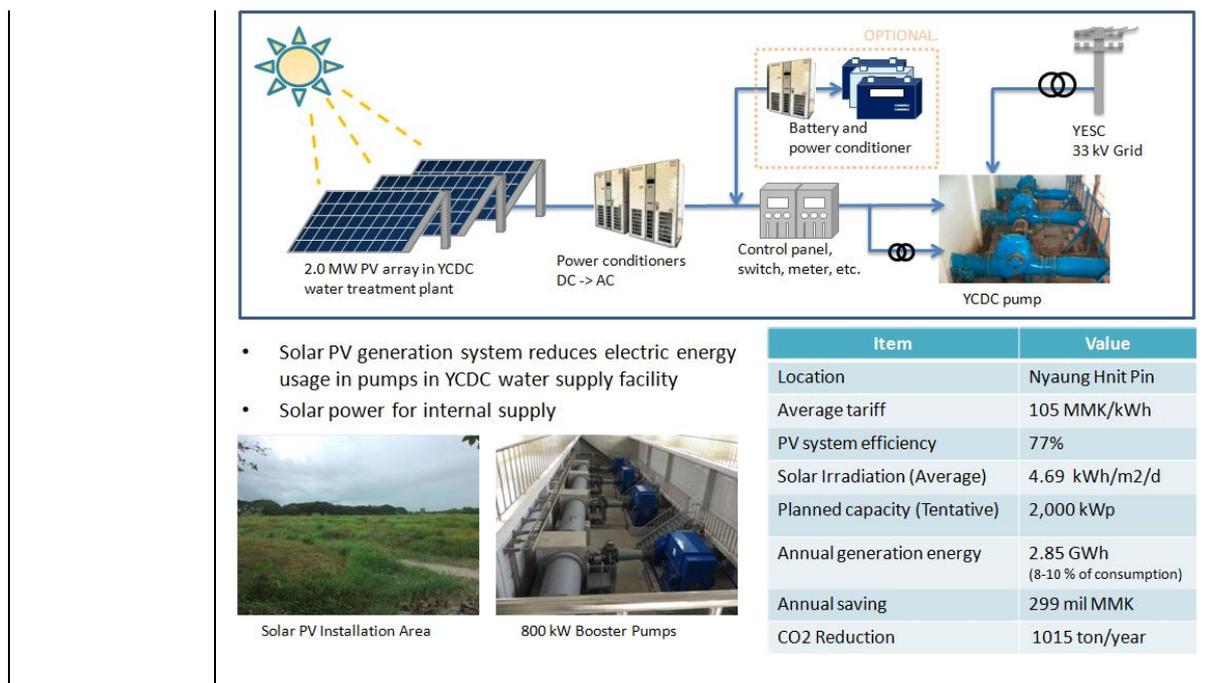
**Table 3-7 Outline of Pilot Project (PP1)**

<b>Project</b>	<b>PP1: Introduction of high efficiency equipment into factory</b>	<b>FY2016 FS, Planned to implement after 2017</b>
Target	New or existing factory	
Implementation body	Private sector	
Project Summary	It aims to reduce GHG emission and fuel consumption by introduction of high efficiency equipment into factory.	
	 <p>High-efficiency compressor for refrigerator</p> <ul style="list-style-type: none"> <li>• Cascade system of high-efficiency reciprocating refrigerators can reduce electricity consumption and CO2 emission</li> <li>• 28% electricity reduction</li> </ul>	 <p>High-efficiency once-through boiler with monitoring system</p> <ul style="list-style-type: none"> <li>• High-efficiency once-through oil boiler reduce fossil fuel and CO2 emission</li> <li>• Co-benefit of reduction of air pollutant</li> <li>• 9.6% fuel reduction</li> </ul>

Source: The Study Team

**Table 3-8 Outline of Pilot Project (PP2)**

<b>Project</b>	<b>PP2: Introduction of Solar PV system into existing pumping station</b>	<b>FY2016-17 FS, Planned to implement after 2017</b>
Target	Nyaung Hnit Pin pumping station	
Implementation body	YCDC Engineering Department of Water and Sanitation	
Project Summary	By introduction solar PV system into existing pumping station which is managed by YCDC, it saves a part of electricity consumption of the facility.	



Source: The Study Team

**Table 3-9 Outline of Pilot Project (PP3)**

<b>Project</b>	<b>PP3: Introduction of high efficiency pumps into existing pumping station</b>	<b>FY2017 FS, planned to implement after 2018</b>																		
<b>Target</b>	Existing pumping station																			
<b>Implementation body</b>	YCDC Engineering Department of Water and Sanitation																			
<b>Project Summary</b>	By introduction of high efficiency pumps into existing pumping station, electricity consumption and GHG emission shall be reduced.																			
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Old Pump system (image)</p> </div> <div style="text-align: center;"> <p>New high-efficiency pumps (example)</p> </div> </div> <ul style="list-style-type: none"> <li>Hlawga water treatment plant installed pump in total 2 MW capacity in 1980</li> <li>Old, low efficiency pumps are to be replaced with new, high-efficiency pumps</li> <li>Efficiency improvement of pumps reduces electric energy consumption and reduce CO2 emission</li> </ul> <table border="1"> <thead> <tr> <th>Item</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Location</td> <td>Hlawga</td> </tr> <tr> <td>Current Pump efficiency</td> <td>80? % (tentative)</td> </tr> <tr> <td>Pump efficiency</td> <td>90?% (tentative)</td> </tr> <tr> <td>Electricity consumption</td> <td>11,038MWh/yr</td> </tr> <tr> <td>Pump load</td> <td>2.0-2.1 MW</td> </tr> <tr> <td>Current monthly tariff</td> <td>96mil MMK/m</td> </tr> <tr> <td>Annual saving</td> <td>128 mil MMK/yr</td> </tr> <tr> <td>CO2 Reduction</td> <td>ton/year</td> </tr> </tbody> </table>		Item	Value	Location	Hlawga	Current Pump efficiency	80? % (tentative)	Pump efficiency	90?% (tentative)	Electricity consumption	11,038MWh/yr	Pump load	2.0-2.1 MW	Current monthly tariff	96mil MMK/m	Annual saving	128 mil MMK/yr	CO2 Reduction	ton/year
Item	Value																			
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Pump load	2.0-2.1 MW																			
Current monthly tariff	96mil MMK/m																			
Annual saving	128 mil MMK/yr																			
CO2 Reduction	ton/year																			

Source: The Study Team

**Table 3-10 Outline of Pilot Project (PP4)**

<b>Project</b>	<b>PP4: Introduction of Waste to Energy Plant in Yangon City</b>	<b>FY 2017 FS, planned to implement after 2018</b>
Target	Pilot areas in Yangon city	
Implementation body	YCDC Pollution Control and Cleansing Department	
Project Summary	<p>2,700 tons of solid waste is collected daily in Yangon city. There is no private company that conduct solid waste management in Yangon city, and Yangon city (Pollution Control and Cleansing Department: PCCD) collects and treats all solid waste generated in Yangon city. Currently, at least four incinerator plants are needed in Yangon city.</p> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;">  <p>Waste-to-energy facility under construction</p> </div> <div style="flex: 1; text-align: center;">  <p>Landfill Site</p> </div> <div style="flex: 2;"> <p>Build and operate a waste-to-energy plant :</p> <ul style="list-style-type: none"> <li>- JCM model project with JFE</li> <li>- generates electricity, some of which will be supplied to a power company, resulting in reduction of fossil fuel consumption</li> <li>- reduces CH4 emissions from landfill disposal</li> <li>- improves of waste management in Yangon City.</li> <li>- Low CO, NOx technique</li> </ul> </div> </div>	

Source: The Study Team

### 3.2.4 Further Action

This year's objective for Low Carbon Action Plan was to develop draft of LCAP and select of pilot projects. As for further action of LCAP, it is planned to formulate the LCAP and implement pilot projects. In the following, the basic policy for next fiscal year is summarized.

#### 1) Spread of LCAP

LCAP needs to be understood by YCDC.

#### 2) Preparation of system for introduction of low carbon technology

It is necessary to prepare standards for introduction of saving energy and incentive system. Aiming for implementation by FY2020, it is discussed and prepared for development of such systems.

#### 3) Capacity development of YCDC staff

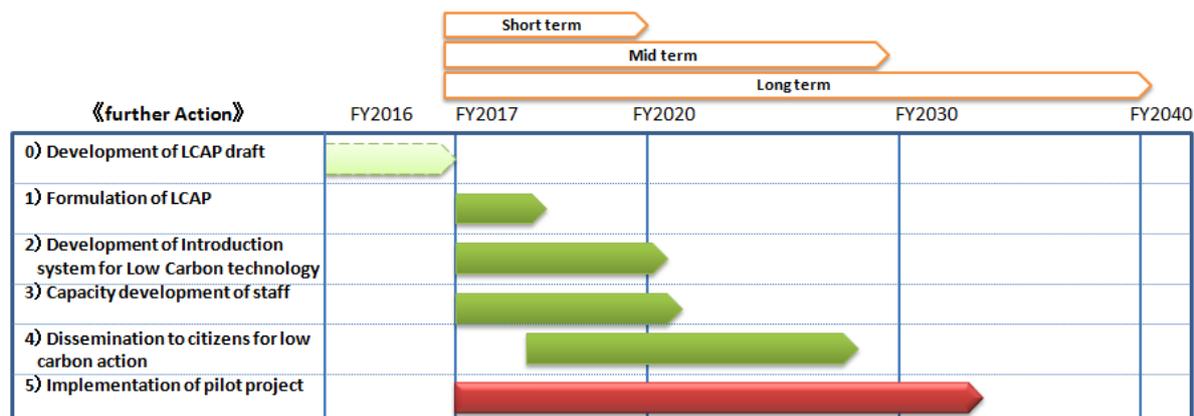
In order to precede low carbon society, it is necessary to conduct capacity development of YCDC for understanding and knowledge of low carbon technology. It promotes capacity development of YCDC staff from the midterm wise.

#### 4) Dissemination activities to citizens

It is necessary to have citizen's cooperation for achievement of low carbon society. It promotes dissemination activities to citizens on low carbon technology and recycling activities.

#### 5) Implementation of pilot projects

Pilot projects are listed in the 2<sup>nd</sup> year study. The list of pilot project shall be updated based on needs and situation if needed.



Source: The Study Team

**Figure 3-3 Schedule for Further Action**

### 3.3 STUDY RESULT FOR CITY TO CITY COORPORATION

#### 3.3.1 Summary

In the study, it was discussed between Kawasaki city and YCDC about issues and counteraction for implementation of low carbon society. Also, a relationship of both cities was connected strongly through the study by sharing Kawasaki city's experience and knowledge for environmental technology and development of low carbon society which comes with regeneration from pollution issues.

For JCM model project formulation in this fiscal year, the feasibility surveys of both "Introduction of high efficiency pumps into existing pumping station (hereinafter as the pump project)" and "Introduction of IoT system into wastes collection (hereinafter as the waste management project)" under the city-to-city collaboration.

In the following table, the study results for city to city cooperation are summarized.

**Table 3-11 Study results for city to city cooperation**

Content	Schedule	Summary
Kick-off meeting at Tokyo	Apr 26 <sup>th</sup> 2017 15PM~17PM	<ul style="list-style-type: none"> <li>Explanation of proposed scheme and schedule</li> <li>Issues and policy of counteraction</li> </ul>
The 1 <sup>st</sup> field study	May 15 <sup>th</sup> to 20 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>Meeting with YCDC (PCCD, EDWS), Embassy of Japan in Myanmar</li> <li>Site visit to Hlawga pumping station for the pump project</li> <li>Meeting with relevant companies of the pump project</li> </ul>
The 2 <sup>nd</sup> field study	June 12 <sup>th</sup> to 16 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>Meeting with YCDC (PCCD, EDWS)</li> <li>Conduct of survey in Hlawga pumping station for the pump project</li> <li>Meeting with relevant companies of the pump project</li> <li>Meeting with relevant companies of the waste management project</li> </ul>
The 3 <sup>rd</sup> field study	July 3 <sup>rd</sup> to 7 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>Meeting with YCDC (PCCD, EDWS), JETRO, and Embassy of Japan in Myanmar</li> <li>Meeting with relevant companies of the waste management project</li> </ul>

<b>Content</b>	<b>Schedule</b>	<b>Summary</b>
JCM workshop at Kawasaki	July 24 <sup>th</sup> to 29 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>• Conduct JCM workshop at Kawasaki city and invite four officials from YCDC</li> <li>• Site visit in Kawasaki city</li> </ul>
The 4 <sup>th</sup> field study	Aug 14 <sup>th</sup> to 17 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>• Conduct a workshop with YCDC in regard to LCAP</li> <li>• Meeting with YCDC (PCCD, EDWS), JICA experts and Embassy of Japan in Myanmar</li> <li>• Meeting with relevant companies of the pump project</li> </ul>
The 5 <sup>th</sup> field study	Sep 19 <sup>th</sup> to 27 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>• Meeting with relevant companies of the pump project</li> <li>• Meeting with YCDC (EDWS)</li> </ul>
The 6 <sup>th</sup> field study	Sep 27 <sup>th</sup> to Oct 4 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>• Meeting with YCDC (PCCD)</li> <li>• Meeting with relevant companies of the waste management project</li> </ul>
The 7 <sup>th</sup> field study	Oct 10 <sup>th</sup> to 14 <sup>th</sup> 2017	<ul style="list-style-type: none"> <li>• Meeting with relevant companies of the pump project</li> <li>• Meeting with YCDC (EDWS)</li> </ul>
The 8 <sup>th</sup> field study	Jan 22 <sup>nd</sup> to 26 <sup>th</sup> 2018	<ul style="list-style-type: none"> <li>• Meeting with YCDC (PCCD)</li> <li>• Meeting with relevant companies of the waste management project</li> </ul>
JCM workshop at Tokyo	Jan 30 <sup>th</sup> 2018	<ul style="list-style-type: none"> <li>• Conduct JCM workshop at Kawasaki city and invite two officials from YCDC</li> </ul>
The 9 <sup>th</sup> field study	Feb 15 <sup>th</sup> to 16 <sup>th</sup> Feb 2018	<ul style="list-style-type: none"> <li>• Meeting with relevant companies of the pump project</li> <li>• Final meeting with YCDC (EDWS) to confirm scope of work/ project cost etc of the pump project</li> <li>• Meeting with relevant companies of the waste management project</li> </ul>

Source: The Study Team

### **3.3.2 Discussion between Kawasaki city and YCDC**

At 4<sup>th</sup> field study, two officials from Kawasaki city (one officer from International Economic Affairs Office, and another officer from Water and Sewer Department) had meetings with YCDC.

To reconfirm the contents of LCAP with each other and discuss on future collaboration among the both cities, the workshop was organized with YCDC in August. In the workshop, Kawasaki city officer from International Economic Affairs Office gave a presentation about our activities of this city-to-city collaboration and the goals of LCAP. YCDC (the head of PCCD) mentioned about priority issues and needs in Yangon city as well.

Also, the meeting with YCDC (EDWS) was held in order to formulate JCM model project regarding to the pump project. Kawasaki city officer from Water and Sewer Department gave a presentation to EDWS to introduce the water treatment facilities in Kawasaki city, their operation and maintenance system, and their activities such as Kawasaki Water Business Network (KaWaBiz NET). In this meeting, it was confirmed that Kawasaki city will support YCDC staffs to implement suitable O&M for the introduction of high-efficiency pumps into Hlawga pumping station.



The Workshop on LCAP at YCDC office



The Workshop on LCAP at YCDC office



The Workshop on LCAP at YCDC office



The Workshop on LCAP at YCDC office



The meeting with YCDC (EDWS) and Kawasaki



The meeting with YCDC (EDWS) and Kawasaki

### 3.3.3 JCM workshop at Kawasaki city (July 2017)

Four officials from YCDC (two officials from PCCD, and two officials from EDWS) participated JCM workshop in the end of July 2017 which was organized by Ministry of the Environment, Japan and visited low carbon facilities in Kawasaki city.

In Kawasaki city, YCDC officials visited some facilities related to the pump project and the waste management project.

**Table 3-12 Facilities for site visit (July, 2017)**

Proposed project	Facilities
The pump project	<ul style="list-style-type: none"> <li>Nagasawa water purification plant</li> <li>Kitachiba water purification plant (this facility is operated and managed by a candidate company of the representative participant of the international consortium.)</li> </ul>
The Waste management project	<ul style="list-style-type: none"> <li>Ozenji Disposal Center</li> <li>A facility introduced ICT technologies</li> </ul>

Source: The Study Team

<Site Visit>



Water purification plant



Solar panel introduced on the cover of plant



Monitoring panel for showing generated electricity



Exhibition room in Water purification plant



Ozenji Disposal Center



Ozenji Disposal Center



Ozenji Disposal Center



Kitachiba water purification plant



Kitachiba water purification plant



Q&A session after site visit

<JCM workshop at Kawasaki city>



Presentation of YCDC officials



JCM workshop in

### 3.3.4 JCM seminar at Tokyo (January 2018)

JCM seminar at Tokyo was conducted on 23<sup>rd</sup> and 24<sup>th</sup> of January. In the seminar, the study result was presented and Kawasaki official participated in the panel discussion on the role of city government of the study.

### 3.3.5 Kawasaki International Eco-Tech Fair

From 1<sup>st</sup> to 2<sup>nd</sup> of February, Kawasaki International Eco-Tech Fair 2018 was held in Kawasaki city. In the fair, the city-to-city collaboration between Yangon city and Kawasaki city was introduced as well as activity of Kawasaki Green Innovation Cluster.

## CHAPTER 4 JCM MODEL PROJECT FORMULATION (INTRODUCTION OF HIGH-EFFICIENCY PUMPS INTO EXISTING PUMPING STATION)

### 4.1 OUTLINES

Yangon city has built water supply system and provided water since 1842. There are 6.8million population served by piped water, coverage of the water supply system is about 38% (2011), the sewerage system coverage rate is less than 5%. It means that over 60% of the population are not provided water supply well, and they take the waters of groundwater, rivers, and lakes. Non-Revenue Water is approximately 67% in Yangn city, and leak of water by aging pipings and illegal connection to water pipe are critical issues. Furthermore, the quality of supply water in Yanagon is not good and some bacteria are detected in most tap water.

Yangon city supplies 636,440 m<sup>3</sup>/day of water in Yangon city, however, it is necessary to cope with future water demand which is expected to increase in the near future due to increasing population.

Hlawga pumping station managed by YCDC was constructed in 1980 and started operation in 1981(36 years ago), soYCDC have a plan to install new pumps. In this project aims to improve the efficiency of pumps and save energy consumptions by replacement of aging pumps. It can achieve stable water supply in Yanagon city.

**Table 4-1 Outline of Proposed JCM Model Project**

Project owner	Yangn City Development Committee (YCDC), Engineering Department of Water and Sanitation
Project site	Hlawga pumping station managed by YCDC (water intake pump station)
Outline of technology	High-efficiency pumps (Vertical Double Suction Volute Pump)
	 <p style="text-align: center;">Source: Catalogue of Ebara Thailand Limited</p> <p style="text-align: center;"><b>Figure 4-1 Proposed high-efficiency pump (Vertical Double Suction Volute Pump)</b></p>
Project Output	The high-efficiency pumps installed in this project reduce GHG emission 919.6 ton-CO <sub>2</sub> /year.

	There are mainly five water treatment facilities in Yangon managed by Yangon city, but all equipment in the facilities have been working for decades. So, it is expected that these equipment and facilities will be replaced one by one. Also, Yangon city plans to construct new facilities such as purification plants in order to cope with water demands in Yangon city. Therefore, this project is expected to provide some incentives to Yangon city.
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Source: The Study Team

## 4.2 METHOD FOR THE PROJECT FORMULATION

The formulation of JCM Model Project was conducted based on the following study method. Results of the study are also summarized in the same table.

**Table 4-2 Study Method and Result of JCM Model Project Formulation**

#	Item	Study Method	Study Results
1	Confirmation of the Current Situation of Existing Pumps and Consideration of Specification of Introduced High-Efficiency Pumps	<ul style="list-style-type: none"> <li>To conduct field survey to check the current situation of existing pumps and operation &amp; maintenance in Hlawga pumping station.</li> <li>To propose a specification of introduced high-efficiency pumps</li> </ul>	<ul style="list-style-type: none"> <li>Confirmation of the current conditions of existing pumps by field surveys</li> <li>Consideration of specification of new pumps</li> <li>Calculation of GHG emission reductions by new pumps</li> </ul>
2	Monitoring Plan	<ul style="list-style-type: none"> <li>To consider and create monitoring plan for MRV, based on specification of new pumps</li> </ul>	<ul style="list-style-type: none"> <li>Consideration of monitoring plan for JCM model project</li> </ul>
3	Confirmation of Necessary Approvals	<ul style="list-style-type: none"> <li>To confirm licenses/ approvals to introduce new pumps into Yangon city</li> </ul>	<ul style="list-style-type: none"> <li>Confirmation of necessary licenses and approvals</li> </ul>
4	Coordination for International Consortium for Application of JCM Model Project	<ul style="list-style-type: none"> <li>To select representative participant of International consortium</li> <li>To confirm details of international consortium agreement</li> </ul>	<ul style="list-style-type: none"> <li>Selection of international consortium members for JCM model project</li> <li>Confirmation of roles of each member</li> <li>Discussion with YCDC on the international consortium agreement</li> </ul>
5	Confirmation of the laws related to procurement in Yangon	<ul style="list-style-type: none"> <li>To confirm necessity of tender procedures to introduce new pumps</li> </ul>	<ul style="list-style-type: none"> <li>Confirmation with YCDC that the pump project will not need a bid</li> </ul>
6	Capacity Building of YCDC staffs for O&M of the pump	<ul style="list-style-type: none"> <li>To conduct field surveys to confirm current O&amp;M situation.</li> <li>To transfer knowledge to YCDC from Kawasaki on management and maintenance of the pump station</li> </ul>	<ul style="list-style-type: none"> <li>YCDC (EDWS) officials were invited to Kawasaki city, and conducted site visit of facilities in Kawasaki.</li> <li>The method of O&amp;M for water treatment facilities in Kawasaki city was shared by Kawasaki.</li> </ul>

Source: The Study Team

### 4.3 STUDY RESULTS

#### 4.3.1 Confirmation of the Current Situation of Existing Pumps and Consideration of Specification of Introduced High-Efficiency Pumps

Field survey in the Hlawga pumping station were conducted to confirm the current situation of existing pumps. The following table shows outline of existing pumps.

**Table 4-3 Outline of Existing Pumps**

Items	Outline
Existing pumps	Intake pump 4 units (83 m <sup>3</sup> /min x 54m x 740 rpm x 1000kW)
Year of installation	1980
Working time	<ul style="list-style-type: none"> <li>• Normally 2 pumps are operated/ 24 hours/ 365 days</li> <li>• Switch working pumps in every 2-3 days</li> </ul>

Source: The Study Team

Under normal operation of Hlawga pumping station (2 pumps operated), data collection from YCDC and measurement survey in Hlawga pumping station were conducted. The results of the survey are shown in the following table.

**Table 4-4 Results of field survey**

No.	Contents	Existing Pumps
1	Operating points under two (2) pumps operation	According to site measurement data, two (2) pumps operating point is approximately total 235 [m <sup>3</sup> /min] x 38.7 [m]
2	Flow velocity in main pipeline	1.83 [m/s] under flow rate of 235 [m <sup>3</sup> /min]
3	Pump size	Suction bore 750 [mm] Discharge bore 600 [mm]
4	Motor output	1,000 [kW] x 8 poles
5	Power consumption under 240 [m <sup>3</sup> /min] flow rate conditions	Motor input [kW]=0.163 x 120 [m <sup>3</sup> /min] x 38 m / (η <sub>p</sub> x η <sub>m</sub> ) =1,031 [kW] η <sub>p</sub> : pump efficiency = 81 [%] η <sub>m</sub> : Motor efficiency = 89 [%]
6	Saving energy per year under two (2) pumps continuously operating	1,031 [kW] x 2 pumps x 24 hours x 365 days =18,063,120 [kWh/Year]
7	Reduction of Electricity fee/year (75kyat/ 1 kWh)	= 1,354.73 Million kyat per year

Source: The Study Team

Based on the results of the investigations, installed pumps were considered to be suitable for the current situation. In this pump project, it is decided to introduce “Vertical Double Suction Volute Pumps” into the pumping station. This type of pumps can save space and operate with low noise.

The specification of introduced pumps is as follows.

**Table 4-5 Proposed new pumps**

No.	Contents	New Pumps
1	Operating points under two (2) pumps operation	Two pumps operating point will be approximately total 240 [m <sup>3</sup> /min] x 40 [m]
2	Flow velocity in main pipeline	1.87 [m/s] under flow rate of 240 [m <sup>3</sup> /min]
3	Pump size	Suction bore 800 [mm] Discharge bore 600 [mm]
4	Motor output	1,000 [kW] x 8 poles
5	Power consumption under 240 [m <sup>3</sup> /min] flow rate conditions	Motor input [kW]=0.163 x 120 [m <sup>3</sup> /min] x 40 m / (η <sub>p</sub> x η <sub>m</sub> ) =898.1 [kW] η <sub>p</sub> : pump efficiency = 90 [%] η <sub>m</sub> : Motor efficiency = 96.8 [%]
6	Saving energy per year under two (2) pumps continuously operating	898.1 [kW] x 2 pumps x 24 hours x 365 days = 15,734,712 [kWh/Year]
7	Reduction of Electricity fee/year (75kyat/ 1 kWh)	= 1,180.10 Million kyat per year

Source: The Study Team

To confirm the details of current situation and consider the specification of introduced pumps, discussions with YCDC (EDWS) and field surveys were conducted multiple times in Yangon since May 2017. The details of results of investigation are shown in attachment-2.



Discussion in the office at Hlawga pumping station



Survey at Hlawga pumping station



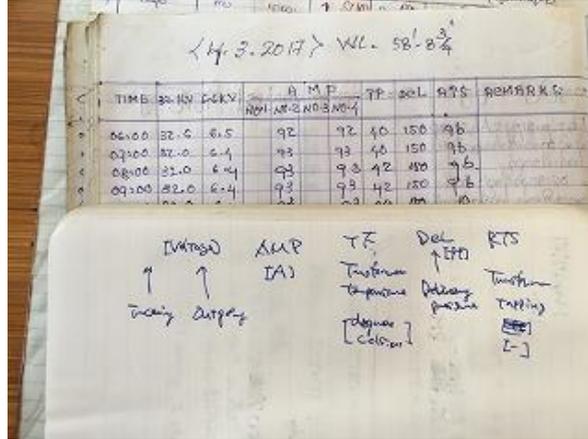
Survey at Hlawga pumping station



Discussin with YCDC (EDWS)

### 4.3.2 Monitoring Plan

As for monitoring records, the hearing survey to YCDC (EDWS) was conducted in Hlawga pumping station. Currently, recording time, Voltage(incoming/outgoing), AMP[A], TF (transformer temperature) [degree, Celsius], Del (delivery pressure) [ft], RTS(Transfer tapping)[No unit] are recorded every one hour in a notebook.



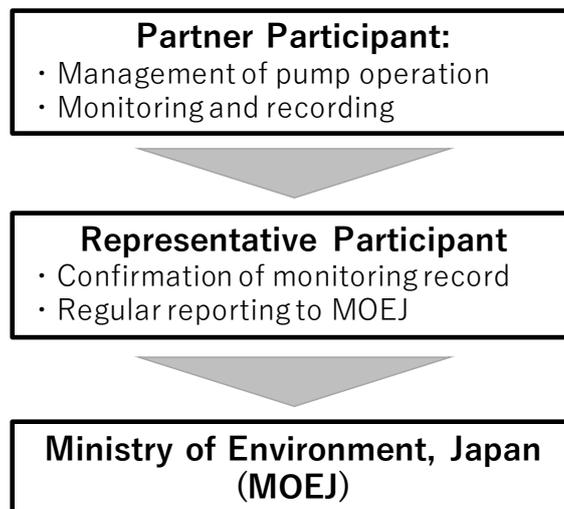
Source: The Study Team

**Figure 4-2 Monitoring record in Hlawga pumping station**

The monitoring will be conducted by the partner participant as the daily operation works. A local company assigned by the pump manufacturer will support monitoring as necessary.

Also, a representative participant of this pump project is a private company which is a member of Kawasaki Water Business Network (KaWaBiz NET), and they have a lot of experiences and knowledge in regard to water and sewer management. So, the representative participant will also support YCDC for MRV of JCM model project.

The monitoring implementation structure is as shown in the figure below. The recorded data in the pump operation and maintenance will be sent from the partner participant to representative participant and will be used for reporting to MOEJ.



Source: The Study Team

**Figure 4-3 Monitoring Structure**

### 4.3.3 Confirmation of Necessary Approvals

It is necessary for adoption of JCM Model Project applicant to clear necessary approval matters in Myanmar. The required approval items and environmental clearance for the project are as summarized in the table below. Hlawga

**Table 4-6 Required Approval Matters and Study Result**

No.	Items	Result of Study
1	Approval for investment and construction	Approval for constructions is not needed because only construction work for pump replacement will be conducted in the pump house.
2	Application of IEE approval	IEE approval is not needed for this project.
3	Inspection for pump installation	Inspection procedure for pump installation will be conducted by YCDC.

Source: The Study Team

### 4.3.4 Coordination for International Consortium for Application of JCM Model Project

It is necessary to establish International Consortium for application of JCM Model Project. The outline of International Consortium is as shown in the table below.

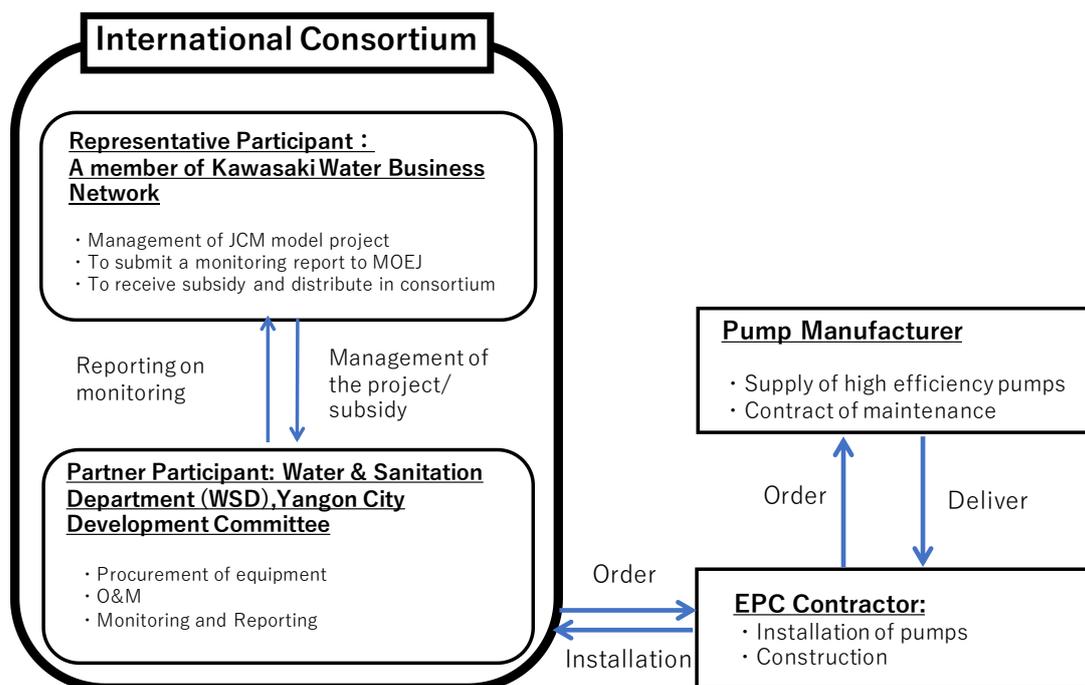
**Table 4-7 Study Items for Project Implementation Structure**

Item	Description
Selection of representative participant of International consortium	Representative Participant is necessary to select for the application of JCM Model Project. Japanese company who have many experiences of water/sewer management and a member of KaWaBiz NET in Kawasaki city will be the Representative Participant.
Selection of local contractor	The contractor with plenty of equipment procurement and installation experiences was selected. The contractor is a Japanese private company which has their office in Kawasaki city.

Source: The Study Team

The project will be adapted in September in 2018, and the project period will be for about one and a half year from October 2018 to May 2020.

Based on the items above, the project implementation structure is as shown in the figure below.



Source: The Study Team

**Figure 4-4 JCM Model Project Implementation Structure**

**Table 4-8 Party and Roles and Responsibility**

Party	Roles and Responsibility
Representative Participant <Japanese food company>	- Application for JCM Model Project - Supervision and management of the JCM Model Project
Local Participant <Local food factory>	- Project implementation - Management and monitoring of the Project
EPC Contractor <Japanese construction company>	- Pump equipments procurement and delivery - Equipment installation
Pump Manufacturer <Japanese company Thailand office>	- Pump equipments manufacture and delivery

Source: The Study Team

#### 4.3.5 Confirmation of the laws related to procurement in Yangon

This pump project is implemented with YCDC as a public work, so normally a tender is needed. However, it was confirmed at a discussion with YCDC (EDWS) that this project will not need a bid. Therefore, the international consortium members, EPC contractor, and the pump manufacturer will be the same as the proposed members in 4.3.4.

Also, the survey team had a discussion on an application and confirmation of YCDC's budget. The fiscal year of Yangon city is as same as Japanese, it means that fiscal year start in April and end in March. However, the fiscal year of Yangon will be changed from next fiscal year. New fiscal year of Yangon city will start in October and end in September. For this year (2018), from April to September will become a dual circulation period and temporary budget will be

applied for the period. YCDC’s budget for new fiscal year will be secured in August 2018, inclusive of the pump project’s cost. The pump project will start from October 2018 if the proposal is selected, so the budget for project will be confirmed before implementation.

#### 4.4 PREPARATION OF JCM MODEL OROJECT

##### 4.4.1 Project Outlines

Following table summarizes the details of JCM Model Project.

**Table 4-9 Outline of JCM Model Project**

Project owner	Yangon City Development Committee (YCDC), Engineering Department of Water and Sanitation (EDWS)
Project summary	Hlawga pumping station managed by YCDC was constructed in 1980 and started operation in 1981(36 years ago), so YCDC have a plan to install new pumps. In this project aims to improve the efficiency of pumps and save energy consumptions by replacement of aging pumps. It can achieve stable water supply in Yanagon city.
Technology	High-efficiency pumps (“Vertical Double Suction Volute Pump” was selected based on the current condition of the existing pumps.)
Financial plan	The initial investment is covered by YCDC (EDWS) 100%.
Implementation Structure	<pre> graph TD     subgraph Consortium [International Consortium]         RP[Representative Participant: A member of Kawasaki Water Business Network - Management of JCM model project - To submit a monitoring report to MOEJ - To receive subsidy and distribute in consortium]         PP[Partner Participant: Water &amp; Sanitation Department (WSD), Yangon City Development Committee - Procurement of equipment - O&amp;M - Monitoring and Reporting]         RP &lt;--&gt;  Reporting on monitoring / Management of the project/subsidy  PP     end     Consortium -- Order --&gt; EPC[EPC Contractor: - Installation of pumps - Construction]     EPC -- Order --&gt; PM[Pump Manufacturer: - Supply of high efficiency pumps - Contract of maintenance]     PM -- Deliver --&gt; EPC     EPC -- Installation --&gt; Consortium     </pre>
CO <sub>2</sub> emission reduction	Assumed GHG emission reduction is 919.6 t-CO <sub>2</sub> /year

Source: The Study Team

Photos of the project site are shown below.



Hlawga pumping station (1<sup>st</sup> Floor)



Hlawga pumping station (the first basement floor)

## CHAPTER 5 JCM PROJECT FORMULATION (LAW CARBONIZATION OF WASTE MANAGEMENT)

### 5.1 OUTLINES

The project for low carbonization of waste management has discussed formulation of JCM projects to alleviate waste management issue of Yangon city through the city-to-city collaboration between Kawasaki and Yangon city.

Approximately 2,700 tons of solid waste is collected daily in Yangon city. There is no private company that conduct solid waste management in Yangon city, and Yangon city (Pollution Control and Cleansing Department: PCCD) collects and treats all solid waste generated in Yangon city. PCCD uses four types of collecting system (bell collection, container collection, street collection and individual collection), and has about 400 waste collection vehicles. Garbage boxes for collection of solid waste by garbage trucks are three sizes (120/240/660 litters). Additionally, PCCD has containers (25m<sup>3</sup>) located at 53 places where substantial garbage is generated. Container collection volume is about 600 ton/day, and it accounts for 22% of whole collected garbage. As there is no relay facility, the garbage is conveyed and dumped into final dumping site, and collection efficiency is low since garbage volume in garbage boxes and containers aren't checked. Large scale final dumping sites are located in city west (Htein Bin) and city east (Htawe Chaung). However, the type is open dumping, and garbage weighing, leachate treatment and covering with soil aren't made. The situation is an issue of Yangon city and adequate treatment system has to be introduced.



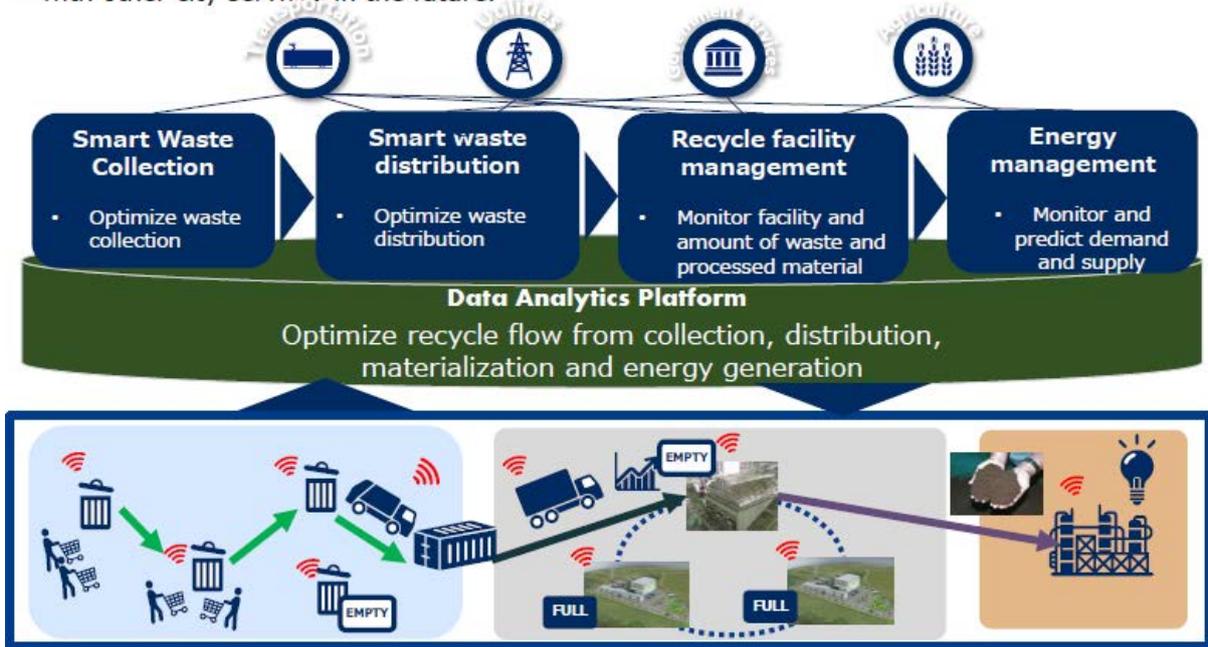
Garbage collection container



Htein Bin final dumping site

The project aims to optimize the recycle flow between collection, transportation, materialization and energy generation using IoT technology, and realize a low carbon society. The project focuses on the materialization and energy generation to formulate JCM model project as it is possible to expect enough cost effectiveness, conducting study. Regarding to system construction of collection and transport of solid waste, the project considered future possibility. The objective of the project is emission reduction of CO<sub>2</sub> and CH<sub>4</sub> by generating electricity with solid waste using efficient solid waste treatment system, together with gathering several data from the treatment process.

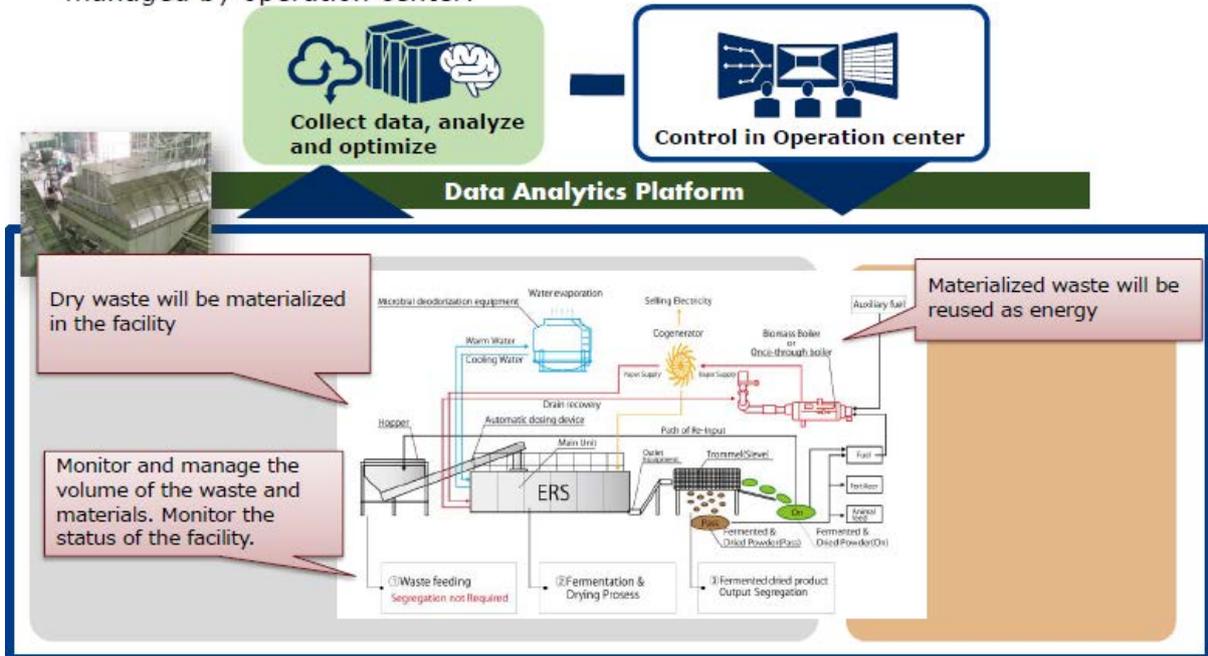
- Optimize waste management flow from waste collection, distribution to biomass energy generation utilizing IoT platform and 4 vertical applications.
- Data analyzed by big data technology will be utilized for total city optimization by integrating with other city services in the future.



Source: NEC

Figure 5-1 Image of Recycle Flow Optimization

- Distributed waste will be materialized in the facility, and reused as energy supply. The volume of waste, energy and status of the facility will be monitored and managed by operation center.



Source: NEC

Figure 5-2 Image of Materialization and Energy Generation from Solid Waste in the Project

## 5.2 METHOD OF PROJECT FORMULATION

JCM project formulation study was conducted based on the proposed method as shown in the table below. The study has implemented by Nippon Koei CO., Ltd in collaboration with NEC Corporation.

**Table 5-1 Method of JCM Project Formulation**

	Item	Method
1	Consideration of introduction destination of Waste-to-Energy plant	Yangon City Development Committee (YCDC) and private company are considered as introduction destination. In case of YCDC, the study confirms availability of relay facility and land use around final dumping site, and select introduction destination taking access and electric power selling into consideration. In case of private company, the study confirms waste generation amount and electricity demand.
2	Plan of materialization and energy generation	The study draws up plans such as system design, procurement, construction and facility setting.
3	Collection of information related to JCM project formulation	As it was difficult to confirm willingness of YCDC in advance, the study visits private companies from the beginning stage, collecting costs of electricity, fuel, labor, tipping fee, waste composition, and waste volume.
4	Evaluation of financial feasibility and revision of project plan.	Based on the information collected above, the study evaluates financial feasibility such as IRR and payback period, and verifies or revises project plan.
5	Monitoring plan	The study confirms that necessary monitoring is possible with ICT system that optimize materialization of waste.
6	Consideration of implementation structure towards application to JCM model project	The study prepares a draft consortium agreement including clarification of role sharing and allocation of subsidy from MOEJ.
7	Consideration of waste collection and transportation system using IoT	The study discusses necessary system for optimization of waste collection such as installation of sensors and setting relay facility for efficient waste collection in Yangon city.

Source: The Study Team

## 5.3 STUDY RESULT

### 5.3.1 Consideration of Introduction Destination of Waste-to-Energy Plant

The study discussed on introduction of waste materialization plant with PCCD that is responsible for waste management in YCDC. However, PCCD has commenced a plan that divide Yangon city into four areas and order the waste treatment business to private sector. Therefore, the materialization plant that treat 100t/d of waste didn't suit to the plan. Hence the study altered its target to private companies in Yangon city, and discussed with fish processing

companies, agri-business companies, etc. to find suitable companies. The organizations with which the project discussed are as follows.

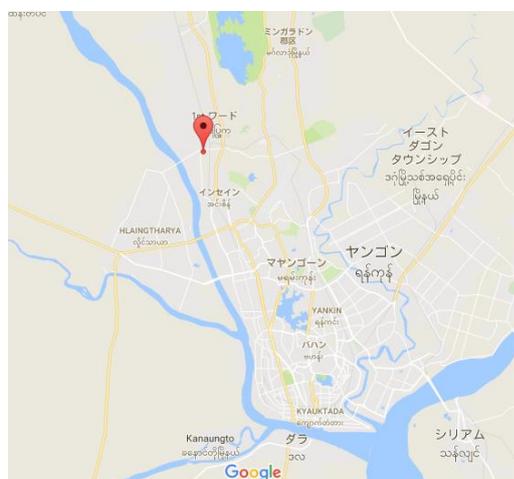
**Table 5-2 Organizations discussed for introduction of waste materialization plant**

	Date	Category	Name
1	4 <sup>th</sup> Jul 2017	Government	PCCD
2	4 <sup>th</sup> Jul 2017	Waste treatment	Golden DOWA
3	5 <sup>th</sup> Jul 2017	Industry	Mingaladon Industrial Park
4	6 <sup>th</sup> Jul 2017	Industry	Myanmar Industrial Association
5	7 <sup>th</sup> Jul 2017	Supermarket	Super one Group Companies
6	28 <sup>th</sup> Sep 2017	Supermarket	AEON mall
7	2 <sup>nd</sup> Oct 2017	Fishery	Clean Fishery
8	2 <sup>nd</sup> Oct 2017	Commerce	The Union of Myanmar Federation of Chambers of Commerce & Industry
9	2 <sup>nd</sup> Oct 2017 23 <sup>rd</sup> Jan 2018	Commerce	Dagon International Limited
10	24 <sup>th</sup> Jan 2018	Fishery	Myanmar Fishery Federation

Source: The Study Team

Among discussions, the study identified Danyingone Fruits and Vegetable Wholesale Market that is invested by Dagon International Limited and YCDC and operated by Myanmar Agro Exchange Public Limited (MAEX) as a prospect of introduction destination. The market opened in December 2017, is large scale market, and has substantial electricity demand. Dagon International Limited and MAEX are parts of Dagon Group, a big conglomerate in Myanmar, and Dagon International Limited has a lot of budget. CEO of Dagon International Limited is interested in JCM and expressed interest to introduction of waste energy generation.

Location of the market is shown below.

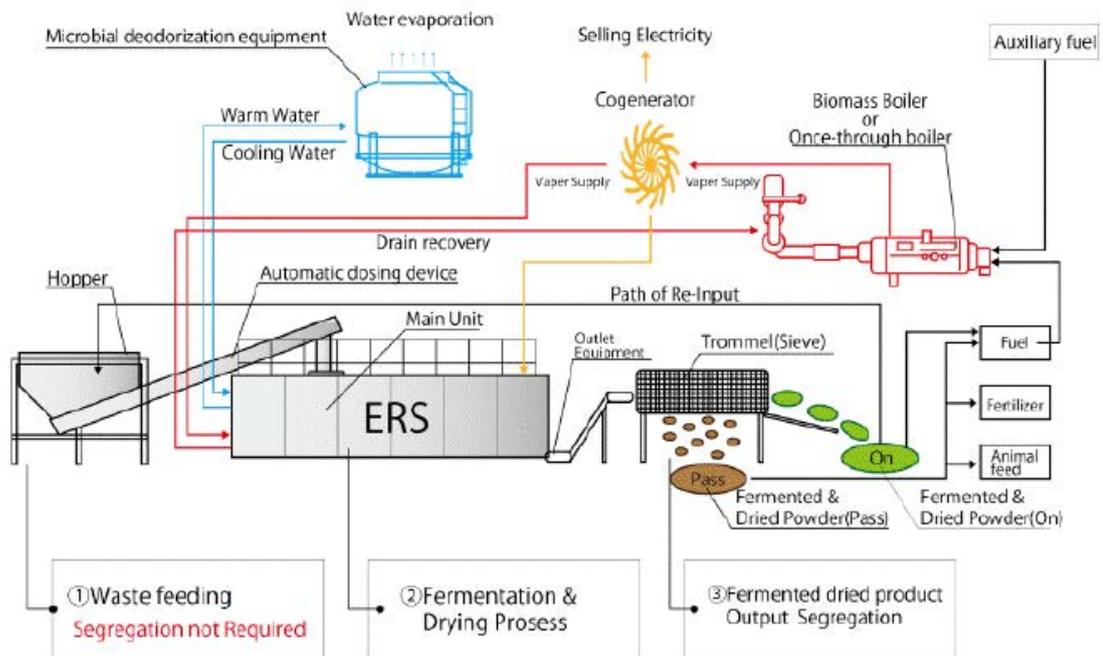


**Figure 5-3 Location of Danyingone Fruits and Vegetable Wholesale Market**

### 5.3.2 Plan of Materialization and Energy Generation

The study planned to use Environmental Recycling System (ERS) developed by a manufacturer for materialization of waste, NEC is proceeding with cooperation contract with the manufacturer. ERS is a plant to ferment organic material rapidly using indigenous bacteria. Its processing capacity is 0.5 – 100 ton/day. ERS is able to materialize any organic material, and in case the source of organic material is waste, segregation is not necessary. The material is possible to be used as fishmeal, feed and fertilizer, as well as fuel in order to generate electricity.

The study designed biomass energy generation system with ERS in combination with a boiler and a generator. The system furthermore improves energy generation efficiency and accurate monitoring adding ICT devices developed by NEC. Image of the system is shown below.



Source: The Study Team

Figure 5-4 Image of ERS and Energy Generation



Source: The Study Team

Figure 5-5 Improvement of Waste Treatment

By using IC card authentication system, MAEX is able to measure volume of the waste in each tenant. In addition, the IC card could be connected to other applications like gate control.



Source: The Study Team

**Figure 5-6 Improvement of Waste Treatment with ICT**

### 5.3.3 Collection of Information Related to JCM Project Formulation

The study collected information from PCCD and Dagon International Limited in order to consider economic efficiency and cost effectiveness of JCM model project. The collected information are as follows.

**Table 5-3 Collected Information**

<u>General Information</u>
Electricity unit price (MMK/t) *: Household & commercial
Electricity selling price (MMK/kWh)
Heavy oil unit price (MMK/l)
Water unit price (MMK/t) *: Household & commercial
<u>Information from PCCD</u>
Number of track and track size (ton)
Labor cost (MMK/m) *: Manager, driver & worker
<u>Information from Dagon International Limited</u>
Fruit and vegetable market construction and operation plan
Waste generation (t/d)
Waste compaction rate *: weight & volume
Cost of waste treatment (MMK/t & MMK/y)
Electricity consumption (kWh/y) *: Grid & generator
Cost of diesel generation fuel (MMK/l)
Efficiency of diesel generator (MMK/l) *: 200 kW & 500 kW
Cost of electric generation (MMK/d)
Labor cost (MMK/y) *: Admin, worker & electricity generator
Composition of waste

Source: The Study Team

### 5.3.4 Evaluation of Financial Feasibility and Revision of Project Plan

#### 1) Project Plan and Economic Effect

It is expected that garbage will be generated about 40 ton/day (after compaction) in the market within next year. [REDACTED]

[REDACTED] O&M cost for heavy oil, water, labor, vender maintenance would be 468,397USD. Benefit would be 1,472,282USD as annual electricity generation would be 3,150MWh. Accordingly, net benefit would be 1,003,885USD. These are shown in the following Table.

**Table 5-4 Cost & Benefit of the Market**

	Heavy Oil	Electricity	Water	Labor	Vender Maintenance	Waste treatment cost reduction	Diesel generation cost reduction	Electricity buying cost reduction	Initial cost (ERS exclude construction)	Subsidy	Total
CAPEX Cost											
O&M Cost /year	59	0	4.617	10.18							
Benefit / year						28,054	2,332,971	228,729			2,589,754

Source: The Study Team

#### 2) Estimation of Subsidy using JCM Model Project

Electricity demand would be 4,380MWh for some facilities such as cold storage in the market, and generated electricity by ERS could be used in the market. Therefore, the study adopted 0.8tCO<sub>2</sub>/MWh as emission factor. Statutory durable years of National Tax Administration Agency Japan are 17 years. As a guide of MOEJ, cost effectiveness of CO<sub>2</sub> emission reduction for subsidy is 4,000 yen (about 35.7 USD)/tCO<sub>2</sub> in JCM Model Project, and in order to satisfy the guide, the subsidy of introduction of ERS would be [REDACTED]

**Table 5-5 Estimation of Subsidy**

No	Item	Amount	Unit	Calculation
1	Waste	40	ton	
2	Annual power generation	3,150	MWh/y	=8.630MWhx365
3	CAPEX		USD	
4	Emission Factor	0.80000	tCO <sub>2</sub> /MWh	
5	Annual CO <sub>2</sub> reduction	2,520	tCO <sub>2</sub>	=2x4
6	Legal durable years	17	year	
7	Total CO <sub>2</sub> reduction	42.840	tCO <sub>2</sub>	=5x6
8	Cost effectiveness			
9	Subsidy			

Source: The Study Team

#### 3) Economic Evaluation

[REDACTED]

**Table 5-6 Payback period and IRR when using JCM Model Project**

**a. Payback Period**

Capex (USD)	Annual Benefit (USD)	Payback Period
	1,003,885	

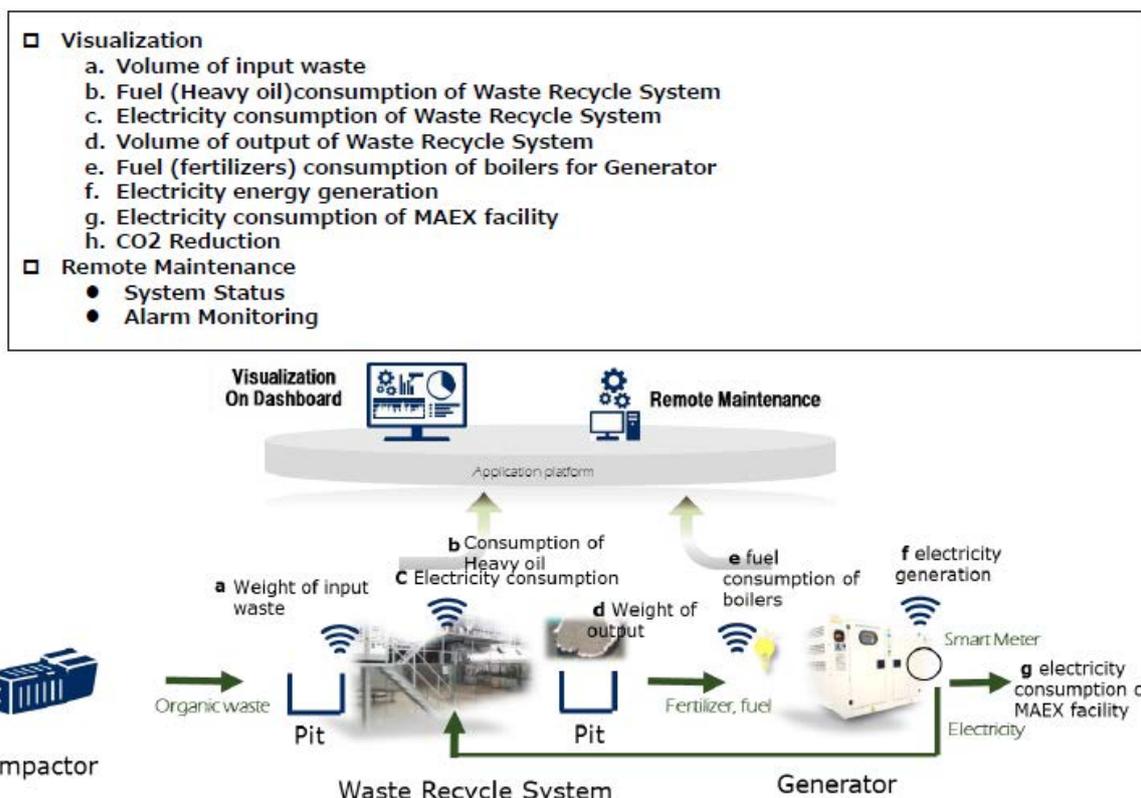
**b. IRR**

Year	Capex	Annual Benefit	Cash Flow
1		1,003,885	
2		1,003,885	
3		1,003,885	
4		1,003,885	
5		1,003,885	
6		1,003,885	
7		1,003,885	
8		1,003,885	
9		1,003,885	
10		1,003,885	
11		1,003,885	
12		1,003,885	
13		1,003,885	
14		1,003,885	
15		1,003,885	
16		1,003,885	
17		1,003,885	
		<b>IRR (17 years)</b>	

Source: The Study Team

### 5.3.5 Monitoring Plan

This project introduces ERS with ICT function so that several information is gathered analysed to improve the plant efficiency. The ICT function is much enough to monitor the emission reduction of CO<sub>2</sub>. The ICT function is shown below.



**Figure 5-7 ICT Function**

### 5.3.6 Consideration of Implementation Structure towards Application to JCM Model Project

Following table summarises issues for the project implementation.

**Table 5-7 Issues on Implementation Structure**

Issue	Description
1) Selection of Representative Participant of International Consortium	Representative Participant is necessary to select for the application of JCM Model Project. The Representative Participant was nominated from a member company of Green Innovation Cluster promoted by Kawasaki city, since the project was formulated through Yangon-Kawasaki city-to-city collaboration, and NEC, a member company, was selected.
2) Role of ERS Supplier Company	The ERS supplier is small scale company. Though the company has experiences introducing ERS in Japan and some South-East contries, it is difficult for the company to conduct O&M freakently. Hence, the study considered that NEC would support O&M through collaboration contract with the company.
3) Selection of Contractor	Myanmar local EPC company does not have experience for Waste-to-Energy. Selection of EPC is important for successful project implementation. EPC cotractor with several experiences of equipment procurement and construction should be selected.

Source: The Study Team

The study considered project implementation structure taking account of above issues.

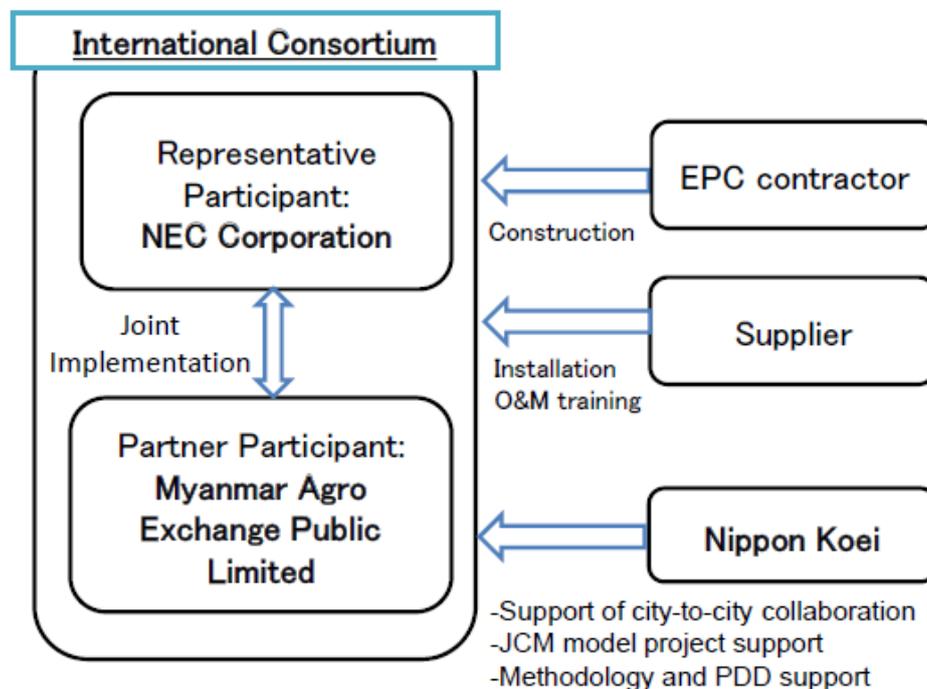
International Consortium would be formed for the application and implementation of JCM Model Project. Myanmar Agro Exchange Public Limited (MAEX) invested by Dagon International Limited would be partner participant, NEC, a member company of Green Innovation Cluste promoted by Kawasaki city, would be representative participant, and Yangon branch of a company in Kawasaki City would undertake. The roles are listed below.

**Table 5-8 Implementation Structure and Responsibility**

Party	Responsibility
Representative Participant of International Consortium <NEC Corporation>	<ul style="list-style-type: none"> <li>● Consideration of JCM Model Project with Waste-to-Energy</li> <li>● Application fo JCM Model Project</li> <li>● Project management, supervision and reporting</li> </ul>
Partner Participant <MAEX >	<ul style="list-style-type: none"> <li>● Implementation of Waste-to-Energy</li> <li>● Arrangement of location</li> <li>● Daily maintenance, management and monitoring</li> </ul>
EPC Contractor <Subsidiary of a Company in Kawasaki City>	<ul style="list-style-type: none"> <li>● Equipment procurement and delivery</li> <li>● Equipment installation</li> </ul>

Source: The Study Team

Project implementation structure is shown in the figure below.



Source: The Study Team

**Figure 5-8 Project Implementation Structure**

The project includes design, procurement, delivery, installation, commissioning test, and training, taking approximately two years for the commencement of operation.

### **5.3.7 Consideration of Waste Collection and Transportation System using IoT**

The study had recommended to make the process from collection to treatment of waste efficient using IoT technology. In order to proceed with the project, intermediate waste disposal facilities were necessary, but the study understood its difficulty through the discussion with PCCD. PCCD has a plan to entrust waste collection and incineration to the private sector. The plan and IoT recommendation were different, and budget of YCDC was limited, therefore, the study recognized that the introduction of IoT technology to waste collection is not realistic. Though it is a field to be developed in future with global trend of smart city formation, the study concluded that the introduction in Yangon is too early.

In the meantime, PCCD requested to support collection and treatment of medical waste and waste tires. Therefore, the study involved ICT Star Group Myanmar Co., Ltd (iSGM) that is an affiliate Myanmar Company of NEC, and recommended to introduce a collection system using bar cord and QR cord. PCCD is positive to introduce the system, and agreed to work with iSGM. It is not JCM project, but accredited as a favourable output of city-to-city collaboration. The study introduced some examples of waste tire treatment such as cutting, shredding and burning for thermal and material recycle. However, it was just a reference, and the study didn't consider for JCM. As the technology needs to purchase some expensive equipment, PCCD expressed a policy to begin with basic method with low cost for the time being.

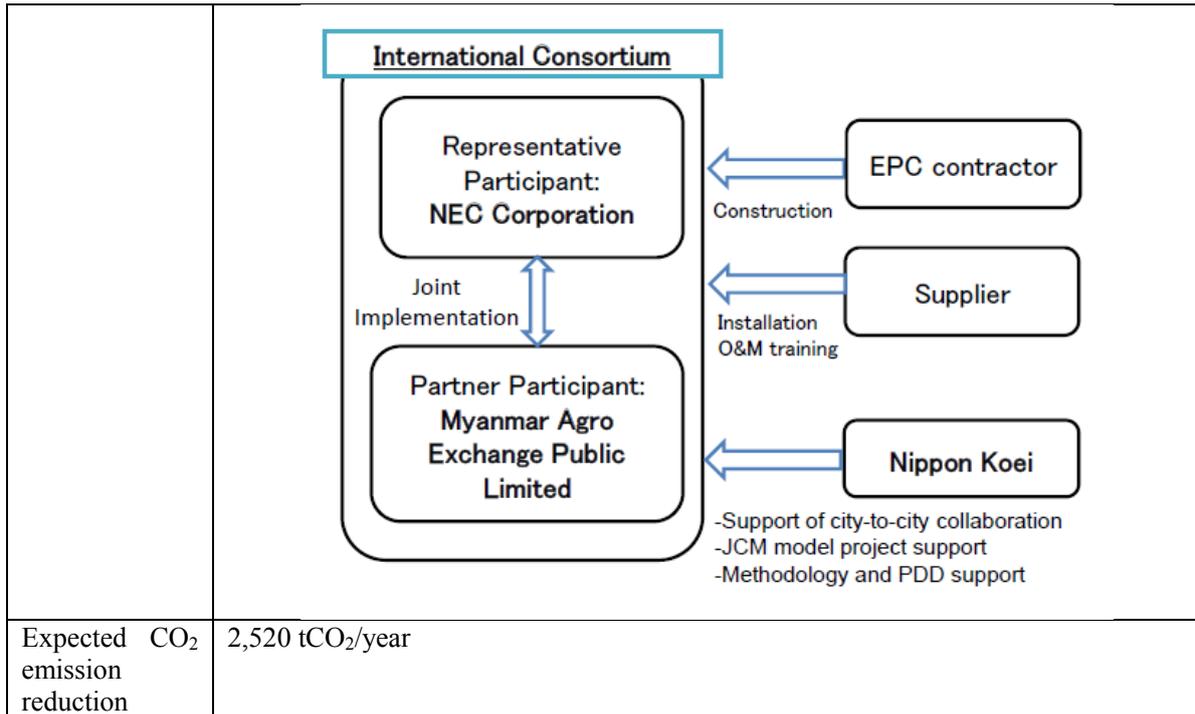
## **5.4 PROPOSED JCM MODEL PROJECT**

### **5.4.1 Outline of the Project**

Regarding low carbonization of waste management, the candidate JCM Model Project in JFY 2018 is described in the following table.

**Table 5-9 Outline of the Project**

Project implementing body	NEC (a member company of Green Innovation Cluste promoted by Kawasaki city) and MAEX
Project Outline	The project materializes 40 ton/day of waste, and generate 3,150 MWh/year with 360kW Waste-to-Energy system. The generated electricity would be used for facilities such as cold storage in the market.
Cash balance	MAEX makes 100% initial investment. IRR is assumed as 6.5%.
Project implementation structure	



Source: The Study Team

## CHAPTER 6 ISSUES AND FURTHER ACTIONS

### 6.1 ISSUES

#### 6.1.1 Issues Related to Introduction of high-efficiency pumps into existing pumping station

Hlawga pumping station managed by YCDC was constructed in 1980 and started operation in 1981(36 years ago). YCDC (EDWS) has operated the water treatment facility by themselves since then. And the maintenance of all aging equipments inclusive of repair works also have been managed by YCDC (EDWS). So, YCDC (EDWS) has many engineers who have good knowledge and experinces about their own facilities.

The current condition of O&M in Hlawga pumping station have been not so bad. However, there is no denying that the way of their O&M is their own style. To reduce energy consumption and GHG emission in the facility, not only replacement of aging pumps but also acquirement of appropriate way of operation are necessary for YCDC (EDWS).

In the project of “Introduction of high-efficiency pumps into existing pumping station”, the pump manufacturer can support maintenance of the introduced pumps. Furthermore, the representative participant is a Japanese private company which has many results in regard to water and sewer treatment in Japan. The representative participant has been considering plan to develop capacity for YCDC (EDWS) to manage the equipments properly. This project is expected to achieve appropriate operation by YCDC (EDWS) and also stable water supply in Yangon city.

#### 6.1.2 Issues Related to Low Carbonization of Waste Management

##### 1) Electricity Generation Efficiency with ERS

It is implied that electricity generation using ERS with materialization of garbage in the fruit and vegetable market may be economically inefficient for business operators as described in Chapter 5. The material, output of ERS, becomes a fuel enough to generate electricity, but ERS produces smaller amount of material with the garbage from the market containing substantial water, and electricity generation is reduced.

Materializations of garbage from fish processing factory and convenience store usually make high economic values. For example, materialization of garbage from fish processing factory produces high quality fishmeal and fertilizer. However, the material is not especially good as fuel. Accordingly, it is difficult to make high effect with electricity generation in Myanmar where there is no FIT and the electricity bill is inexpensive.

##### 2) Delay of Formulation of Introduction Structure

NEC is discussing collaboration with ERS supplier. However, NEC and the supplier are still seeking condition of collaboration, and no prospect for actual business. [REDACTED]

[REDACTED] On the other hand, Dagon Group is planning several actions for improvement of garbage treatment, and if the collaboration is

delayed for a long period, Dagon Group may lose their interest.

### **3) Difference between the Recommendation and PCCD's needs regarding Efficient Garbage Collection**

As mentioned in 5.3.7, efficient garbage collection using IoT didn't suit to the needs/plan of PCCD. The study team had recognized that PCCD wanted to improve their garbage collection and treatment system before the commencement of the study, but confirmation if the recommendation would be acceptable or not was not enough. It is an issue for the project that formulate JCM Model Project identifying a prospected candidate.

## **6.2 FURTHER ACTIONS**

### **6.2.1 Recommendation with regard to Introduction of high-efficiency pumps into existing pumping station**

YCDC (EDWS) has the plan to repair and update of aging equipments or facilities for stable water supply in Yangon city. Hlawga pumping station is a water intake pumping station in Yangon, and the replacement of these aging intake pumps in Hlawga is one of priority issues in YCDC (EDWS). Project of "Introduction of high-efficiency pumps into existing pumping station" will be proposed as JCM model project in next fiscal year's announcement, and will be implemented with cooperation between Japanese private companies and YCDC (EDWS).

In addition, it can be considered to expand these high-efficiency pumps to other water treatment facilities in Yangon city. There are mainly five water treatment facilities in Yangon managed by YCDC (EDWS), but all equipment in the facilities have been working for decades. There is a big potential in Yangon to apply leading low carbon technologies such as the high-efficiency pumps to the other water treatment facilities as JCM model project. The study team will continue to discuss with YCDC (EDWS) to find their issues in regard to water treatment.

### **6.2.2 Recommendation with regard to Low Carbonization of Waste Management**

Dagon Group still has demand to introduce Waste-to-Energy in the fruit and vegetable market. In order to introduce as JCM Model Project, the project needs to ensure the economic performance with more efficient Waste-to-Energy technology as well as subsidy. The study team met with a company that has a branch in Kawasaki City and has biogas generation technology. The study, through discussions, found that the biogas generation technology could improve electricity generation efficiency depending on garbage composition. It is recommended that garbage composition survey be conducted and electricity generation be scrutinized. Another recommendation is to sell the biogas. As the price of LNG is high in Myanmar, economic performance must be high, if the distribution is possible.

Based on the information gathered in the study, outline of the economic performance with biogas electricity generation in the fruit and vegetable market is as follows.

[Rough estimation of biogas generation project in the market]

Waste Amount: 40 ton/day

Initial Investment: 6,250,000 USD

Electricity Generation: 876MWh/year (using waste cabbage)  
Subsidy: 425,000 (cost effectiveness of subsidy is 35USD/tCO<sub>2</sub>)  
IRR: 10.3%  
Payback Period: 8.7 years

A company in Kawasaki City identified with another city-to-city collaboration is expressing an interest to be a representative participant. A member company of Kawasaki Green Innovation Cluster developing business in Yangon is possible to be EPC contractor. Dagon Group hasn't made a specific Waste-to-Energy plan, therefore, the study team recommend to continue the formulation of JCM Model Project in JFY2018 as city-to-city collaboration project.

## **Attachment**

- 1 Documents of City-to-City Collaboration Activities
  - 1.1 JCM workshop and Site visit in Kawasaki (July 2017)
  - 1.2 Workshop in YCDC (August 2017)
- 2 JCM Project Formulation: “Introduction of high-efficiency pumps into existing pumping station”
  - 2.1 Outline of the project
  - 2.2 Site Investigation Report (1)
  - 2.3 Site Investigation Report (2)
- 3 JCM Project Formulation: “Low Carbonization of Waste Management”
  - 3.1 Proposal to PCCD
  - 3.2 Proposal to MAEX
  - 3.3 Proposal to Food Processing Company
  - 3.4 Others



# 1 Documents of City-to-City Collaboration Activities

## 1.1 JCM workshop and Site visit in Kawasaki (July 2017)



## Schedule of Site Visit in Kawasaki City and JCM seminar

### JCM Project Formulation Study through City-to-City Collaboration in Yangon Phase-3

[Program in City of Kawasaki and JCM Seminar in Kawasaki]

Date	Time	Program
24th (Mon.)	9:50	PCCD staffs WSD staffs
	9:50	Departure at Yangon (TG304)
	21:10	Arrival in Tokyo (TG660 via BKK)
	---	Stay at "Nikko Hotel" in City of Kawasaki
25th (Tue.)	9:00	Orientation
	9:30	Transferring
	10:30	Site Visit: Nagasawa Water Purification Plant (Information Center)
	12:00	Lunch
26th (Wed.)	13:00	Site Visit: Nagasawa Water Purification Plant (Water Purification Plant)
	14:00	Transferring
	14:30	Site Visit: Ozenji Disposal Center.
	16:30	Transferring
27th (Thurs.)	18:30	Welcome Party
	---	Stay at "Nikko Hotel" in City of Kawasaki
	9:00	Site visit to NEC's facilities
	---	Lunch
28th (Fri.)	---	Transferring
	13:30	Site visit to NEC's facilities
	16:00	Site visit to NEC's facilities
	---	Stay at "Nikko Hotel" in City of Kawasaki
29th (Sat.)	All day	JCM seminar hosted by MOEJ
	All day	JCM seminar hosted by MOEJ
30th (Sun.)	10:35	Departure at Haneda (TG 683)
	18:45	Arrival in Yangon (TG305 via BKK)

第1日目/DAY1

7月25日 (火) /Tuesday, 25 July

時間 Time	スケジュール Schedule	備考 Note
8:45	招聘者と待ち合わせ/ Please wait at the lobby of the hotel.	Nippon Koai will pick you up.
9:00	オリエンテーション Orientation	川崎フロンティアビル6階会議室 Kawasaki Frontier Building 6F
9:30	移動/transferring 長沢浄水場 (広域施設) 視察	ミニバンで移動/ by a mini van
10:30	Site Visit: Nagasawa Water Purification Plant (Information Center)	
12:00	昼食/ Lunch	お弁当/ Lunch box
13:00	長沢浄水場 (浄水処理施設) 視察 Site Visit: Nagasawa Water Purification Plant (Water Purification Plant)	
14:00	移動/transferring	ミニバンで移動/ by a mini van
14:30	主禅寺処理センター視察 Site Visit: Ozenji Disposal Center	
16:30	移動/transferring	ミニバンで移動/ by a mini van
18:30	懇親会 Welcome party	川崎市内/Kawasaki city (TBD)
---	川崎日航ホテル Kawasaki Nikko Hotel	

新市間連携ワークショップ エッセ 川崎市  
Time schedule for the workshop of city to city collaboration programme at Kawasaki city

第3日目/DAY3 7月27日(木)/Thursday, 27 July	セッション Session 1: Status of City-to-City Collaboration Project and its Expected Outcome	セッション Session 2: The activities and issues for creating the low carbon society
9:10	9:10 開会挨拶/Opening Remarks 9:15 川崎市の低炭素化推進目標について-新市間連携事業の概要と期待される成果- 9:25 川崎市の低炭素化推進目標について(医師) 9:30 川崎市の低炭素化推進目標について(企業) 9:45 川崎市の低炭素化推進目標について(自治体) 10:00 川崎市の低炭素化推進目標について(企業) 10:15 川崎市の低炭素化推進目標について(企業) 10:30 川崎市の低炭素化推進目標について(企業)	9:10 開会挨拶/Opening Remarks 9:15 川崎市の低炭素化推進目標について-新市間連携事業の概要と期待される成果- 9:25 川崎市の低炭素化推進目標について(医師) 9:30 川崎市の低炭素化推進目標について(企業) 9:45 川崎市の低炭素化推進目標について(自治体) 10:00 川崎市の低炭素化推進目標について(企業) 10:15 川崎市の低炭素化推進目標について(企業) 10:30 川崎市の低炭素化推進目標について(企業)
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第3日目/DAY3 7月28日(金)/Friday, 28 July	セッション Session 1: Status of City-to-City Collaboration Project and its Expected Outcome	セッション Session 2: The activities and issues for creating the low carbon society
9:10	9:10 開会挨拶/Opening Remarks 9:15 川崎市の低炭素化推進目標について-新市間連携事業の概要と期待される成果- 9:25 川崎市の低炭素化推進目標について(医師) 9:30 川崎市の低炭素化推進目標について(企業) 9:45 川崎市の低炭素化推進目標について(自治体) 10:00 川崎市の低炭素化推進目標について(企業) 10:15 川崎市の低炭素化推進目標について(企業) 10:30 川崎市の低炭素化推進目標について(企業)	9:10 開会挨拶/Opening Remarks 9:15 川崎市の低炭素化推進目標について-新市間連携事業の概要と期待される成果- 9:25 川崎市の低炭素化推進目標について(医師) 9:30 川崎市の低炭素化推進目標について(企業) 9:45 川崎市の低炭素化推進目標について(自治体) 10:00 川崎市の低炭素化推進目標について(企業) 10:15 川崎市の低炭素化推進目標について(企業) 10:30 川崎市の低炭素化推進目標について(企業)
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第2日目/DAY2  
7月26日(水)/Wednesday, 26 July  
【スケジュール(A)/Schedule(A) for PCCD staffs】

時間 Time	スケジュール(A) Schedule(A)	備考 Note
8:15	招聘者お迎え/ Please wait at the lobby of the hotel.	Nippon Koei will pick WSD staffs up.
8:20	移動/ transferring	電車/ by train
9:00	NEC品川イノベーションワールド Site visit: NEC Shinagawa Innovation World (To introduce ICT technologies and waste management solutions)	NEC品川イノベーションワールド NEC Shinagawa Innovation World
12:00	昼食/ Lunch	品川駅付近/ Shinagawa Sta.
13:00	移動/ transferring	電車/ by train
13:30	ICT事例に紹介(有楽町もしくは中津谷近辺の予定) Site visit: Yurakucho or Shibuya to introduce ICT Technologies	TBD
15:00	移動/ transferring 川崎日航ホテル Kawasaki Nikko Hotel	電車/ by train
---		

【スケジュール(B)/Schedule(B) for WSD staffs】

時間 Time	スケジュール(B) Schedule(B)	備考 Note
8:45	招聘者お迎え/ Please wait at the lobby of the hotel.	Nippon Koei will pick WSD staffs up.
9:00	ポンプ事業に係る関係者間協議 Discussion on the project	川崎フロントティアビル6階会議室 Kawasaki Frontier-Building 6F
10:30	移動/ transferring	ミニバンで移動/ by a mini van
12:00	昼食/ Lunch 北千葉浄水場 (流山市)	流山おたかの森駅周辺 Nagarevama city
13:30	Site visit: Kitchiba water purification plant	
15:30	移動/ transferring 川崎日航ホテル Kawasaki Nikko Hotel	ミニバンで移動/ by a mini van
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※配布資料は「2024年環境アクションプラン」を参照してください。新市間連携ワークショップ開催、各都府のアクションプランを参照して整理し、記入していただきます。

※配布資料は、各都府の環境政策に関する最新情報に基づいて作成されています。また開催に際しては最新の環境政策を参照し、記入していただきます。

【住所/ Address】

視察先/Site	住所/Address
長沢浄水場 Nagasawa Water Purification Plant	〒214-0034 神奈川県川崎市多摩区三田5-1-1
玉瀬寺処理センター Ozenji Disposal Center	5-1-1 Mita Tama-ku Kawasaki-shi Kanagawa 214-0034 〒215-0013 神奈川県川崎市麻生区玉瀬寺1285
北千葉浄水場 Kitachiba water purification plant	1285 Ozenji Aso-ku Kawasaki-shi Kanagawa 215-0013 〒270-0172 千葉県流山市阿ヶ谷130
NEC品川イノベーションワールド NEC Shinagawa Innovation World	130 Kitagaya Nagareyama-shi Chiba 270-0172 東京都港区港南2-16-1 品川イノベーションタワー7F East 1 tower 7th floor, 2-16-1, Konan Minato-ku, Tokyo
川崎フロントエアビル Kawasaki Frontier Building	〒210-0007 川崎区駅前本町11番地2 11-2 Honcho Ekimae Kawasaki-ku 210-0007

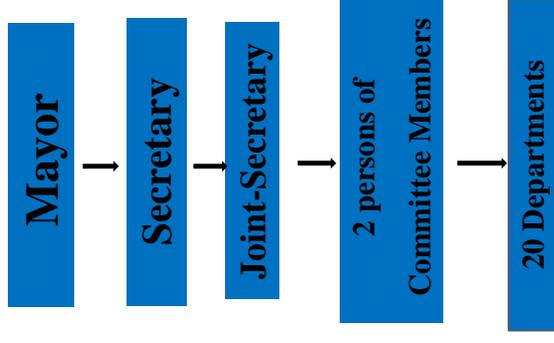
招待者宿泊ホテル/ Hotel	住所/ Address
川崎日新ホテル Kawasaki Nikko Hotel	〒210-0024 神奈川県川崎市川崎区日通町1 1 Nisshin-cho Kawasaki-ku Kawasaki-shi Kanagawa 210-0024 Tel: 81-44-244-5941 Fax: 81-44-244-4445

# JCM Project Formulation Study through City-to-City Collaboration

between YCDC and Kawasaki city

Presented by  
**Mr. Zaw Win Naing**  
Assistant Head of Department  
Pollution Control and Cleansing Department  
Yangon City Development Committee

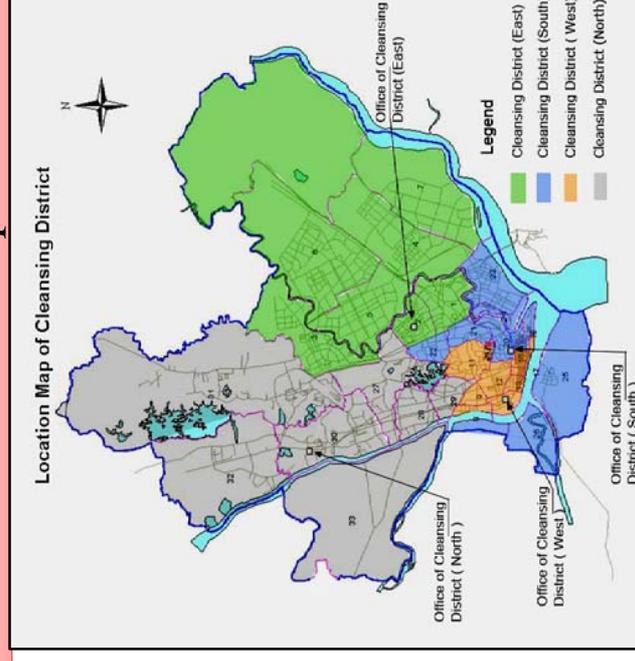
# Organizational Chart of YCDC



## Profile

Area	-	The administrative boundary of YCDC, in 1985 ( 133.643 Sq-Miles) and now a day ( 292.426 ) Square Miles.
Population	-	5.2 million (2014)
Township	-	33 Townships
Generation Rate	-	0.41 Kg / Capita / Day
Household Waste Generated	-	2500 tons per day
Volume of Daily Water Supply-	-	205 Million Gallons/Day

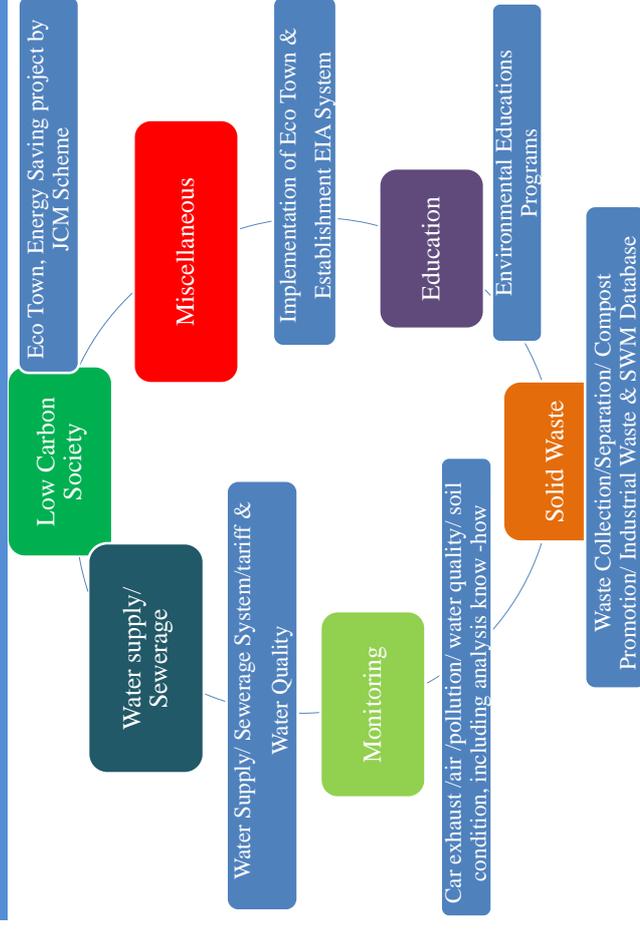
## Area Map



## Objectives between Yangon City and Kawasaki City

- To contribute to sustainable development and realize low carbon society in Yangon
- To formulate prospective JCM projects collaborate with Kawasaki city and Japanese private entities, which have high-efficiency and low carbon technologies.
- To implement Clean Development Mechanism (CDM) including clean air, clean land and clean water.
- To cooperate and obtain carbon credit project with Kawasaki City according to JCM Scheme.

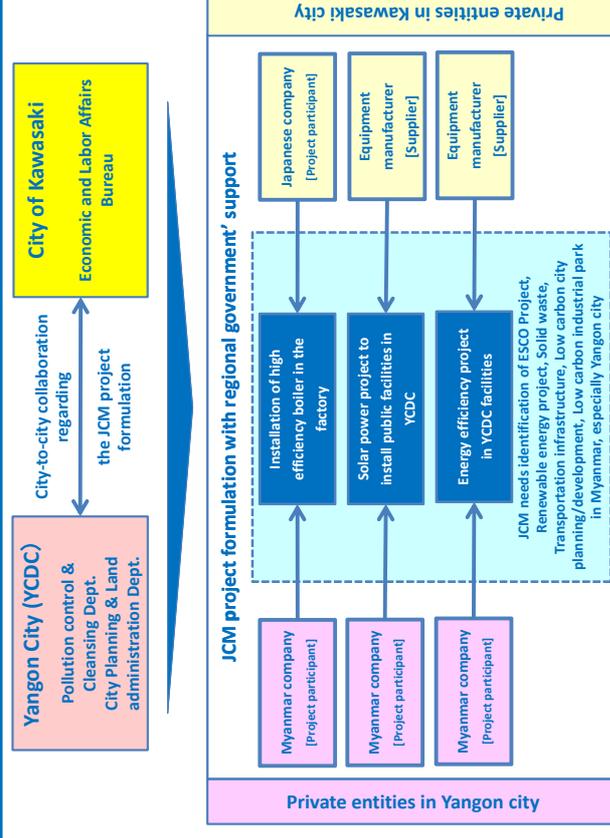
## Menu of City-to-City Collaboration from Kawasaki City



## <Low Carbon Society Sector>

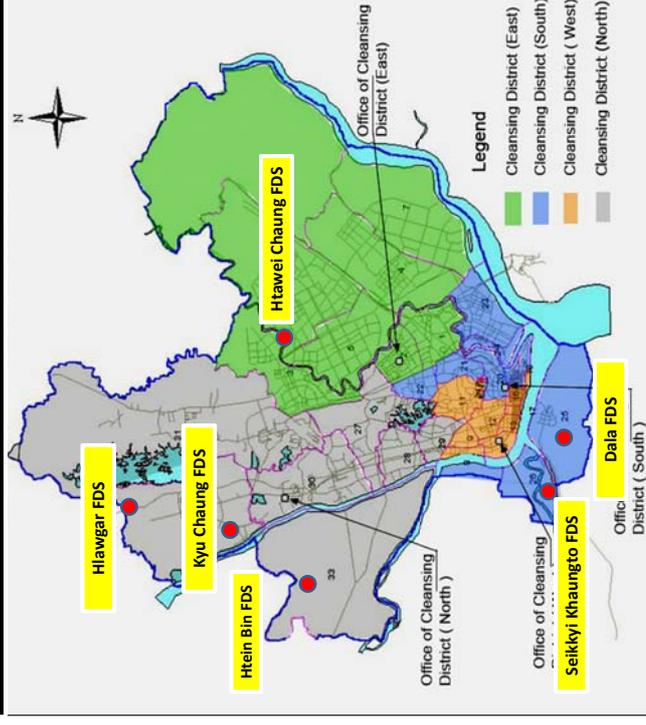
- Three major items for project-
  - 1) Preparation for low carbon action plan supported by Kawasaki city
  - 2) JCM project formulation for PV generation project in YCDC
  - 3) JCM project formulation for High-efficiency Drum-less Boiler in Factories

## Overview of the 2<sup>nd</sup> year project



## Solar PV Pilot Project collaborated with Pollution Control and Cleansing Department

Map of Final Disposal Site



Items	Contents
Name of landfill Site	Htein Bin Final Disposal Site
Location	Right side of Nyaung Tone Rd, Kalargyisu village ward, HlaingTharYar Township, Yangon
Waste source	North and West district
Area	150 acre (68.18 ha)
Dumping area	70 acre (31.82 ha), Remaining Area-80 acre (36.36 ha)
Open Year	2003
Dumping Method	Open dumping
Facility	Management office, washing station, 1 tractor, 2 Dozer, 1 Backhoe, 1 Excavator
Staff number	Manager: 1, Supervisor: 1, Driver: 5, Labor : 55
Working shift	Day crew and night crew (2 shifts)

Htein Bin FDS



### Daily Disposed amount of Htein Bin Final Disposal Site

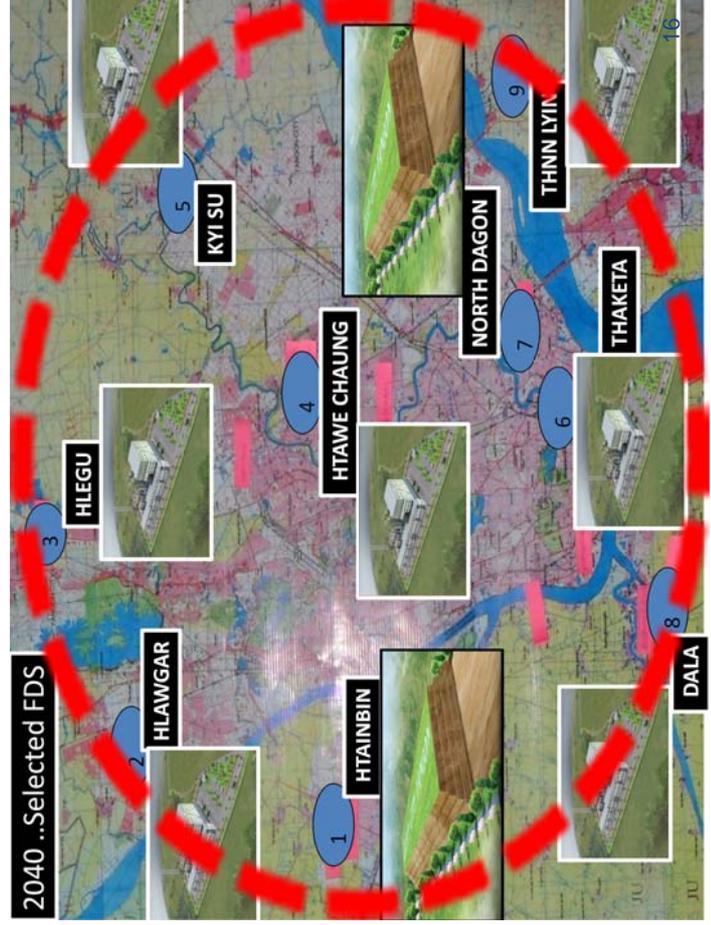
No	District Name	Waste Generated Amount (ton/day)
1	West	407.73
2	North	703.39
	<b>Total</b>	<b>1111.12</b>

### Site Visit to Htein Bin FDS



### Selection of Solar PV Pilot Project of YCDC Facility

Candidate	Status	Load	Project Output
Htein Bin FDS	PV Solar Plant	Land Capacity (4) Ha <Electricity Output-1 MW>	- Cover Daily Electricity Usage of (0.89 MW) in FDS and Cemetery Housing . - Net Electricity Input to National Grid Line purchase by YESC. - Safety Electricity Usage.



## Energy efficiency project collaborated with Engineering Department (Water & Sanitation)

### No.(1) Hlawgar Pumping Station

Horse Power - (1000 KW) (1342 HP)

High of Pumping Power -177 ft (54 M)

Daily Water Supply/Pump(GL) - 26 MGD

Maximum Daily Water Supply(GL) - 52 MGD

Water Supplying System - (2) pumps running, (2) pumps stand by

Type of Water Supply Pipe and size - 66"Ø (Concrete)

### Selection of Solar PV Generation Pilot Project of YCDC Facility

- Selection of pilot project site:
  - Interview survey → Site survey → Document review
- Criteria for selection: needs, demand, location

Candidate	Status	Load	Selection result
<b>Hlawga</b>	- 24hr, fixed demand - 1MW x 2nos, 6.6 kV - Pump installation in 2008	2 MW	1 <sup>st</sup> priority: (1000 KW x 4 unit of lift-up pump)
Nyaung Hnit Pin	-Peak 7MW, off-peak 6.8 Nw, 24 hr operation -1 <sup>st</sup> phase 2014, 2 <sup>nd</sup> phase 2015	440 kW (LV) 3.2MW+3.4 MW (HV)	PV possible to supply LV side. (110 kW x 4 unit of lift-up pump) For HV side, further study necessary.
La Gun Byin	132kWx6+25 kWx6 + 30 kWx4, 400V Peak 450 kW, off-peak 350 kW	450 kW	Too small, remote

### Satellite Map of Hlawgar Pumping Station

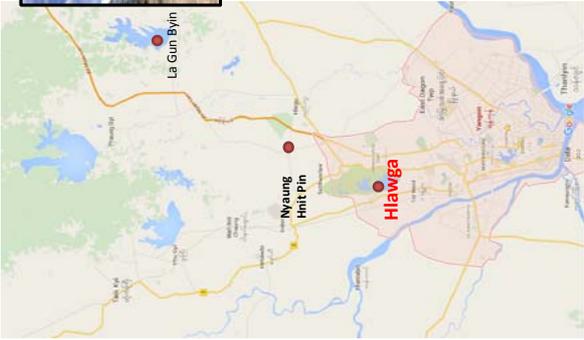


### Hlawgar Reservoir



### Hlawgar Pumping Station Pilot Project Site

Pump room



Electric room (PV -related equipment can be stored)



Outdoor Unit

21

### 1000 KW Pump Repairing



### 6.6KV, Starter Panel of Hlawgar Reservoir



12KV, 1250A Incoming Panels, Bus-Coupler Panel and 630A Feeder Panels of Sub-Station



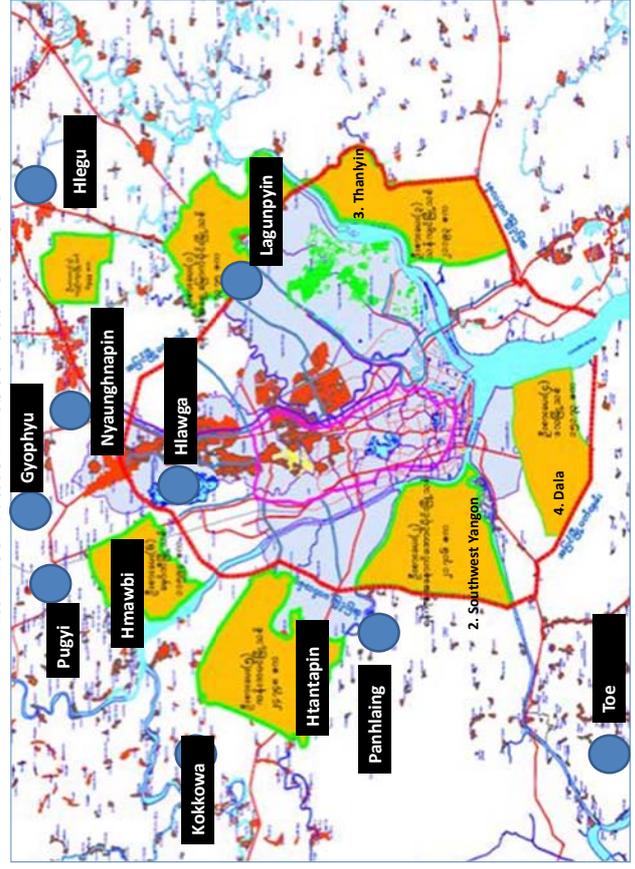
### 33KV, Remote Control Panel of Sub-Station



33KV, Remote Control Panel of Sub-Station



### Planned Water Resources for 2040



## Recommendation

- ❖ To promote city-to-city collaboration between YCDC and Kawasaki city and have to share future vision of low carbon development of YCDC
- ❖ To support and promote JCM project by selecting pilot project in the Low Carbon Action Plan
- ❖ To promote sustainable development of YCDC in collaboration of Kawasaki city
- ❖ YCDC wants to get technology transfer from JCM scheme.

Yangon wish many experiences from Kawasaki City Towards Low-carbon and Environmentally Sustainable City

Thank you For Your Attention



## 1.2 Workshop in YCDC (August 2017)

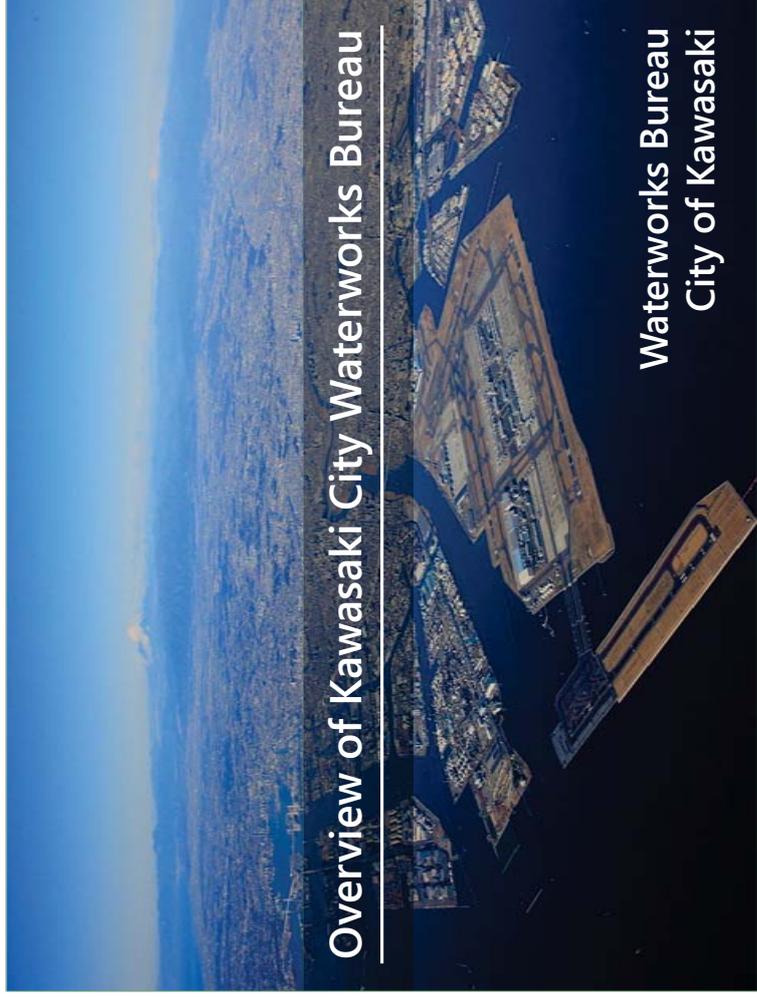


**JCM Project Formulation Study through City-to-City Collaboration in Yangon Phase-3**  
**- Agenda of Small Workshop on 16<sup>th</sup> August 2017 -**

- Date: 2017/08/16 (Wednesday) 13:30-15:15
- Place: Pollution Control and Cleansing Dept.(PCCD)/ Meeting Room
- Participants: Pollution Control and Cleansing Dept.(PCCD) from YCDC,  
 Water and Sanitation Dept.(WSD) from YCDC,  
 City of Kawasaki, TESCO Co., Ltd., Fuji Furukawa E&C, Ebara Thailand Limited  
 and Nippon Koei Co., Ltd.
- Objectives:
- To explain the purpose and activities of our city-to-city collaboration
  - To promote the purpose and activities of “Low Carbon Action Plan”
  - To discuss on our future collaborative work among Yangon city and city of Kawasaki

<i><b>Time</b></i>	<i><b>Contents</b></i>	<i><b>Presenter</b></i>
13:30-13:40 (10 min)	Explanation of an objective of this small workshop	City of Kawasaki
13:40-13:55 (15 min)	Introduction of outline of City-to-City Collaboration between Yangon and Kawasaki	Nippon Koei Co., Ltd.
13:55-14:05 (10 min)	Explanation of Kawasaki City Comprehensive Plan and Policy Structure	City of Kawasaki
14:05-14:25 (20 min)	Explanation of drafted Low Carbon Action Plan in Yangon	Nippon Koei Co., Ltd.
14:25-15:05 (50 min)	Discussion on our activities and future policies of our city-to-city collaboration	ALL
15:05-15:15 (10 min)	Closing Remarks	YCDC City of Kawasaki

End



## Overview of Kawasaki City Waterworks Bureau

Waterworks Bureau  
City of Kawasaki

## Overview of Kawasaki City



**Population : 1,501,697 per.**  
(As of Jun. 1, 2017)

**Area : 144.35 km<sup>2</sup>**

## Contents



- 1 Overview of Kawasaki City
- 2 Overview of Kawasaki City Waterworks Bureau
- 3 Overview of Waterworks
- 4 Overview of International Activities



## Overview of Kawasaki City

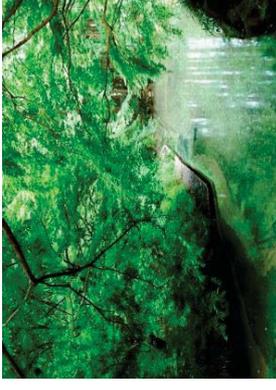
*City with Diverse Charms*



Kawasaki Port



High-rise condominium



Rich natural environment

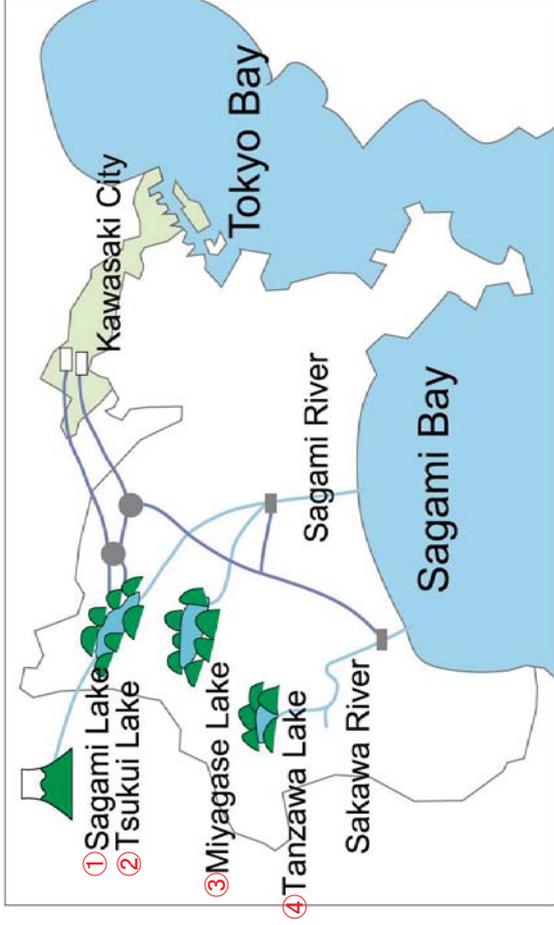


Industrial area



## Overview of Waterworks

### Water Supply System



## Overview of Waterworks

### Water Source



① Sagami Lake



② Tsukui Lake



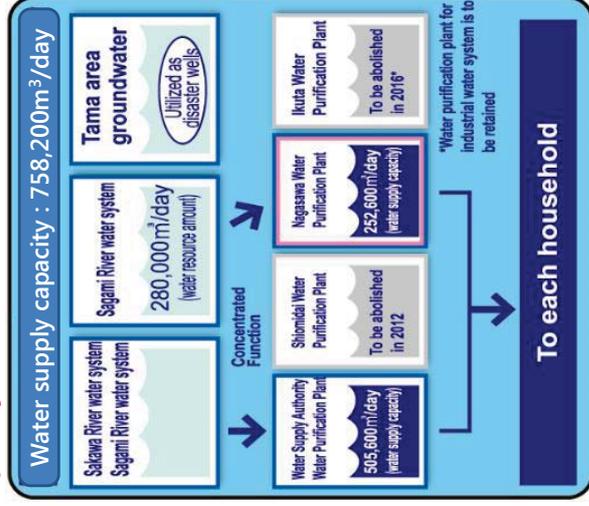
③ Miyagase Lake



④ Tanzawa Lake

## Overview of Waterworks

### Water Supply Capacity



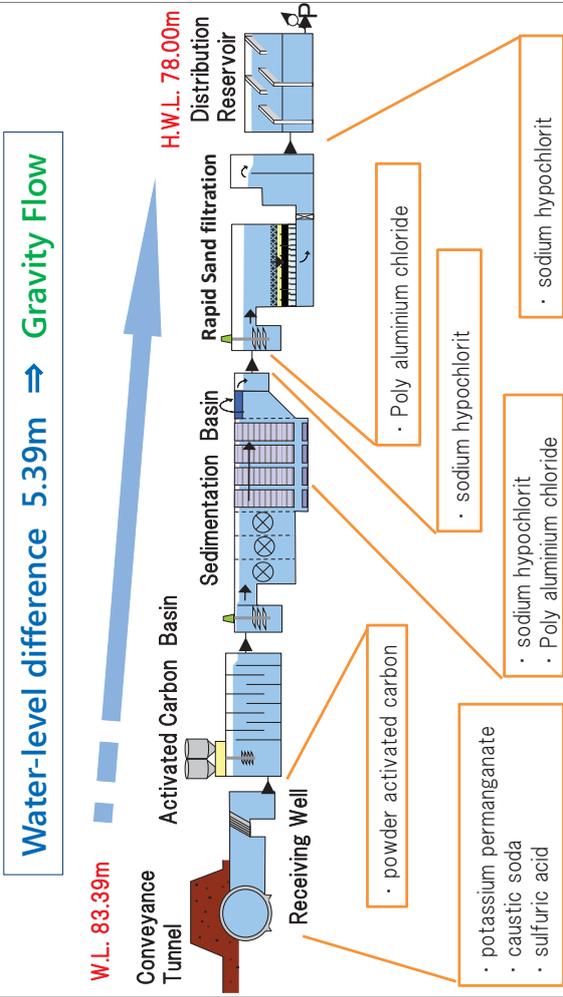
## Overview of Waterworks

### Nagasawa Water Purification Plant



# Overview of Waterworks

## Purification Process



# Overview of Waterworks

## Overview of Water Utility Facilities

**Water Purification facilities**

Name of Water Purification Plants	Installed capacity( m <sup>3</sup> /day)	Treatment method
Nagasawa of Water Purification Plant	280,000	Rapid sand filtration method

**Distribution facilities (distribution reservoir)**

Name of distribution reservoirs	Effective storage capacity( m <sup>3</sup> )
Nagasawa Distribution Reservoirs	40,622
Shionidai Distribution Reservoirs	27,840
Ikuta Distribution Reservoirs	47,698
Saginuma Distribution Reservoirs	109,608
Sueyoshi Distribution Reservoirs	72,360
Kurokawa Distribution Reservoirs	10,767
Kurokawa High-Zone Service Area Distribution Reservoirs	1,998

**Distribution facilities (regulating reservoir)**

Name of elevated distribution reservoir	Effective storage capacity( m <sup>3</sup> )
Takaishi Elevated Distribution Reservoir	6,280
Yurigoka Elevated Distribution Reservoir	514
Hosoyama Elevated Distribution Reservoir	1,899
Chiyosoka Elevated Distribution Reservoir	3,504
Miyazaki Elevated Distribution Reservoir	2,512



Ikuta Distribution Reservoirs



Miyazaki Elevated Distribution Reservoir

# Overview of Waterworks

## Conceptual Diagram of Implementation Policy

**Fundamental Objective**  
 Promotion of International Contribution to Improve Global Issues of Water Environment

- Expected Effects**
- Improvement of Global Issues of Water Environment
  - International Expansion of Water Business

### Directions

- <Direction 1>**  
 Public-Private Partnership
- Activity of "Kawasaki Water Business Network" (KaWaBiz NET)
- <Direction 2>**  
 Technical Cooperation
- Participate in MaWaSU
  - Acceptance of Trainees and Visitors from overseas

# Overview of International Activities

## Activity of Kawasaki Water Business Network

A platform for the promotion of water businesses, the Kawasaki Water Business Network (KaWaBiz NET) was established in August 2012.



**KaWaBiz NET Members**

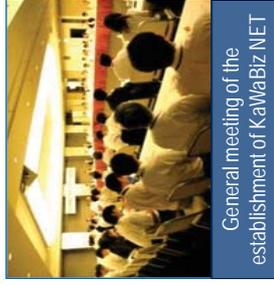
**Support**

Kawasaki City

- Provision of technologies and expertise of waterworks management
- Information Service to members
- Coordination to form team
- Provision of a project support environment based on a G-to-G relationship

Cooperators (MHLW / METI / MLIT / JICA / others)

**Kawasaki Water Business Network (56 members, 12 cooperators)**



General meeting of the establishment of KaWaBiz NET

KaWaBiz NET HP  
<http://www.kawabiznet.com>

## Overview of International Activities

### *Acceptance of Trainees and Visitors from overseas*

Taking advantage of the favorable geographical location, Kawasaki City provides training and lectures at waterworks and sewerage facilities for trainees and visitors from around the world.

822 visitors from 49 countries/regions (FY2011 ~ FY2016)



Thank you for your attention



"Kappy"  
Sewerage Project  
character



"Wo-tan"  
Waterworks Project  
character

# JCM Project Formulation Study through City-to-City Collaboration between Yangon city and City of Kawasaki

## Introduction of outline of City-to-City Collaboration between Yangon and Kawasaki

16<sup>th</sup> August, 2017  
Small workshop with YCDC

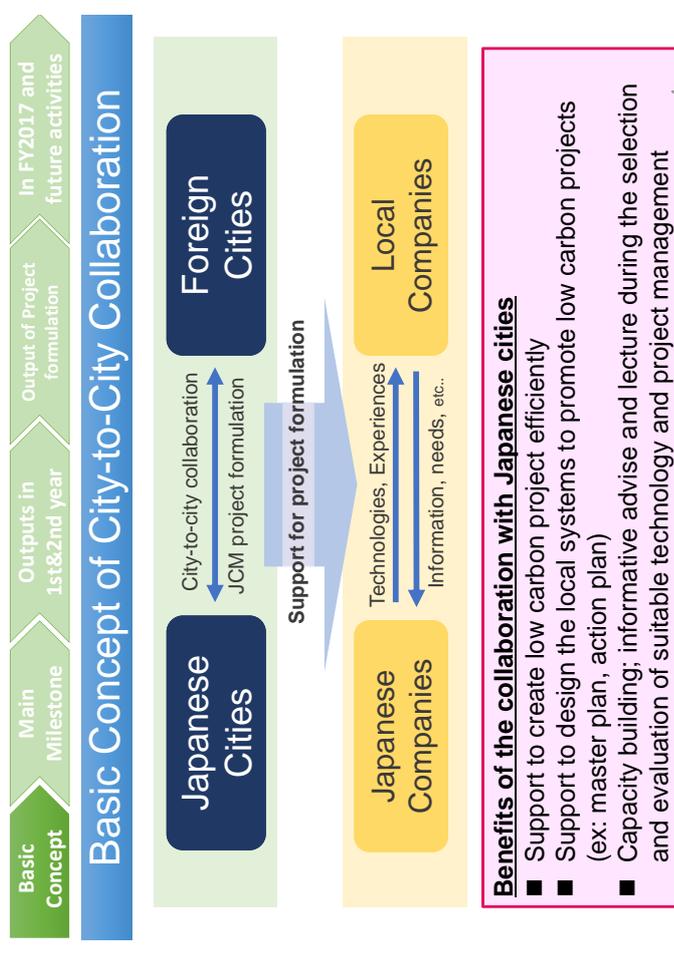
City of Kawasaki  
Nippon Koei Co., Ltd.

## Topics of this presentation

1. Basic concept
2. Main milestone
3. Outputs in 1<sup>st</sup> and 2<sup>nd</sup> year of city-to-city collaboration between Yangon and Kawasaki
4. Outputs of project formulation in 1<sup>st</sup> and 2<sup>nd</sup> year
5. Activities of City-to-city collaboration in FY2017 and in the future

2

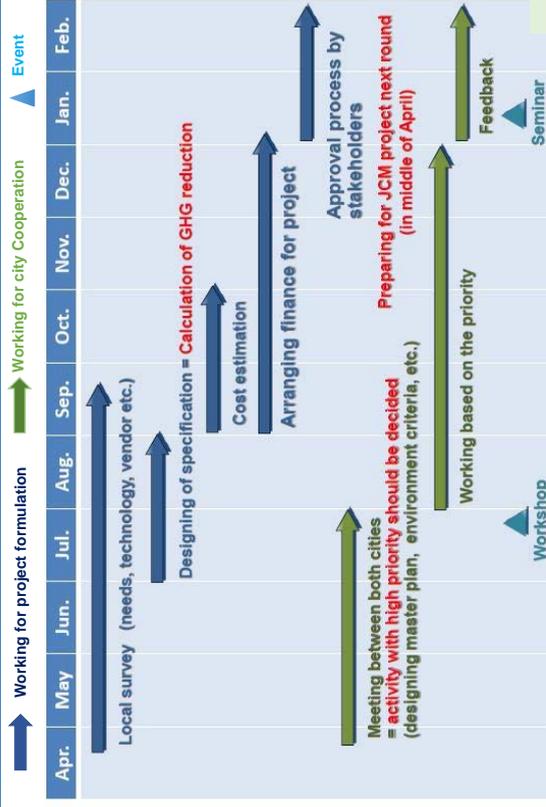
## JCM City-to-City Collaboration



3

Basic Concept → Main Milestone → Outputs in 1st&2nd year → Output of Project formulation → In FY2017 and future activities

## Main milestone for the city-to-city collaboration



## The City-to-City Collaboration between Yangon city and Kawasaki city

Basic Concept → Main Milestone → Outputs in 1st&2nd year → Output of Project formulation → In FY2017 and future activities

## Outputs in 1st and 2nd year of city-to-city collaboration

- Jul. 2015 • Commencement of City-to-City Collaboration
- Oct. 2015 • Invite Managing Directors of Urban Planning Department and Public Sanitation Department to Kawasaki City. Observe low carbon facilities and provide a lecture at Environmental Institute.
- Jan. 2016 • Hold a workshop for City-to-City Collaboration in Yangon City. Mayor and deputy Mayor attended.
- Mar. 2016 • **Sign on MOU to commit about future low carbonization and development of both cities**
- Apr. 2016 • Begin 2<sup>nd</sup> year
- Jun. 2016 • Two projects were adopted as JCM Model Project.
- Nov. 2016 • Presentations at JCM Kita-Kyusyu Seminar and COP22
- Dec. 2016 • Invite Economy & Finance Minister to Kawasaki City, and observe low carbon facilities
- Jan. 2017 • **Preparation of Draft Low Carbon Action Plan**

Basic Concept → Main Milestone → Outputs in 1st&2nd year → Output of Project formulation → In FY2017 and future activities

## Outputs in 1st and 2nd year of city-to-city collaboration

Members of Urban Planning Department of Yangon, Myanmar  
 and the City of Kawasaki, Japan  
 signed the MOU on the City-to-City Collaboration

1. Both parties shall be friendly to promote city-to-city collaboration for addressing the urban city-to-city collaboration between Yangon and Japan for achievement of low carbon city in Yangon and for members in the urban property of both, the City of Kawasaki and the City of Yangon hereby agree upon the following:

- Both parties shall be friendly to promote city-to-city collaboration for addressing the urban city-to-city collaboration between Yangon and Japan for achievement of low carbon city in Yangon and for members in the urban property of both, the City of Kawasaki and the City of Yangon shall be able to exchange information, technology, and services exchange as well as develop cooperative (network) based on the idea of both cities are on an urban-to-urban relationship.
- Members of urban planning department, both parties shall cooperate with each other in the following areas:  
 (A) Encouraging and supporting of low carbon projects utilizing low carbon technology (JCM) urban  
 (B) Exchanged information and information exchange for reducing low carbon society  
 (C) Other  
 (D) Members of the Myanmar (Urban Planning) MOU, they shall be back to back members to have exchange and study visit to both cities.
- This MOU shall become effective on the signed date and remain valid for three years, after which time it shall be automatically extended for another three years unless one of the parties gives notice to terminate the MOU. They shall remain in writing, hence one of the parties shall be notified in a written manner within a written agreement of both parties.
- Any dispute which arises from interpretation of the MOU shall be solved in a friendly way based on both parties' best and fairer.
- This MOU shall be made in an original copies in English.

Made at Yangon, Myanmar  
 17<sup>th</sup> July 2015

U. H. Aung  
 Mayor of Yangon

M. Yoshida  
 Mayor of Kawasaki



## Outputs of project Formulation in 1<sup>st</sup> and 2<sup>nd</sup> year

Activities	FY2015 1 <sup>st</sup> year	FY2016 2 <sup>nd</sup> Year	FY2017 3 <sup>rd</sup> Year
JCM Model Project		(1) Brewing System to Beer Factory in Yangon (2) Once-through Boiler in Instant Noodle Factory in Yangon	
FS Study for Project Formulation	(1) Introduction of boiler and refrigeration system (2) Introduction of boiler	(3) (Introduction of PV..... system)	(4) Replacement of pumps at a water treatment plant (5) Low carbonization of waste management

Adoption (between JCM Model Project and FS Study for Project Formulation in FY2015 and FY2016)

MOU (between JCM Model Project and FS Study for Project Formulation in FY2015)

To apply to JCM Model Project (dotted arrow from (2) to (4))

## Activities of City-to-city collaboration in FY2017 and in the future

### FS Studies for Project Formulation

#### FY2017

- ◆ Introduction of high-efficiency pumps into existing pumping station
- ◆ Project for Low Carbonization of Waste Management
- ◆ Survey on Local needs for next projects

#### FY2018 and future action

- To apply to JCM Model Project in FY2018
- Implementation of new FS studies (tentative)

### City-to-City Collaboration between Yangon and Kawasaki

#### FY2017

- ◆ Site visit in Kawasaki city (in July and January (tentative))
- ◆ Drafted low carbon action plan
  - Capacity development
  - Establishment of regulations for low carbon projects (tentative)
  - Others (Discussion will be made later, if necessary)

#### FY2018 and future action

- Site visit in Kawasaki city (tentative)
- Capacity development by using low carbon action plan (tentative)
- Others (Discussion will be made later, if necessary)

Thank you for your kind attention



## 2 JCM Project Formulation: “Introduction of high-efficiency pumps into existing pumping station”

### 2.1 Outline of the project



**Project Title :** Introduction of high-efficiency pumps into existing pumping station  
**PP (Japan):** Kawasaki Mizu Biz Network Company / **PP (Myanmar):** Yangon City Development Committee (YCDC)

**Outline of GHG Mitigation Activity**



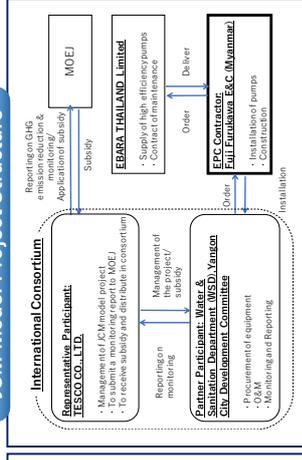
**Existing Water Facility**



**Introduced High efficiency pumps**

It aims to introduce high efficiency pumps which are customized as to fit the existing condition into existing aged pumps. The project contributes saving energy in the pumping station and reducing GHG emission.

**JCM Model Project Structure**



**GHG Emission Reductions and Project Site**



**1,997tCO<sub>2</sub>/Year**  
 -Legal Life : 18 years

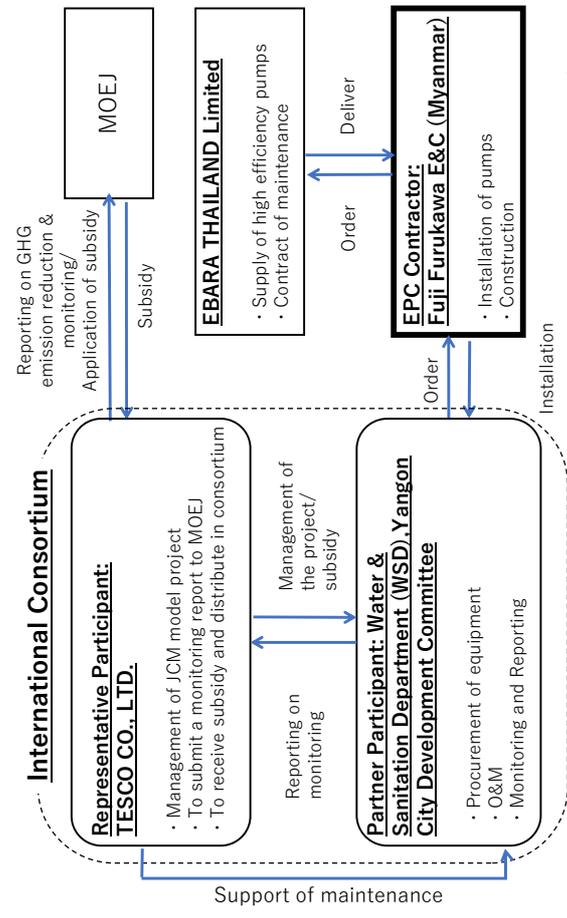
JCM Model Project  
 Site : Yangon city

**Merits of City-to-City Collaboration to Realize JCM Projects**

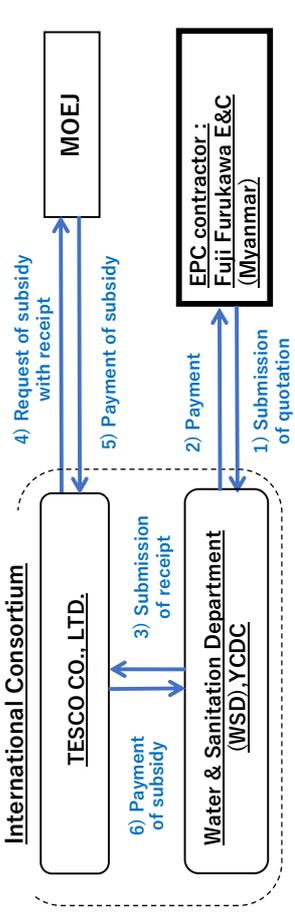
<b>Support for project implementation</b>	As for procurement of facility, it is considered without the bidding method by support of Kawasaki city considering its experience and knowledge.
<b>Support for monitoring</b>	As for monitoring and operation of the pumps, the capacity building of YCDDC staff shall be conducted by Kawasaki city in Japan as well as Yangon city.
<b>Promotion for dissemination</b>	The proposed project is listed as the pilot project under low carbon action plan and priority project under SUPP, so, it is promoted to proceed the authorization by YCDDC.

**JCM Project Formulation Study through City-to-City Collaboration in Yangon Phase-3**  
 - Introduction of high-efficiency pumps into existing pumping station -

**Introduction of high-efficiency pumps into existing pumping station**  
 Implementation Structure of JCM model project



**Introduction of high-efficiency pumps into existing pumping station**  
 Image of Cashflow of JCM model project



Step	Activities	Remarks
1	Submission of quotation	From Fuji Furukawa E&C to YCDC
2	Payment to EPC contractor by YCDC	From YCDC to Fuji Furukawa E&C
3	Submission of receipt	After payment, YCDC will hand over the receipt to TESCO for application of subsidy
4	Request of subsidy with receipt	TESCO will submit receipt to MOEJ
5	Payment of subsidy	Up to 50% of total project cost
6	Payment of subsidy	With deduction of commission fee

## Introduction of high-efficiency pumps into existing pumping station

### Schedule of JCM Model Project

Date	Items
April, 2018	Announcement of call for proposals of JCM model Project
Middle of May, 2018	Deadline for submitting proposals
<b>End of June, 2018</b>	<b>Selection of model projects</b> after the evaluation of proposals
Within 90 days from the date of preliminary selection	<ul style="list-style-type: none"> <li>Review of application documents</li> <li>Notice of Contract of Finance issued to participants</li> <li><b>Implementation of model project (September, 2018)</b></li> </ul>
---	Implementation of the project
February – March, 2019	<ul style="list-style-type: none"> <li>Midterm inspection by MOEJ (document review and onsite inspection, etc. if necessary)</li> <li>Submission of midterm reports</li> </ul>
<b>April, 2019</b>	<b>Disbursement of financial support</b>
---	Implementation of the project
End of the project	<ul style="list-style-type: none"> <li>Submission of final reports (due by 8 March)</li> <li>Inspection by GEC (document review and on-site inspection, etc. if necessary)</li> </ul>
<b>After inspection by MOEJ</b>	<b>Disbursement of financial support</b>

## Introduction of high-efficiency pumps into existing pumping station

### Costs Eligible for Financing of JCM model project

The JCM model project covers the following costs.

Note that the financial support is limited only to those costs that can be verified as having been spent for implementation of eligible projects.

- Cost of main construction work
- Cost of ancillary work
- Cost of machinery and appliances
- Cost of surveying and testing
- Cost of facilities (including monitoring equipment)
- Cost of administrative work; and
- Other necessary costs approved by GEC

[Reference] Maximum amount of financial support shall be calculated by multiplying the aggregate amount of eligible costs by the percentage listed as follows.

Number of already selected project(s) using a similar technology in each partner country	Percentage of financial support
None (0)	Up to 50% (determined by participants)
Up to 3 (1 – 3)	Up to 40% (determined by participants)
More than 3 (>3)	Up to 30% (determined by participants)

6

## Introduction of high-efficiency pumps into existing pumping station

### [REFERENCE] Costs NOT eligible for financing of JCM model project

[Costs NOT eligible for financing.]

The following costs are not covered by the model project:

- Cost of removing existing facilities (including miscellaneous expenses related to removal costs)
- Consumable supplies and materials to be used for periodical maintenance during the commercial operation
- Civil engineering work and building (excluding structures that directly contribute to energy related CO2 emission reductions)
- Cost related to a “simple restoration of function,” such as restoring the function to the state at the time of installation by updating existing facilities
- Facilities that are necessary for model projects but could become a source of small amounts of CO2 emissions
- Peripheral facilities that does not contribute to CO2 emission reductions (excluding monitoring equipment)
- Spare items used for the repair or replacement of failed units
- Cost related to writing reports
- Cost of setting up a forward exchange contract and bank transfer fee

7

## Introduction of high-efficiency pumps into existing pumping station

### Schedule of JCM project formulation

Actions	2017												2018			
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May			
<b>Activities on JCM project formulation</b>																
1 Confirmation of existing condition																
2 Preparation of draft proposal to YCDC, including cost																
3 Consideration of international consortium																
4 Discussion with YCDC on the JCM scope of work																
5 Decision on the JCM project scope																
6 Further discussion on Hwanga PS																
7 Preparation for proposal of JCM model project																
8 Submission of JCM proposal to MOEJ																
<b>Other activities under city-to-city collaboration</b>																
1 JCM seminar in Japan and site visit at Kawasaki																
2 Technical workshop at Kawasaki city																
3 Preparation of final report (phase 3)																

8

## 2.2 Site Investigation Report (1)



**TITLE** Site Investigation Report of Hlawga Pumping Station, Myanmar Doc. No. JCM-WP180112-A

**CUSTOMER** NIPPON KOEI CO., LTD. COMPLETE IN SHEETS WITH COVER 30

**FINAL USER** YANGON CITY DEVELOPMENT COMMITTEE (YCDC)

**PROJECT** HLAWGA PUMPING STATION SERVICE DISTRIBUTION PUMP

**CONTRACT NO.** ETL SER. No.

**ITEM No.** MODEL/ EQUIP. SET

CONTENT

1. INTRODUCTION
2. SPECIFICATION OF EXISTING EQUIPMENT
  - 2.1) PUMP
  - 2.2) MOTOR
3. INVESTIGATION RECORD
  - 3.1) 1<sup>ST</sup> INVESTIGATION ( JUNE 2017 )
  - 3.2) 2<sup>ND</sup> INVESTIGATION ( OCTOBER 2017 )
4. SUMMARY OF INVESTIGATION RESULT
  - 4.1) OPERATING POINT OF PUMP
  - 4.2) NEW PUMP TECHNICAL SPECIFICATION
  - 4.3) CALCULATION OF ENERGY SAVING
5. CONCLUSION
6. ATTACHMENT
  - ATTACHMENT-1 : SITE FLOW MEASUREMENT AND RECOMMENDATION OF NEW PUMP RATING
  - ATTACHMENT-2 : GENERAL ARRANGEMENT OF PUMPING STATION
  - ATTACHMENT-3 : TRAVEL RECORD

ISSUED BY PROJECTENGINEERING. DIV

APPROVED BY *[Signature]*

CHECKED BY

PREPARED BY WUTTHAI P. 12-Jan-18

REV. PAGE DATE APP'D BY

5

4

3

2

1



### 1. INTRODUCTION

Hlawga pumping station was constructed in 1980, and started operation in 1981 (36 years ago), so YCDC have a plan to improve reliability of this pumping station. Due to aging equipment and old technology the efficiency of pumps and motors become low efficiency and not meet with present water demand.

To study the feasibility to improve reliability of Hlawga pumping station, we conduct 1<sup>st</sup> site investigation on 13-14 June 2017 and 2<sup>nd</sup> investigation on 31 October 2017 for measuring operating point by use of portable flow meter, details are as below,

### 2. SPECIFICATION OF EXISTING EQUIPMENT

1)	CENTRIFUGAL PUMP	x	4 sets
	MANUFACTURER	:	DENGYOSHA MACHINE WORKS, LTD.
	TOTAL HEAD	:	54 M
	CAPACITY	:	83 M <sup>3</sup> /MIN
	SPEED	:	725 RPM
2)	INDUCTION MOTOR	x	4 sets
	MANUFACTURER	:	MEIDENSHA ELECTRIC MFG. CO., LTD.
	OUTPUT	:	1000 KW
	HERTZ	:	50 HZ
	VOLTAGE	:	6600 V
	POLES	:	8
	SPEED	:	725 RPM

### 3. INVESTIGATION RECORD

#### 3.1) 1<sup>ST</sup> INVESTIGATION (JUNE 2017)

Information from Officer & Operator of YCDC

- 1) Hlawga pumping station started operation in 1981 as a distribution pumping station (direct feed water to user) and there is no water treatment plant.
- 2) There are 4 pumps in this pumping station and YCDC normally operate 2 pumps, 24 hours, 7 days per week. Pump will operate as rotate number, switch every 2 – 3 days.
- 3) At beginning of starting operation on this pumping station, pressure at main header pipe (dia. 66") was approx. 170 feet (52 m). In 1992 pressure at main header reduced to 150 feet (45 m).
- 4) There are Flow measurement device "Dall Tube" installed at main pipe line of this pumping station. And instrument for flow measurement was mounted on "Indicator meter board" inside pumping station. However, the instrument for flow rate is already malfunction.

Information by site investigation and operation check.

- 1) Under 2 pumps operation, pumps operated at total head approx. 40 m, which is difference from existing pump's rated head on 54 m (@ 83 m<sup>3</sup>/min). On the other hand, due to flow meter malfunction, we cannot get the flow rate.
- 2) Shut off pressure of existing pump = 73.4 m (approx.)
- 3) There is cavitations when operate only 1 pump.

YCDC requirements

- 1) All mechanical equipment in the pumping station shall be replaced, namely Pump, Motor, suction and discharge Valves and all pipes between suction to discharge valve.
- 2) Starter panel shall be replaced.

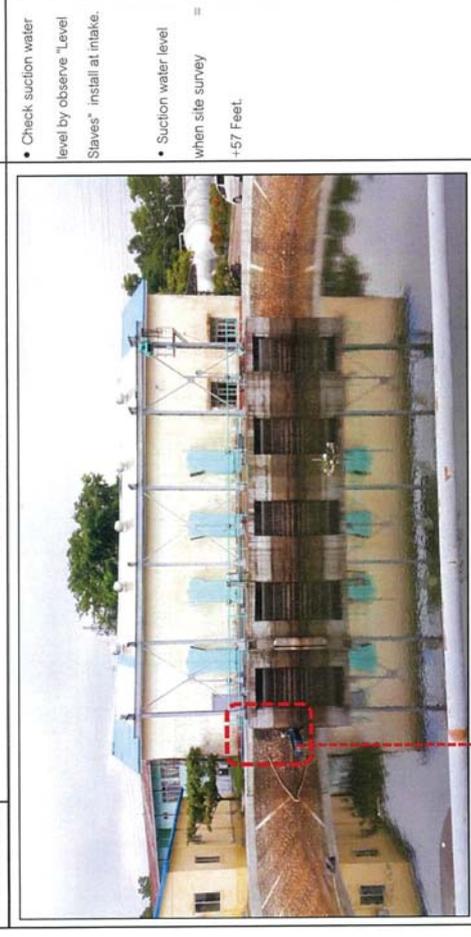
Please refer to 1<sup>st</sup> Investigation photo record for more information.

1<sup>st</sup> INVESTIGATION PHOTO RECORD  
( 13-14 JUNE 2017 )

PHOTOGRAPH RECORD

STATION NAME	HILAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
SURVEY DATE	13 - 14 JUNE 2017

Picture Name	Suction water level
--------------	---------------------



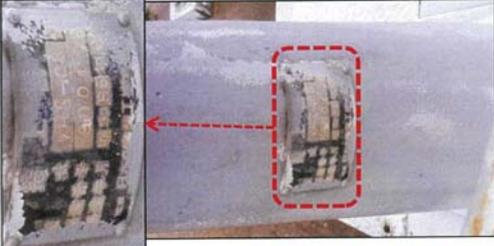
Note

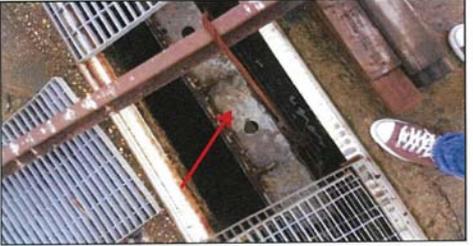
- Check suction water level by observe "Level Slaves" install at intake.
- Suction water level when site survey = +57 Feet.

PHOTOGRAPH RECORD

P.2 of 11

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

Picture Name	Condition of Sluice gate	Note
  	<ul style="list-style-type: none"> <li>At suction side, there are both sluice gate and stoplog.</li> </ul>	

Picture Name	Stoplog & Hoist for install/remove	Note
 		



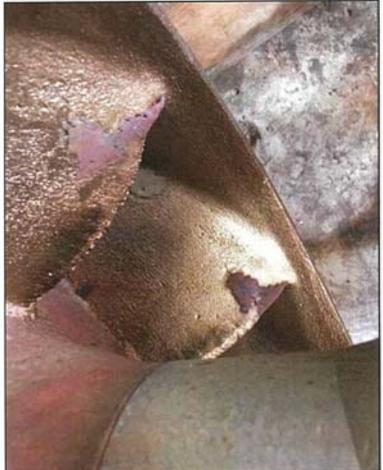
EBARA (THAILAND) LIMITED

PHOTOGRAPH RECORD

P.3 of 11

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

Picture Name	Rotating part of pump no.2	Note
 	<ul style="list-style-type: none"> <li>On Survey date, pump No.2. is overhaul.</li> </ul>	

Picture Name	Impeller condition of pump No.2	Note
 		



EBARA (THAILAND) LIMITED

PHOTOGRAPH RECORD

STATION NAME	HILAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

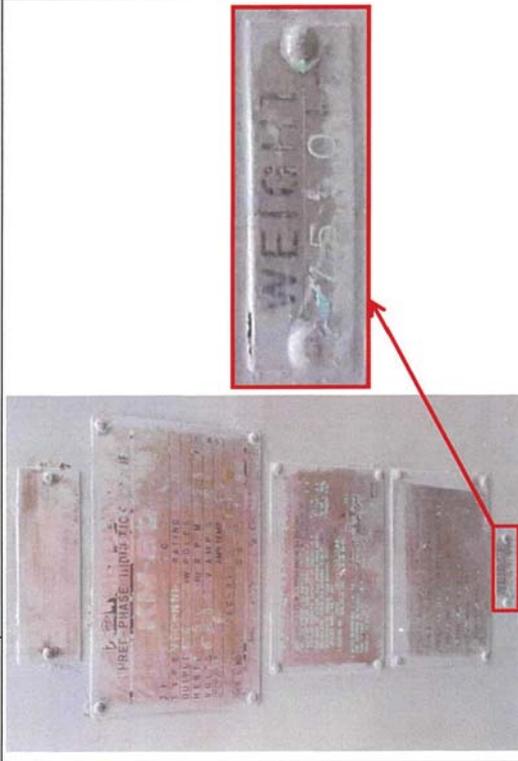
Picture Name	Overview on motor floor	Note
		

Picture Name	Main incoming panel 33kV	Note
		<ul style="list-style-type: none"> <li>Annunciator and protection relay mount on 33kV incoming panel.</li> </ul>



PHOTOGRAPH RECORD

STATION NAME	HILAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

Picture Name	Motor name plate	Note
		<ul style="list-style-type: none"> <li>Weight of existing motor = 7.560 kg.</li> </ul>

Picture Name	Motor name plate	Note
		<ul style="list-style-type: none"> <li>Motor rated : 1,000 kW 6,600 kV, 50Hz, 8 Poles.</li> <li>Insulation class: F. Design Ambient Temp: 45C</li> <li>Manufacturing since Year 1980.</li> </ul>

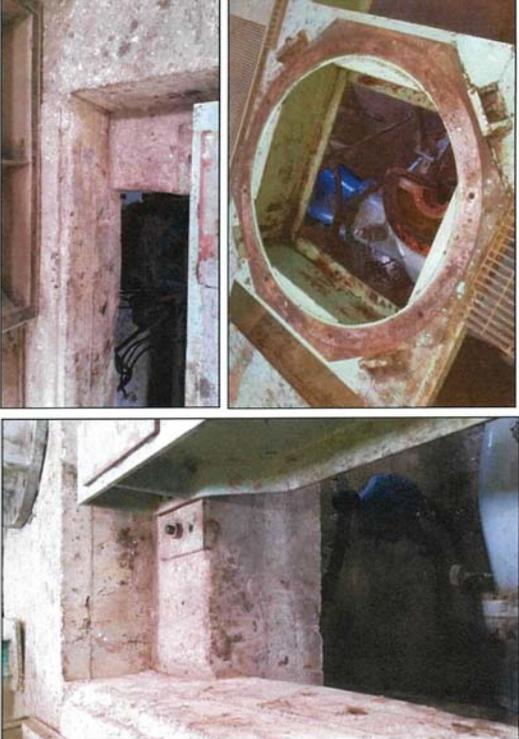


PHOTOGRAPH RECORD

P.6 of 11

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

Picture Name	No.3 Motor pedestal	Note
		<ul style="list-style-type: none"> <li>Motor No. 3 is under maintenance.</li> </ul>

Picture Name	No.3 Motor pedestal	Note
		

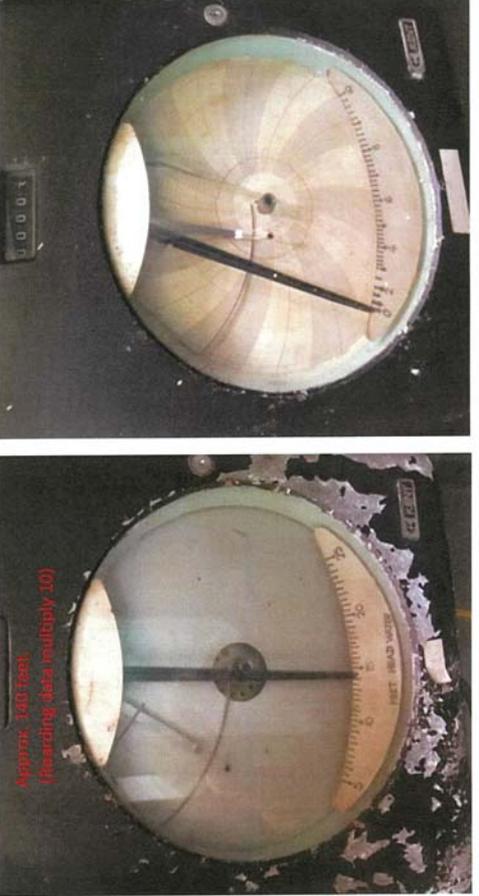


PHOTOGRAPH RECORD

P.7 of 11

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

Picture Name	Indicator meter board	Note
		<ul style="list-style-type: none"> <li>Operator record pressure of header pipe by utilize instrument in this panel.</li> <li>Instrument in this panel connected with "Venturi" that located near surge vessel tank.</li> <li>Record when 2 pumps operate Head approx. 140 Feet.</li> </ul>

	
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PHOTOGRAPH RECORD

P.8 of 11

STATION NAME	HILAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

Picture Name Pump No.1 Pressure gauge (13 Jun 2017)



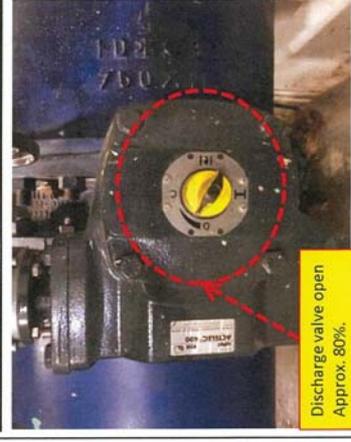
Discharge pressure gauge = 0.44 MPa



Suction pressure gauge = 0.5 kg/cm2

Note

- Install pressure gauge at pump suction and discharge.
- Pump parallel operate 2 units (No.1 & No.4) under normal operation.
- Record time is 4:30 P.M. on date 13 June 2017
- Discharge pressure at Header = 0.3 Mpa



PHOTOGRAPH RECORD

P.9 of 11

STATION NAME	HILAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

Picture Name Pump No.1 Pressure gauge (14 Jun 2017)



Discharge pressure gauge = 0.26 MPa



Suction pressure gauge = 0.5 kg/cm2

Note

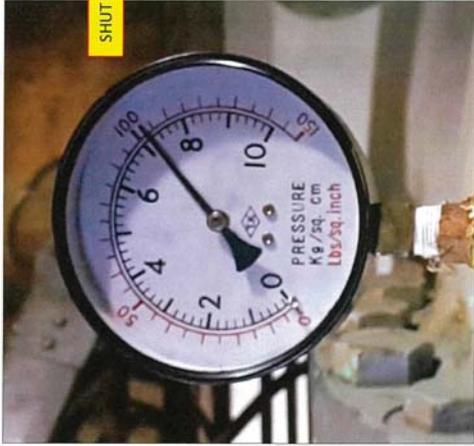
- Pump operate 1 unit under normal operation.
- Record time is 11:15 A.M. on date 14 June 2017
- Discharge pressure at Header = 0.1 Mpa

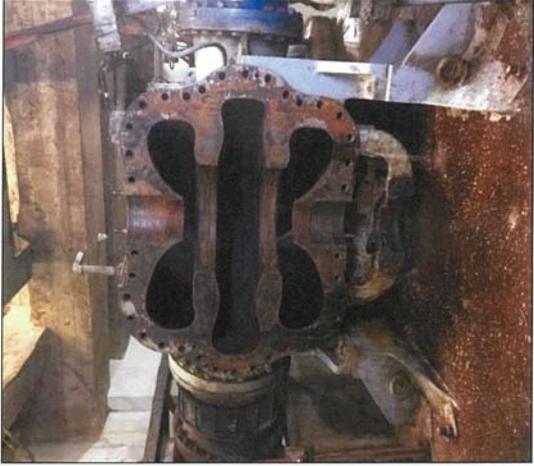


PHOTOGRAPH RECORD

P.10 of 11

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

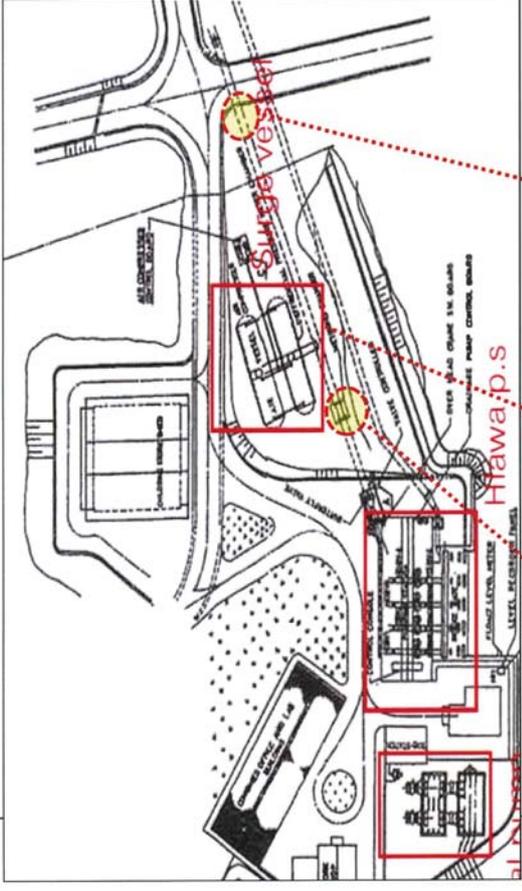
Picture Name	Pump No. 4 Pressure gauge (14 June 2017)	Note
		Discharge pressure gauge = 7.2 kg/cm2

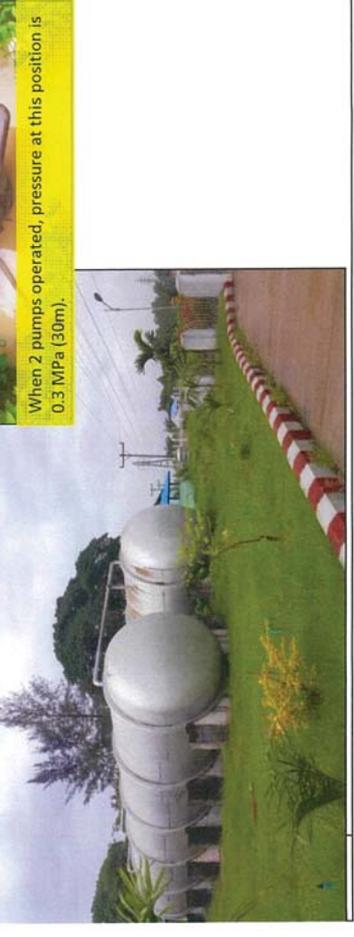
Picture Name	Pump No. 3 is under overhaul	Note
		

PHOTOGRAPH RECORD

P.11 of 11

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE
DATE	13 - 14 JUNE 2017

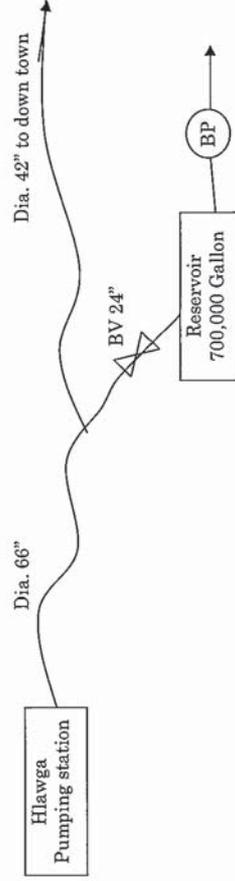
Picture Name	PLANT OVER VIEW
	
<p>Location of Venturi that connected with "i" indicator panel board in pumping station. When 2 pumps operate, Head that read at "i" indicator panel board" is 140 Feet. (45m)</p>	
<p>Install position of pressure gauge at header pipe</p>	
<p>When 2 pumps operate, pressure at this position is 0.3 MPa (30m).</p>	



### 3.2) 2<sup>ND</sup> INVESTIGATION (OCTOBER 2017)

After 1<sup>st</sup> investigation we study on operating data of Hlawga pumping station by using Ebara's pump characteristic curve which is almost similar to existing pump, as we cannot get existing pump curve from YCDC. As well, to make sure that we can select the most suitable pump for Hlawga pumping station, we decide 2<sup>nd</sup> Investigation for measuring present flow rate on 31 October 2017.

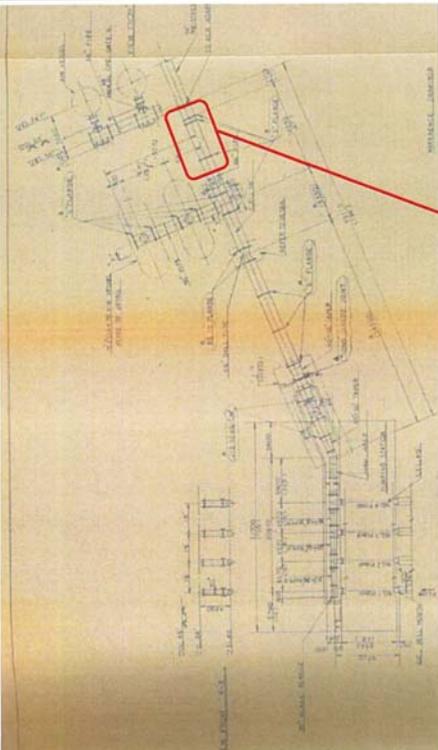
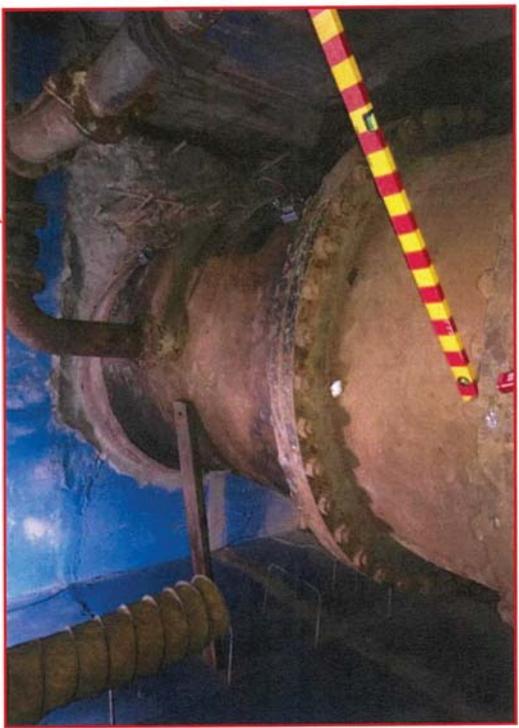
The result of 2<sup>nd</sup> investigation will be shown in "2<sup>nd</sup> Investigation photo record"  
 Moreover, we got the information from YCDC that this Hlawga pumping station is operated 2 pumps for 24 hr as a Distribution Pumping Station. Its delivery water from Hlawga reservoir pass through main pipe 66" to Yangon City as show "Flow scheme" below.  
 Only time from 6:00am to 12:00am, Butterfly Valve 24" will be opened (50%) to supply the water to Reservoir, which capacity is 700,000 gallon and through booster pumps, water is delivered to residences also. So the operating point of the pumps in Hlawga Pumping Station will be changed upon the open-close time of butterfly valve 24" at the reservoir.



"Flow Scheme of Hlawga Pumping Station"

### 2<sup>ND</sup> INVESTIGATION PHOTO RECORD ( 30-31 OCTOBER 2017 )

PHOTOGRAPH RECORD

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION	
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE	
SURVEY DATE	30-31 October 2017	
Picture Name	Flow measurement at Main Pipe	Note
		Measurement Total Flow Rate under 2 pumps operated by using Ultrasonic Flow Meter install at Main Pipe dia. 66".
		



EBARA (THAILAND) LIMITED

PHOTOGRAPH RECORD

STATION NAME	HLAWGA WATER DISTRIBUTION PUMP STATION	
FINAL USER	YANGON CITY DEVELOPMENT COMMITTEE	
DATE	30-31 October 2017	
Picture Name	Flow measurement result	Note
		Flow measurement on 31 Oct 17 on 13:30 - 2 pumps operated - Total Q = 225 - 242 m <sup>3</sup> /min - Pump's Dis. Pressure = 46 m - Suc. Water Level = 61' 8" - Pump Total Head = 40 m (approx.)
Picture Name	Meeting with YCDC	
		Meeting with YCDC for the Result of Flow measurement



EBARA (THAILAND) LIMITED

#### 4. SUMMARY OF INVESTIGATION RESULT

##### 4.1) OPERATING POINT OF PUMP

As the result of 1<sup>st</sup> and 2<sup>nd</sup> Investigation and information from YCDC, we confirmed that Hlawga Pumping Station is normally operated by 2 pumps for 24 hr./day. And the Operating point of pumps under parallel 2 pumps was difference from the rated point of the existing pump. Pumps are operated at Total Head = 40 m (approx.), which is far from existing Pump's Rated Head of 54 m

To confirm the new pump rating which meet with present operating point and water demand of Hlawga Pumping Station, we measure the present flow rate on 2<sup>nd</sup> Investigation in October 2017.

Measuring result and operating point are as follows;

- Suction Water Level	:	EL +61.8 ft
- Total flow rate	:	225 to 240 m <sup>3</sup> /min ( 2 pumps operated )
- Unit capacity	:	112.5 to 120 m <sup>3</sup> /min
- Pump Total Head	:	37.7 to 40.3 m

Base on 1<sup>st</sup> and 2<sup>nd</sup> Investigation, New Pump Rated Point is determined as below;

- Rated Capacity	:	120 m <sup>3</sup> /min	(Existing Pump = 83 m <sup>3</sup> /min)
- Rated Head	:	40 m	(Existing Pump = 54 m)
- Speed	:	740 rpm	(Same as existing)
- Motor Output	:	1000 kW	(Same as existing)

\*\*For detail of Flow Measurement Result, please refer to ATTACHMENT-1 "Site Flow Measurement and Recommendation of New Pump Rating" Doc. No. JCM-WP171108-A

#### 4.2) NEW PUMP TECHNICAL SPECIFICATION

# CENTRIFUGAL PUMP DATA SHEET

Doc. No. Q175190-1210-0101 Rev.0 P.1/1

FOR PRELIMINARY

CUSTOMER	YANGON CITY DEPARTMENT COMMITTEE (YCDC)	
FINAL USER	YANGON CITY DEPARTMENT COMMITTEE (YCDC)	
PROJECT	JCM-HLAWGA DISTRIBUTION PUMPING STATION	
ITEM No.		
SERVICE	RAW WATER PUMP	
DRIVER	INDOOR MOTOR	
PERFORMANCE	NPSH REQ.(AT PUMP CENTER) 8.0 m	
LIQUID	FRESH WATER	
CAPACITY	7200 m <sup>3</sup> /h	
TOTAL HEAD	40 m	
SPEED	740 min <sup>-1</sup>	
PUMP SHAFT POWER	871.5 kW	
SHUT OFF HEAD (APPROX.)	60.5 m	
PUMP EFFICIENCY	90 %	
MOTOR OUTPUT	1000 kW	
MOTOR VOLTAGE	6600 V	
MOTOR STARING METHOD	XONDORESTART (4N, 7HP)	
MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR	
ROTATION VIEWED FROM MOTOR	CW	

NOZZLE	SIZE	RATING	FACING	POSITION	COMPANION FLANGE
SUCTION	800 mm	JIS 10K	FF	SIDE	NO
DISCHARGE	500 mm	JIS 10K	FF	SIDE	NO
PUMP TYPE	VERTICAL	SPLIT		AXIAL	
IMPELLER TYPE	CLOSED			FLEXIBLE SPACER COUPLING	
SUCTION	DOUBLE			RUBBER BEARING & BALL BEARING	
No. of STAGE	1			THRUST BEARING BALL BEARING	
MOUNT	BETWEEN BEARING			BEARING LUBRICATION OIL BATH	
TYPE VOLLUTE	SINGLE			BASE PLATE COMMON	
CASE MOUNT	FOOT			SHAFT SEAL GLAND PACKING	
				UTILITY	

MATERIAL (JIS CODE)	
CASING	FC250
IMPELLER	IAC403
SLEEVE	SUS304
SHAFT	SUS403Q
PUMP BASE	SS400
ACCESSORIES (PER UNIT)	

PUMP BASE X 1SET, MOTOR BASE PLATE X 1SET, MOTOR PEDESTAL X 1SET, FOUNDATION BOLTS X 1SET (FOR PUMP AND MOTOR), COUPLING - GUARD X 1SET, SPACER COUPLING X 1SET, SPECIAL TOOL X 1SET.

HYDRO. TEST PRESS.	0.98 MPa.G
APPROX. MASS	
PUMP PROPER	9150 kg
WATER IN PUMP	2200 kg
PUMP BASE	1600 kg
SPACE COUPLING - LATER	
MOTOR BASE	1600 kg
MOTOR	LATER
SOLE PLATE	280 kg
TOTAL	LATER

ISSUED BY	ENGINEERING DEPT.
APPROVED BY	K.MORI
DATE	01-Aug-17
CHECKED BY	V.HUNG
DATE	01-Aug-17
PREPARED BY	C.TOAN
DATE	01-Aug-17

EBARA VIETNAM PUMP CO., LTD.



**PUMP CHARACTERISTIC CURVE** DATA: 01-Aug-17 Rev.0

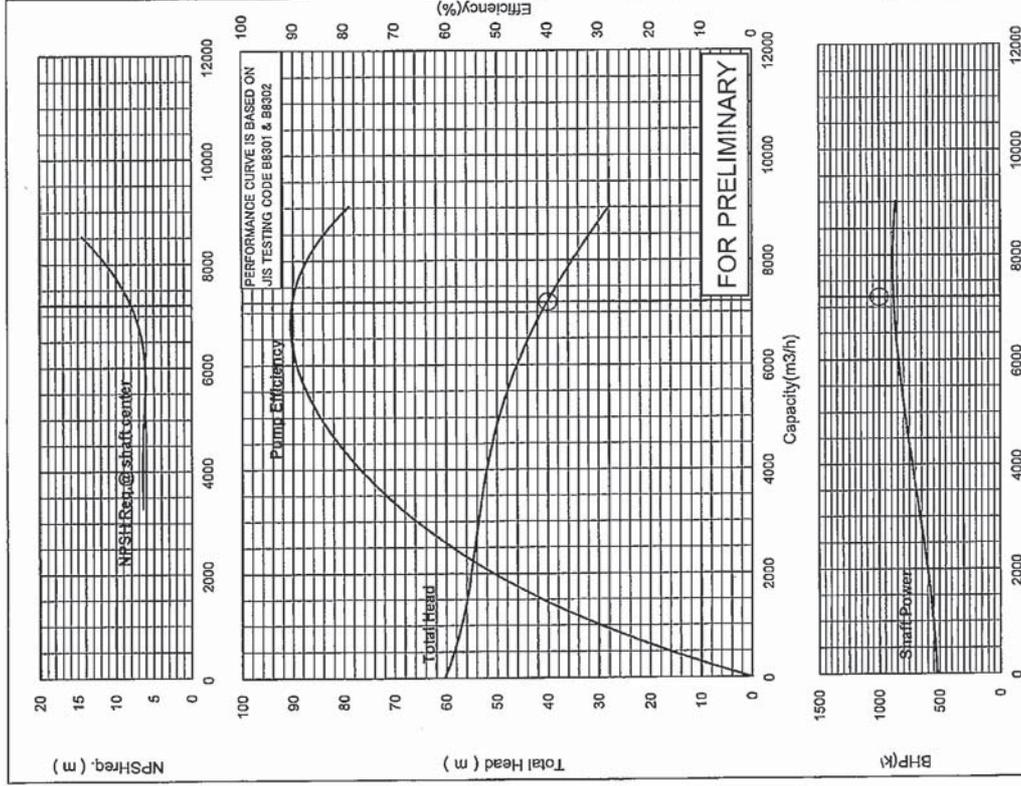
Item No. - Doc.No. Q175190/1210/0102

Customer YANGON CITY DEPARTMENT COMMITTEE Service RAW WATER PUMP

Ser.No. FOR PROPOSAL Model 800X500VDM

Specified Condition 7200 m<sup>3</sup>/h x 40 m x 740 min<sup>-1</sup> x 1000 kW

Liquid Handled Fresh Water Sp.Gr. 1.000 Temp. Nor °C Vis. -



App'd by V.HUNG

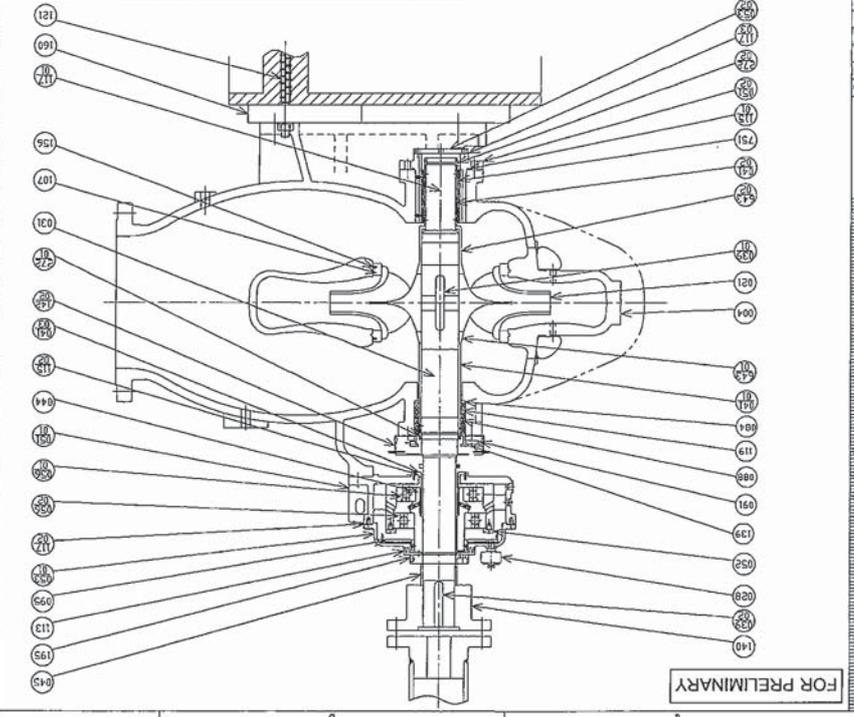
Check'd by C.TOAN

Prep'd by T.TOAN

EBARA

Ebara Vietnam Pump Co., Ltd.

NO.	NAME OF PARTS	MATERIAL	
		QTY	REMARKS
751	RUBBER GEARNS	BRASS AND RUBBER	CHINA, NBR
643-01	UPPER SLEEVE HEAD	STAINLESS STEEL	SUS 304
272-03	JOURNAL NUT	ROLLED STEEL	S5400
272-02	LOWER SLEEVE NUT	STAINLESS STEEL	SUS 304
272-01	UPPER SLEEVE NUT	STAINLESS STEEL	SUS 304
195	ADJUSTING NUT	CARBON STEEL	S45C



NO.	NAME OF PARTS	MATERIAL	
		QTY	REMARKS
160	PUMP BASE	ROLLED STEEL	S5400
156	POWER PIN	STAINLESS STEEL	SUS 316
148	SPACE COUPLING	CARBON STEEL	S45C
139	GRAND BOLT	STAINLESS STEEL	SUS 304
121	ANCHOR BOLT	CARBON STEEL	S0285A
117-03	SHEET GASKET	-	-
117-02	SHEET GASKET	-	-
117-01	SHEET GASKET	NON-ASBESTOS	-
115-02	O-RING	-	-
115-01	O-RING	-	-
113	LAPWINTH	CAST IRON	FC250
107	CASING RING	STAINLESS STEEL	C40C03
099	OIL DEFLECTOR	ROLLED STEEL	S5400
091	GLAND	CAST IRON	FC200
088	LANTERN RING	STAINLESS STEEL	SUS 304
084	PACKING PLATE	STAINLESS STEEL	SUS 304
066-02	BALL BEARING	-	-
066-01	BALL BEARING	-	-
053-02	LOWER BEARING COVER	ROLLED STEEL	S5400
053-01	THRUST BEARING COVER	CAST IRON	FC200
052	THRUST COLLAR	ROLLED STEEL	S5400
051-02	LOWER BEARING HOUSING	CAST IRON	FC200
051-01	THRUST BEARING HOUSING	CAST IRON	FC200
049	SETTING RING	CARBON STEEL	S45C
044	JOURNAL	CARBON STEEL	S45C
043-02	OIL SLEEVE	ROLLED STEEL & STAINLESS STEEL	S5400
041-02	LOWER SLEEVE	STAINLESS STEEL	SUS 304
041-01	UPPER SLEEVE	STAINLESS STEEL	SUS 304
039-02	COUPLING KEY	CARBON STEEL	S50C
039-01	IMPELLER KEY	STAINLESS STEEL	SUS 304
031	SHAFT	STAINLESS STEEL	SUS 304
028	AIR BREAKER	-	-
021	IMPELLER	BRONZE CASTING	C40C03
004	CASING	CAST IRON	FC250

FORM NO.	NO.	NAME OF PARTS	MATERIAL	QTY	REMARKS
	004	CASING	CAST IRON	1	1 SET
	021	IMPELLER	BRONZE CASTING	1	1 SET
	028	AIR BREAKER	-	1	1 SET
	031	SHAFT	STAINLESS STEEL	1	1 SET
	039-01	IMPELLER KEY	STAINLESS STEEL	1	1 SET
	039-02	COUPLING KEY	CARBON STEEL	1	1 SET
	041-01	UPPER SLEEVE	STAINLESS STEEL	1	1 SET
	041-02	LOWER SLEEVE	STAINLESS STEEL	1	1 SET
	043-02	OIL SLEEVE	ROLLED STEEL & STAINLESS STEEL	1	1 SET
	044	JOURNAL	CARBON STEEL	1	1 SET
	049	SETTING RING	CARBON STEEL	1	1 SET
	051-01	THRUST BEARING HOUSING	CAST IRON	1	1 SET
	051-02	LOWER BEARING HOUSING	CAST IRON	1	1 SET
	052	THRUST COLLAR	ROLLED STEEL	1	1 SET
	053-01	THRUST BEARING COVER	CAST IRON	1	1 SET
	053-02	LOWER BEARING COVER	ROLLED STEEL	1	1 SET
	066-01	BALL BEARING	-	1	1 SET
	066-02	BALL BEARING	-	1	1 SET
	084	PACKING PLATE	STAINLESS STEEL	2	2 SET
	088	LANTERN RING	STAINLESS STEEL	2	2 SET
	091	GLAND	CAST IRON	2	2 SET
	099	OIL DEFLECTOR	ROLLED STEEL	2	2 SET
	107	CASING RING	STAINLESS STEEL	2	2 SET
	113	LAPWINTH	CAST IRON	1	1 SET
	115-01	O-RING	-	1	1 SET
	115-02	O-RING	-	1	1 SET
	117-01	SHEET GASKET	NON-ASBESTOS	1	1 SET
	117-02	SHEET GASKET	-	1	1 SET
	117-03	SHEET GASKET	-	1	1 SET
	121	ANCHOR BOLT	CARBON STEEL	6	6 SET
	139	GRAND BOLT	STAINLESS STEEL	2	2 SET
	148	SPACE COUPLING	CARBON STEEL	1	1 SET
	156	POWER PIN	STAINLESS STEEL	2	2 SET
	160	PUMP BASE	ROLLED STEEL	1	1 SET

NO.	DESCRIPTION	DATE	BY	APP.

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	117-03	SHEET GASKET	-	1	1 SET



# VERTICAL DOUBLE SUCTION VOLUTE PUMP

MODEL VD

BORE 600~1000mm (24~40 in.)



**APPLICATIONS**

- Water works Water intake/water supply/booster
- Industrial use Water intake/water supply/booster/water circulation/drainage/sea water desalination/chemical/refinery/fire fighting
- Irrigation Water supply/drainage
- Building Water supply/drainage/air conditioning
- Pipe line Water & crude oil transfer/booster

**APPLICATION RANGE**

Capacity : Approx.35 ~ 250m<sup>3</sup>/min (9200 ~ 66000 USGPM)  
 Total head : Approx.7 ~ 190m (23 ~ 620 ft)  
 Liquid : Fresh water/industries/river water/sea water/brine/paper stock/hydrocarbon etc.

**SPECIFICATIONS**

	STANDARD	OPTIONAL
Liquid temperature	Below 60°C (176°F)	81~120°C(177 ~ 248°F)
Shaft seal	Gland packing	Mech. seal
Direction of rotation	CW(Viewed from driver)	CCW
Flange	JIS 10K/JIS 20K	Any standard
Succ./Disch. direction	Side-side	Other direction such as bottom suction
Drive method	Motor direct drive	Diesel engine drive, Turbine drive through gear, etc.
Accessories	Common base, foundation bolts, shaft coupling, air vent piping, self sealing water piping, drain piping	Pump base, pressure gauge, compound gauge, vacuum gauge, priming detector, solenoid valve for priming line, pressure switch, bearing thermometer, bearing dial thermometer with an alarm contact, tools, companion flange, etc.

(NOTE) Other specifications can be available, if required.

**MATERIALS (Typical material combinations)**

	Fresh water/River water/industries	Sea water	Hydrocarbon
Casing	Cast Iron	Low Alloy Cast Iron/Ni-resist D2/316S.S.	Cast Steel
Impeller	Cast Iron/Bronze/304S.S.	316S.S.	410S.S.
Shaft	Carbon Steel/4140 Steel	316S.S.	Carbon Steel/4140 Steel
Packing sleeve	304S.S.	316S.S.	420S.S.
Casing ring	Cast Iron/Bronze/304S.S.	316S.S.	403S.S.

(NOTE) \* Other materials such as Nickel aluminum bronze, Duplex stainless steel, Monel, Alloy 20, etc. can also be applied.  
 \* Selection of material requires careful study of the properties of the liquid handled and of the operating conditions, etc.  
 For specific details, please consult our factory.

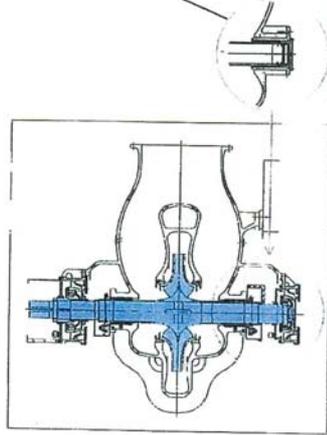
## Vertical Double Suction Volute Pump

VD

**FEATURES & BENEFITS**

- 1 Easy maintenance**  
Split case design permits easy inspection and disassembly works as removal of suction/discharge pipework not required should maintenance work is deemed necessary.
- 2 Optimal pump performance**  
Advanced double suction design with good suction performance ensures high suction lifts even during large capacities operation.
- 3 Energy saving**  
High pump operating efficiency over a wide range of capacities reduce motor output, thus reducing operating cost.
- 4 Space saving**  
Vertical mounting enhances space saving. Pump operating with low noise, smaller pressure pulsation enhance operating environment.
- 5 Wide materials choice**  
Offers wide choices of variable combination of materials to suit most pumping application.

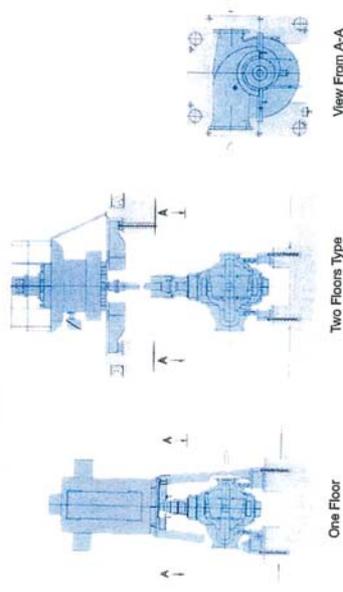
**TYPICAL SECTIONAL VIEW**



**Ceramic or Rubber bearing type (option)**

1. Eliminate lower seal gland packing / mechanical seal  
- Easy maintenance  
- Simple design
2. Solving the problem of bearing flood.
3. Less spare parts.
4. Lower pump center line because no maintenance space is necessary for lower seal.

**TYPICAL INSTALLATION**



View From A-A

Two Floors Type

One Floor

Typical Arrangement (for SHOP TEST)

Note: All specifications subject to change without prior notice. \*Multi-floor type available upon request.



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 International Division, Tokyo

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**4.3) CALCULATION OF ENERGY SAVING**

Power consumption shall be compared as below, on the basis of "Operating Data Record" on 31 Oct 2017 (refer OPERATING DATA RECORD of ATTACHMENT-1) and "New Pump Technical Specification" ;

(Compare at total flow 240 m<sup>3</sup>/min, 120 m<sup>3</sup>/min per unit)

Existing Pump operating point

Q = 120 m<sup>3</sup>/min  
 H = 38 m  
 Pump Efficiency = 81% (expected)  
 Motor Efficiency = 89% (expected)  
 Motor Input Power =  $\frac{0.163 \times 120 \times 38}{0.81 \times 0.89}$   
 = 1031.0 kW

New Pump

Q = 120 m<sup>3</sup>/min  
 H = 40 m  
 Pump Efficiency = 90%  
 Motor Efficiency = 96.8%  
 Motor Input Power =  $\frac{0.163 \times 120 \times 40}{0.9 \times 0.968}$   
 = 898.1 kW

# New Pump can reduce motor power input per unit = 132.9 kW

For reference	
By using measured voltage, current and flow rate of "Operating Data record of Attachment-1", motor input power is also calculated approximately as below;	
Data on 1:30 PM	
Total Flow	= 239.3 m <sup>3</sup> /min
Voltage	= 6243 V
Current	= 103.8 A
Power Factor	= 0.9 (approx.)
kW	= $\frac{\sqrt{3} \times V \times I \times P.F.}{1000}$
	= 1010 kW

**5. CONCLUSION**

By using high efficiency pump and motor suitable for present operating condition, power consumption can be reduce 132.9 kW/unit

So, under 2 pumps operated x 24 hour/day, Energy Saving will be ;

= 6,379.2 kWh/day (2 pumps x 24 hour per day)  
 = 2,328,408 kWh/year (x 365 days per year)

CO<sub>2</sub> Emission factor = 0.39495 tCO<sub>2</sub>/MWh  
 Life Time of Pump = 18 years  
 Total CO<sub>2</sub> Emission = 16,552.9 t CO<sub>2</sub>  
 (= 919.6 t CO<sub>2</sub>/year)

TITLE Site Flow Measurement and Recommendation of New Pump Rating Doc. No. JCM-WP171108-A

CUSTOMER YANGON CITY DEVELOPMENT COMMITTEE (YCDC) COMPLETE IN SHEETS WITH COVER

FINAL USER YANGON CITY DEVELOPMENT COMMITTEE (YCDC)

PROJECT HLAWGA PUMPING STATION SERVICE DISTRIBUTION PUMP

CONTRACT NO. ETL SER. No.

ITEM No. MODEL/ EQUIP. SET

ATTACHMENT-1  
SITE FLOW MEASUREMENT AND RECOMMENDATION OF  
NEW PUMP RATING

EBARA (THAILAND) LIMITED



ISSUED BY PROJECTENGINEERING.DIV

5	APPROVED BY
4	
3	CHECKED BY
2	
1	

REV.	PAGE	DATE	APPD	BY	PREPARED BY
					WUTTICHAI P.

9-Nov-17



PROJECT : HLAWGA PUMPING STATION  
 INVESTIGATION DATE : 31 October 2017  
 PREPARED BY : EBARA (THAILAND) LIMITED

### 1. INTRODUCTION

Hlawga Pumping Station has existing pumps that installed since 1980 with rated point of 83 m<sup>3</sup>/min at 54 m. total pump head and YCDC have a plan to replace these existing pumps. To get the suitable pumps (Capacity and pressure to present operating condition) for this pumping system we need to know operating point of existing pumps. As well, this pumping station is continuously operated 2 pumps for 24 hr/day by information from YCDC. And we cannot find the existing pump Performance Curve in As-built documents, so we conduct this site flow measurement on 31-Oct-2017 and the result as below.

### 2. SITE FLOW MEASUREMENT RESULT

Under normal operation of Hlawga Pumping Station (2 pumps operated), we performed site operation check on 31-Oct-17 from 7:00 to 17:00 to collect pump operating data (Q, H and Power Input) and operation record as per "Attachment 1\_Operating Data Record"

As for measuring data of flow rate in the morning, it is judged that flow rate is not correct, as sensor is installed on the elbow position, not straight pipeline.

### SUMMARY OF MEASUREMENT

From operating data from 13:30 to 17:00 Pump No.1 & No.2, operating data are summarized as follows;

- Suction Water Level	:	EL +61.8 ft
- Total flow rate (at main pipe)	:	225 to 240 m <sup>3</sup> /min (flow velocity 1.75 to 1.87 m/s)
- Pump unit Capacity	:	112.5 to 120 m <sup>3</sup> /min
- Pump Total Head	:	37.7 to 40.3 m

### 3. COMPARISON BETWEEN EXISTING PUMP AND EBARA'S PROPOSED PUMPS

Existing Pump	:	83 m <sup>3</sup> /min x 54m x 740 rpm x 1000 kW
Ebara' Proposal	:	120 m <sup>3</sup> /min x 40m x 740 rpm x 1000 kW

For comparison table please refer to "Attachment 3\_Comparison between Existing Pumps and Proposed Pumps"

1) Total Flow Rate almost same as existing 2 pumps operation.  
 (Refer to Attachment 2)

2 pumps operated around 235 m<sup>3</sup>/min (unit capacity 117.5 m<sup>3</sup>/min) at total head 38.7m. for existing pump

Ebara's Proposal pumps at 120 m<sup>3</sup>/min x 40m (2 pumps operated = 240 m<sup>3</sup>/min) is almost same as the present operating condition of existing pumps.

2) Flow Velocity at main pipe is almost same.

Flow velocity on main pipeline 66"(near pumping station) at 240 m<sup>3</sup>/min = 1.87 m/s that almost same as present flow rate of 235 m<sup>3</sup>/min = 1.83 m/s.

### 3) Motor output and Pole is same as existing motor.

Motor output for New pump = 1,000 kW x 6,600V x 8 Poles, which is same as existing one. As result, no modification of existing sub-station is required.

### 4) Proposed pumps are lower motor power input and power consumption

Comparing with existing pumps (compare at 240 m<sup>3</sup>/min)

#### Existing Pump

(By using similar Ebara's pump characteristic curve as existing pump)

Operating Point Q = 120 m<sup>3</sup>/min

H = 38 m

Pump Efficiency = 81%

Motor Efficiency = 89%

Motor Input Power =  $\frac{0.163 \times 120 \times 38}{0.81 \times 0.89} = 1031.0 \text{ kW}$

#### Ebara's Proposed Pump

Operating Point Q = 120 m<sup>3</sup>/min

H = 40 m

Pump Efficiency = 90%

Motor efficiency = 96.8%

Motor Input Power =  $\frac{0.163 \times 120 \times 40}{0.9 \times 0.968} = 898.1 \text{ kW}$

So, New Pump can reduce motor power input per unit = 132.9 kW

Therefore, under 2 pumps operated Power saving energy

= 6,379.2 kWh/day

1 year Power saving (x 365 day/year) = 2,328,408 kWh/year

(Electrical Charge = 75 kyat/kWh)

Electrical Charge saving = 174.63 Million kyat per year



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### 4. CONCLUSION

Based on the above study, it is recommended new pumps rating is 120 m<sup>3</sup>/min x 40 m, which can be operated in similar present operating condition. As result of higher pump and motor efficiency of propose pumps, electric charge will be reduced approx. 174.63 Million kyat per year by reduction of the power consumption of 2,328,408 kWh/year.

### 5. ATTACHMENTS:

ATTACHMENT 1 : Operating Data Record

ATTACHMENT 2 : Parallel Pump Curve

ATTACHMENT 3 : Comparison between Existing Pumps and Proposed Pumps

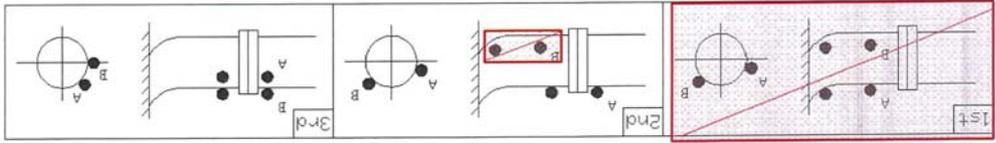


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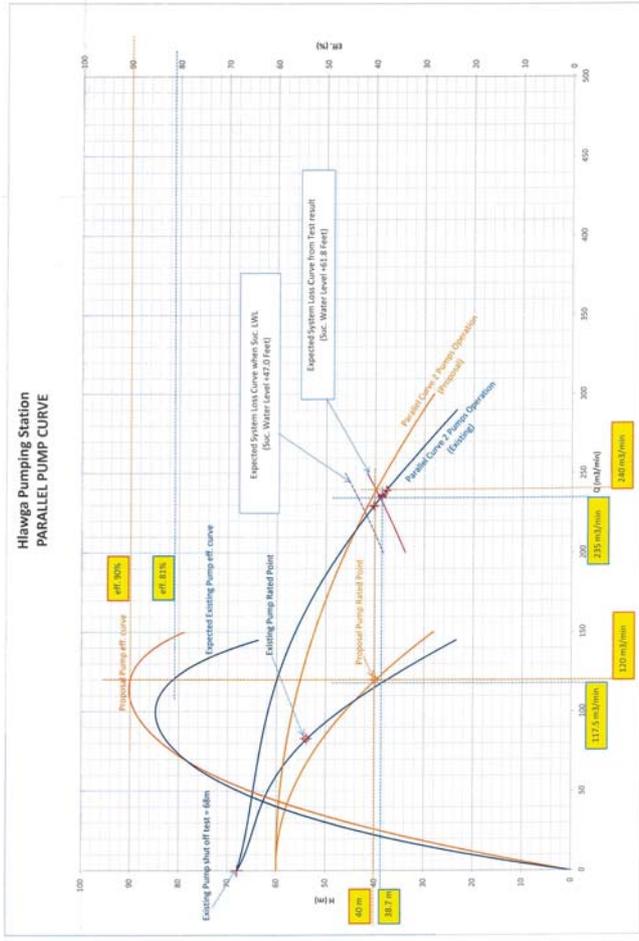
ATTACHMENT 1 : OPERATING DATA RECORD

Time	Pump No.	Suction Water Level (ft)	Suction Pressure (m)	Discharge Pressure (m)	Pump Total Head (Dis. Suction Pressure) (m)	Pressure at Header Pipe (kgf/cm <sup>2</sup> )	Voltage (V)	Current (A)	Motor Input (kW)	Total Flow rate (m <sup>3</sup> /min)	Flow rate	Checkpoint	Remark	Flow rate Checkpoint	
														No.1	No.2
7:00 am	No.1	61.8	0.435	44.4	37.7	3.4	6300	105.4	1033.1	A) -			Flow meter not setting		
	No.2	61.8	0.435	44.4	37.7	3.4	6219	106.4	1031.5	A) 184.0					
8:00 am	No.1	61.8	0.435	44.4	37.7	3.4	6217	104.3	1010.8	B) -			Flow meter B not setting		
	No.2	61.8	0.435	44.4	37.7	3.4	6088	104.5	991.7	B) -					
9:00 am	No.1	61.8	0.435	44.4	37.7	3.4	6089	106.7	1012.7	A) 176.5			Flow meter B not setting		
	No.2	61.8	0.435	44.4	37.7	3.4	6129	105.9	1011.8	B) -					
10:00 am	No.1	61.8	0.435	44.4	37.7	3.4	6129	105.9	1011.8	A) 179.3 / 212.4			Switch sensor for checking data		
	No.2	61.8	0.439	44.4	37.7	3.4	6129	103.8	991.7	B) 212.4 / 178.1					
11:00 am	No.1	61.8	0.439	44.4	37.7	3.4	6253	105.2	1025.4	A) -			Flow meter A not setting		
	No.2	61.8	0.435	44.4	37.7	3.4	6253	103.1	1004.9	B) 215.7					
11:30 am	No.1	61.8	0.435	44.4	37.7	3.4	6266	103.5	1010.9	A) 230.5					
	No.2	61.8	0.435	44.4	37.7	3.4	6267	101.7	989.6	B) 217.7					
1:30 pm	No.1	61.8	0.435	44.4	37.7	3.4	6243	104.1	1013.1	A) 225.5					
	No.2	61.8	0.435	44.4	37.7	3.4	6243	103.8	1010.1	B) 239.3					
2:00 pm	No.1	61.8	0.460	46.9	40.3	3.7	6211	101.6	1002.1	A) 212.5					
	No.2	61.8	0.445	45.4	38.7	3.6	6211	101.6	983.7	B) 229.4					
3:00 pm	No.1	61.8	0.445	45.4	38.7	3.6	6200	103.1	1015.7	A) 215.6					
	No.2	61.8	0.445	45.4	38.7	3.6	6200	103.1	996.4	B) 235.8					
4:00 pm	No.1	61.8	0.445	45.4	38.7	3.6	6082	106.6	1010.6	A) 221.8					
	No.2	61.8	0.445	45.4	38.7	3.6	6084	104.5	991.1	B) 236.3					
5:00 pm	No.1	61.8	0.445	45.4	38.7	3.6	6160	105.4	1012.1	A) 217.9					
	No.2	61.8	0.445	45.4	38.7	3.6	6160	103.4	992.9	B) 234.8					



1. Flow Measurement from 7:00am to 11:40 Install the Sensor at the elbow point not strength pipe. Then Flow rate result on that time not acculated.

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**EXPLANATION ON ATTACHMENT 2**

- 1) Existing Pump Q-H Curve expected from Shut-off head = 68 m, Rated Point and Operating data on this report by using similar Ebara's pump curve.
- 2) Ebara's Proposed curve plotted together for comparing with existing and new pump.
- 3) It is clear that present operating point is quite far from pump design point of existing pumps  
 Existing Pump Rated Point : 83 m<sup>3</sup>/min x 54 m  
 Operating Point : 117.5 m<sup>3</sup>/min x 38.7m
- 4) Operating point of Ebara's Proposed pump is almost same as existing pumps.  
 Existing Pump Operating Point : 2 pumps operate at 235 m<sup>3</sup>/min x 38.7 m  
 : unit capacity = 117.5 m<sup>3</sup>/min  
 New Pump Operating Point : 2 pump operate at 240 m<sup>3</sup>/min x 40 m  
 : unit capacity = 120 m<sup>3</sup>/min
- 5) In case Suction water level is at Low Water Level of EL +47.0 ft. Operating point will be  
 Existing Pump Operating Point : 2 pumps operate at 224 m<sup>3</sup>/min x 43.9 m  
 New Pump Operating Point : 2 pumps operate at 226 m<sup>3</sup>/min x 44.1 m



**Comparison between Existing Pumps and Proposed Pumps**

Note: 1. As existing pump characteristic curve could not find out from "As-built drawings", similar pump curve is used from "Ebara pump curve" having similar size and head.

No.	Contents	Existing Pumps	New pumps	Results
1	Operating points under two(2) pumps operation	According to site measurement data, two(2) pumps operating point is approximately 235 m <sup>3</sup> /min x 38.7 m	Two pump operating point will be approx. 240 m <sup>3</sup> /min x 40 m.	Operating point under two(2) pumps are almost similar flow rate.
2	Flow velocity in main pipeline	1.83 m/s under flow rate of 235m <sup>3</sup> /min.	1.87 m/s under flow rate of 240m <sup>3</sup> /min	Almost similar flow velocity
3	Pump size	Suction bore 750 mm, Discharge bore 600 mm	Suction bore 800mm, Discharge bore 600 mm	New pump can install at existing space in the pump room
4	Motor output	1,000 kW x 8 pole	1,000 kW x 8 pole	No modification of existing sub-station is required.
5	Power consumption under 240 m <sup>3</sup> /min flow rate conditions	Motor input kW = 0.163 x 120 m <sup>3</sup> /min x 38m / (η <sub>pp</sub> x η <sub>m</sub> ) = 1031 kW η <sub>pp</sub> : pump efficiency=81% η <sub>m</sub> : Motor efficiency=85%	Motor input kW = 0.163 x 120 m <sup>3</sup> /min x 40m / (η <sub>pp</sub> x η <sub>m</sub> ) = 898.1 kW η <sub>pp</sub> : pump efficiency=90% η <sub>m</sub> : Motor efficiency=86.8%	New pump can reduce (1031-898.1) = 132.9 kWh

ATTACHMENT 3

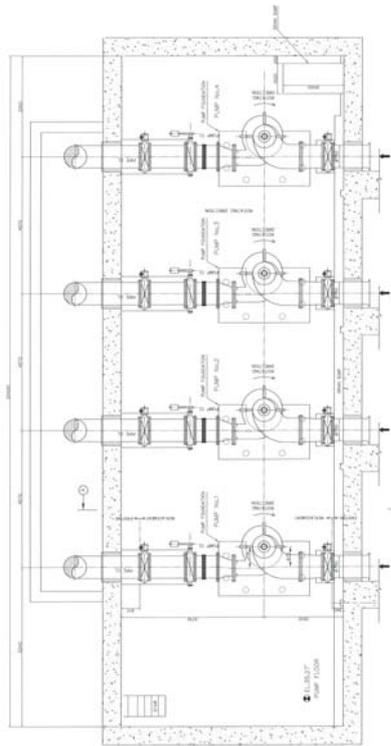
No.	Contents	Existing Pumps	New pumps	Results
6	Saving energy per year under two(2) pumps continuously operating	1031kW x 2 pumps x 24 hours x 365 day = 18,063,120 kWh/year	896,1kW x 2 pumps x 24 hr. x 365 day = 15,734,712kWh/year	Power Saving 132.9kW x 2 pumps x 24 hours x 365 day =2,328,408 kWh/ Year
7	Reduction of Electricity fee/year (75kbat / 1 kWh)	= 1,354.73 Million kbat per year	= 1,180.10 Million kbat per year	Saving = 174.63 Million kbat per year

Pump rating:

- Existing pump : 83 m<sup>3</sup>/min x 54 m x 740 rpm x 1000 kW
- Proposed New Pump : 120 m<sup>3</sup>/min x 40 m x 740 rpm x 1000 kW

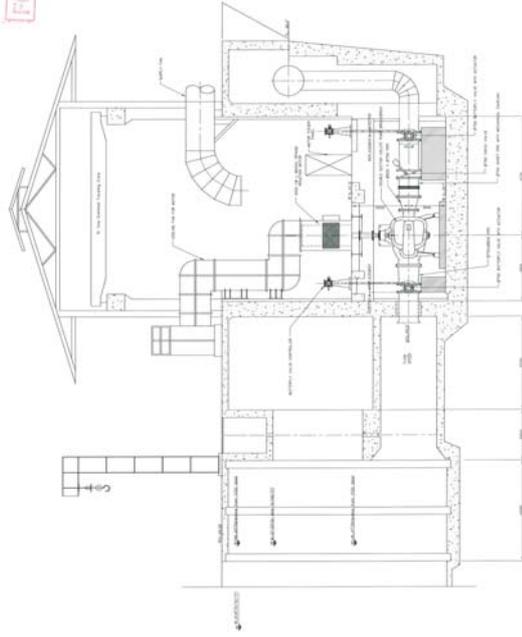
ATTACHMENT-2  
GENERAL ARRANGEMENT OF PUMPING STATION

FOR PRELIMINARY



MASON CITY WATER SUPPLY DISTRICT	
PROJECT NAME	
PROJECT NO.	
DATE	
DRAWN BY	
CHECKED BY	
SCALE	
SHEET NO.	
TOTAL SHEETS	

FOR PRELIMINARY



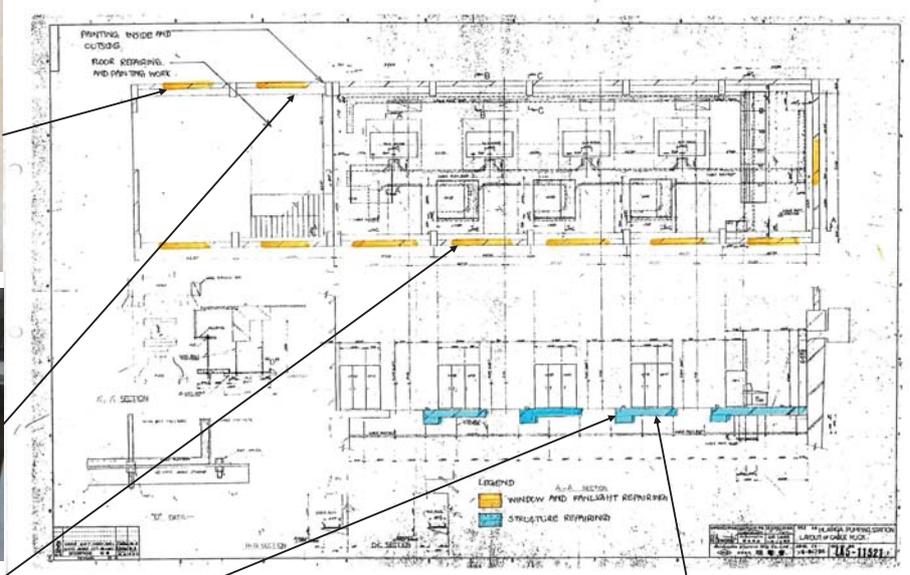
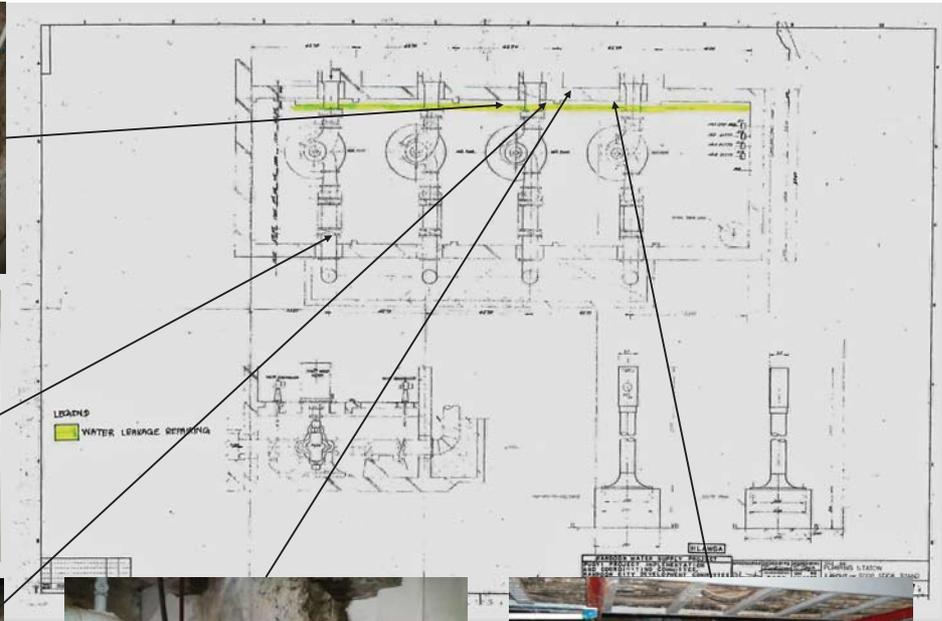
SECTION A-A

MASON CITY WATER SUPPLY DISTRICT	
PROJECT NAME	
PROJECT NO.	
DATE	
DRAWN BY	
CHECKED BY	
SCALE	
SHEET NO.	
TOTAL SHEETS	

## 2.3 Site Investigation Report (2)







The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 11	<p><u>Condition</u> Opening under roof No insulation at roofing sheet</p> <p><u>Countermeasure</u> Close by brick Apply insulation sheet</p> <p>Electric Room</p>
	No. 12	<p><u>Condition</u> Opening under roof No insulation at roofing sheet Wall painting not smooth</p> <p><u>Countermeasure</u> Close by brick Apply insulation sheet Repaint</p> <p>Electric Room</p>
	No. 13	<p><u>Condition</u> Lauvor Wall dirty</p> <p><u>Countermeasure</u> Close by brick Repaint</p> <p>Electric Room</p>
	No. 14	<p><u>Condition</u> Wall dirty</p> <p><u>Countermeasure</u> Repaint</p> <p>Electric Room</p>
	No. 15	<p><u>Condition</u> Lauvor Wall dirty</p> <p><u>Countermeasure</u> Close by brick Repaint</p> <p>Electric Room</p>

[3/11]

FFEC-MM

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 1	<p><u>Condition</u> Metal sliding door Lauvor</p> <p><u>Countermeasure</u> Change double leave steel door Close by brick</p> <p>Electric Room</p>
	No. 2	<p><u>Condition</u> Floor damage Wall dirty</p> <p><u>Countermeasure</u> Repair and paint Repaint</p> <p>Electric Room</p>
	No. 3	<p><u>Condition</u> Floor damage Wall dirty</p> <p><u>Countermeasure</u> Repair and paint Repaint</p> <p>Electric Room</p>
	No. 4	<p><u>Condition</u> Floor damage</p> <p><u>Countermeasure</u> Repair and paint</p> <p>Electric Room</p>
	No. 5	<p><u>Condition</u> White ant buiding</p> <p><u>Countermeasure</u> Need to clean up</p> <p>Electric Room</p>

[1/11]

FFEC-MM

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 31	<p><u>Condition</u> Walk way steel grating need for walk</p> <p><u>Countermeasure</u> Make new and fix</p>
	Pumping station (Basement 1)	
	No. 32	<p><u>Condition</u> Water leakage</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 1)	
	No. 33	<p><u>Condition</u> Water leakage</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 1)	
	No. 34	<p><u>Condition</u> Water leakage</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 1)	
	No. 35	<p><u>Condition</u> Water leakage</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 1)	
		Pumping station (Basement 1)
		FFEC-MM
[7/11]		Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 21	<p><u>Condition</u> Entrance cement plaster damage Wall dirty</p> <p><u>Countermeasure</u> Repair and repaint Repaint</p>
	Pumping station (GF)	
	No. 22	<p><u>Condition</u> Window broken and damage Wall dirty</p> <p><u>Countermeasure</u> Repair and paint Repaint</p>
	Pumping station (GF)	
	No. 23	<p><u>Condition</u> Cement plaster damage</p> <p><u>Countermeasure</u> Repair and paint</p>
	Pumping station (GF)	
	No. 24	<p><u>Condition</u> Window broken and damage Wall dirty</p> <p><u>Countermeasure</u> Repair and paint Repaint</p>
	Pumping station (GF)	
	No. 25	<p><u>Condition</u> Window damage</p> <p><u>Countermeasure</u> Repair, clean and repaint</p>
	Pumping station	
		FFEC-MM
[8/11]		Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 51	<b>Condition</b> Wall dirty
		<b>Countermeasure</b> Repair
	No. 52	<b>Condition</b> Wall dirty Entrance door dirty and rustiness Sunshade frame
		<b>Countermeasure</b> Repair Repair and repaint Repaint
	No. 53	<b>Condition</b> Wall Dirty
		<b>Countermeasure</b> Repaint
	No. 54	<b>Condition</b> Window broken and damage Window sunshade slab damage Wall dirty
		<b>Countermeasure</b> Repair and paint Repair and paint Repaint
	No. 55	<b>Condition</b> Window broken and damage Window sunshade slab damage
		<b>Countermeasure</b> Repair and paint Repair and paint
		<b>Pumping station(Outside)</b>

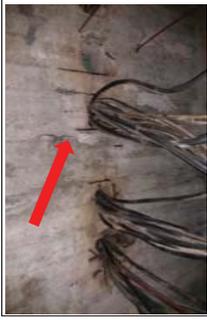
[11/12]

FFEC-MM

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 41	<b>Condition</b> Slab rebar rustiness
		<b>Countermeasure</b> Give treatment and repair
	No. 42	<b>Condition</b> Beam rebar cutting
		<b>Countermeasure</b> Give treatment and repair
	No. 43	<b>Condition</b> Beam rebar cutting Slab rebar rustiness
		<b>Countermeasure</b> Give treatment and repair Give treatment and repair
	No. 44	<b>Condition</b> Water leakage
		<b>Countermeasure</b> Repair and repaint
	No. 45	<b>Condition</b> Water leakage
		<b>Countermeasure</b> Repair and repaint
		<b>Pumping station (Basement 2)</b>

[9/11]

FFEC-MM

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 16	<u>Condition</u> Aluminium sliding window
	<u>Countermeasure</u> Close by brick	
	No. 17	<u>Condition</u> Aluminium sliding window Aluminium sliding door Wall dirty
	<u>Countermeasure</u> Close by brick Change by double door leave steel door Repaint	
	No. 18	<u>Condition</u> Lauvor Wall dirty
	<u>Countermeasure</u> Close by brick Repaint	
	No. 19	<u>Condition</u> Plain sheet door
	<u>Countermeasure</u> Change single leaf steel door	
	No. 20	<u>Condition</u> Floor damage
	<u>Countermeasure</u> Repair and paint	
		Electric Room

[4/11]

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 6	<u>Condition</u> Floor damage Wall dirty
	<u>Countermeasure</u> Repair and paint Repaint	
	No. 7	<u>Condition</u> Plain sheet door
	<u>Countermeasure</u> Change by double door leave steel door	
	No. 8	<u>Condition</u> Lauvor Wall dirty
	<u>Countermeasure</u> Close by brick Repaint	
	No. 9	<u>Condition</u> Ceiling sagging
	<u>Countermeasure</u> Repair	
	No. 10	<u>Condition</u> Ceiling frame paint
	<u>Countermeasure</u> repair and repaint	
		Electric Room

[2/11]

FFEC-NM

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 36	<p><u>Condition</u> Water leakage from wall crack</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 1)	
	No. 37	<p><u>Condition</u> Water leakage</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 1)	
	No. 38	<p><u>Condition</u> Water leakage from wall crack</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 1)	
	No. 39	<p><u>Condition</u> Water leakage</p> <p><u>Countermeasure</u> Repair and repaint</p>
	Pumping station (Basement 2)	
	No. 40	<p><u>Condition</u> Slab rebar rustiness</p> <p><u>Countermeasure</u> Give treatment and repair</p>
	Pumping station (Basement 2)	

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 26	<p><u>Condition</u> Glass broken and fanlight damage Wall dirty</p> <p><u>Countermeasure</u> Fix glass, repair and repaint Repaint</p>
	Pumping station (GF)	
	No. 27	<p><u>Condition</u> Water leakage Wall dirty</p> <p><u>Countermeasure</u> Repair Repaint</p>
	Pumping station (GF)	
	No. 28	<p><u>Condition</u> Wall Dirty</p> <p><u>Countermeasure</u> Repaint</p>
	Pumping station (Basement 1)	
	No. 29	<p><u>Condition</u> Water leakage</p> <p><u>Countermeasure</u> repair and repaint</p>
	Pumping station (Basement 1)	
	No. 30	<p><u>Condition</u> Walk way steel granting need for walk</p> <p><u>Countermeasure</u> Make new and fix</p>
	Pumping station (Basement 1)	

The Result of Site Survey (Hlawga)

4-Sep-2017

	<p>No. 56</p> <p><b>Condition</b> Window broken and damage Window sunshade slab damage Wall dirty</p> <p><b>Countermeasure</b> Repair and paint Repair and paint Repaint</p> <p>Pumping station(Outside)</p>
	<p>No. 57</p> <p><b>Condition</b> Window broken and damage Window sunshade slab damage Wall dirty</p> <p><b>Countermeasure</b> Repair and paint Repair and paint Repaint</p> <p>Pumping station(Outside)</p>
	<p>No. 58</p> <p><b>Condition</b> Glass broken and fanlight damage Wall dirty</p> <p><b>Countermeasure</b> Fix glass, repair and repaint Repaint</p> <p>Pumping station(Outside)</p>
	<p>No. 59</p> <p><b>Condition</b> Fanlight timber frame damage</p> <p><b>Countermeasure</b> Repair and paint</p> <p>Pumping station(Outside)</p>
	<p>No. 60</p> <p><b>Condition</b> Fanlight broken and damage Window sunshade slab damage Wall dirty</p> <p><b>Countermeasure</b> Repair and paint Repair and paint Repaint</p> <p>Pumping station(Outside)</p>
	<p>No. 60</p> <p><b>Condition</b> Fanlight broken and damage Window sunshade slab damage Wall dirty</p> <p><b>Countermeasure</b> Repair and paint Repair and paint Repaint</p> <p>Pumping station(Outside)</p>

【12/12】

FFEC-MM

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

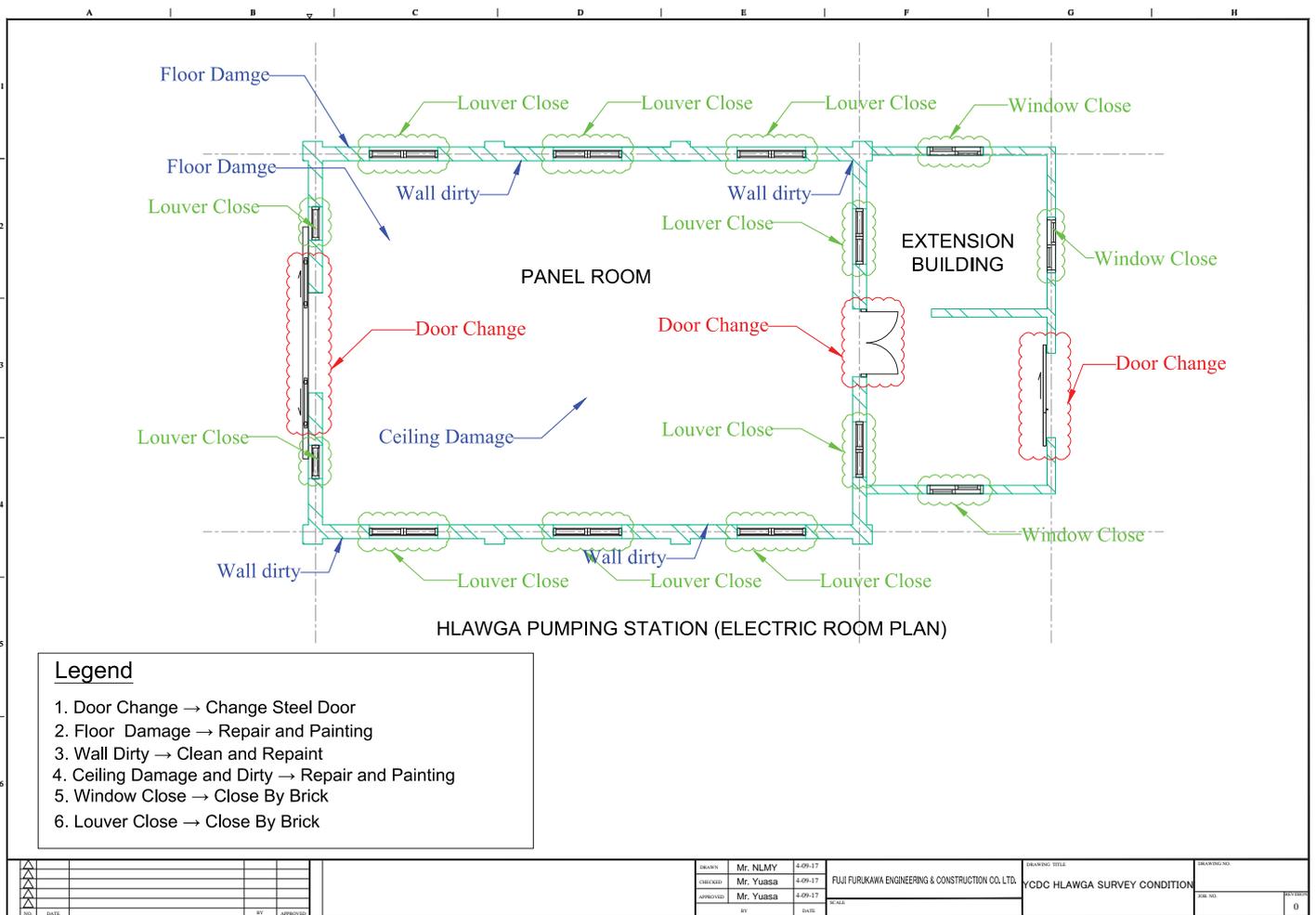
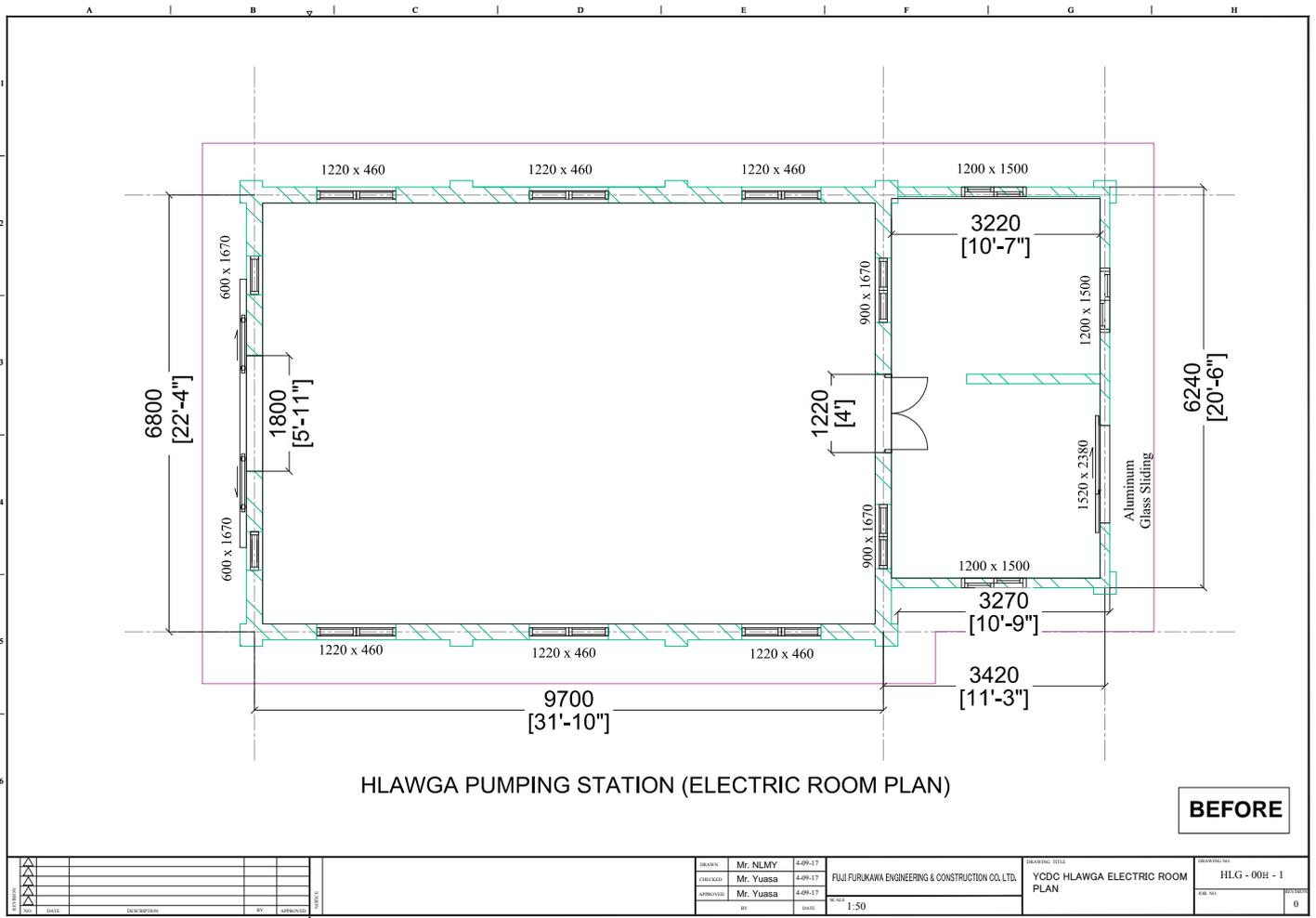
4-Sep-2017

	<p>No. 46</p> <p><b>Condition</b> Water leakage</p> <p><b>Countermeasure</b> Repair and repaint</p> <p>Pumping station (Basement 2)</p>
	<p>No. 47</p> <p><b>Condition</b> Water leakage</p> <p><b>Countermeasure</b> Repair and repaint</p> <p>Pumping station (Basement 2)</p>
	<p>No. 48</p> <p><b>Condition</b> Water leakage</p> <p><b>Countermeasure</b> Repair and repaint</p> <p>Pumping station (Basement 2)</p>
	<p>No. 49</p> <p><b>Condition</b> Water leakage</p> <p><b>Countermeasure</b> Repair and repaint</p> <p>Pumping station (Basement 2)</p>
	<p>No. 50</p> <p><b>Condition</b> Water leakage</p> <p><b>Countermeasure</b> Repair and repaint</p> <p>Pumping station (Basement 2)</p>
	<p>No. 50</p> <p><b>Condition</b> Water leakage</p> <p><b>Countermeasure</b> Repair and repaint</p> <p>Pumping station (Basement 2)</p>

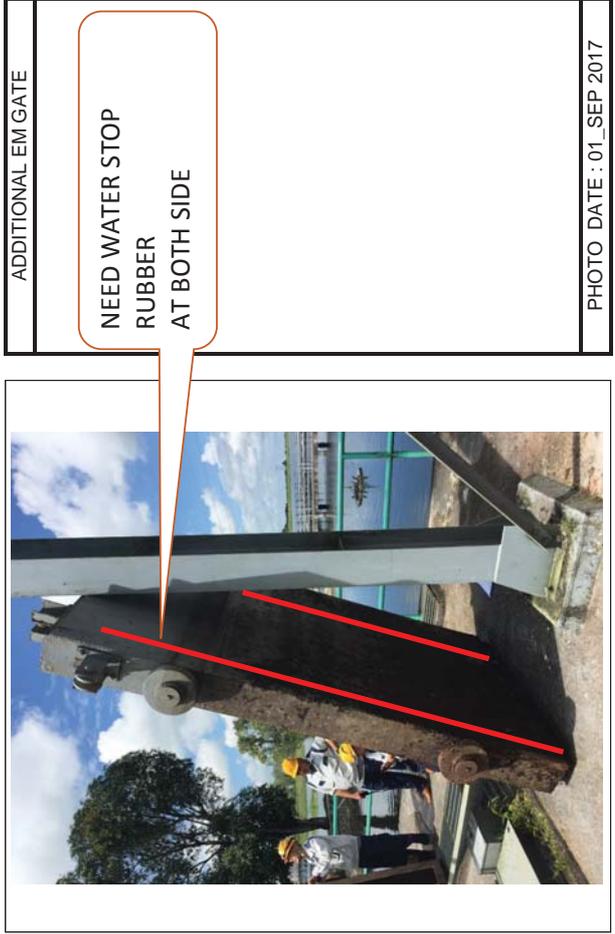
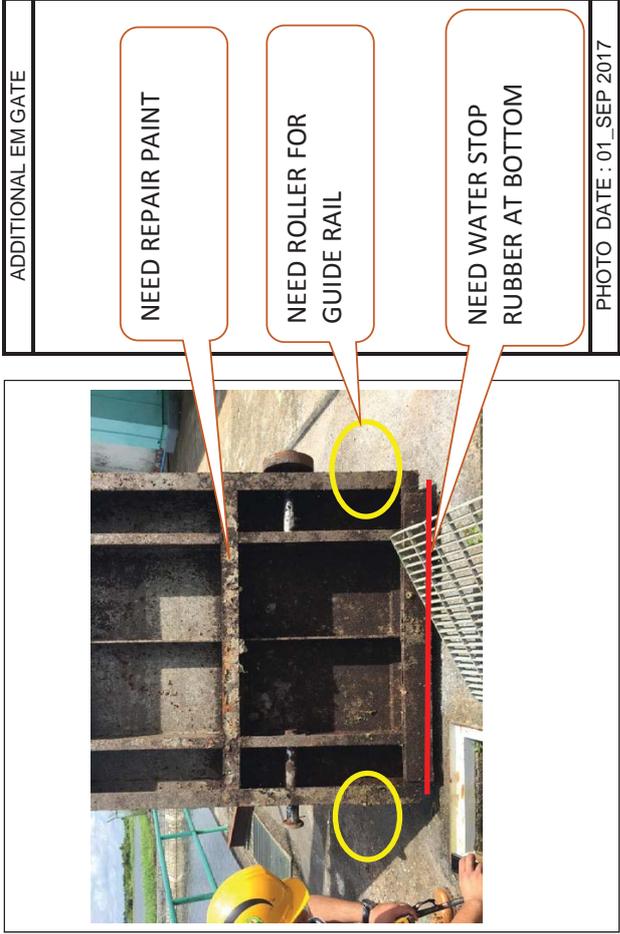
【10/11】

FFEC-MM

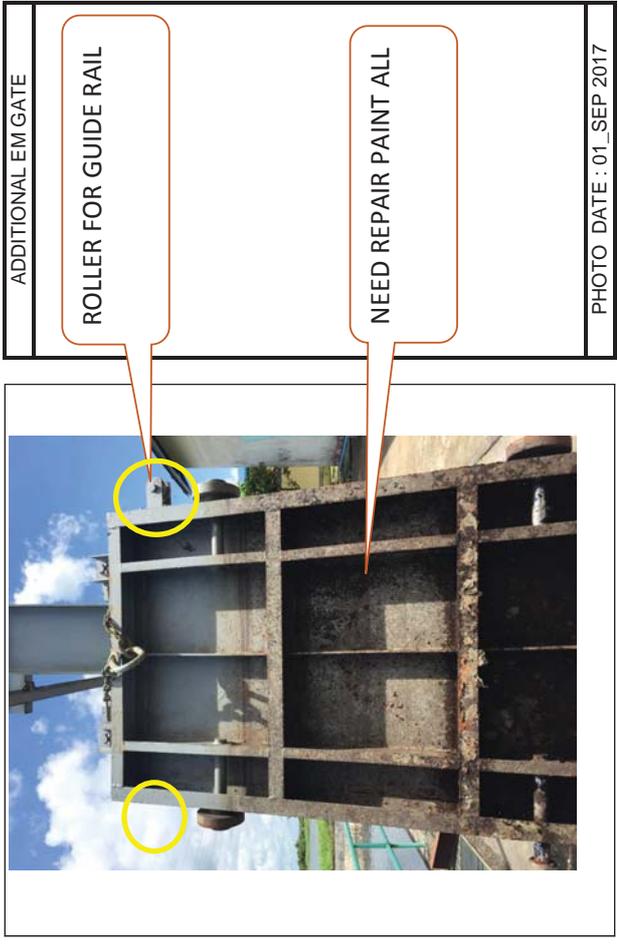
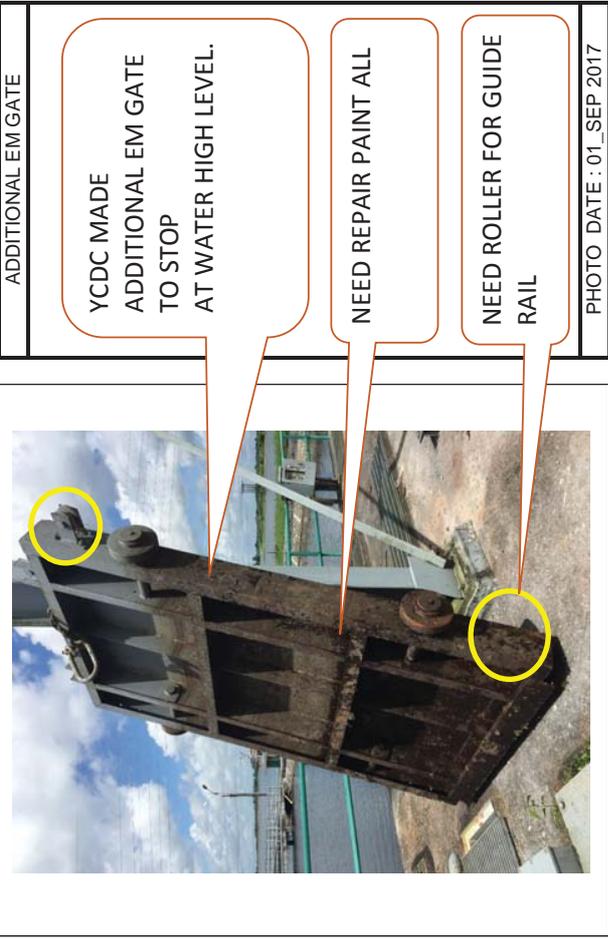
Nay Lin Maung Yee



PROJECT : H-LAWGA PUMP STATION RENOVATION WORK EM\_GATE



PROJECT : H-LAWGA PUMP STATION RENOVATION WORK EM\_GATE



PROJECT : HLAWGA PUMP STATION RENOVATION WORK EM GATE



ORIGINAL EM GATE

ORIGINAL EM GATE  
NEED MAINTENANCE  
AND RE-PAINT.  
NORMALLY KEEPING IN  
THE WATER.

PHOTO DATE : 01\_SEP 2017



ORIGINAL EM GATE

PHOTO DATE : 01\_SEP 2017

PROJECT : HLAWGA PUMP STATION RENOVATION WORK EM GATE



ADDITIONAL EM GATE

ROLLER FOR WALL  
DO NOT MOVE  
NEED REPAIR

PHOTO DATE : 01\_SEP 2017



ADDITIONAL EM GATE

NEED WATER STOP  
RUBBER AT BOTTOM

PHOTO DATE : 01\_SEP 2017



ADDITIONAL EM GATE

PROJECT : HLAWGA PUMP STATION RENOVATION WORK EM\_GATE



ORIGINAL EM\_GATE

ROLLER FOR GUIDE RAIL

PHOTO DATE : 01\_SEP 2017



ORIGINAL EM\_GATE

PHOTO DATE : 01\_SEP 2017



ORIGINAL EM\_GATE

ROLLER FOR GUIDE RAIL

PHOTO DATE : 01\_SEP 2017

PROJECT : HLAWGA PUMP STATION RENOVATION WORK EM\_GATE



ORIGINAL EM\_GATE

NEED REPAIR PAINT

PHOTO DATE : 01\_SEP 2017



ORIGINAL EM\_GATE

ROLLER FOR WALL  
NEED MAINTENANCE

PHOTO DATE : 01\_SEP 2017



ORIGINAL EM\_GATE

ROLLER FOR GUIDE RAIL

PHOTO DATE : 01\_SEP 2017

**PROJECT : HLAWGA PUMP STATION RENOVATION WORK EM GATE**

ORIGINAL EM GATE

WATER STOP RUBBER  
NEED CLEANING

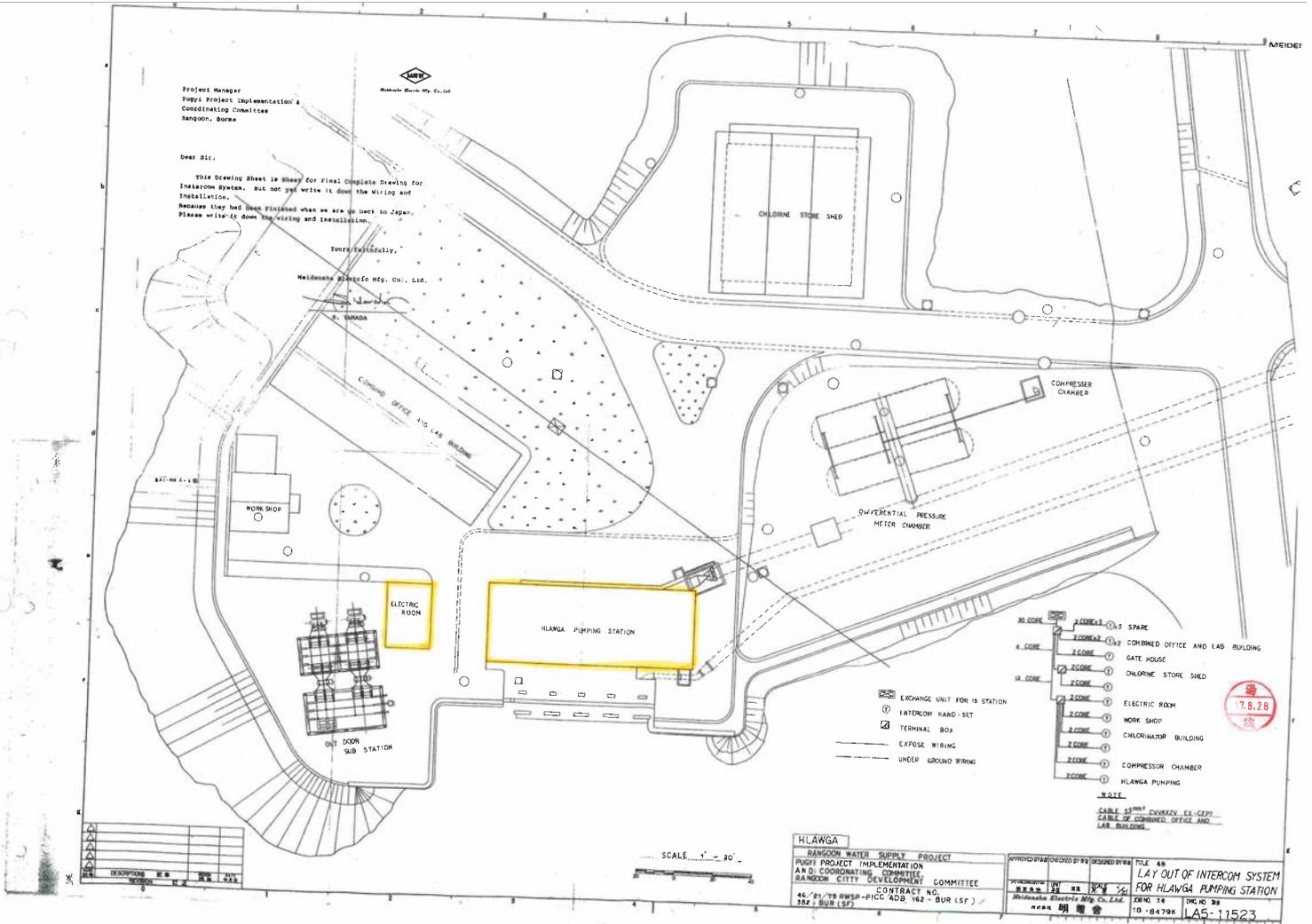
PHOTO DATE : 01\_SEP 2017



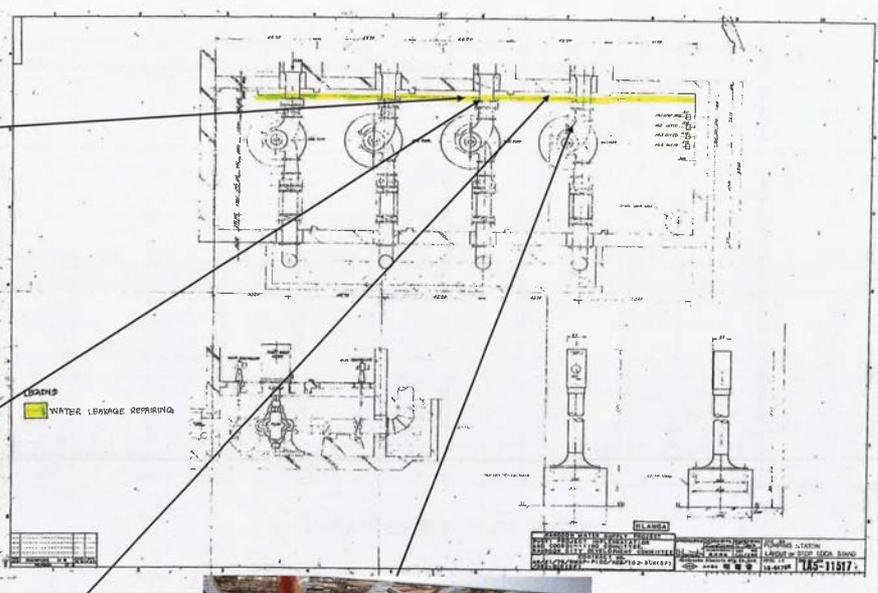
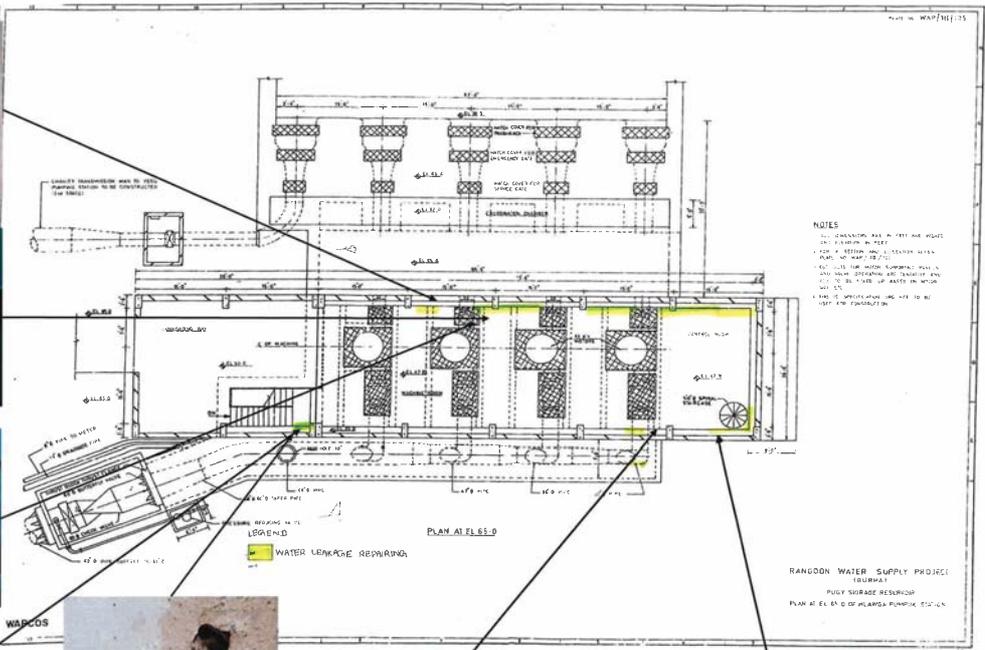
ORIGINAL EM GATE

ME GATE GUIDE RAIL  
STAINLESS STEEL  
GOOD CONDITION

PHOTO DATE : 01\_SEP 2017



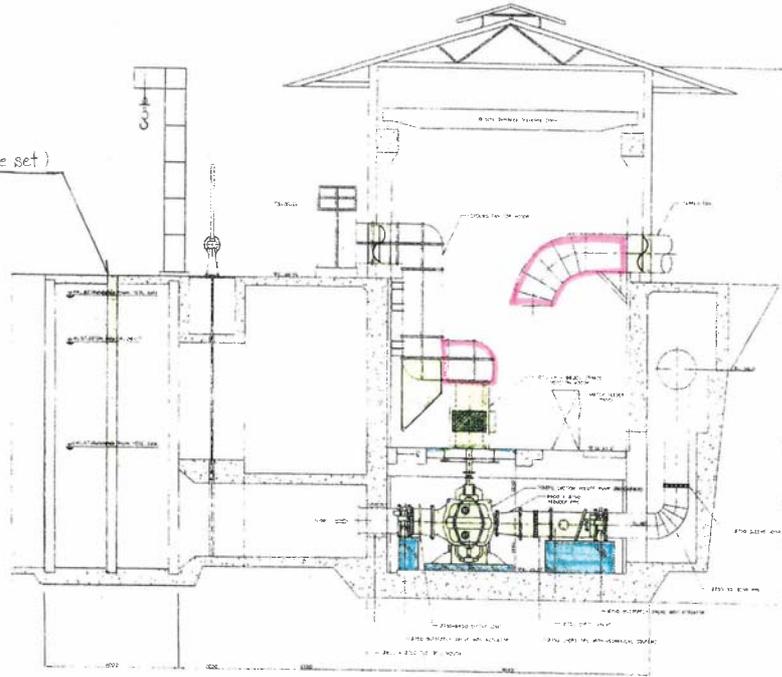




PUMP HOUSE BASEMENT

Section of Pump House

New Stop Log (only one set)



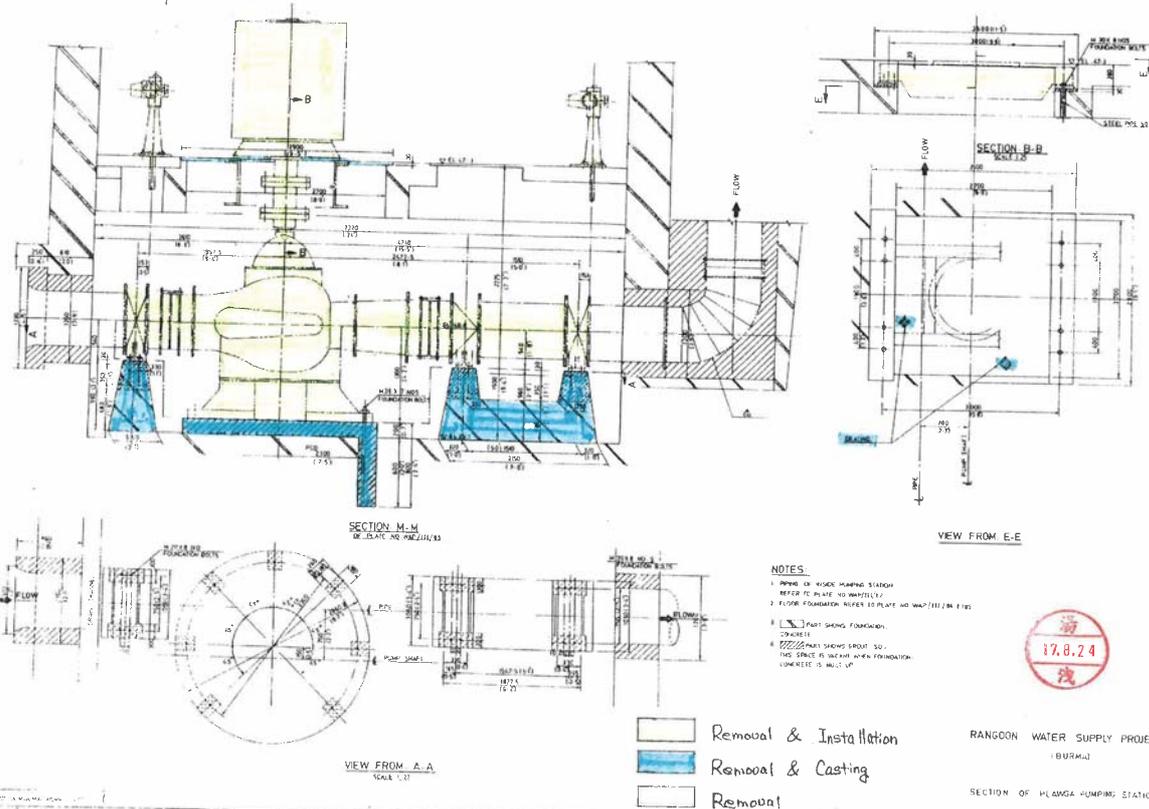
- Removal & Installation
- Removal & Casting
- Removal

湯  
17.8.24  
洩

FOR PLANNING DRAWING		YANGON CITY DEVELOPMENT COMMITTEE (YCDC) YANGON - THAILAND	
Drawn by	DATE	PROJECT NAME	DATE
Checked by	DATE	CONTRACTOR	DATE
Approved by	DATE	SCALE	

(1/5)

Detail of Pump & Valve



- NOTES
1. PUMP IS WOOD PUMPING STATION
  2. FLOOR FOUNDATION MUST BE PLATE NO. WAP/111/24. 17.8
  3. FLOOR FOUNDATION MUST BE PLATE NO. WAP/111/24. 17.8
  4. FLOOR FOUNDATION MUST BE PLATE NO. WAP/111/24. 17.8
  5. FLOOR FOUNDATION MUST BE PLATE NO. WAP/111/24. 17.8
  6. FLOOR FOUNDATION MUST BE PLATE NO. WAP/111/24. 17.8

湯  
17.8.24  
洩

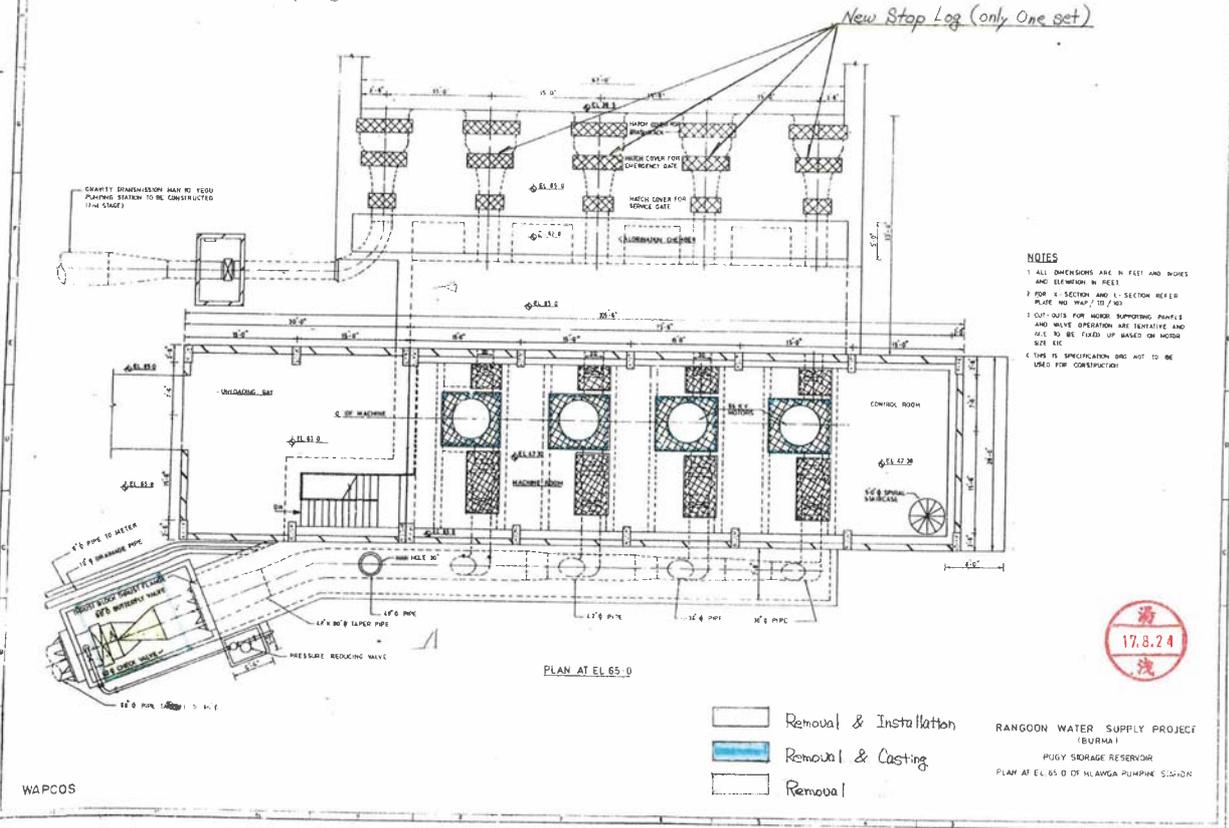
- Removal & Installation
- Removal & Casting
- Removal

RANGOON WATER SUPPLY PROJECT  
(BURMA)  
SECTION OF PLAWGA PUMPING STATION

2017.5.18

(2/5)

Plan of Valve Pit & Stop Log

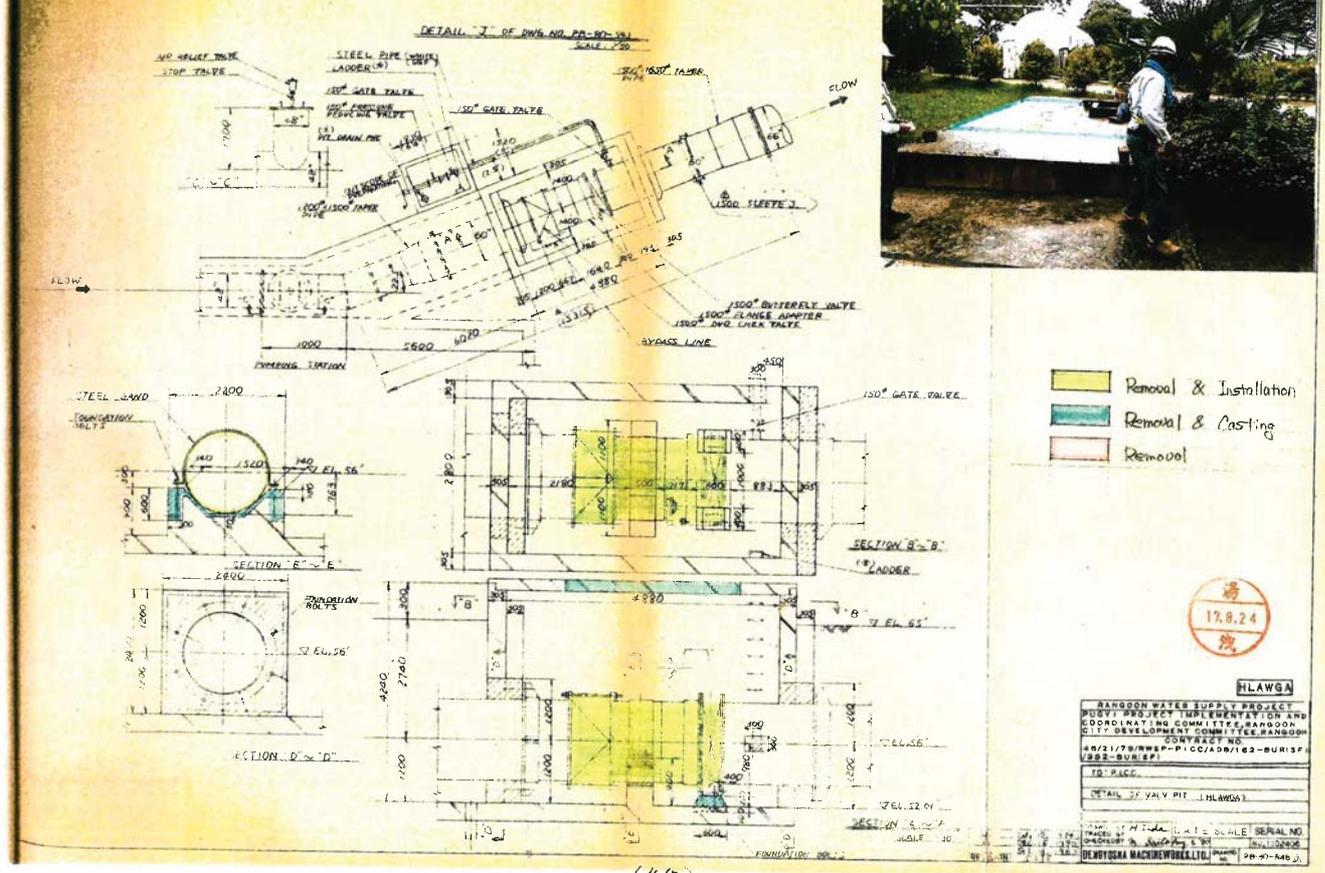


- NOTES
1. ALL DIMENSIONS ARE IN FEET AND INCHES AND ELEVATION IN FEET.
  2. FOR A SECTION AND L-SECTION REFER PLATE NO. WAP/101/83.
  3. CUT-OUTS FOR INDOOR SUPPORTING PLANKS AND WHEEL OPERATION ARE INDICATED AND ARE TO BE FIXED UP BASED ON INDOOR SIZE SPEC.
  4. THIS IS SPECIFICATION AND NOT TO BE USED FOR CONSTRUCTION.



RANGOON WATER SUPPLY PROJECT  
(BURMA)  
RUGY STORAGE RESERVOIR  
PLAN AT EL. 65.0 OF HLANGA PUMPING STATION

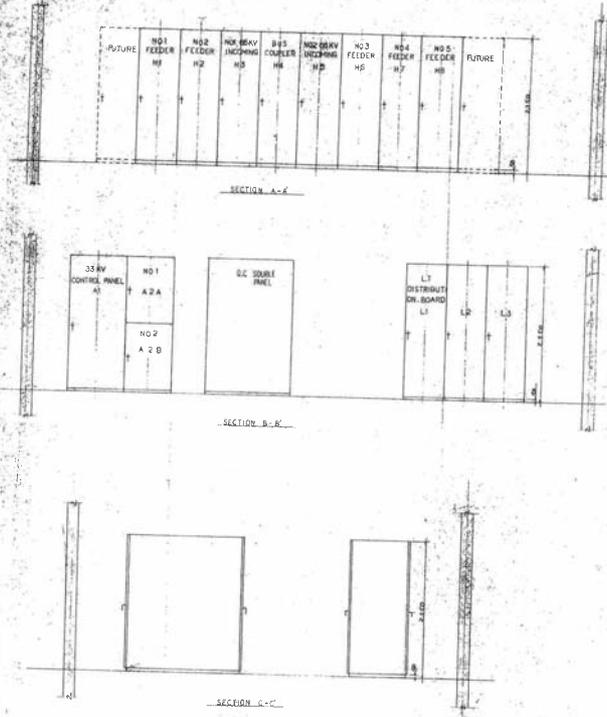
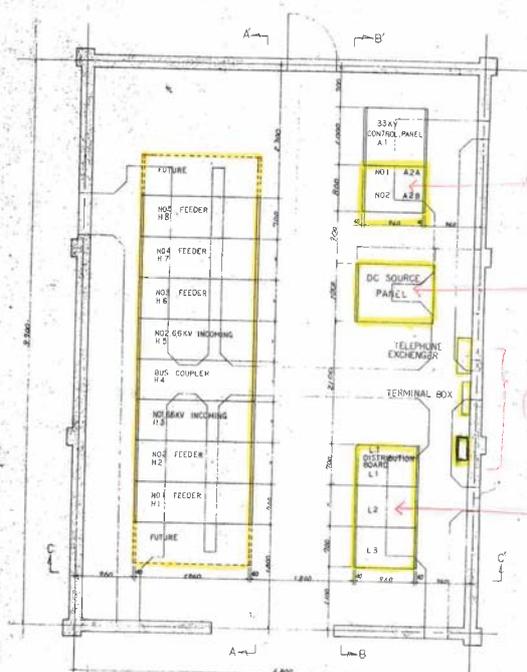
Detail of Valve Pit



- Removal & Installation
- Removal & Casting
- Removal



HLAWGA  
RANGOON WATER SUPPLY PROJECT  
RUGY STORAGE RESERVOIR IMPLEMENTATION AND COORDINATING COMMITTEE, RANGOON  
CITY DEVELOPMENT COMMITTEE, RANGOON  
PROJECT NO.  
101-101  
DETAIL OF VALVE PIT (HLAWGA)  
SCALE 1:50  
SERIAL NO.  
DRAWN BY  
CHECKED BY  
APPROVED BY  
DATE

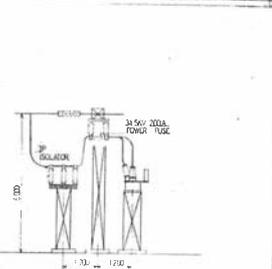
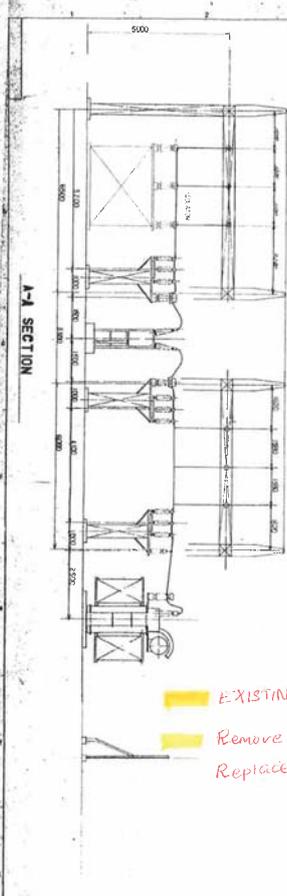


HILWAGA ELECTRIC ROOM

Remove Equipment  
 EXISTING Equipment

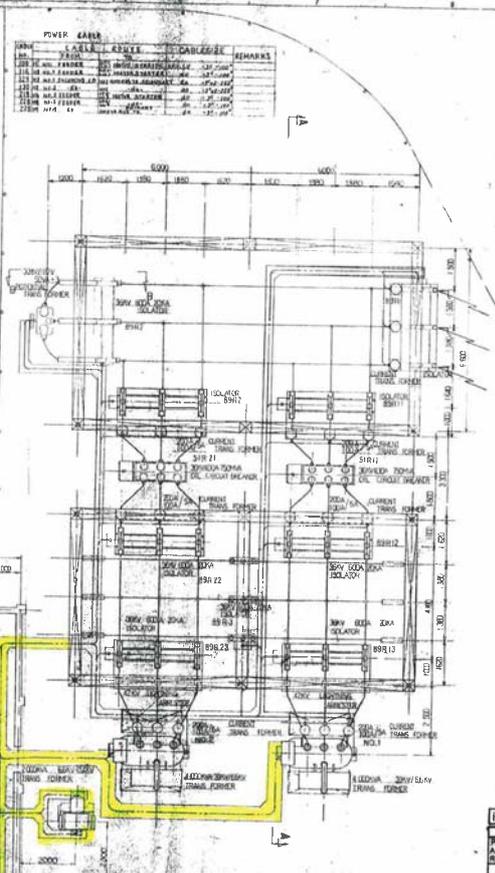
HILWAGA  
 RANDON WATER SUPPLY PROJECT  
 FEEDER PROJECT IMPLEMENTATION  
 AND COORDINATING COMMITTEE  
 RANDON CITY DEVELOPMENT COMMITTEE  
 CONTRACT NO.  
 16/21/79/WSP-PICC/ADB/162-BUR(6P)  
 162-BUR(6P)

LAYOUT OF ELECTRIC ROOM  
 16-8479K 1A5-11507



CABLE ROUTE

NO.	FROM	TO	CABLE TYPE	REMARKS
1	33kV CONTROL PANEL A1	NO1 A2A	4x 25mm <sup>2</sup> SVT	
2	33kV CONTROL PANEL A1	NO2 A2B	4x 25mm <sup>2</sup> SVT	
3	33kV CONTROL PANEL A1	DC SOURCE PANEL	4x 25mm <sup>2</sup> SVT	
4	33kV CONTROL PANEL A1	TELEPHONE EXCHANGER	4x 25mm <sup>2</sup> SVT	
5	33kV CONTROL PANEL A1	TERMINAL BOX	4x 25mm <sup>2</sup> SVT	
6	33kV CONTROL PANEL A1	DISTRIBUTION BOARD L1	4x 25mm <sup>2</sup> SVT	
7	33kV CONTROL PANEL A1	DISTRIBUTION BOARD L2	4x 25mm <sup>2</sup> SVT	
8	33kV CONTROL PANEL A1	DISTRIBUTION BOARD L3	4x 25mm <sup>2</sup> SVT	
9	33kV CONTROL PANEL A1	NO18	4x 25mm <sup>2</sup> SVT	
10	33kV CONTROL PANEL A1	NO4 H7	4x 25mm <sup>2</sup> SVT	
11	33kV CONTROL PANEL A1	NO5 H6	4x 25mm <sup>2</sup> SVT	
12	33kV CONTROL PANEL A1	NO2 CBKV INCOMING H5	4x 25mm <sup>2</sup> SVT	
13	33kV CONTROL PANEL A1	BUS COUPLER H4	4x 25mm <sup>2</sup> SVT	
14	33kV CONTROL PANEL A1	NO2 CBKV INCOMING H3	4x 25mm <sup>2</sup> SVT	
15	33kV CONTROL PANEL A1	NO4 FEEDER H2	4x 25mm <sup>2</sup> SVT	
16	33kV CONTROL PANEL A1	NO1 FEEDER H1	4x 25mm <sup>2</sup> SVT	

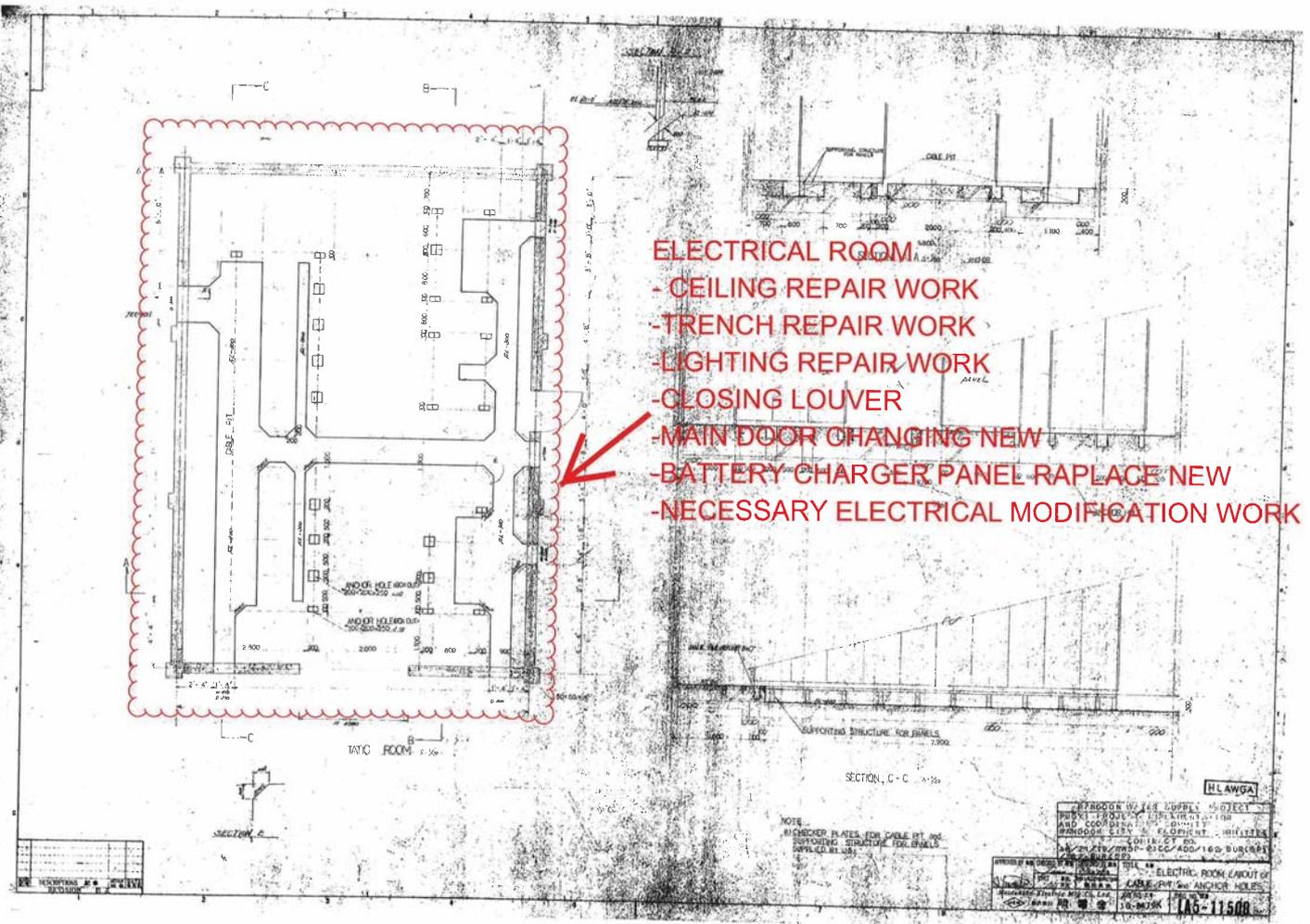


POWER CABLE

NO.	FROM	TO	CABLE TYPE	REMARKS
1	33kV CONTROL PANEL A1	NO1 A2A	4x 25mm <sup>2</sup> SVT	
2	33kV CONTROL PANEL A1	NO2 A2B	4x 25mm <sup>2</sup> SVT	
3	33kV CONTROL PANEL A1	DC SOURCE PANEL	4x 25mm <sup>2</sup> SVT	
4	33kV CONTROL PANEL A1	TELEPHONE EXCHANGER	4x 25mm <sup>2</sup> SVT	
5	33kV CONTROL PANEL A1	TERMINAL BOX	4x 25mm <sup>2</sup> SVT	
6	33kV CONTROL PANEL A1	DISTRIBUTION BOARD L1	4x 25mm <sup>2</sup> SVT	
7	33kV CONTROL PANEL A1	DISTRIBUTION BOARD L2	4x 25mm <sup>2</sup> SVT	
8	33kV CONTROL PANEL A1	DISTRIBUTION BOARD L3	4x 25mm <sup>2</sup> SVT	
9	33kV CONTROL PANEL A1	NO18	4x 25mm <sup>2</sup> SVT	
10	33kV CONTROL PANEL A1	NO4 H7	4x 25mm <sup>2</sup> SVT	
11	33kV CONTROL PANEL A1	NO5 H6	4x 25mm <sup>2</sup> SVT	
12	33kV CONTROL PANEL A1	NO2 CBKV INCOMING H5	4x 25mm <sup>2</sup> SVT	
13	33kV CONTROL PANEL A1	BUS COUPLER H4	4x 25mm <sup>2</sup> SVT	
14	33kV CONTROL PANEL A1	NO2 CBKV INCOMING H3	4x 25mm <sup>2</sup> SVT	
15	33kV CONTROL PANEL A1	NO4 FEEDER H2	4x 25mm <sup>2</sup> SVT	
16	33kV CONTROL PANEL A1	NO1 FEEDER H1	4x 25mm <sup>2</sup> SVT	

HILWAGA  
 RANDON WATER SUPPLY PROJECT  
 FEEDER PROJECT IMPLEMENTATION  
 AND COORDINATING COMMITTEE  
 RANDON CITY DEVELOPMENT COMMITTEE  
 CONTRACT NO.  
 16/21/79/WSP-PICC/ADB/162-BUR(6P)  
 162-BUR(6P)

WIRING PLAN FOR SUBSTATION  
 16-8479K 1A5-11509



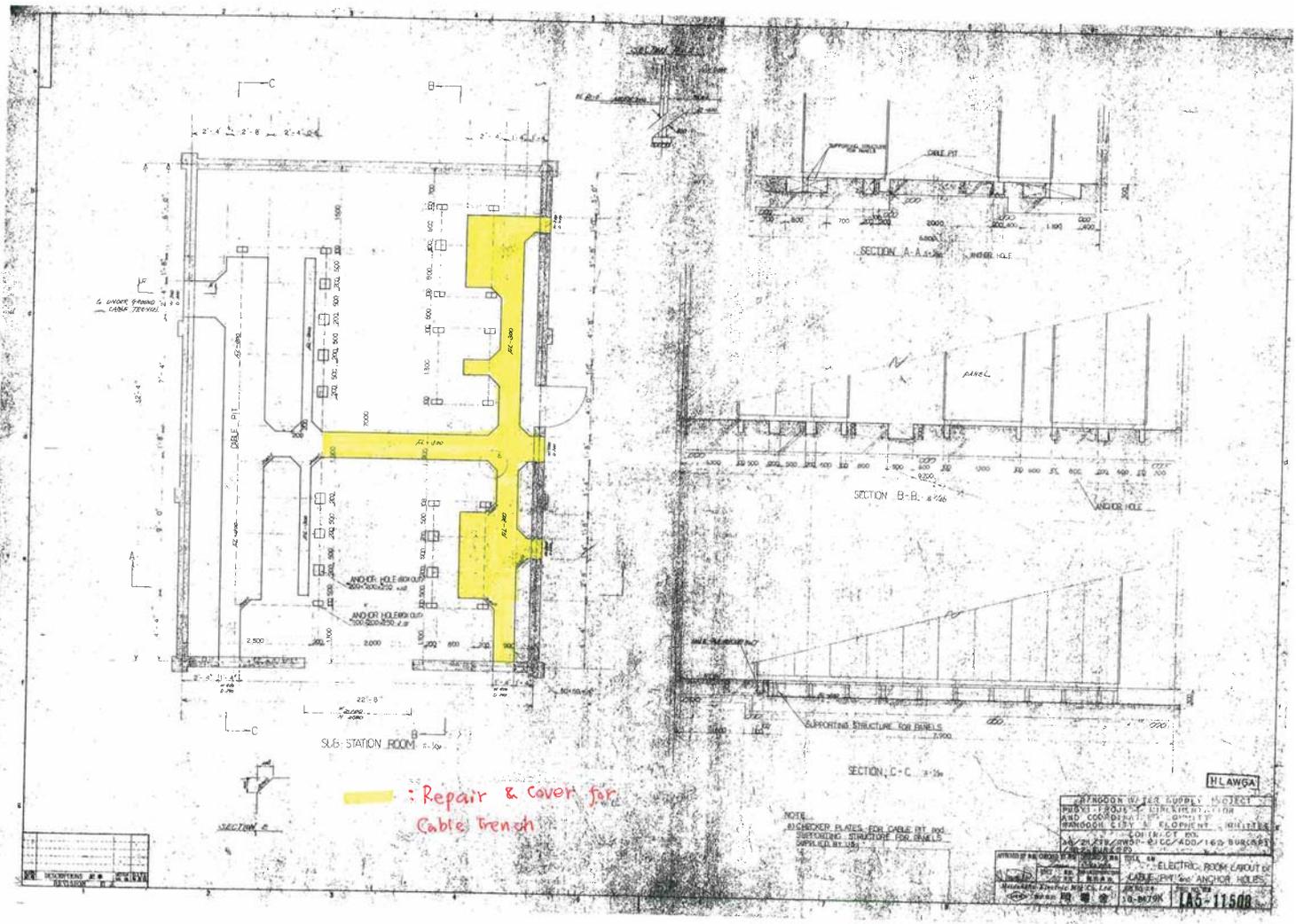
- ELECTRICAL ROOM**
- CEILING REPAIR WORK
  - TRENCH REPAIR WORK
  - LIGHTING REPAIR WORK
  - CLOSING LOUVER
  - MAIN DOOR CHANGING NEW
  - BATTERY CHARGER PANEL RPLACE NEW
  - NECESSARY ELECTRICAL MODIFICATION WORK

HLAWGA

STATION WATER SUPPLY PROJECT  
 PROJECT NO. 11508  
 AND COORDINATE WITH THE  
 WINDSONG CITY & COUNTY UTILITIES  
 DEPARTMENT. CONTRACT NO.  
 W-21-274-0001-010-ADD-160-BURKAP  
 (2021-2022)

ELECTRIC ROOM LAYOUT OF  
 WINDSONG CITY & COUNTY UTILITIES  
 PROJECT NO. 11508  
 CONTRACT NO. W-21-274-0001-010-ADD-160-BURKAP  
 (2021-2022)

11508



Repair & cover for  
Cable trench

HLAWGA

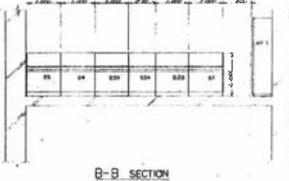
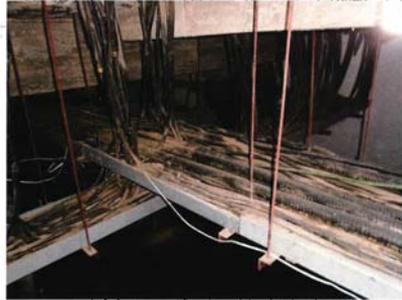
STATION WATER SUPPLY PROJECT  
 PROJECT NO. 11508  
 AND COORDINATE WITH THE  
 WINDSONG CITY & COUNTY UTILITIES  
 DEPARTMENT. CONTRACT NO.  
 W-21-274-0001-010-ADD-160-BURKAP  
 (2021-2022)

ELECTRIC ROOM LAYOUT OF  
 WINDSONG CITY & COUNTY UTILITIES  
 PROJECT NO. 11508  
 CONTRACT NO. W-21-274-0001-010-ADD-160-BURKAP  
 (2021-2022)

11508

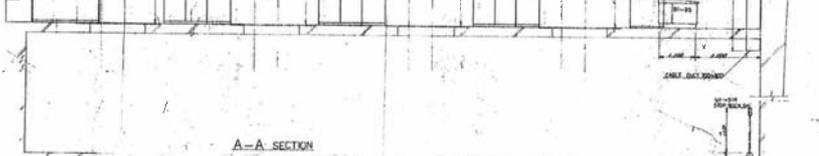
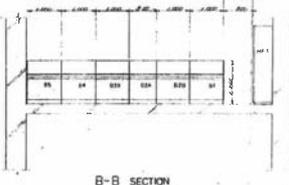


CABLE LADDER AND OTHERS NECESSARY ELECTRICAL WORK



BANGKOK WATER SUPPLY PROJECT	
PROJECT IMPLEMENTATION AND COORDINATING COMMITTEE	
BANGKOK CITY DEVELOPMENT COMMITTEE	
CONTRACT NO. 10/2557-PICC/ADB/162-BUN(S)	
SHEET NO. 2552-SUB(E)	
HLAWGA	SITE NO. HLAUGA
LAYOUT OF PUMPING STATION	
SCALE: 1:100	DATE: 10-04-79
DESIGNED BY: M. S. J. J.	DRAWN BY: M. S. J. J.
CHECKED BY: M. S. J. J.	SCALE: 1:100
LA5-11516	

Modification work for the control panel in GF



BANGKOK WATER SUPPLY PROJECT	
PROJECT IMPLEMENTATION AND COORDINATING COMMITTEE	
BANGKOK CITY DEVELOPMENT COMMITTEE	
CONTRACT NO. 10/2557-PICC/ADB/162-BUN(S)	
SHEET NO. 2552-SUB(E)	
HLAWGA	SITE NO. HLAUGA
LAYOUT OF PUMPING STATION	
SCALE: 1:100	DATE: 10-04-79
DESIGNED BY: M. S. J. J.	DRAWN BY: M. S. J. J.
CHECKED BY: M. S. J. J.	SCALE: 1:100
LA5-11516	

Remove indicator panel from Basement

	No. 11	<p><u>Condition:</u> Opening under roof No insulation at roofing sheet</p> <p><u>Countermeasure:</u> Close by brick Apply insulation sheet</p> <p>Electric Room</p>
	No. 12	<p><u>Condition:</u> Opening under roof No insulation at roofing sheet Wall painting not smooth</p> <p><u>Countermeasure:</u> Close by brick Apply insulation sheet Repaint</p> <p>Electric Room</p>
	No. 13	<p><u>Condition:</u> Lauvor Wall dirty</p> <p><u>Countermeasure:</u> Close by brick Repaint</p> <p>Electric Room</p>
	No. 14	<p><u>Condition:</u> Wall dirty</p> <p><u>Countermeasure:</u> Repaint</p> <p>Electric Room</p>
	No. 15	<p><u>Condition:</u> Lauvor Wall dirty</p> <p><u>Countermeasure:</u> Close by brick Repaint</p> <p>Electric Room</p>

	No. 1	<p><u>Condition:</u> Metal sliding door Lauvor</p> <p><u>Countermeasure:</u> Change double leave steel door Close by brick</p> <p>Electric Room</p>
	No. 2	<p><u>Condition:</u> Floor damage Wall dirty</p> <p><u>Countermeasure:</u> Repair and paint Repaint</p> <p>Electric Room</p>
	No. 3	<p><u>Condition:</u> Floor damage Wall dirty</p> <p><u>Countermeasure:</u> Repair and paint Repaint</p> <p>Electric Room</p>
	No. 4	<p><u>Condition:</u> Floor damage</p> <p><u>Countermeasure:</u> Repair and paint</p> <p>Electric Room</p>
	No. 5	<p><u>Condition:</u> White ant building</p> <p><u>Countermeasure:</u> Need to clean up</p> <p>Electric Room</p>

4-Sep-2017

The Result of Site Survey (Hlawga)

	<p>No. 31</p> <p><u>Condition:</u> Walk way steel grating need for walk</p> <p><u>Countermeasure:</u> Make new and fix</p> <p>Pumping station. (Basement 1)</p>
	<p>No. 32</p> <p><u>Condition:</u> Water leakage</p> <p><u>Countermeasure:</u> Repair and repaint</p> <p>Pumping station. (Basement 1)</p>
	<p>No. 33</p> <p><u>Condition:</u> Water leakage</p> <p><u>Countermeasure:</u> Repair and repaint</p> <p>Pumping station. (Basement 1)</p>
	<p>No. 34</p> <p><u>Condition:</u> Water leakage</p> <p><u>Countermeasure:</u> Repair and repaint</p> <p>Pumping station. (Basement 1)</p>
	<p>No. 35</p> <p><u>Condition:</u> Water leakage</p> <p><u>Countermeasure:</u> Repair and repaint</p> <p>Pumping station. (Basement 1)</p>

[7/11]

FFEC-MM

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

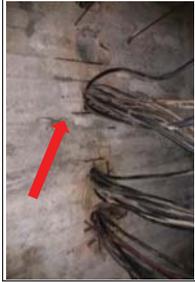
4-Sep-2017

	<p>No. 21</p> <p><u>Condition:</u> Entrance cement plaster damage Wall dirty</p> <p><u>Countermeasure:</u> Repair and repaint Repaint</p> <p>Pumping station. (GF)</p>
	<p>No. 22</p> <p><u>Condition:</u> Window broken and damage Wall dirty</p> <p><u>Countermeasure:</u> Repair and paint Repaint</p> <p>Pumping station. (GF)</p>
	<p>No. 23</p> <p><u>Condition:</u> Cement plaster damage</p> <p><u>Countermeasure:</u> Repair and paint</p> <p>Pumping station. (GF)</p>
	<p>No. 24</p> <p><u>Condition:</u> Window broken and damage Wall dirty</p> <p><u>Countermeasure:</u> Repair and paint Repaint</p> <p>Pumping station. (GF)</p>
	<p>No. 25</p> <p><u>Condition:</u> Window damage</p> <p><u>Countermeasure:</u> Repair, clean and repaint</p> <p>Pumping station</p>

[5/11]

FFEC-MM

Nay Lin Maung Yee

	No. 41
	<u>Condition:</u> Slab rebar rustiness
	No. 42
	<u>Condition:</u> Beam rebar cutting
	No. 43
	<u>Condition:</u> Beam rebar cutting Slab rebar rustiness
	No. 44
	<u>Condition:</u> Water leakage
	No. 45
	<u>Condition:</u> Water leakage

	No. 51
	<u>Condition:</u> Wall dirty
	No. 52
	<u>Condition:</u> Wall dirty Entrance door dirty and rustiness Sunshade frame
	No. 53
	<u>Condition:</u> Wall Dirty
	No. 54
	<u>Condition:</u> Window broken and damage Window sunshade slab damage Wall dirty
	No. 55
	<u>Condition:</u> Window broken and damage Window sunshade slab damage

The Result of Site Survey (Hlawga)

4-Sep-2017

	No. 16	<u>Condition</u> Aluminium sliding window
	<u>Countermeasure</u> Close by brick	
	No. 17	<u>Condition</u> Aluminium sliding window Aluminium sliding door Wall dirty
	<u>Countermeasure</u> Close by brick Change by double door/leave steel door Repaint	
	No. 18	<u>Condition</u> Lavor Wall dirty
	<u>Countermeasure</u> Close by brick Repaint	
	No. 19	<u>Condition</u> Plain sheet door
	<u>Countermeasure</u> Change single leaf steel door	
	No. 20	<u>Condition</u> Floor damage
	<u>Countermeasure</u> Repair and paint	
		Electric Room

[4/11]

Nay Lin Maung Yee

The Result of Site Survey (Hlawga)

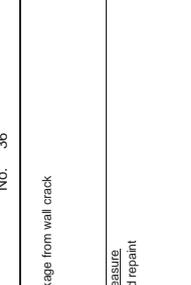
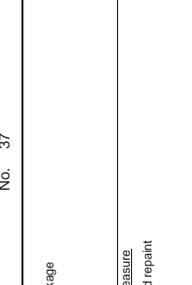
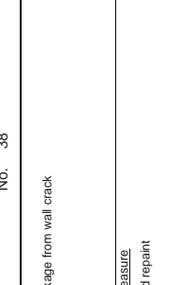
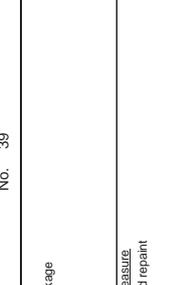
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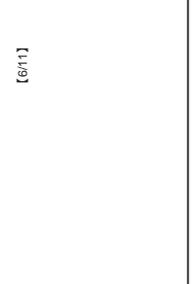
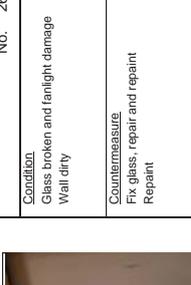
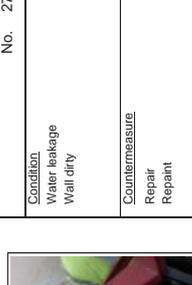
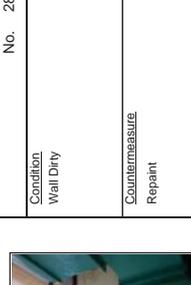
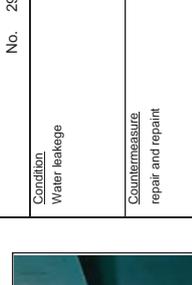
	No. 6	<u>Condition</u> Floor damage Wall dirty
	<u>Countermeasure</u> Repair and paint Repaint	
	No. 7	<u>Condition</u> Plain sheet door
	<u>Countermeasure</u> Change by double door/leave steel door	
	No. 8	<u>Condition</u> Lavor Wall dirty
	<u>Countermeasure</u> Close by brick Repaint	
	No. 9	<u>Condition</u> Ceiling sagging
	<u>Countermeasure</u> Repair	
	No. 10	<u>Condition</u> Ceiling frame paint
	<u>Countermeasure</u> repair and repaint	
		Electric Room

[2/11]

FFEC-MM

Nay Lin Maung Yee

	No. 36
	Condition: Water leakage from wall crack
	Countermeasure: Repair and repaint
	Pumping station (Basement 1)
	No. 37
	Condition: Water leakage
	Countermeasure: Repair and repaint
	Pumping station (Basement 1)
	No. 38
	Condition: Water leakage from wall crack
	Countermeasure: Repair and repaint
	Pumping station (Basement 1)
	No. 39
	Condition: Water leakage
	Countermeasure: Repair and repaint
	Pumping station (Basement 2)
	No. 40
	Condition: Slab rebar rustiness
	Countermeasure: Give treatment and repair
	Pumping station (Basement 2)

	No. 26
	Condition: Glass broken and fanlight damage Wall dirty
	Countermeasure: Fix glass, repair and repaint Repaint
	Pumping station (GF)
	No. 27
	Condition: Water leakage Wall dirty
	Countermeasure: Repair Repaint
	Pumping station (GF)
	No. 28
	Condition: Wall Dirty
	Countermeasure: Repaint
	Pumping station (Basement 1)
	No. 29
	Condition: Water leakage
	Countermeasure: repair and repaint
	Pumping station (Basement 1)
	No. 30
	Condition: Walk way steel grating need for walk
	Countermeasure: Make new and fix
	Pumping station (Basement 1)

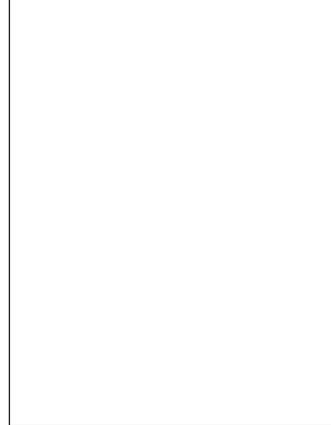
	No. 56	<u>Condition:</u> Window broken and damage Window sunshade slab damage Wall dirty
		<u>Countermeasure:</u> Repair and paint Repair and paint Repaint
Pumping station(Outside)		
	No. 57	<u>Condition:</u> Window broken and damage Window sunshade slab damage Wall dirty
		<u>Countermeasure:</u> Repair and paint Repair and paint Repaint
Pumping station(Outside)		
	No. 58	<u>Condition:</u> Glass broken and fanlight damage Wall dirty
		<u>Countermeasure:</u> Fix glass, repair and repaint Repaint
Pumping station(Outside)		
	No. 59	<u>Condition:</u> Fanlight timber frame damage
		<u>Countermeasure:</u> Repair and paint
Pumping station(Outside)		
	No. 60	<u>Condition:</u> Fanlight broken and damage Window sunshade slab damage Wall dirty <u>Countermeasure:</u> Repair and paint Repair and paint Repaint
		<u>Countermeasure:</u> Repair and paint Repaint
Pumping station(Outside)		

	No. 46	<u>Condition:</u> Water leakage
		<u>Countermeasure:</u> Repair and repaint
Pumping station (Basement 2)		
	No. 47	<u>Condition:</u> Water leakage
		<u>Countermeasure:</u> Repair and repaint
Pumping station (Basement 2)		
	No. 48	<u>Condition:</u> Water leakage
		<u>Countermeasure:</u> Repair and repaint
Pumping station (Basement 2)		
	No. 49	<u>Condition:</u> Water leakage
		<u>Countermeasure:</u> Repair and repaint
Pumping station (Basement 2)		
	No. 50	<u>Condition:</u> Water leakage
		<u>Countermeasure:</u> Repair and repaint
Pumping station (Basement 2)		

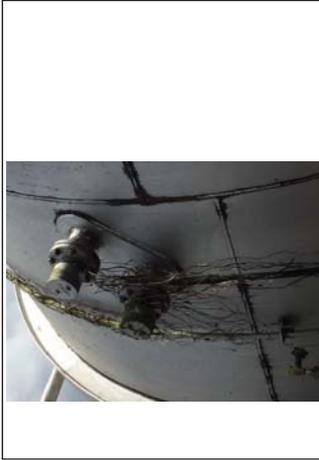


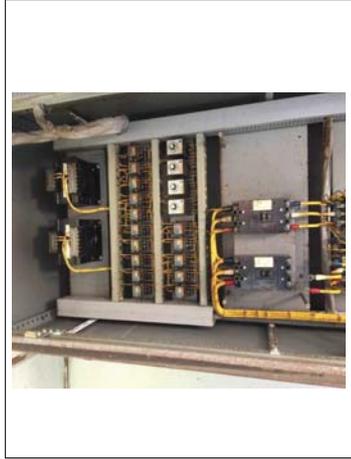
	<p>No. 4</p> <p><u>Condition</u> No.1 Air compressor cannot use No.2 Air compressor only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 5</p> <p><u>Condition</u> Recipro Air compressor IWATA AIR COMPRESSOR MFG CO.,LTD TYPE : MC-15 MAX W.P 8.5 Kg / cm2</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 6</p> <p><u>Condition</u> No.1 Air compressor cannot use No.2 Air compressor only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>

	<p>No. 1</p> <p><u>Condition</u></p> <p><u>Countermeasure</u></p> <p>COMPRESSOR ROOM</p>
	<p>No. 2</p> <p><u>Condition</u> No.1 Air compressor cannot use No.2 Air compressor only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 3</p> <p><u>Condition</u> No.1 Air compressor cannot use No.2 Air compressor only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>

	<p>No. 10</p> <p><u>Condition</u> No.1 Radiator cannot use No.2 Radiator only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 11</p> <p><u>Condition</u> Motor for Air compressor 3 φ 400V 15KW 4POLE</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 12</p> <p><u>Condition</u></p> <p><u>Countermeasure</u></p> <p>COMPRESSOR ROOM</p>

	<p>No. 7</p> <p><u>Condition</u> No.1 Radiator cannot use No.2 Radiator only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 8</p> <p><u>Condition</u> No.1 Radiator cannot use No.2 Radiator only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 9</p> <p><u>Condition</u> No.1 Radiator cannot use No.2 Radiator only manual start</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>

	<p>No. 16</p> <p><u>Condition</u> Air Vessel Level Switch cannot work properly</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>AIR VESSEL</p>
	<p>No. 17</p> <p><u>Condition</u> Air Vessel Level Switch cannot work properly</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>AIR VESSEL</p>
	<p>No. 18</p> <p><u>Condition</u> Air Vessel Level Switch cannot work properly</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>AIR VESSEL</p>

	<p>No. 13</p> <p><u>Condition</u> Air compressor control panel Cannot operate automatic mode</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 14</p> <p><u>Condition</u> Air compressor control panel Cannot operate automatic mode</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>
	<p>No. 15</p> <p><u>Condition</u> Air compressor control panel Cannot operate automatic mode</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>

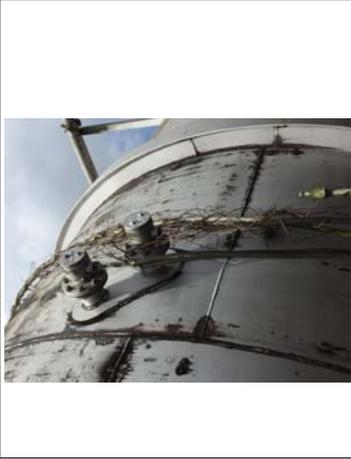
The Result of Site Survey (Hlawga)

2-Oct-2017

	<p>No. 19</p> <p><u>Condition</u> Damage ceiling</p> <p><u>Countermeasure</u> Damage ceiling</p> <p>COMPRESSOR ROOM</p>
	<p>No. 20</p> <p><u>Condition</u></p> <p><u>Countermeasure</u></p> <p>COMPRESSOR ROOM</p>

The Result of Site Survey (Hlawga)

2-Oct-2017

	<p>No. 19</p> <p><u>Condition</u> Air Vessel Level Switch cannot work properly</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>AIR VESSEL</p>
	<p>No. 20</p> <p><u>Condition</u> Air Vessel Level Switch cannot work properly</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>AIR VESSEL</p>
	<p>No. 21</p> <p><u>Condition</u> Pressur Gauge 3.1 kg / cm</p> <p><u>Countermeasure</u> Replace all equipment</p> <p>COMPRESSOR ROOM</p>

### 3 JCM Project Formulation: “Law Carbonization of Waste Management”

#### 3.1 Proposal to PCCD



## Agenda 1.1 (PCCD)

- Feasibility Study in 2017
- Introduction to NEC Smart Waste Recycle
- Understanding for current waste issues in Yangon
- Discussion – how to solve issues.
- Next step

# Feasibility study in 2017

## Feasibility Study for Yangon (2017)

As inter-city cooperation between Yangon and Kawasaki city, NEC'S state-of-the-art technology contributes to optimize waste management and reduce CO2 in Yangon.

### Background

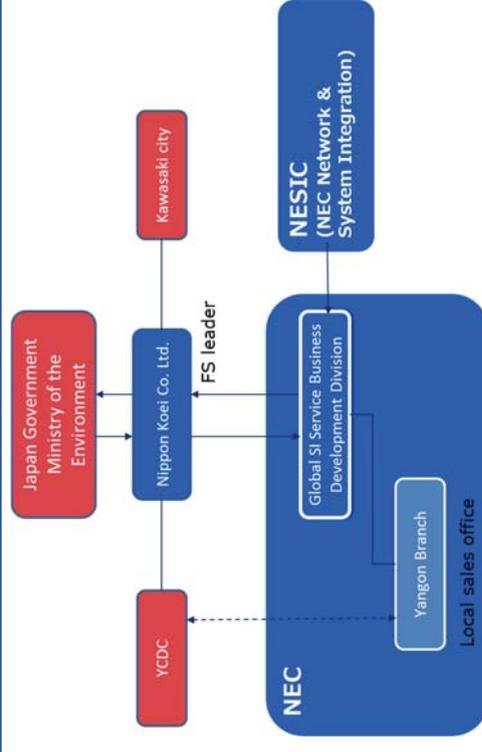
- As part of international contribution by environmental technology of Kawasaki green innovation cluster, Yangon and Kawasaki have signed off MOU regarding low-carbon. (2016)
- Three organization consists of Kawasaki city, Nippon Koei Co., Ltd, NEC Corporation have got order from Japanese Minister of Environment in order to study feasibility for low-carbon in Yangon. Based on the preliminary survey, NEC's smart recycle solution helps to reduce **4,400t/year (74,800t/17 years) CO2**, then further specific study for actual business will be needed.

### schedule

- 2017 April ~2018 February Feasibility Study
- 2018 ~ Implement equipment 【Plan to apply after FS】

## Organization of feasibility study

NEC is leading this feasibility study from the perspective of ICT under Nippon Koei and Japanese Ministry of the Environment.



# Introduction to NEC Smart Waste Recycle solution

## Solution concept

- Optimize waste management flow from waste collection, distribution to biomass energy generation utilizing IoT platform and 4 vertical applications.
- Data analyzed by big data technology will be utilized for total city optimization by integrating with other city services in the future.



## NEC's smart city

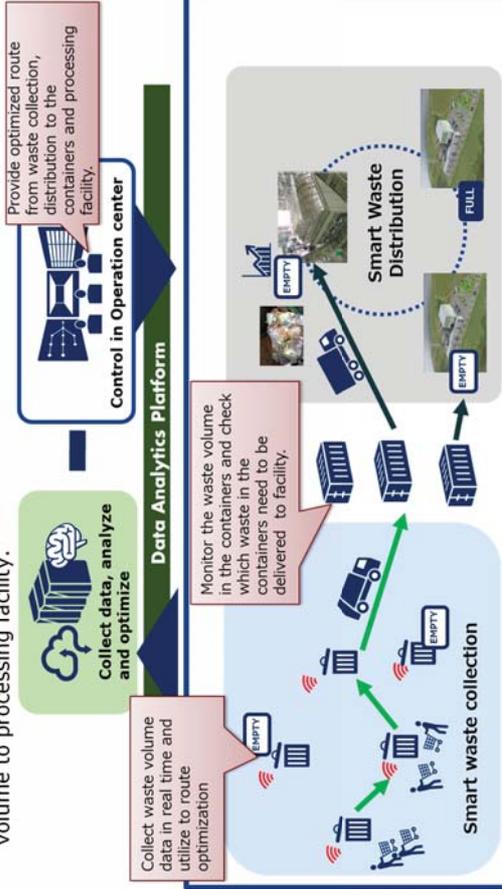
NEC contributes to create sustainable smart city by using state of the art IoT solutions towards SDG goals.



## Smart Waste Collection & Distribution

## Smart Waste Collection & Smart Waste distribution

Install sensors on waste bins, containers and recycle facilities to monitor waste volume. Optimize collected waste volume, vehicle route and the distributed volume to processing facility.

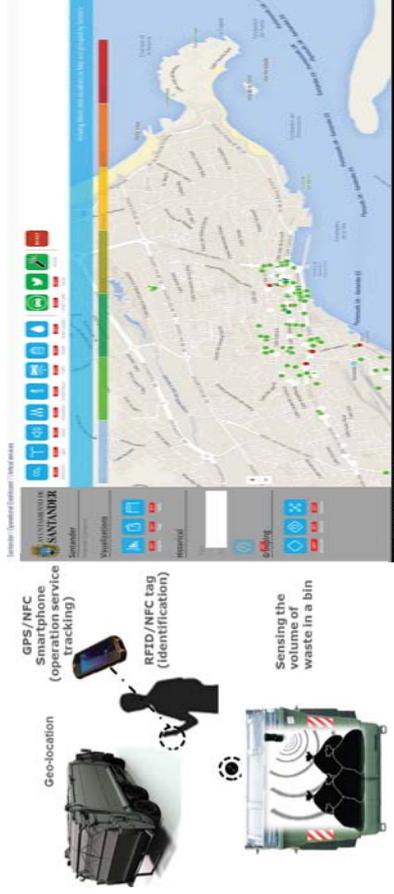


## Santander: Monitoring and operation management



Real time operations of service workers and vehicles are followed-up and controlled.

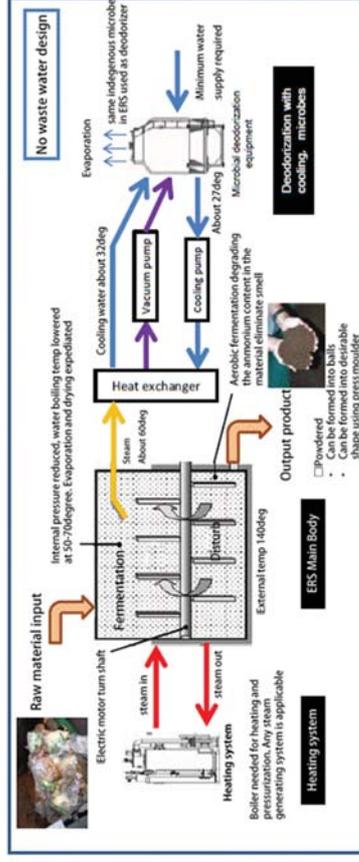
Monitoring is based on a tracking software of vehicles activity displayed in the mobile device used in their daily operations.



## Recycle Facility - ERS (Environment Recycle System)

ERS: A high speed fermentation & drying system employed indigenous microbes. It's suitable for treating sludge & food waste with various moisture containing.

With a vapor generating system, such as boiler, provides ERS main unit with steam, reduces pressure, disturbs feedback, enables the high speed fermentation & drying process. Adding a vapor cooling system, it becomes a design for non-waste water, model including feedback (closed-loop) process.



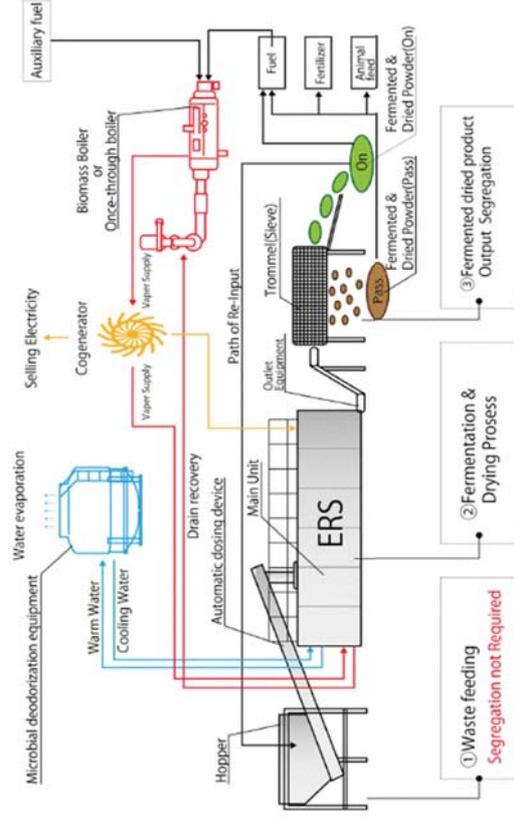
### Specifications

Process Capacity	0.5-100t/day (please refer manual)
Technology	Heated and depressurized speed fermentation and dry
Indigenous Microbes	Local microbes selected & cultivated from soil near by the installation. (Further supply is no need)
Application	Any organic materials
Energy sources	Electricity (For whole system), Class A, fuel Oil (for steam boiler)
Specialty	High speed ferment & dry, need no bearing replacement, no waste water design
	Only 3 microbes selected & remained. These 3 kinds are IPDD registered
	Patent for whole system are obtained in 2007

### Input & the Output

Trash 10t, Process waste	Convert to Fish Meal
Brewery waste (Bagasse)	Animal feed
Food waste	Animal feed or Bio Fertilizer
Organic waste	Animal feed or Bio Fertilizer
Fertil processing waste	Bio Fertilizer
Sludge and sludge	Bio Fertilizer or fuel (Phosphoric can be collected)
Unusable sludge	Fertilizer with microbes, Fuel (※ P recovery)

## ERS' Process Flow (Fertilizer, Animal feed, and Energy)



## Core Technologies and Properties

### Core technology : Indigenous microbes selections



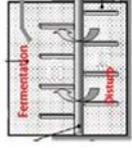
Specific microbes are resident (Indigenous microbes) from regular anaerobic microbes

- Microbes are selected and cultivated from local soil near by the installation
- Resident inside ERS main unit, no need to replace or refill after installed
- Stop operation, restart, no need to refill microbes (Ref. other papers)

### Excellent total cost effectiveness

- Simple machines. No pre-process needed (mix ratio adj.), odor treatment or inter process setup
- Easy maintenance (Simple structure, less troubles and high durability)
- Space saving (Save cost for buildings and etc) \*maintenance cost around at 5% every 7years
- Wastewaterless design (Saves on for wastewater treatment cost)
- Substantial volume deceiver (effective transportation). Dried, easy for handling)
- High nutrition fertilizer produced (higher market price bigger totalcostsaving)

### Heated & depressurized hi-speed ferment and drying



The condition inside the system is controlled for best environment for microbes multiply, growth and mitigate

Efficient fermentation and drying produce high quality and high value products

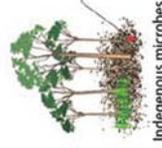
### Flexible application

Possibility to collect phosphorus, CO2 reduction, combination with conventional system and many other possibilities

### Environmental friendly

Indigenous microbes eliminate the bad odors (eliminate raw material bad smells)

## Operation and Maintenance



Indigenous microbes  
Selection of effective indigenous microbe and seed into ERS  
Microbes(Aerobic)

- Operation and maintenance
  - Microbes selections, multiplication and seeding required around 1 week.
  - Manual raw material input and finish product output handling required.
  - During operation, monitoring manpower 1 person required (Job task is to monitor the running condition, suitable vacuum condition for microbes, checking at the parameters and etc.)
  - When trouble happened the operation can be paused and continued the next day.
- Raw material type exchange
  - When changing the raw material type, the cleaning method depend on the next raw material output usage (feed or fertilizer).
- Maintenance
  - General maintenance only required. The main body is tough enough for continuous operation permanently.
  - Consumable parts
    - Motors need to be change about every 7 years.
    - Vacuum pump, cooling water pump, vacuum valve replacement when exhausted.

## ERS Features - Comparison with convectional composter

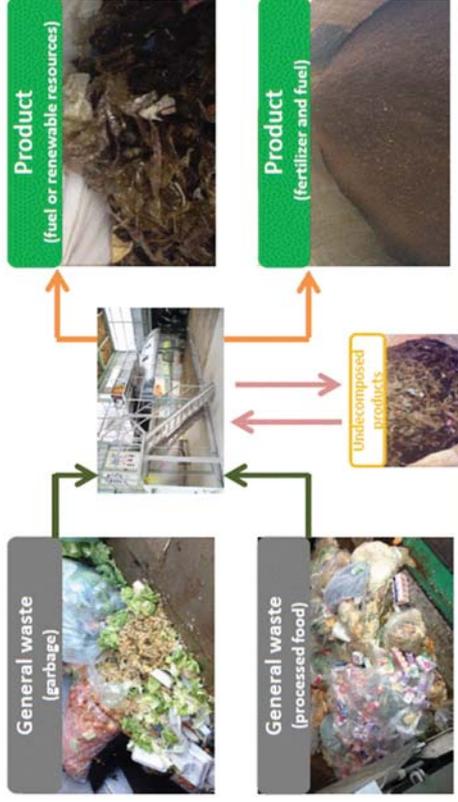
ERS can process any kinds of organic foods at high speed.

	ERS	Conventional Composter	Incinerator
Processable waste	Organic waste (separated from others)	Yes	Yes
	Non organic waste	No	Yes
	Organic waste included in house waste (no separation in advance)	Yes	Yes (*1)
	Oily Food Waste	No	Yes
	Agricultural waste	No	Yes
	Food processing waste (raw fish, vegetable, fishery waste, etc.)	Yes	Yes (*1)
	Livestock (pig, cow, chicken, etc.) manure	No	No (*1)
	Dead animals (pig, cow, chicken, etc.)	No	Yes
	Septic tank sludge and raw human waste	No	No (*1)
Waste processing speed		Days or weeks	hours
Waste processing capacity		small capacity (tens or hundreds kg/day)	
		250Kg/day - 50t/day and more	

\*1) Juicy waste may damage incinerator.

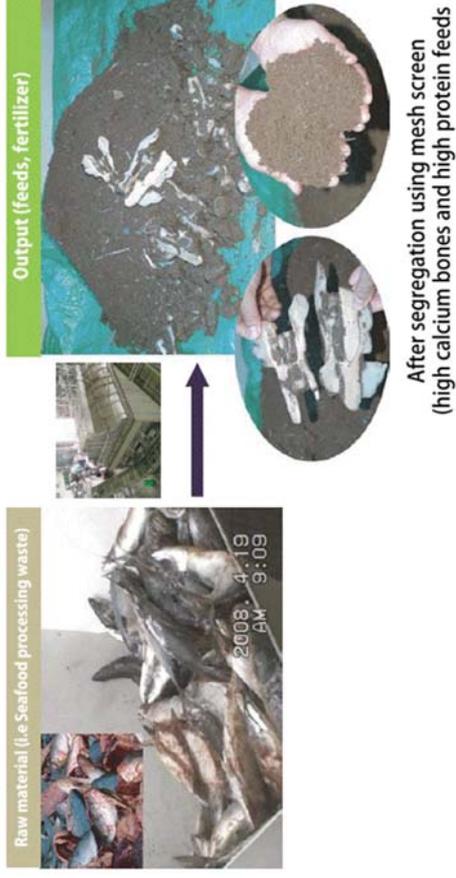
### Application and potential industry : General waste

- Waste can be thrown altogether.
- The output can be easily segregated from plastics and organic product easily. No pre-segregation process required.
- Undecomposed product is processed by the ERS again



### Application and potential industry : Food processing waste

- Raw fish can be thrown as it is.
- After fermented and dried, the output is odorless fertilizer/feeds.
- High protein fishmeal is produced and small bones residue can be segregated.



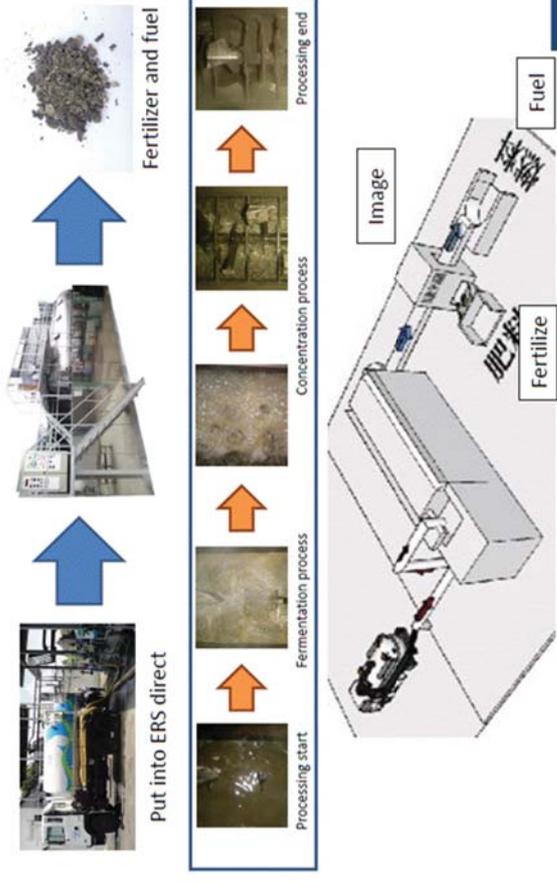
### Application and potential industry : livestock farming excreta

- Cow, pig, chicken manure can be ferment and dried very fast. Solid-liquid separation unnecessary.
- Manure and urine can be thrown together and there will be no waste water.
- The number of bacteria is reduced by ERS processing drastically



### Application and potential industry :Septic tank sludge and raw human waste

- The input to the RDS from vacuum truck directly, the septic tank sludge and raw human waste of 98% moisture content.

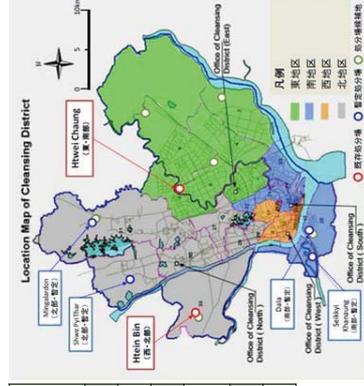


# Understanding for Current Waste Issues in Yangon

## Final Disposal Sites – Dump sites

Would you provide the latest information?  
Where are the Intermediate Waste Stations?  
It seems that all of the FDS sites are going to become full soon.

	Waste volume (t/day)	Area (ha)	Waste occupied (ha)	Start	Close
Htein Bin	847	61	28	2002	2021
Htwel Chaung	612	60	19	2004	2015
Dala	10	1	N/A	1950	N/A
Sekkyi Khanaung	5	0.1	N/A	1962	N/A
Minagalarodon	25	1	N/A	2003	2012
Shwe Pyi Thar	50	1	N/A	1998	2015



Source: JCM Feasibility Study Report 2012

## Issues in Final Disposal

Most of wastes are dumped in dump sites which is harmful to waste pickers and environment.



A dump site in Yangon



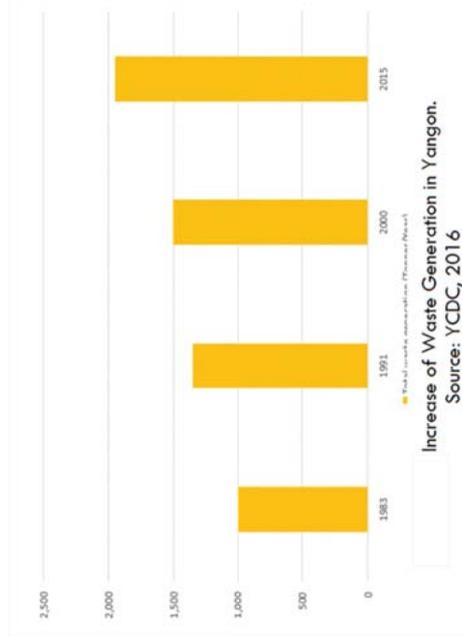
A dump site in Indonesia

### Issues of dump

- Air- and water-borne diseases
- Breeding ground for insects, vermin and scavenging animals
- Contamination of groundwater and surface water by leachate
- Air pollution from burning of waste

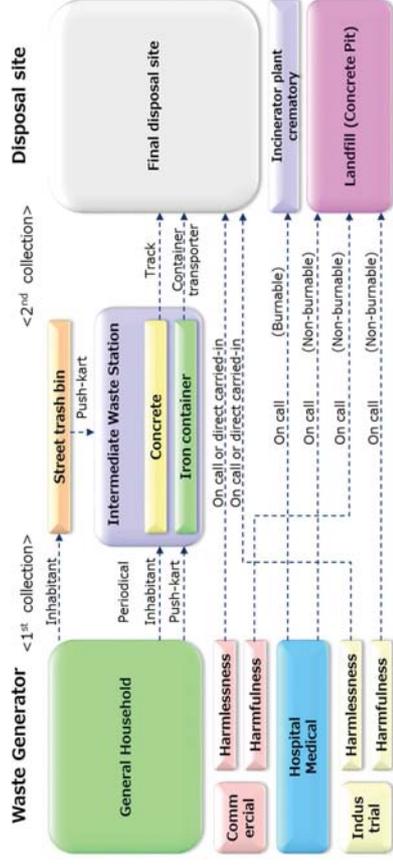
## Increasing waste in Yangon

The volume of waste has been increasing as the economy grows.



## Waste management flow in Yangon

Final disposal sites and its routes to collect/deliver are all dependent on trash source origin.



## No of collection equipment

Would you provide the latest data?

Collection equipment	2012	2017	Future
Push carts	Bell collection 387		
	Street sweeping 699		
Waste bin	660L 471		
	240L 1,425		
Container	15		
Brick Container	558		
Bamboo Container	251		
Track	299		



## Separation of household waste

Is there any changes in the waste separation rule? Do you conduct separate dump for each waste category?

Waste category	Waste bag	Waste collection	Waste
Wet waste	blue	Every day	Food, plant, etc.
Dry waste	green	Every Wednesday and Sunday	Cardboard, pottery, glass, bulb, fluorescent lamp, clothes, cables, plastic, toy, etc.

## Fiscal situation for waste management operation

Based on NEC's assumption, Yangon city faces financial difficulty in operating waste disposal.

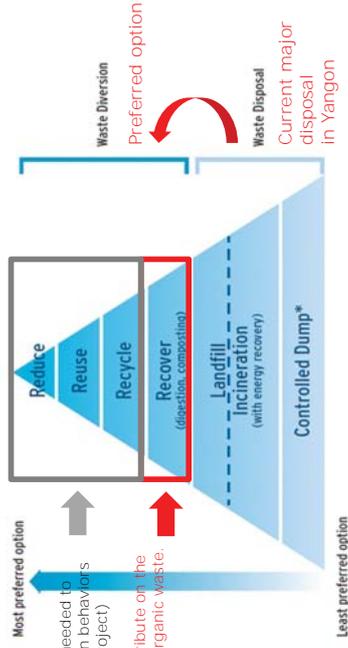
Category	Waste dealing fee (/Household or facility-month)	Revenue	Cost
Household			
CBD District	600 Kyat		
Sub-urban District	450 Kyat		
Satellite District	300 Kyat		
Office	500~400,000 Kyat		
Guest house, Motel	6,500~250,000 Kyat		
Hotel	10,000 Kyat or more		
Hotel (foreign-affiliated)	US\$67~300		
Medical facility	1,200~19,500 Kyat		
		Income/monthly/household	Income/year/household
		450	5,400
			183,607
			991,479,150
			1,555,520,850
			2,547,000,000
			2,364
			28,370
			183,607
			5,209,000,000

Source: NEC assumed figures based on JCM Feasibility Study Report 2012.



## Challenges for Issues 1 "Inappropriate Final Disposal"

The volume of waste to be dumped in Final Disposal Site need to be reduced by Waste Diversion, "4R".

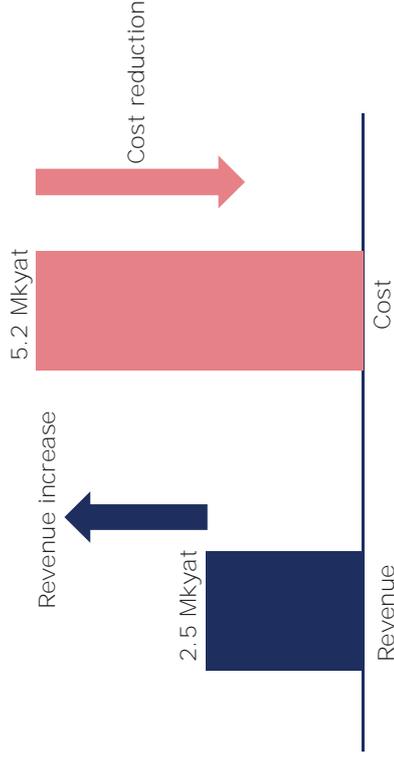


\*As a minimum, waste should be disposed at a "controlled dump," which includes site selection, controlled access, and where practical, compaction of waste. Incineration requires a complementary sanitary landfill, as bottom ash, noncombustibles and by-passed waste needs to be landfilled.

Source: World Bank Report 2012 "What a Waste"

## Challenge for Issue 2 "Financial Difficulty"

We need to discuss some countermeasures for revenue increase and cost reduction for sustainable operation.



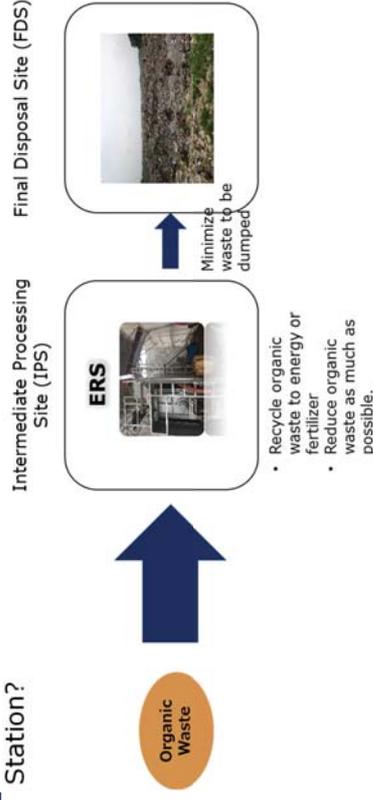
## Discussion points

- Countermeasure for the "Inappropriate FDS" issue
  - Where and how should organic waste be reduced at the dump sites?
- Countermeasure for revenue increase
  - What are the value of ERS reproduction, electricity energy and fertilizer?
  - How can we increase the waste charge collection rate?
  - Is it possible to increase the waste collection charge?
- Countermeasure for cost reduction
  - Is it possible to reduce the cost of waste collection with Smart Waste Collection?

## Basic Concept: Reduction of Organic Waste to be dumped

Basic concept for solutions to the "Inappropriate FDS" issue is to reduce organic waste at IPS ( Intermediate Processing Site ) and minimize the waste to be dumped.

- Who should own ERS, Waste Generator or PCCD?
- Where should be IPS, Next to FDS or Intermediate Waste Station?



## Solution idea using ERS

Ownership of ERS	Location of ITS	Reproduction	Revenue	Cost
YCDC/PCCD or SPC	Next to FDS	Energy	Increase by selling energy to YESB.	Increase: ERS CAPEX and OPEX Decrease: No
	Intermediate Waste Station (IWS)	Energy or fertilizer	Increase by selling energy or fertilizer	Increase: ERS CAPEX and OPEX Decrease: Waste transportation from IWS to FDS.
Waste Generator (Food processing companies, hotel, industrial park, etc.)	Waste Generator Site	High quality fertilizer	No increase.	Increase: No Decrease: Waste collection from WG.

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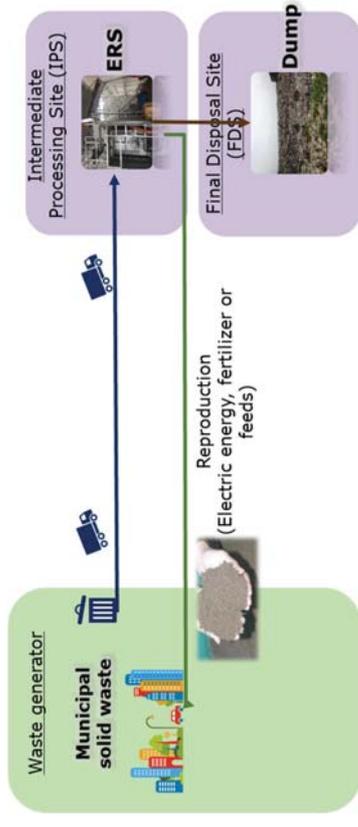
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## 1. Create Intermediate Processing Site next to FDS.

ERS Ownership: YCDC or SPC, Installation site: Next to FDS



### Benefit:

- Reduce organic waste at dump sites which caused serious problems for health and environment.
- Reproduction, electricity energy is expected to create a new revenue.

38

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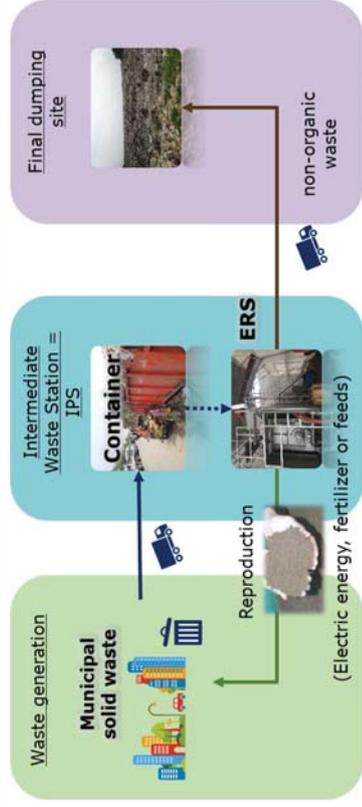
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## 2: Install ERS at Intermediate Waste Station

ERS ownership: YCDC or SPC.  
ERS installation site: Intermediate Waste Station (IWS)



### Benefit:

- Reduce organic waste at IWS. That eventually reduce organic waste at dump sites which caused serious problems for health and environment.
- Reproduction, electricity energy or fertilizer are expected to create a new revenue.

39

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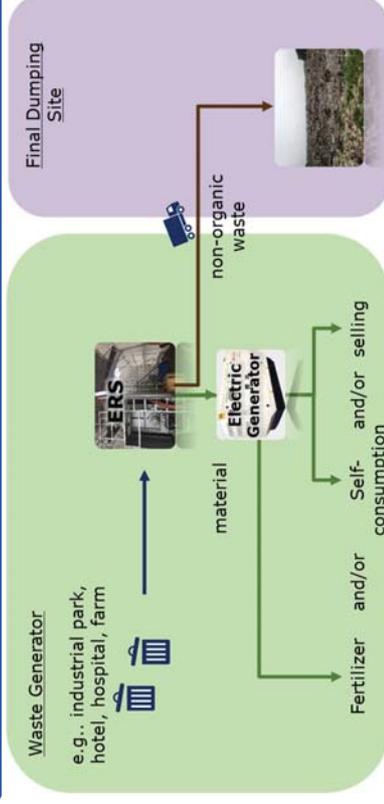
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## Solution 3: ERS owned and operated by Waste Generator.

ERS ownership: Waste Generator  
ERS installation site: Waste Generator



### Benefit:

- Reduce organic waste at WG. That eventually reduce organic waste at dump sites which caused serious problems for health and environment.
- No ERS cost for YCDC/PCCD. It is born by Waste Generator.

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## Agenda 1.2 (PCCD)

### Organic Waste Recycle

- Waste issues in Yangon
- Proposed solutions
- Solution Cost and Benefit Analysis
- Next step

### Medical Waste Treatment

- Introduction to iSGM
- Understanding of the medical waste issues in Yangon
- Medical waste treatment in Tokyo
- Corroborative approach to solve the issues

# Waste issues in Yangon

## Issues in Final Disposal

Most of wastes are dumped in dump sites which is harmful to waste pickers and environment.

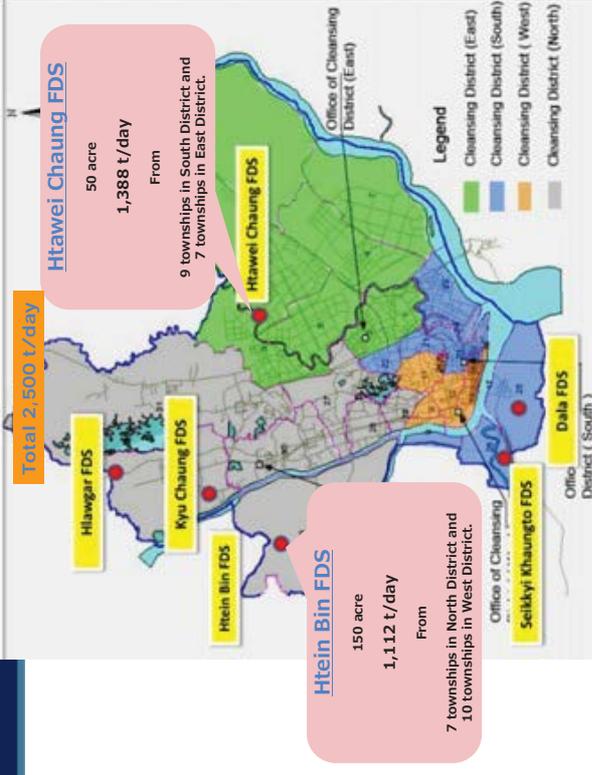


A dump site in Yangon

### Issues

- Air- and water-borne diseases
- Breeding ground for insects, vermin and scavenging animals
- Contamination of groundwater and surface water by leachate
- Air pollution from burning of waste

## Map of Final Disposal Site



## Summary of Waste Issues in Yangon

### ISSUES

#### I Issue1 Inappropriate final disposal

- The current major final disposal, "Dump" give serious damages on health and environment in Yangon.
- All of the dump sites are probably going to become full in years. We need to reduce the volume of waste to be dumped some how.

**Reduce waste for FDS**

#### I Issue2 High cost of Waste Transportation to FDS

**Reduce cost of Waste Transportation**

#### I Issue3 Financial difficulty in waste disposal operation

- Yangon city faces financial difficulties in operating waste disposal.
- The cost is almost double the revenue.

**Create a revenue from Waste Recycle.**

### CHALLENGES

## Proposed solutions

## Reduce waste in every townships

Reduce waste at Township with ERS before going to FDS Dump



### Issues:

- High cost for waste transportation (vehicle fuel and maintenance, personnel)
- Heavy workload due to night time work.
- Deteriorating environmental issues in FDS

### Solution :

- Reduce waste at township with ERS.
- Cost and workload reduction for waste transportation
- Mitigation of FDS environmental issues.
- Create a new revenue (W2E)

## The feature of the recycle system

User and environment friendly system

- Do not need **separate the waste in advance**. Throw the all waste into the system. (\*1)
- Do not need **complex operation**.
- Do not need **waste water treatment**.
- Do not need to worry about **terrible smell**.
- Do not need to **wait the output long time**. Only 120 minutes.

\*1: The recycle system can ferment only organic waste. Non-organic waste will be discharged as it is.

# Solution Cost and Benefit Analysis

## Conditions of simulation

Waste processed at a township

- Volume: 25 t/day
- Composition:
  - Food 65%, wood 15%, Plastic 10%, paper 3.2%, textile 1.9%, leather 1.6%, metal 1%, others 1.8%, glass 0.5%

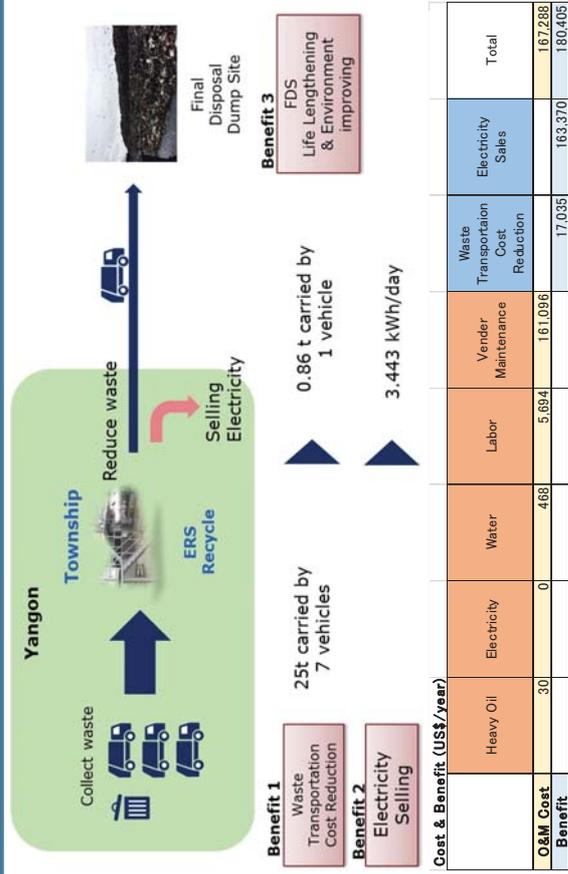
### O&M Cost

The O&M cost was calculated based on the past experience of the ERS vendor. It might be changed depending on operation conditions in Yangon. Especially, the vendor maintenance service cost should be changed depending on SLA and maintenance service.

Cost parameter	Value
Heavy Oil unit price (US\$/t)	0.74
Electricity unit price (US\$/kWh)	0.20
Water unit price (US\$/t)	0.06
Labor (Admin) (US\$/year) - 1 person	1,722
Labor (Worker) (US\$/year) - 3 persons	132
Labor (Electricity Generator) (US\$/year) - 3 persons	1,192

Benefit parameter	Value
Vehicle Size (t)	4
Vehicle Maintenance (US\$/vehicle·year)	100
Vehicle Fuel Efficiency (km/l)	4
Average transportation distance between township and FDS (km/vehicle·round trip)	30
Vehicle Fuel Cost (US\$/l)	0.56
Labor - Vehicle Driver (US\$/person·year)	1,192
Electricity Selling Price (US\$/kWh)	0.13

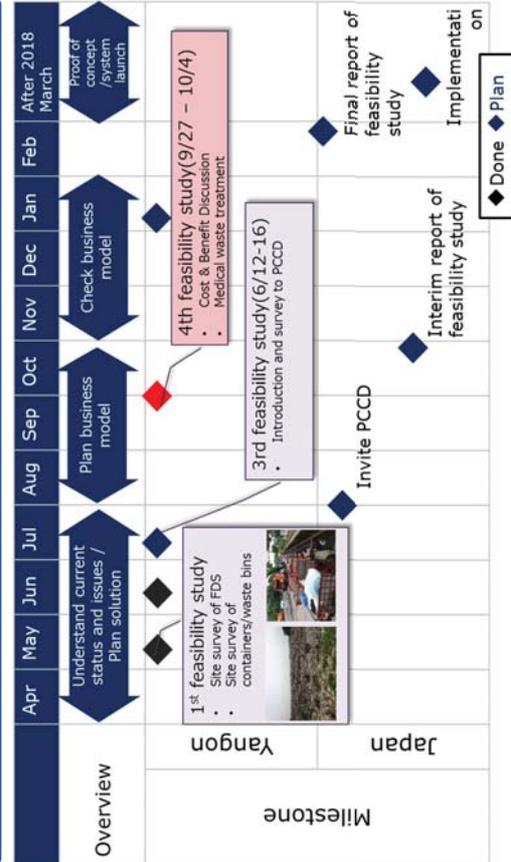
## Result of Cost & Benefit simulation



## Next step

## Schedule plan

Plan and check solutions and business model until Feb 2017



## Medical Waste Treatment

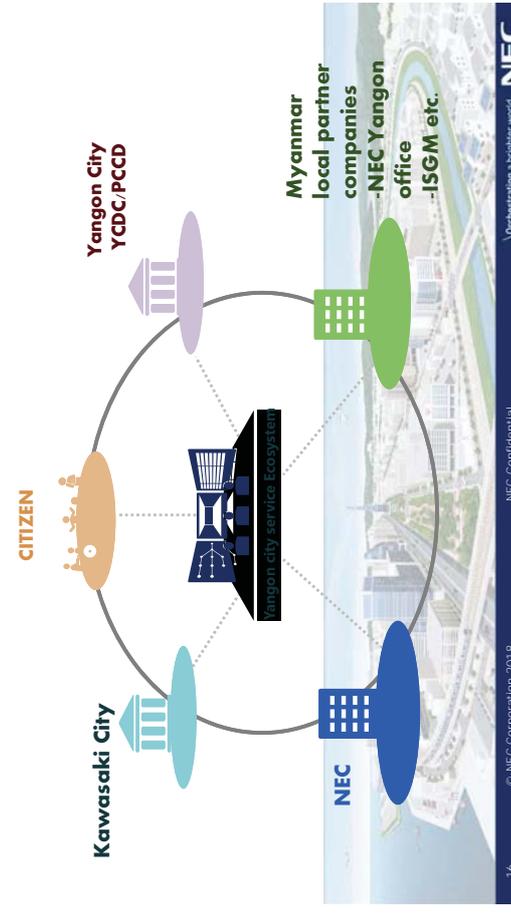
## Yangon city future image starting from waste

Yangon city will be more smarter with collaboration among each city services starting from waste management



## Ecosystem for Yangon's future

Strong collaboration between Myanmar and Japan, and among citizen, city and companies realize advanced city services



## Company profile

Name: ICT Star Group Myanmar Co.,Ltd. (ISGM)

Established: April 25, 2016

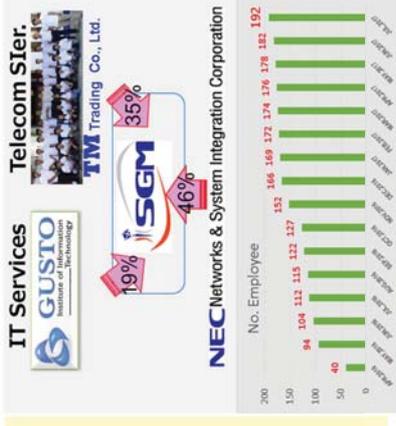
Capital: 1 Million US\$

Head Office: Excel Treasure Tower, 7 Floor, No.520, Kabaraye Pagoda Road, Shwe Gone Daing, Bahan Township, Yangon.

Number of Employees: 193 (as of AUG, 2017)

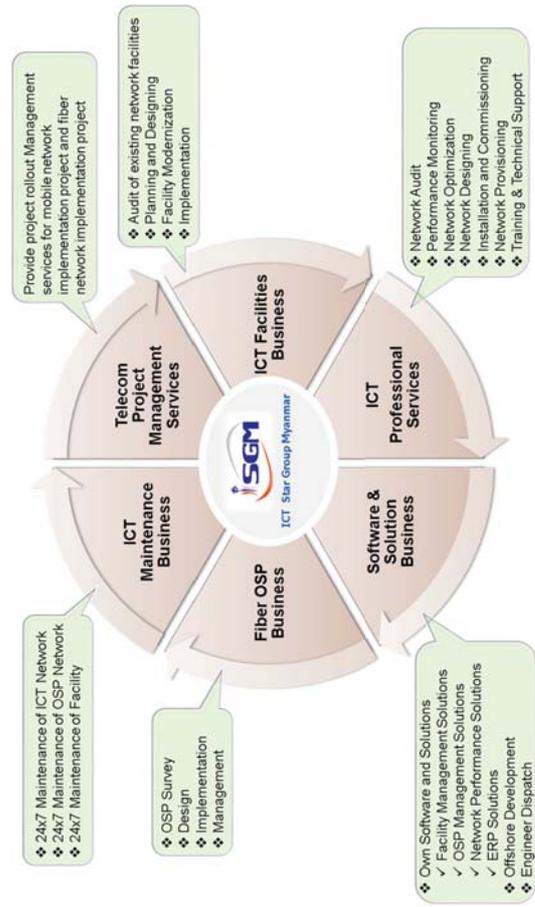
Annual Sales: 9MUSD (as of FY2016)

Main Banks: Sumitomo Mitsui Banking, Myanmar KANBAWZA BANK LIMITED



## Introduction to iSGM

## iSGM Business Domain



## ICT Professional Business

### B2B Network Construction, Provisioning and Maintenance for MPT

- Network Construction on Metro Network in Yangon, NayPyiTaw and Mandalay area
- Provisioning for B2B Internet, IP-VPN services
- Technical Support for NOC operation
- DWDM Network Construction for a ISP
- Metro Transport Network maintenance
- Backbone Transport Network Maintenance
- NMS Monitoring
- Nodes/ Card expansion
- Technical and Management Training



# Fiber Business

## B2B Fiber Line Business

### Yangon Internet Access Fiber Maintenance

- Maintaining the customer fiber internet issues 24x7 stand by when alarm triggered at monitoring system. Provide fault repairing service with SLA guarantee .

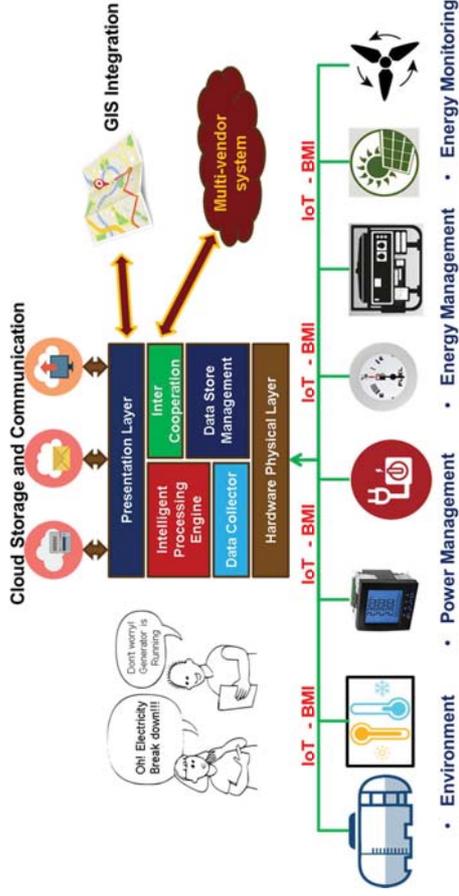
### OSP Mobile & Internet Access Fiber Installation

- Route Survey -> Designing -> Installation -> project management



# Software Development Business

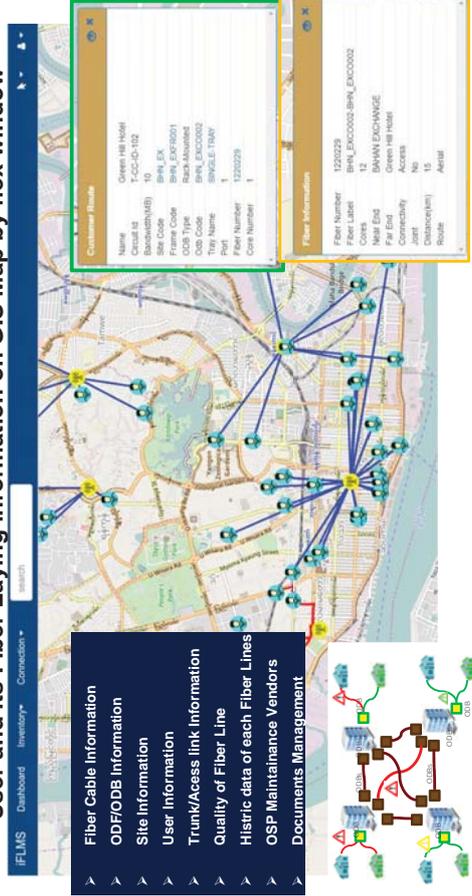
## Intelligent Facilities Management System - IFMS



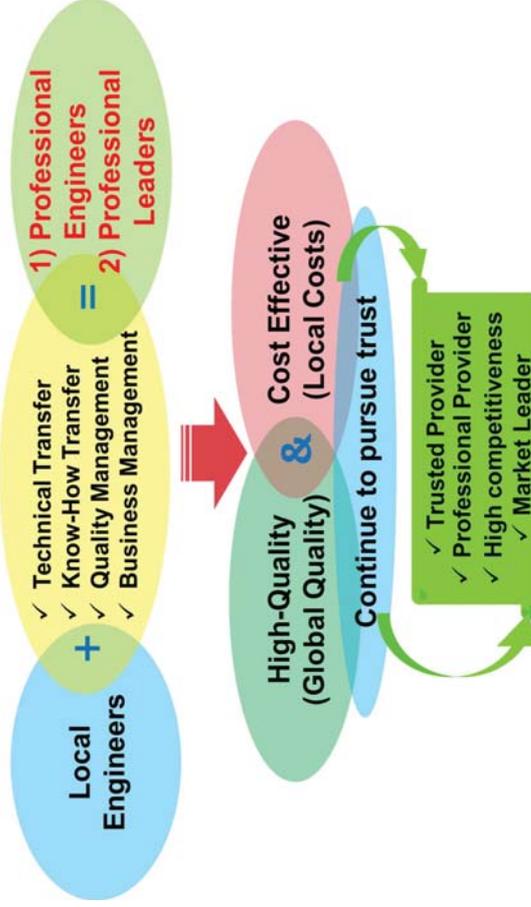
# Software Department Business

## Co-work with MPT to implement the GIS system

### User and its Fiber Laying information on GIS Map by flex window



# Our Values



# Understanding of the medical waste issues in Yangon

## NEC's understanding of medical waste issues in Yangon

Urgent requirements of Medical Waste disposal in Yangon

Improvement of regulations



Enforcement of the rules



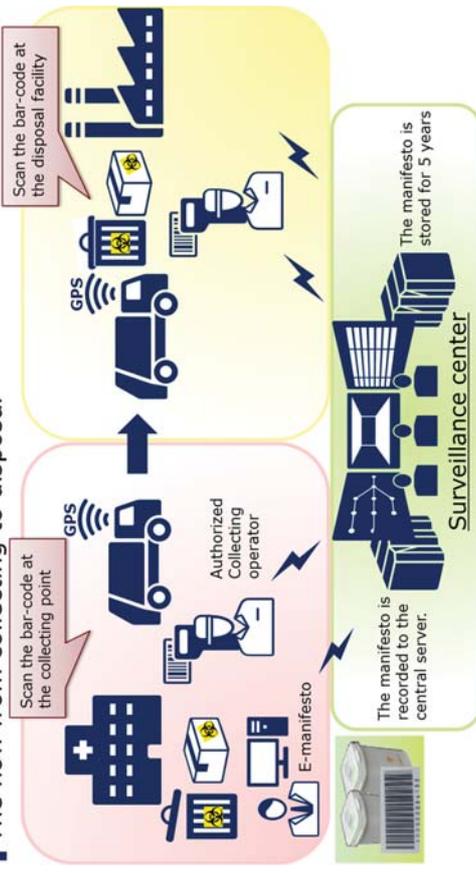
Installation of disposal facilities

# Medical Waste Treatment in Tokyo

## Medical waste disposal system in Tokyo

Individual trace system by bar code is adopted.

The flow from collecting to disposal



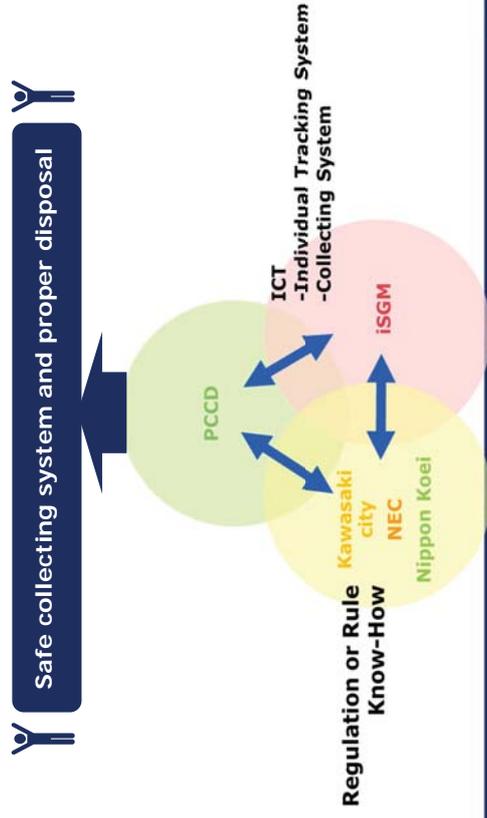
## Required 6 elements

Elements	Japan
<b>Traceability</b>	 <b>Manifesto</b> Trace from collection to disposal
<b>Safety</b>	 <b>Unopenable Special Box</b>
<b>Responsibility</b>	 <b>Hospital or Clinic</b>
<b>Collection</b>	 <b>Licensed Transporter</b>
<b>Disposal</b>	 <b>900°C Rolling Vertical furnace</b>
<b>Penalty</b>	<b>Maximum Penalty</b> Five years' penal servitude Or Penalty of \$50M Or Both

## Collaborative approach to solve the issues

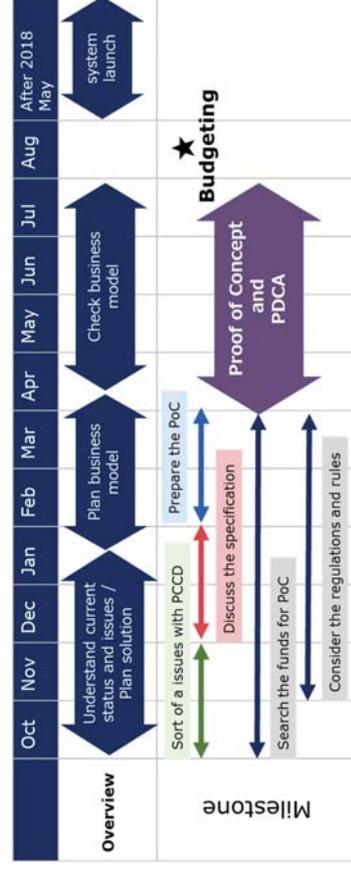
## Overview of solution

We would like to proceed this PJ working with PCCD, Kawasaki city, NEC, ISGM to solve the critical issues of Medical waste in Yangon.



## Schedule plan

Plan and check solutions and business model to Budget of next Fiscal year. Please select the person in charge for each items.



## Agenda 1.3 (PCCD)

- ❑ Medical Waste Treatment

# Medical Waste Management

## Medical Waste Collection Proposal

iSGM (ICT Star Group Myanmar Co., LTD.)

Date : 10-Jan-2018  
Mr.San Lin Naing  
+95-9262748561

## Summary of last meeting with PCCD

■ Followings are what we've discussed on last meeting.

- ❑ Urgent Issues
  - **Medical Waste**
  - Hazardous Waste
  - Tire Waste
- ❑ Target Solution
  - **Barcode Waste Collection System**

## 6 Required for PCCD

Elements	Methods	Require
Traceability	 <b>Manifesto</b> Trace from collection to disposal	***Implement Barcode System ***
Safety	 <b>Un-openable special box</b>	***Implement with local industries***
Responsibility	 <b>Hospital or Clinic</b>	***Collaboration with Ministry of health***
Collection	 <b>Licensed Transporter</b>	PPCD itself is licensed transporter
Disposal	 <b>900°C Rolling Vertical furnace</b>	PCCD itself planning for this
Penalty	 <b>Maximum Penalty 5 years or \$50M or Both</b>	*** PCCD rules implementation***

**Priority**

## Analysis in Current System

The current waste collection system has many inefficiencies:

- ❖ Time consuming. Trucks go and empty containers whether they are full or not.
- ❖ High costs.
- ❖ Greater traffic flow and congestion.
- ❖ Unnecessary fuel consumption.
- ❖ Increased noise and air pollution as a result of more trucks on the road.

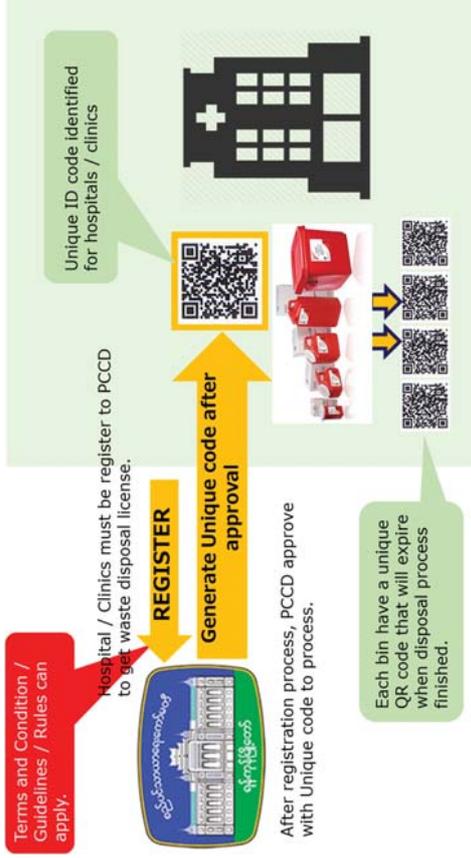
## Solution

- ❖ Promoting and ensuring the effective delivery of waste services
- ❖ Treating and safely disposing of waste
- ❖ Effective compliance with and enforcement of waste regulations
- ❖ Effective monitoring and reporting on performance with waste function
- ❖ Ensure that people are aware of the impact of waste on their health, well-being and the environment
- ❖ Achieving integrated waste management planning
- ❖ Systematic Monitoring

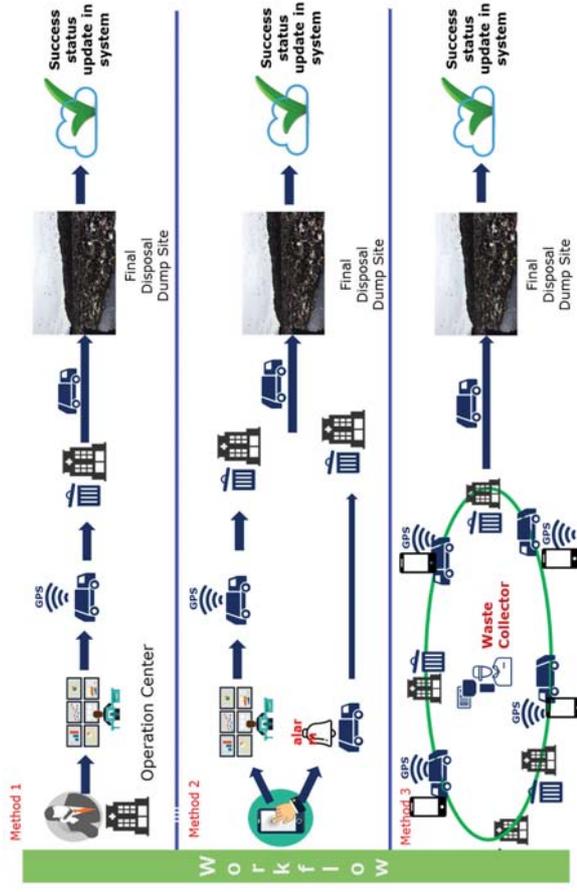
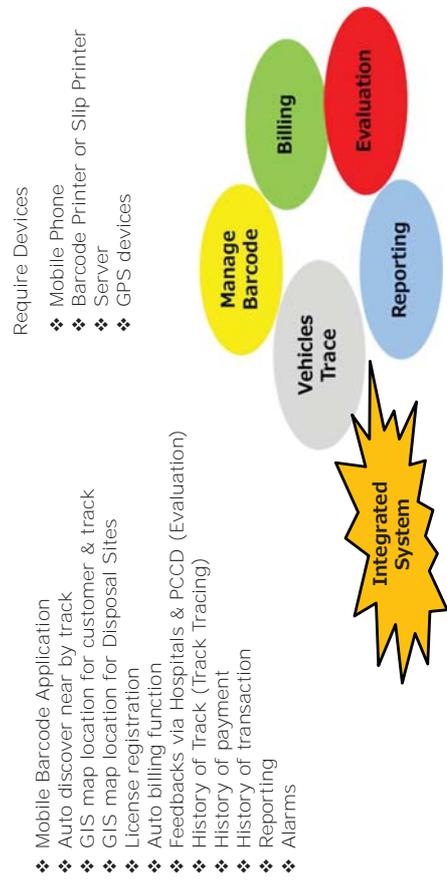
## Reason for failure

- ❖ Lack of awareness about the health hazards
- ❖ Not enough training in proper waste management
- ❖ Absence of waste management and disposal systems
- ❖ Insufficient financial and human resources
- ❖ Lack of appropriate regulations

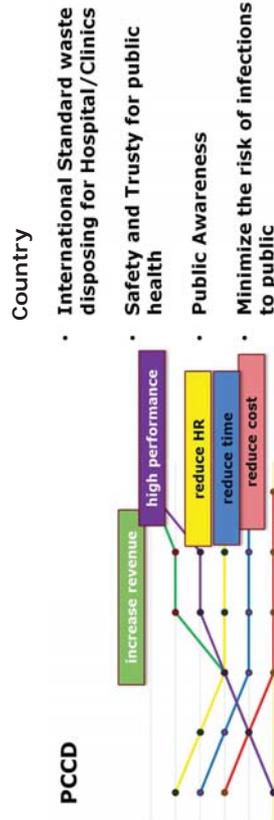
## Hospital or Clinic and PCCD Collaboration with System



## Barcode System Features

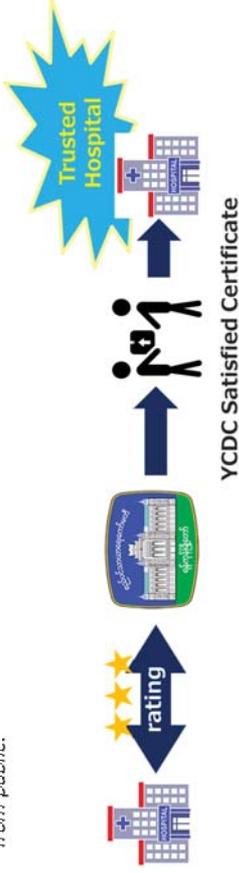


## How the system can help PCCD?



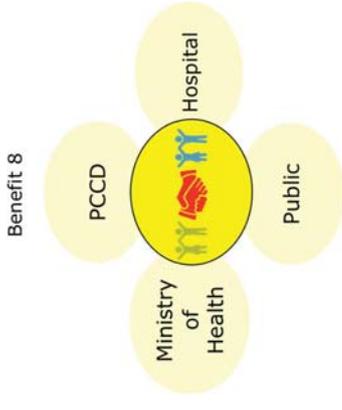
## YCDC certification to Hosoiitals

- ❖ The system include rating features.
- ❖ YCDC can give rates to hospitals if and only if hospitals can give rates to YCDC's services using system.
- ❖ YCDC can give certificates to hospitals that followed their rules in medical waste disposal according to their rates as **YCDC Certified Hospital**.
- ❖ Hospitals that received certificate from YCDC can get **Waste Care Environmental Trust** from public.

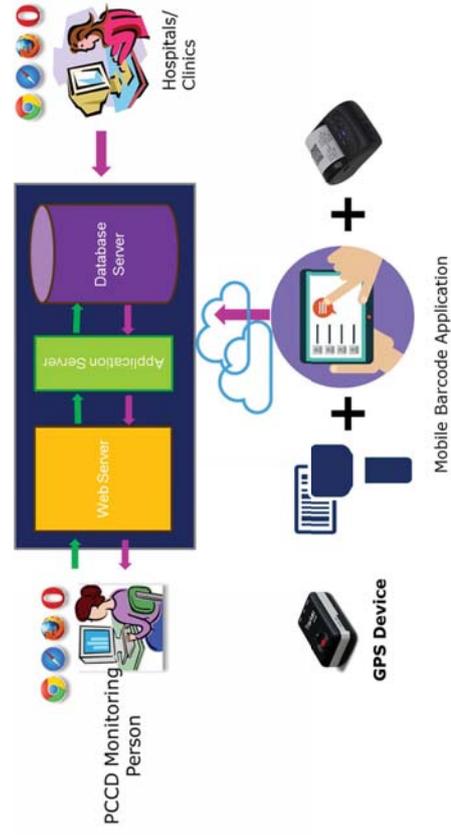


## System Advantages

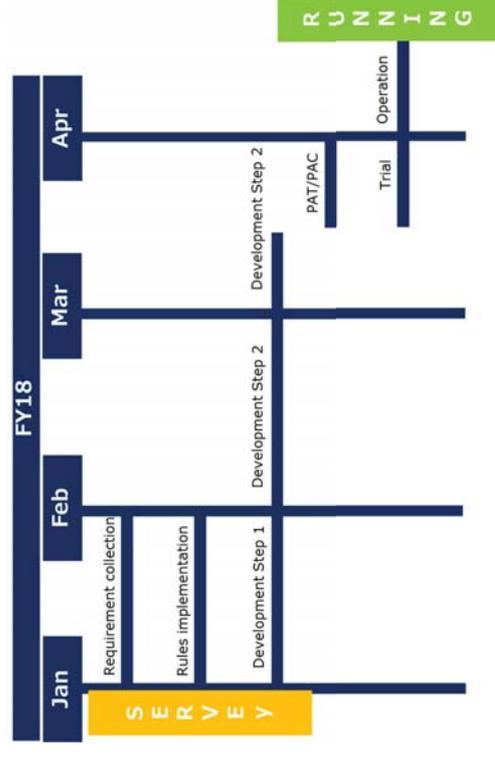
- Benefit 1 **Waste Transportation Cost Reduction**
- Benefit 2 **Labors Cost Reduction**
- Benefit 3 **Fuels Cost Reduction**
- Benefit 4 **Revenue from collection service from hospital/clinics**
- Benefit 5 **Safety & Environmental benefits**
- Benefit 6 **Easy to manage Hospitals/Clinics**
- Benefit 7 **Systematic traceable and less error**



## System Architecture



## Schedule Plan



## Ref : Health Care Waste Sources

- ❖ hospitals and other health facilities
- ❖ laboratories and research centers
- ❖ mortuary and autopsy centers
- ❖ animal research and testing laboratories
- ❖ blood banks and collection services
- ❖ nursing homes for the elderly

## Items to clarify

We would like to clarify the following about the medical waste :

- The Current Operation status of Medical waste.
- Medical Waste Collection Methods & Charges.
- Current Rules and Regulations for Medical waste.
- Coverage Hospitals or clinics level.
- Penalty.
- Current Management Flow.
- Medical waste disposing standard.
- Target Plan to implement Barcode System.

Health care waste sources	How many in YGN?
hospitals and other health facilities	?
laboratories and research centers	?
mortuary and autopsy centers	?
animal research and testing laboratories	?
blood banks and collection services	?
nursing homes for the elderly	?

## 3.2 Proposal to MAEX



## Agenda 2.1 (MAEX)

### □ Proposal to MAEX

## Conditions of estimation 1

Organic waste would be gathered and input to ERS in order to reduce and produces after certain bio treatment then generate electricity to be used for internal consumption.

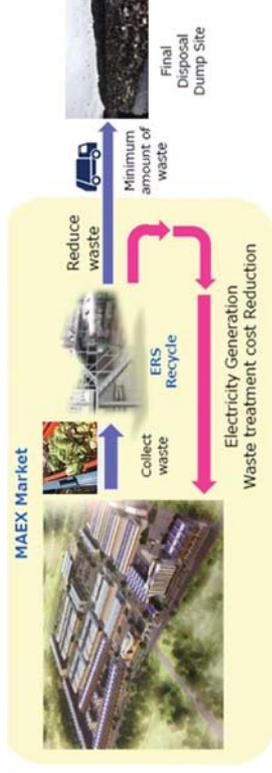
### Application

- Electricity generation used for own property.
- Current electricity supply for MAEX property: diesel generator by MAEX
- Waste composition : mostly vegetables such as cabbage.
- Currency rate: 1 US\$ = Kyat 1359.25

### Note

The O&M cost was calculated based on the past experience of the ERS vendor. It might be changed depending on operation conditions in Yangon. Especially, the vendor maintenance service cost should be changed depending on SLA and maintenance service.

## Cost & Benefit simulation



	Heavy Oil	Electricity	Water	Labor	Vendor Maintenance	Waste treatment cost reduction	Diesel Generation Cost reduction	Electricity selling fee	Initial cost (ERS exclude construction)	Total
<b>O&amp;M Cost /year</b>	30,598	0	74,723	57,143	756,230	468,986	1,203,874	0		918,865
<b>Benefit / year</b>										1,672,861

## ICT function

By using IC card authentication system, MAEX is able to measure volume of the waste in each tenant. In addition, the IC card could be connected to other applications like gate control.

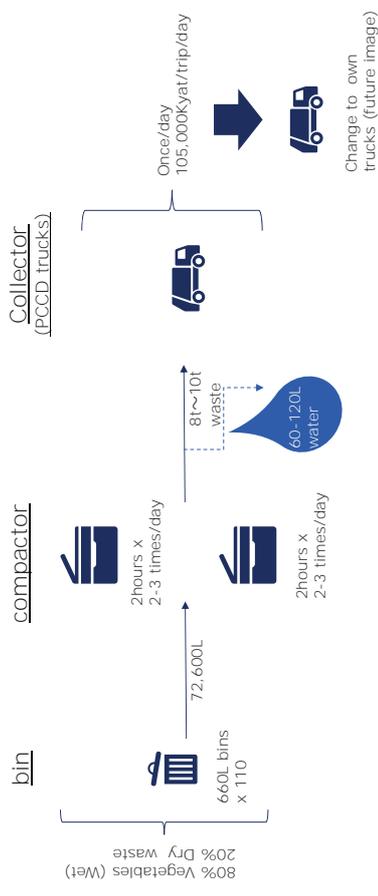


## Agenda 2.2 (MAEX)

- Information from Dagon International Limited

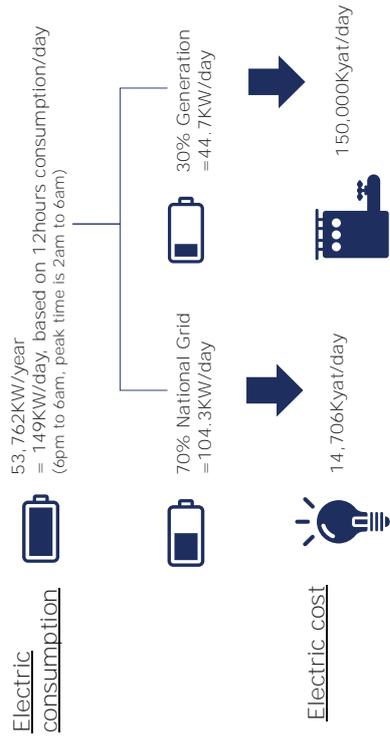
## MAEX waste management

Based on the information from MAEX on 27<sup>th</sup> Jan.



## MAEX Energy

Based on the information from MAEX on 29<sup>th</sup> Jan



### 3.3 Proposal to Food Processing Company

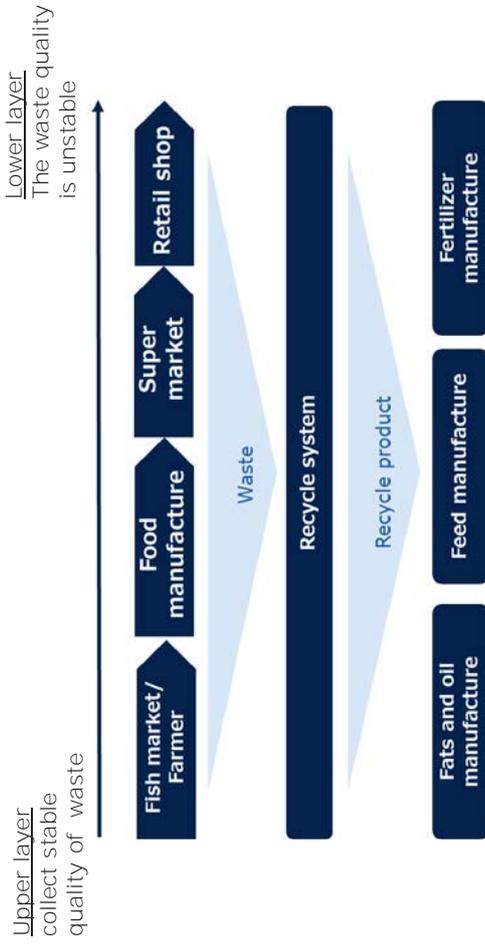


## Agenda 3.1 (Fish Processing Company)

- Change the waste to the new revenue
- Introduction to NEC Smart Waste Recycle

## How to make new revenue from waste in Japan

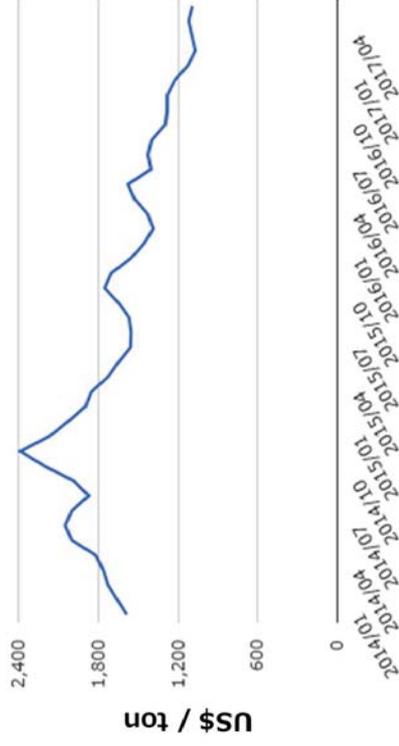
New business of selling recycle product from the waste generated by each process



## Change the waste to the new revenue

## EX.) The price of the fish meal (2014.Jan-2017.Jun)

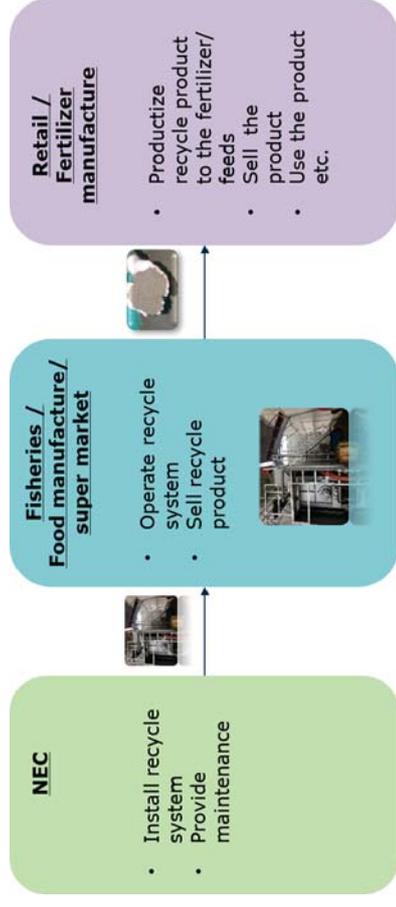
The fish meal is in well demands as a high quality fertilizer even the market size will be reduced from 2014.



Ref : World Economic Reference Note (Japanese)  
[http://ecodb.net/exec/trans\\_image.php?type=PCP&d=PFI&USD&ym=M&scr=](http://ecodb.net/exec/trans_image.php?type=PCP&d=PFI&USD&ym=M&scr=)

## Business model image

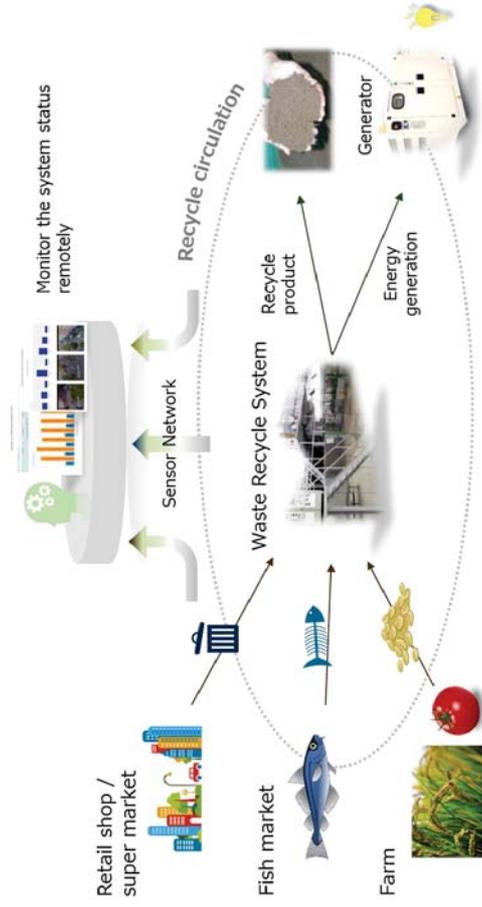
The recycle system can make new revenue as fertilizer, feed and energy from the waste.



# Introduction to NEC Smart Waste Recycle solution

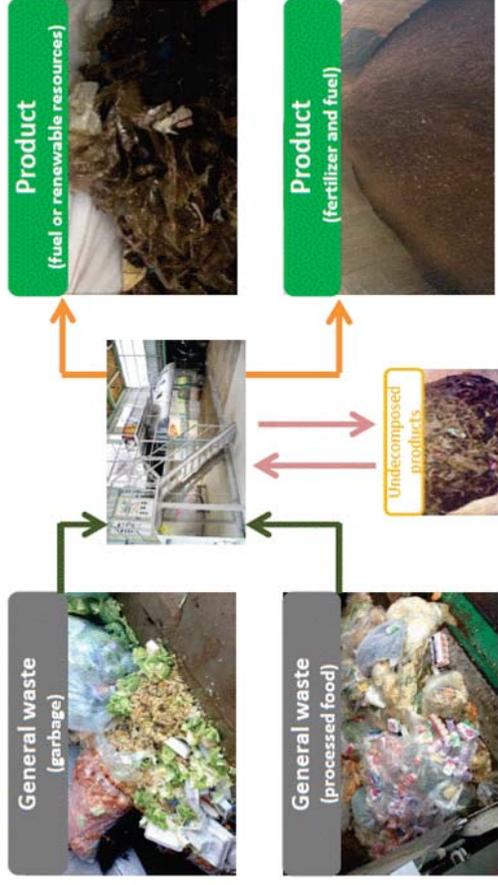
## Smart Waste Recycle High Speed Indigenous Microbes Fermentation System

The system with specific microbes which are collected from the local soil and cultivated by the unique technology, conduct high speed fermentation and drying process of organic wastes and produce feed, fertilizer and fuel.



## Application and potential industry : General waste

- Waste can be thrown altogether.
- The output can be easily segregated from plastics and organic product easily. No pre-segregation process required.
- Undecomposed product is processed by the ERS again



## Application and potential industry : Food processing waste

- Raw fish can be thrown as it is.
- After fermented and dried, the output is odorless fertilizer/feeds.
- High protein fishmeal is produced and small bones residue can be segregated.



### Output component sample

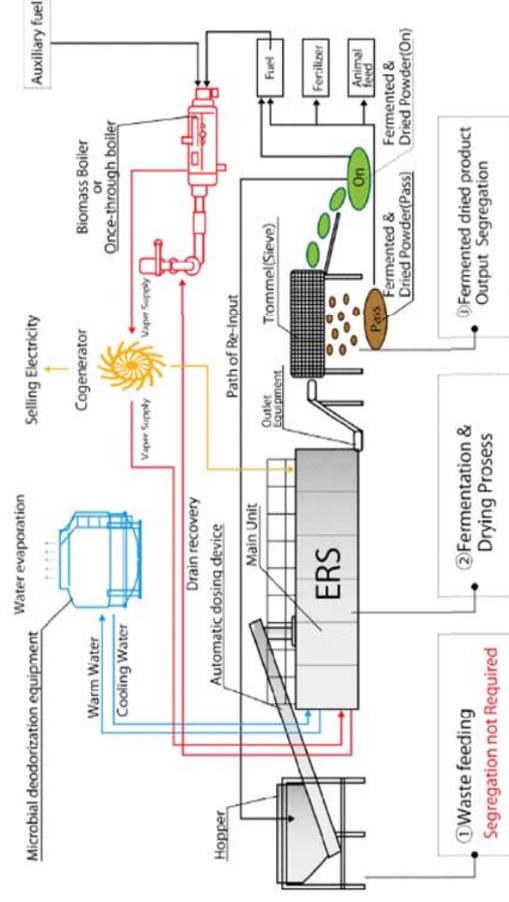
- Crude protein 65.6%
- Crude ash 19.3%

\*The number is a sample of the prior case and it is not guarantee the performance of the system

After segregation using mesh screen  
(high calcium bones and high protein feeds)

## System overview

### System process from waste to feed, fertilizer and energy



## The feature of the recycle system

### User and environment friendly system

- Do not need **separate the waste in advance**. Throw the all waste into the system. (\*1)
- Do not need **complex operation**.
- Do not need **waste water treatment**.
- Do not need to worry about **terrible smell**.
- Do not need to **wait the output long time**. Only 120 minutes.

\*1: The recycle system can ferment only organic waste. Non-organic waste will be discharged as it is.

## Comparing with other system

### Our recycle system is friendly to the environment and economy

"A" company : Fish meal recycle system	Our company's
<ul style="list-style-type: none"> <li>It discharges huge <b>drainage water and treatment machine is needed</b></li> </ul>	<ul style="list-style-type: none"> <li>No drainage water and it <b>doesn't need treatment machine</b></li> </ul>
<ul style="list-style-type: none"> <li>Each equipment are opened and the have a bad smell. High quality <b>deodorizing machine and sealed building is needed</b></li> </ul>	<ul style="list-style-type: none"> <li>No smell, it <b>doesn't need deodorant machine and sealed building</b></li> </ul>
<ul style="list-style-type: none"> <li>The amount of the fish meal is <b>decreased</b> by the increasing of the press water by liquidizing of the un-fresh fish and inner parts by the self digestive.</li> </ul>	<ul style="list-style-type: none"> <li>No press water and <b>yield rate of the fish meal is high</b>.</li> <li>The <b>quality of the product is high</b> because of the low temperature drying.</li> </ul>



## 3.4 Others



## Agenda 4.1 (ICT)

### ICT Function

## ICT functions

- Visualization
  - a. Volume of input waste
  - b. Fuel (Heavy oil) consumption of Waste Recycle System
  - c. Electricity consumption of Waste Recycle System
  - d. Volume of output of Waste Recycle System
  - e. Fuel (fertilizers) consumption of boilers for Generator
  - f. Electricity energy generation
  - g. Electricity consumption of MAEX facility
  - h. CO2 Reduction
- Remote Maintenance
  - System Status
  - Alarm Monitoring

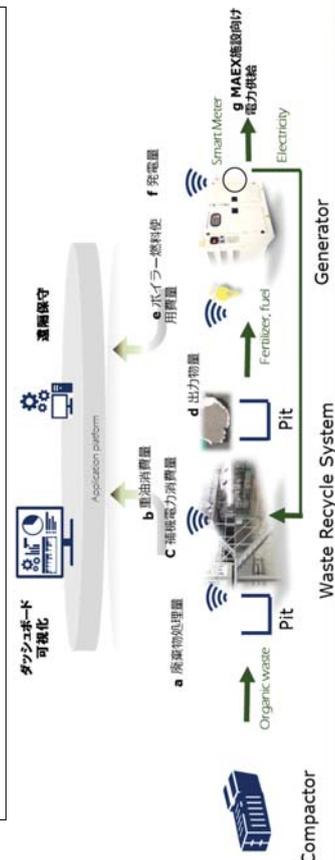


## Visualization details

	Visualization on dashboard	Data collection
a	Volume of input organic waste (kg)	Weight sensors of waste pit
b	Fuel (Heavy oil) consumption of Waste Recycle System (l)	Fuel consumption meter of Waste Recycle System
c	Electricity consumption of Waste Recycle System (kWh)	Smart meter of Waste Recycle System
d	Volume of output from Waste Recycle System (kg)	Weight sensors of output pit
e	Fuel (fertilizer) consumption of boilers for Generator (kg)	Smart meter of boilers
f	Electricity Generation (kWh)	Smart meter of generators
g	Electricity consumption for MAEX facility (kWh)	Calculation: f - c
h	CO2 reduction	Calculation: {CO2 generated by Diesel Generator (f) which is substituted by the system} - {CO2 generated by Fuel Consumption of the system (b)}

## ICT 機能

- 可視化
  - a. 廃棄物処理量
  - b. Waste Recycle System 重油使用量
  - c. Waste Recycle System 補機電力消費量
  - d. Waste Recycle System 出力物量
  - e. 発電機ボイラー燃料消費量
  - f. 発電量
  - g. MAEX施設向け電力供給量
  - h. CO2削減量
- 遠隔保守
  - システム状態管理
  - アラーム監視



## Visualization details

	Visualization on dashboard	Data collection
a	廃棄物処理量 (kg)	ピット重量センサー
b	システム重油消費量 (L)	システムスマートメーター
c	システム補機電力消費量 (kWh)	システムスマートメーター
d	システム出力物量 (kg)	ピット重量センサー
e	発電機ボイラー燃料消費量 (kg)	ボイラースマートメーター
f	発電量 (kWh)	発電機スマートメーター
g	MAEX施設向け電力供給量 (kWh)	計算: f - c
h	CO2 削減量	計算: (ディーゼル発電削減量 (= f)換算CO2削減量) - (システム重油消費量換算CO2発生量)

