Feasibility Studies on Joint Crediting Mechanism Projects towards Environmentally Sustainable Cities in Asia

FY2013

"Supporting low-carbon Yangon city through Joint Crediting Mechanism (JCM) project formulation"

Commission Report

March, 2014

Institute for Global Environmental Strategies

Table of Contents

1. Introduction

In fiscal year 2013 (April-2013 to March 2014), Institute for Global Environmental Strategies (IGES) implemented “Supporting low-carbon Yangon city through Joint Crediting Mechanism (JCM) project formulation” project funded by Ministry of the Environment of Japan. This report summarizes the output of this project.

The project aimed to contribute to sustainable development of the city of Yangon through Joint Crediting Mechanisms (JCM) project formulation and mass diffusion of relevant technologies. The project was implemented in strong partnership with Japanese private firms and local governments. The partnership was important because private firms possess technologies capability to implement JCM projects, and local governments possess experience and know-how on environmental management in urban context.

The project consisted of three major components.

Supporting low-carbon waste management of Yangon

In Yangon, waste management was identified as an area where 1) the host country demand is present, 2) greenhouse gas emission can be abated, and 3) there is interest from Japanese firms. The project contributed to the capacity development of the Yangon City Development Committee (YCDC) through organization of an international workshop in Yangon and a study tour in Japan on waste management.

Research on the potential of off-grid renewable energy in Myanmar

A research on application of off-grid renewable energy sources in Myanmar was conducted in partnership with The Energy and Resources Institute (TERI) of India. A range of renewable energy sources, including solar, wind, biomass and hydropower were analysed, as well as their possible delivery models in off-grid environment.

Organising working group of low-carbon Myanmar

In order to accelerate JCM project formation in Myanmar, “Low-carbon Myanmar Working Group” has been organized with participation from local governments, private firms and other related institutions. The WG meetings were organized three times in Tokyo. In addition, some members of the WG participated in the 3rd Myanmar Green Economy Green Growth Forum.

2. Supporting low-carbon waste management of Yangon

2.1 Current status on waste management in Yangon

Yangon is the most densely populated city in Myanmar and it covers 759km^2 land area. Yangon is the former capital of Myanmar and remains as the most important centre of commerce, politics and culture. As of December 2012, total population in Yangon City Development Committee (YCDC) is about 4.72 million. There are 33 townships in Yangon region and divided into four districts – North, South, East and West.

Waste management in YCDC is a responsibility of Pollution Control and Cleansing Department (PCCD). They are responsible for both daily management and pollution control. Waste collection, transportation and the disposal at the final disposal sites are the major daily management activities. Total waste generation in YCDC is amounted to 1,650 tonnes/day, and 92% of generated waste is being collected. YCDC assumes that the uncollected 140 tonnes of waste go to the recycling fraction and illegal dumping. According to the composition, more than 75% of weight is organic

There are various waste collection approaches such as bell ringing, collection at street dump yards, hand carts etc. In YCDC, waste is separated into two major groups; wet and dry. However, all the separated waste are transported together and disposed at the open dump sites. Waste collection fee is charged from the households and commercial centers, etc. and the service fees vary depending upon the distance from the city center. For instance, monthly fee for waste collection from old suburbs, sub-urban and central business district are 300kyat, 450kyat and 600 kyat per month per household respectively. As far as waste transportation is concerned, there are different types of vehicles such as compactor trucks, tipper trucks are used in the waste collection, and these vehicles are being used more years than the designed lifetime. Total numbers of workers employed in waste collection and transportation system in YCDC is 884.

Open dumping is the major disposal method in YCDC and the collected waste is transported and disposed at 6 dumpsites which are located in different townships. The collected and transported waste is disposed at the nearest dumpsite. There are 6 dumpsites are used for final disposal, and the specification of those dumpsites are presented in the table below. According to the composition, organic fraction is amounted to more 75% of the mass followed by plastic (10%), others (10%) and paper and textile (0.1%). All the dumpsites are causing a huge damage to environment as generated methane and other toxic gases are directly emitted into the atmosphere, and the highly polluted leachate contaminates surface and ground water table.

Table 1: Specifications of the dumpsites in YCDC

No	Location of final disposal site	Disposal capacity (tonnes/day)	Remark
1	HtainBin	847	Depth 15m
2	Htwei Chaung	612	Depth 15m
3	Dala	10	Depth 9m
4	Seikkyi Khanaung To	5	Depth 9m
5	Mingalardon	25	Depth 9m
6	Shwe Pyi Thar	50	Depth 9m
	Total amount of disposal waste	1550	

Besides, a small amount of daily generated waste is recycled, which is amounted to 86 tonnes/day. Valuable recyclables are stored at household level and sold to the nearby junkshops. However, there are no big junk shops in the townships to collect the recyclables from small junkshops and transport to the appropriate recycling centers which have caused the inefficiencies of recycling system. YCDC is running a small-scale plastic recycling plant and green and blue plastics bag is produced using the waste plastic.

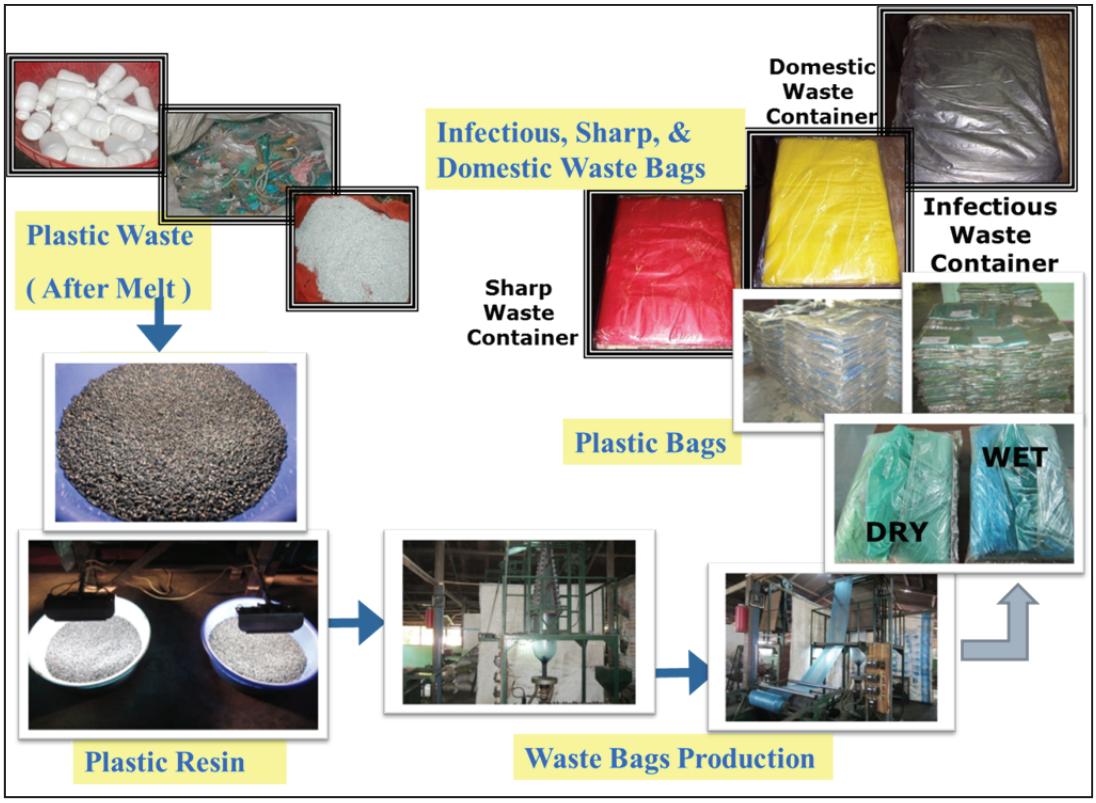


Figure 1: Plastic recycling process at the recycling plant in YCDC

Greenhouse gas (GHG) emissions from the existing waste management in Yangon

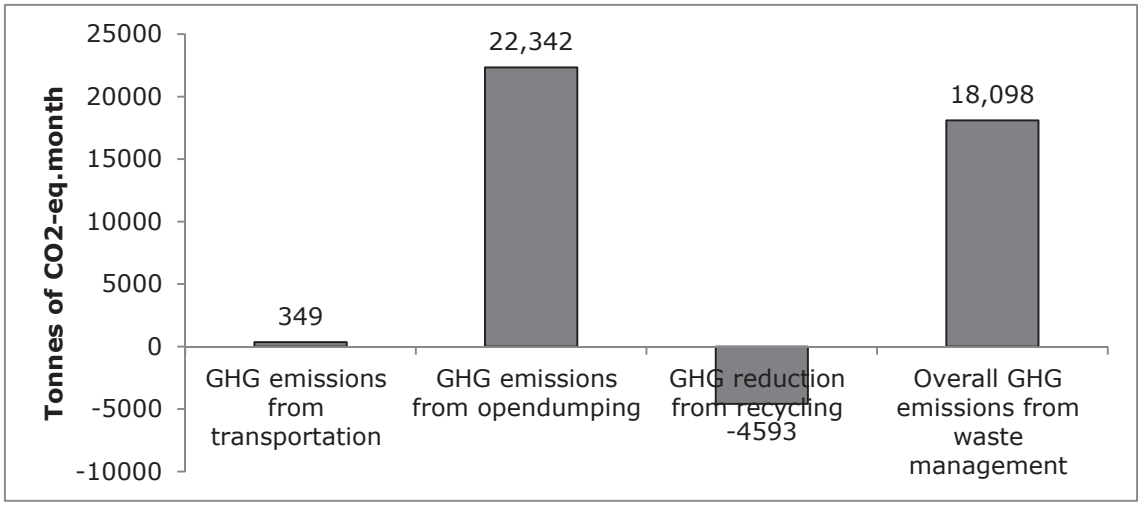
Current waste management activities in Yangon have a significant climate impact as well as other environmental impacts. Therefore, quantification of climate impact from current waste management system is very important for planning and designing the future waste management.

There are two ways that the current waste management system can contribute for climate impacts. One is utilization of fossil fuel for waste collection and transportation. YCDC uses 128,704 L diesel and 900 L of gasoline for waste transportation. GHG emissions from fuel burning for transportation, it is amounted 349 tonnes of CO_2-eq.

The major climate impact is caused due to degradation of waste in open dump sites under anaerobic condition which create methane. By using IGES GHG calculation tool methane emission potential is estimated. It is amounted to 22.8 kg of CH_4 for each tonne of disposal waste. As the climate impact of methane is 25 times higher than CO_2, overall climate impact from each tonne of waste disposal would be 480 kg CO_2 eq. Based on values, total monthly carbon emission from current open dumping in Yangon would be 22,342 tonnes of CO_2-eq.

Material recovery from current recycling activities in Yangon contributes to GHG mitigation. Monthly total GHG reduction from recycling activities in Yangon is 4593 tonnes of CO_2-eq. All in all, total climate impact from the waste management system in Yangon amounts to 18,000 tonnes of CO_2-eq per month, see Figure 2.

Figure 2: GHG emission from waste sector in Yangon



Intended plan of waste management in Yangon city

PCCD is planning to move towards waste-to-energy technologies as a solution to existing poor waste management. Landfill gas-to-energy recovery system will be implemented to replace the HtainBin site, which is the biggest open dumpsite. To replace the other dumpsites, incineration plants will be installed (one big incineration plant with electricity recovery to replace Htwei Chaung site and four small incinerators to replace other small 4 dumpsites). As the initial step, four small incinerators will be implemented by 2015 and electricity production from these incineration plants is very unlikely due to its small capacity. Revenue generation via service fee from households and by selling electricity from incineration plant would not be sufficient to cover the operational costs. Therefore, YCDC is expecting 80% of operation costs from the central government budget in order to run intended waste-to-energy plants.

2.2 Policy recommendations for sustainable waste management in Yangon

YCDC is in the process of development of improved waste management system. Careful planning is very important in this stage for designing of sustainable waste management options that are suitable for local conditions in Myanmar in order to avoid the failure that may happen after the implementation.

Waste-to-energy technologies have been selected as the most preferable options for the waste management in Yangon. For instance, landfill gas to energy recovery (to replace the biggest open dumpsite) and incineration (one big incineration plant with electricity recovery and four small incineration plants without electricity recovery) are chosen as the treatment options for Yangon waste management. However, still there is no clear understanding on how to deal with financial matters such as setting a suitable tipping fee in Myanmar context, dealing with operation and maintenance costs, etc. Further discussion is required between the stakeholders to find appropriate solutions to these issues. In order to develop a successful project, PCCD should pay attention on issues listed below and need to take necessary actions in order to avoid the problems during the functioning phase.

- How to manage a constant waste flow input to the incineration plants?
- How to improve the efficiencies of proposed waste-to energy technologies to extract the maximum amount of energy from waste?
- How to reduce fossil fuel input in proposed waste-to-energy technologies?

- How to deal with the high operational cost of incineration technology? What are the possibilities for applying JCM?

Composition and the moisture content of the waste can greatly affect the efficiency of the incineration plant. Therefore, operating companies should focus on possible pre-treatment methods to reduce the moisture content waste prior to combustion.

In addition, improving the efficiency of the landfill gas recovery is the key to mitigate GHG and also to enhance the financial benefits of the project. Therefore, the operating companies should find possibilities to start gas recovery soon while waste tipping continues, and extending the duration of the gas recovery project to cover the peak production period of methane

Despite all the waste-to-energy technologies, development of a proper recycling scheme in Yangon would contribute to significant environmental, economic and social benefits. Therefore, development of proper recycling scheme, including collection points, processing plants and treatment plants is necessary for improved waste management in Yangon.

Waste management in Yangon has been improving gradually. With recent involvements with different stakeholders, YCDC officials have a much better understanding of the real issues with respect to the current waste management. However, still much focus has been given to implementation of final treatment facilities and less attention given to initiation of effective waste collection and transportation system, implementation of a formal recycling scheme, etc. In order to develop a sustainable waste management, equal attention should be given to all the phases of waste management.

Furthermore, adequate training and capacity-building programs are necessary for the officials on data recording and maintaining the records. Such information is very useful to measure the overall progress of waste management towards sustainability. Also, opportunities should be created to bring all the stakeholders who are involved in the intended waste management in Yangon to discuss the common issues and prospects (e.g. political support, technology needs, financial barriers, cooperation among the stakeholders)

For long term sustainability, development of appropriate integrated systems, designed for maximum resource recovery would be the key driving force towards greenhouse gas mitigation as well as for getting maximum economic and social benefits from waste management in Yangon.

2.3 International workshop on sustainable waste management in Yangon

Date: 20 December 2013, 12:00-17:00
Venue: Yangon City Hall
Participants: Mayor of Yangon, Directors of YCDC, Yangon Regional Government, Ministry of Environmental Conservation and Forestry, CESVI, JFE Engineering, City of Tokyo

Agenda

12:00-12:30	**Registration**
12:30-13:00	**Opening** -U Hla Myint, Mayor of Yangon -Kenta Usui, Climate and Energy area, Institute for Global Environmental Strategies **Photo session**
13:00-13:15	**Tea break**
13:15-14:00 (45mins)	**Part 1: Introduction to Myanmar's waste policies** Chair: YCDC - Yangon's waste management policies, Than Lwin Oo, Head of Department, Pollution Control and Cleansing Department, YCDC - Myanmar's pathway for national waste management policies, MOECAF Q&A
14:00-15:00 (60mins)	**Part 2: Towards low-carbon waste management: an opportunity of integrated waste management system:** Chair: Kenta Usui, IGES - The potential of integrated municipal solid waste management to reduce climate impacts of low-carbon management, Nirmala Menikpura, IGES - Feasibility of incineration technologies, and setting the right tipping fee – Gen Takahashi, JFE Engineering. - Mechanisms to engage local communities for waste management, Takanobu Iwasaki, Tokyo Metropolitan Government Q&A
15:00-16:00 (60 mins)	**Part 3: Understanding the full picture of international cooperation** Chair: Kenta Usui, IGES (5-10 mins each, max 2 slides) - Japanese Joint Crediting Mechanism, Kenta Usui, IGES - Yangon-Tokyo Cooperation on Waste Management, Takanobu Iwasaki, Tokyo Metropolitan Government - GIZ's initiative - CESVI's assistance on Yangon's waste management, Gaetano Romano, CESVI Q&A

16:00-16:45 (45mins)	**Discussion: the way forward for Myanmar** Co-chaired by Nirmala Menikpura, IGES and YCDC <u>Panelists (5 mins each):</u> - Takanobu Iwasaki, Tokyo Metropolitan Government - Gen Takahashi, JFE Engineering - MOECAF - YCDC <u>List of possible questions:</u> - How to promote efficient waste collection - How to make waste management financially sustainable - How to promote low carbon waste management in Yangon with international cooperation - How to effectively coordinate increasing international support - How to engage communities to work on waste management
16:45 – 17:00 (15min)	**Closing Remark** Than Lwin Oo, Head of Department, Pollution Control and Cleansing Department, YCDC

International workshop on sustainable waste management in Yangon was held at City Hall, Yangon on 20 December 2013. The summary of the workshop is as follows:

More than 50 people participated in this workshop representing different government organizations, privet sectors, NGOs etc. The mayor of the YCDC, Secretary, Joint-Secretory, Committee members, Head of twenty departments of YCDC, Deputy Heads of departments, Assistant heads of departments, and Sub-division officers participated from YCDC. In addition, YCDC has invited Assistant director of MOECAF, a member from Mandalay City Development Committee, a member from Naypyitaw Development Committee, a member from Environmental Conservation Sub-Committee Yangon Regional Government, and members from CESVI. Further experts from Tokyo Metropolitan Government, JFE engineering also joined this workshop.

The mayor of the Yangon and Mr. Kenta Usui from IGES, delivered the welcome remarks on behalf of two organizers of the workshop.

The first session of the workshop was to cover the Myanmar's waste management policies. Than Lwin Oo, the Head of Department of YCDC presented the overview of the waste management in Yangon such as the current situation of waste management, budget constraints and other limitations in waste management. Then assistant director of MOECAF, Mr. U Hla Maung Thein presented Myanmar's pathway for national waste management policies. The assistant director highlighted the need of specific rules, regulations and guidelines, national waste management strategies, monitoring

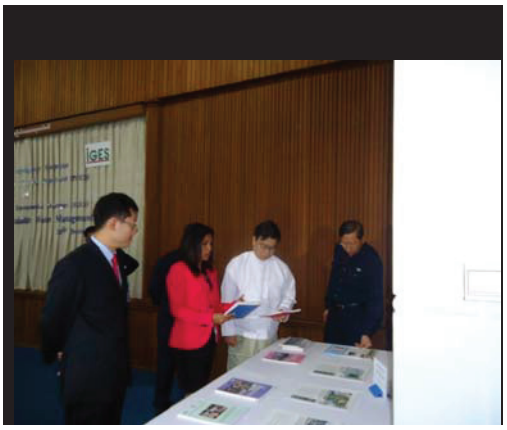
system, technology requirement, coordination mechanism, institutional strengthening, and financial mechanism for developing sustainable waste management system in Myanmar.

The next session of the workshop was on “Towards low-carbon waste management: an opportunity of integrated waste management system”. Dr. Nirmala Menikpura, IGES, presented the importance of an integrated waste management for GHG mitigations showing practical examples from other countries, such as Thailand. Mr. Gen Takahashi from JFE Engineering spoke about the feasibility of incineration technologies, and setting the right tipping fee since it would be a key issue on setting new incineration plants in Yangon to replace the existing open dumping. Then Mr. Takanobu Iwasaki from Tokyo Metropolitan Government presented the Mechanisms to engage local communities for waste management by showing historical experience in the context of Japan.

Third session of the workshop focused on “Understanding the full picture of international cooperation”. In this session, Mr. Kenta Usui from IGES presented the concept of Japanese Joint Crediting Mechanism. Mr. Takanobu Iwasaki from Tokyo Metropolitan Government spoke about the Yangon -Tokyo Cooperation on Waste Management, and the shared experiences, and joint work between two organizations. Then assistant head of YCDC presented GIZ’s initiative on waste management in Yangon on behalf of GIZ.

The last session was the panel discussion, and this session was to hear the opinion from experts on “the way forward for Myanmar," specially focusing future waste management in Yangon. In this session, a distinguished panel of experts (Mr. Takanobu Iwasaki from Tokyo Metropolitan Government, Mr. Gen Tahakashi from JFE engineering, Mr. U Hla Maung Thein from MOECAF, Mr. Gaetano Romano from CESVI, Mr. Kin win from YCDC) discussed some key issues related to sustainable waste management in Yangon. The speakers expressed their opinions and suggestions related to how to promote an efficient waste collection system, how to make waste management financially sustainable, how to promote low carbon waste management in Yangon with international cooperation and how to effectively coordinate increasing international support, and how to engage communities to work on waste management. Many speakers agreed that international cooperation is very important and public-private partnership is essential for sustainable waste management. Collaboration at national level and international level is another important issue. Life cycle management is lacking, and it should be considered for enhancing sustainable waste management.

Invited people for the workshop



Introducing IGES's publication to the Mayor

Presentation at the workshop

2.4 Capacity building for Yangon on waste management

Two staff from YCDC Pollution Control and Cleansing Department were invited to Japan to undergo at study tour on waste management practices.

Participants from YCDC:

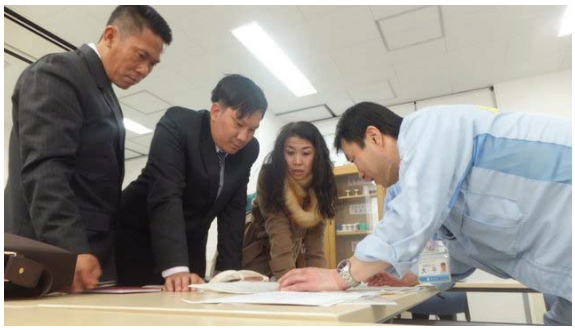
(1) U Ko Ko Kyaw Swar, Divisional Head of Pollution Control and Cleansing Department

(2) U Khin Ohn Thein, Sectional Head of Pollution Control and Cleansing Department

Programme:

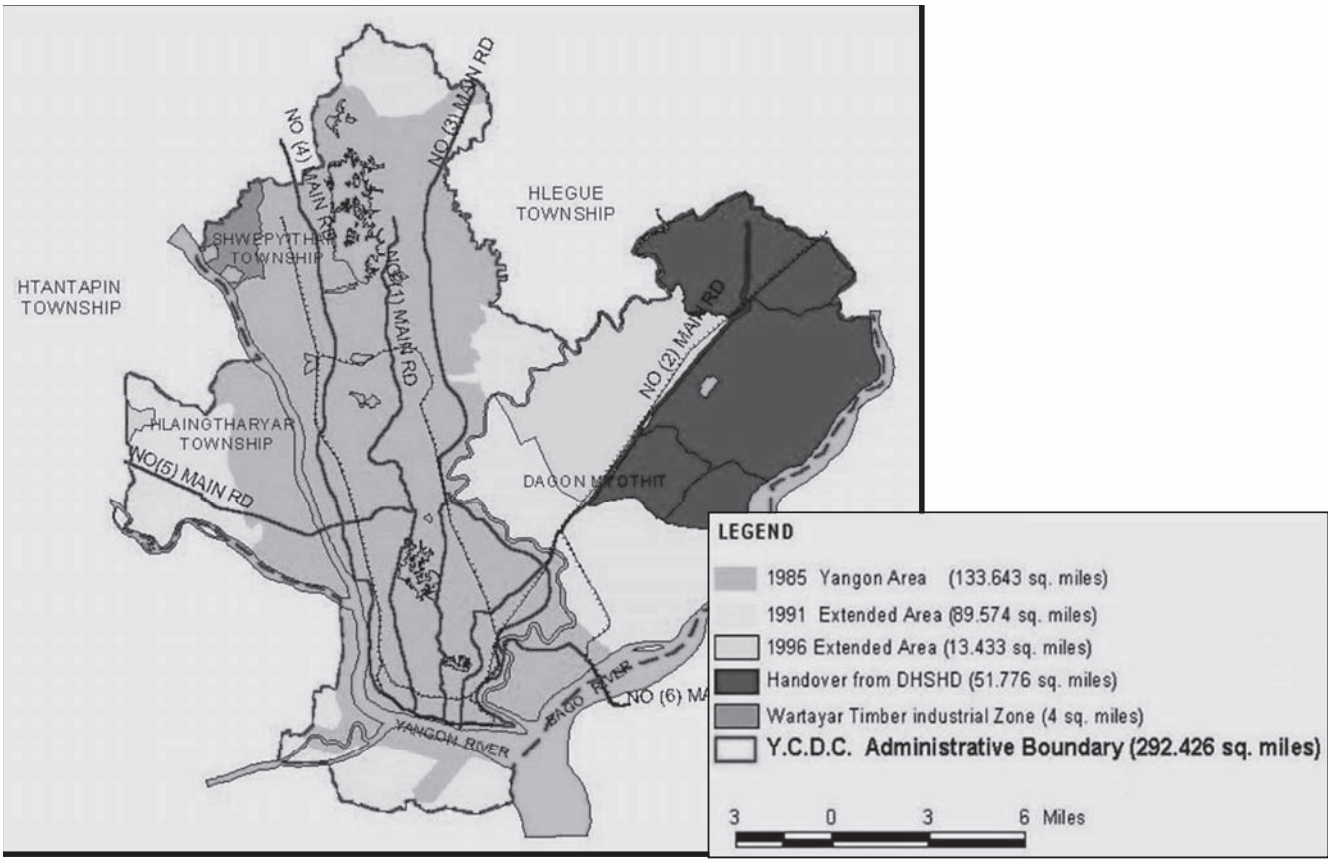
Date	Activities
24 February	Arrival in Tokyo
25	- Meeting with MOEJ - Participation to the 3rd working group meeting on low-carbon Myanmar
26	Study tour in Nerima-ku, Tokyo - Visiting waste collection sites - Lecture of Nerima's work on waste management - Visiting Resource Recovery Center and Incineration Plant of Nerima
27	Study tour in Kawasaki-shi - PET Refine Technology (recycling) - Kureha Ecology Management (Hazardous waste treatment)
28	In-house seminar at IGES
29	- Departing Tokyo

Photos during the study tour




Current Situation
of
Solid Waste Management
in
Yangon City
1


YANGON CITY DEVELOPMENT COMMITTEE
2



The administrative boundary of YCDC,in 1985 (133.643 Sq-Miles) and now a day (292.426) Square Miles.

3

Organizational Chart of YCDC

Mayor

↓

Secretary

↓

Joint-Secretary

↓

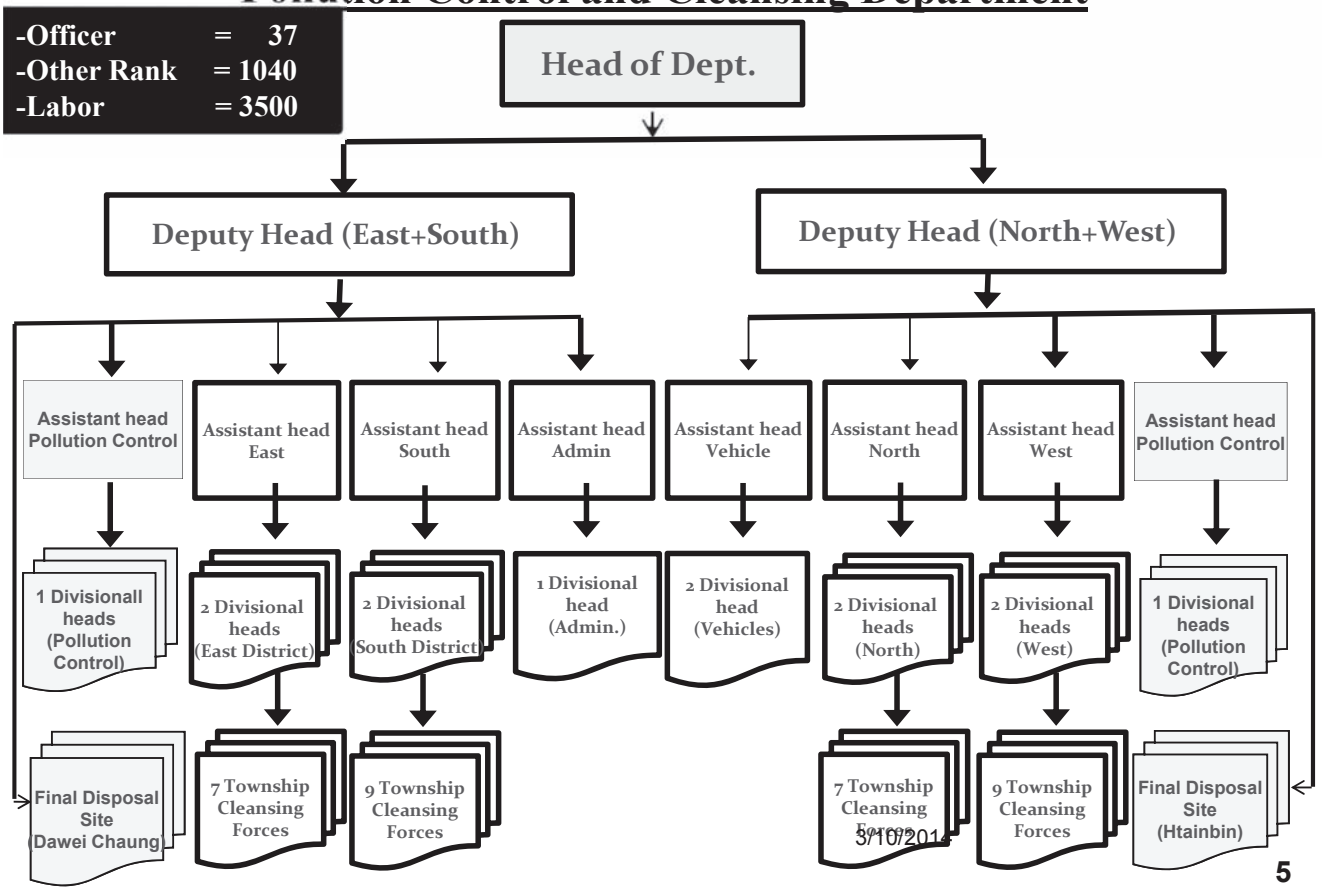
2 persons of Committee Members

↓

20-- Departments (Including Pollution Control and Cleansing Department)

4

Organizational Chart of Pollution Control and Cleansing Department



3/10/2014

5

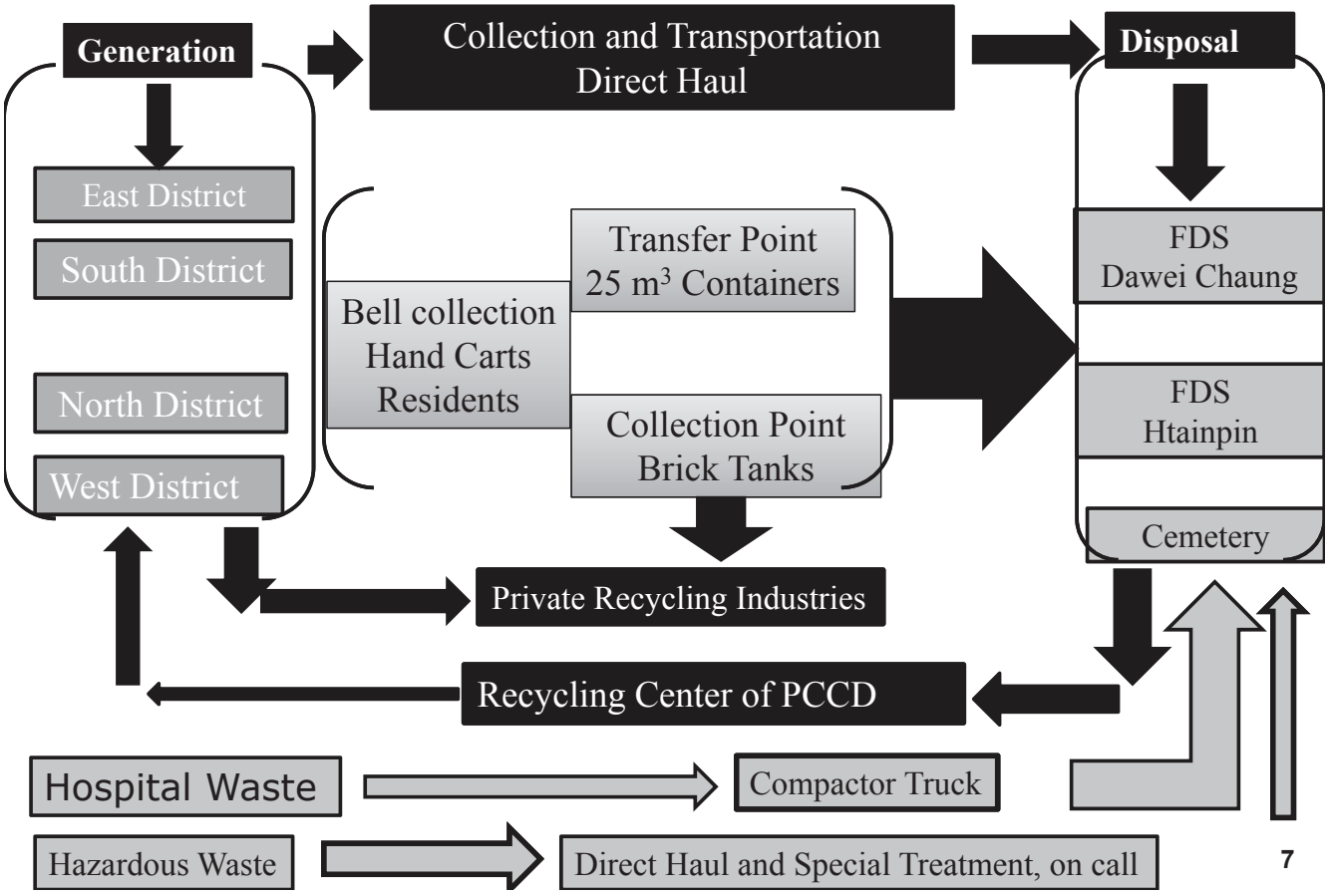
Duties and Function

- Daily Cleansing .
  - Waste Collection (House Holds, Markets, Kerbshops, Commercials, Clinics and others)
  - Waste Transportation.
  - Disposed To Final Disposal Site.

- Pollution Control.
  - Final Disposal Site Management
  - Cemeteries Management
  - Recycling Activities(YCDC and Privates)
  - Green Composting
  - Awareness Program for Local Communities and Schools

6

Waste Flow in Yangon (2012)



7

Solid Waste Management

Bell ring collection, Manual Loading, Transport and dispose to FDS.

Temporary Brick Tanks (617) Nos

8

Solid Waste Management

Dust Bin, transfer to push cart, loading to waste truck, Transport and dispose to FDS.

120 Liter Dust Bins,
On Ground used = 186 - Sets

240 Liter Dust Bins, On
Ground used = 2056 -Nos

660 Liter Dust Bins,
On Ground used = 1295 - Nos

10-Mar-

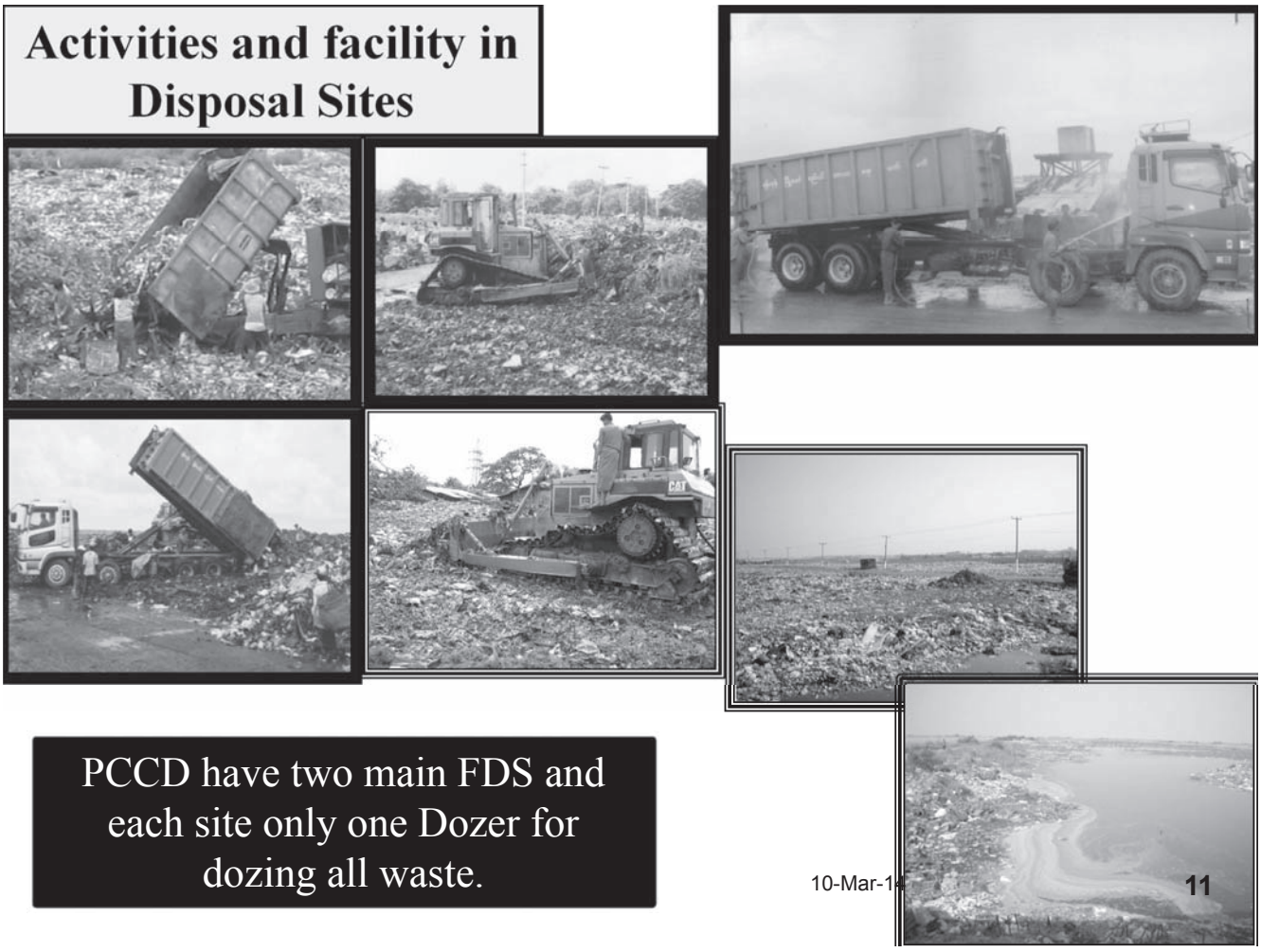
9

Waste collection Vehicle on Road = 294 Nos

There are various types of vehicles, used in transportation of solid waste. Many trucks are too obsolete to use for long term. It should be replaced with new ones.

10

Activities and facility in Disposal Sites

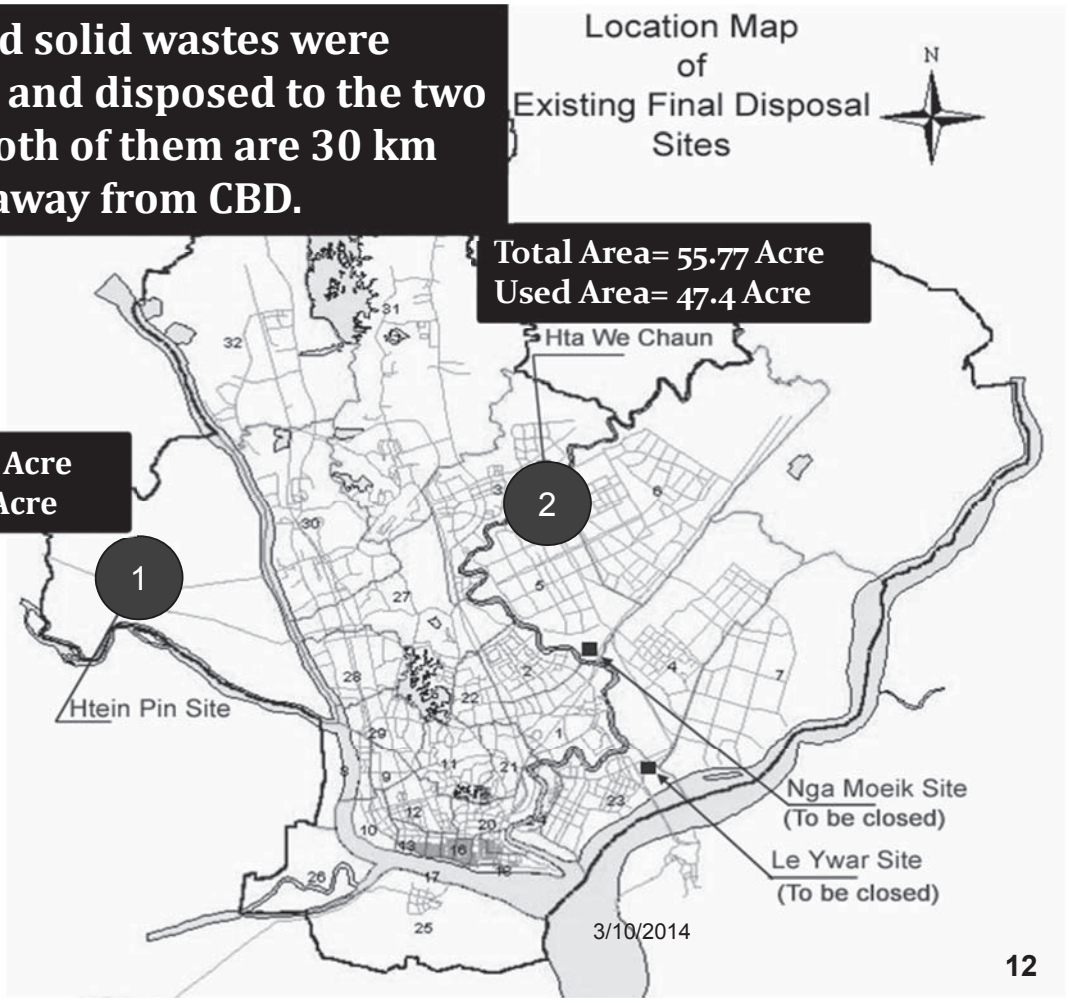


PCCD have two main FDS and each site only one Dozer for dozing all waste.

10-Mar-14

11

The collected solid wastes were transported and disposed to the two Main FDS. Both of them are 30 km and 26 km away from CBD.



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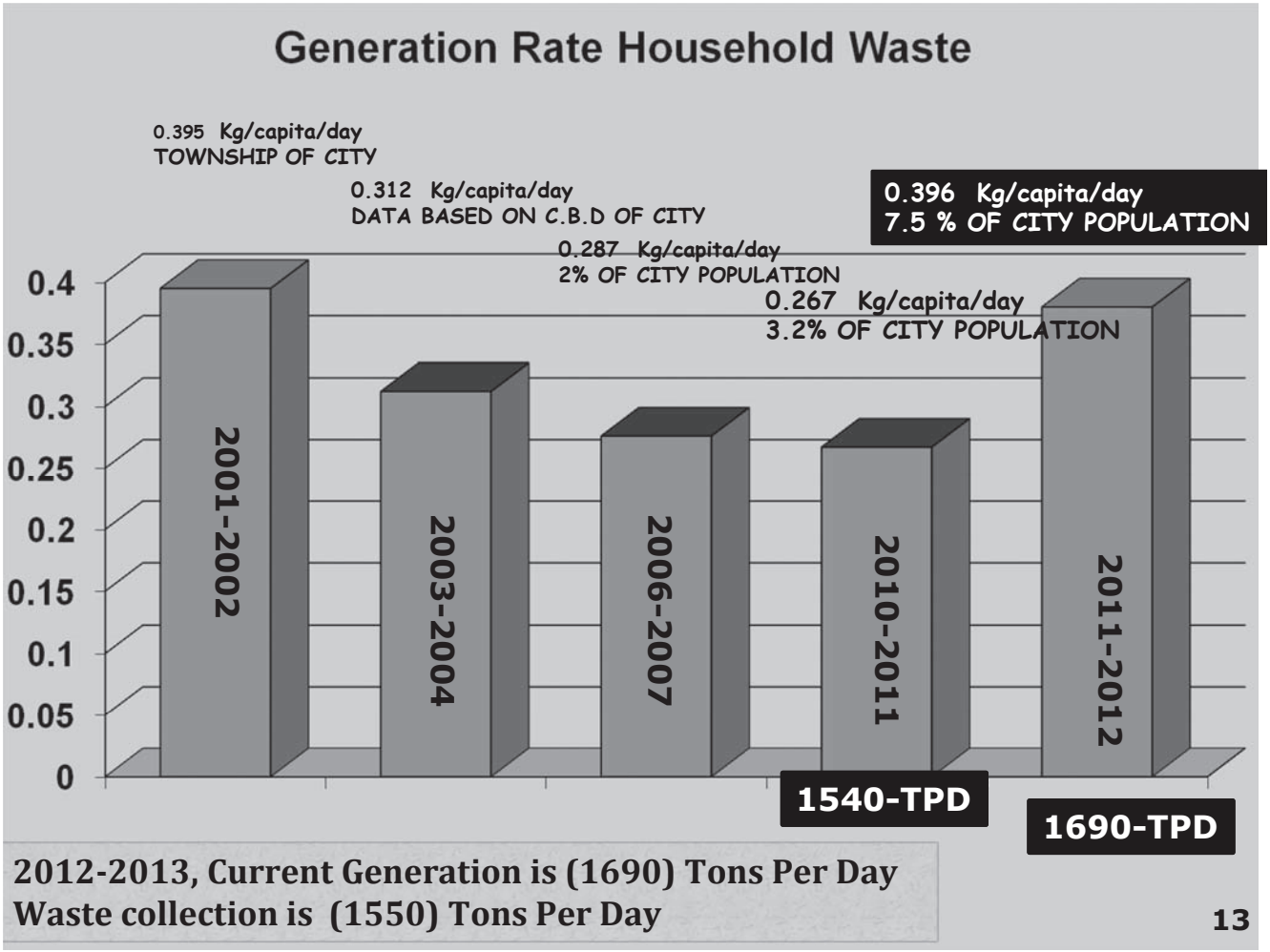
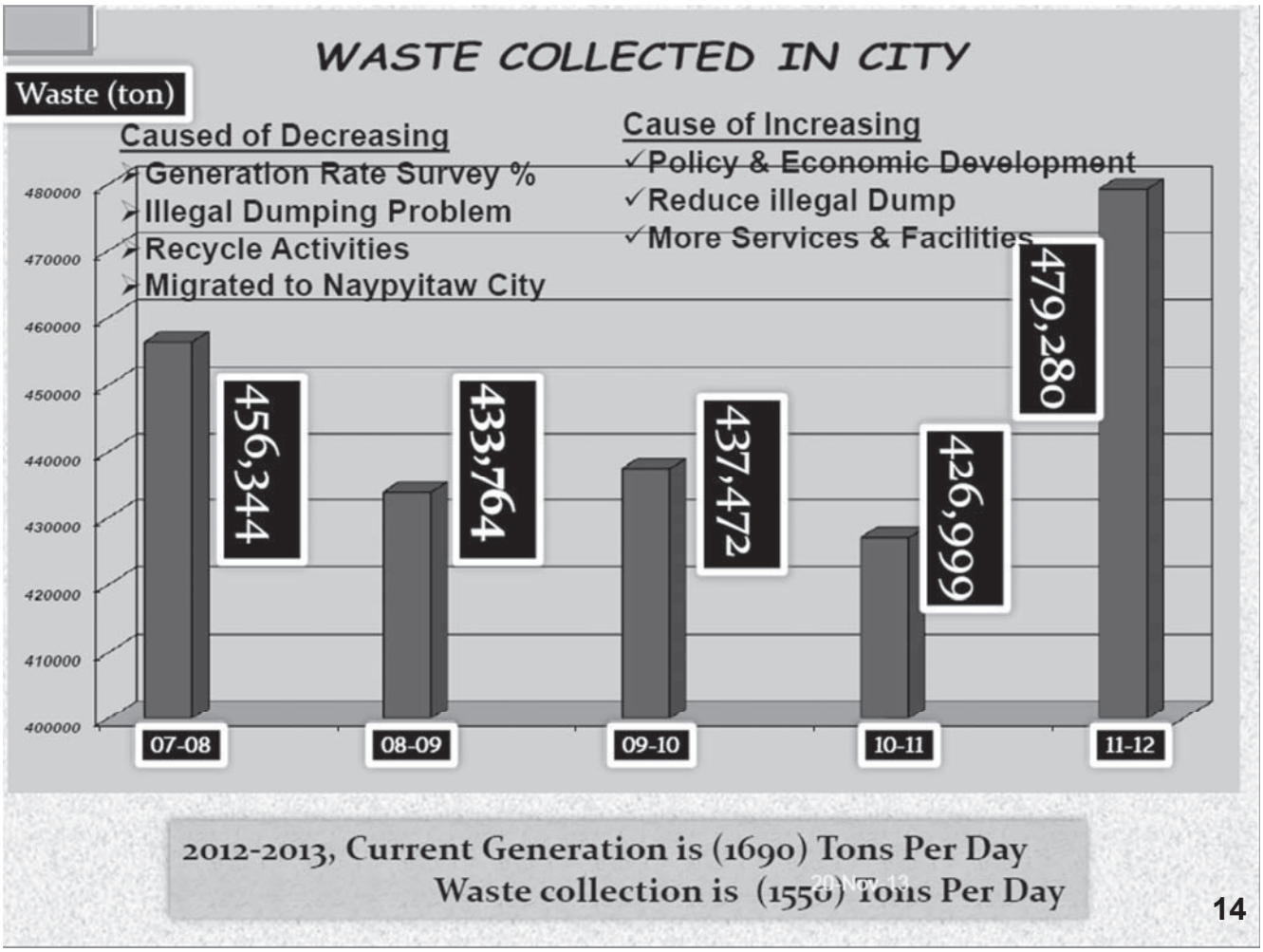
12


Generation Rate Household Waste
0.395 Kg/capita/day
TOWNSHIP OF CITY
0.312 Kg/capita/day
DATA BASED ON C.B.D OF CITY
0.287 Kg/capita/day
2% OF CITY POPULATION
0.267 Kg/capita/day
3.2% OF CITY POPULATION
0.396 Kg/capita/day
7.5 % OF CITY POPULATION
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2001-2002
2003-2004
2006-2007
2010-2011
2011-2012
1540-TPD
1690-TPD
2012-2013, Current Generation is (1690) Tons Per Day
Waste collection is (1550) Tons Per Day
13


WASTE COLLECTED IN CITY
Waste (ton)
Caused of Decreasing
Generation Rate Survey %
Illegal Dumping Problem
Recycle Activities
Migrated to Naypyitaw City
Cause of Increasing
✓Policy & Economic Development
✓Reduce illegal Dump
✓More Services & Facilities
480000
470000
460000
450000
440000
430000
420000
410000
400000
456,344
433,764
437,472
426,999
479,280
07-08
08-09
09-10
10-11
11-12
2012-2013, Current Generation is (1690) Tons Per Day
Waste collection is (1550) Tons Per Day
14

Existing Used Main (2) Final Disposal Sites & (4) Temporary Small FDS

NO	Location of FDS site	Constructed Year	Planned Capacity	Site (Plant) Area	Dispose Ton Per Day (Current)	Remark
1	HtainBin	2002	-	150- Acre Used- 70 Ac	847	Open Dumping
2	Htwei Chaung	2001	-	55.77 – Acre Used-47.4 Ac	612	Open Dumping
3	Dala	2003	-	1.3- Acre	10	Low Landfill Temporary site
4	Seikkyi Khanaung To	2003	-	0.25 - Acre	5	Low Landfill Temporary site
5	Mingalardon	2003	-	0.91 - Acre	25	Low Landfill Temporary site
6	Shwe Pyi Thar	2005	-	1 - Acre	50	Low Landfill Temporary site

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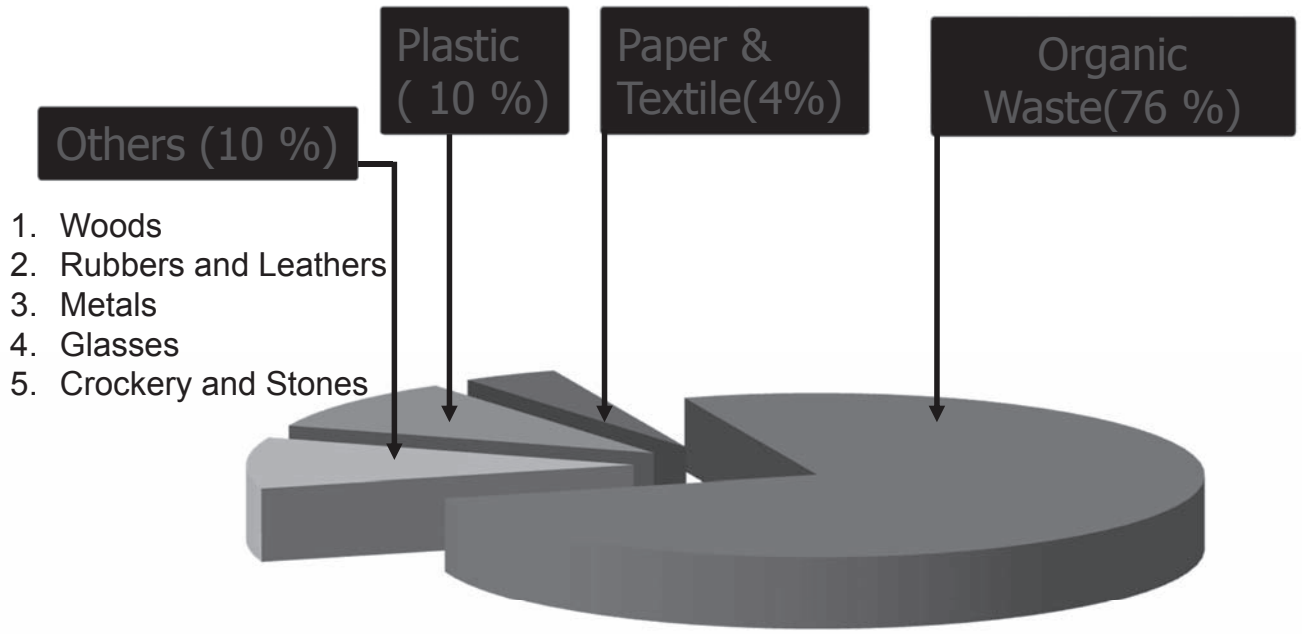
Typical Composition



Base on common composition which a few different percentage.
(Depend upon the Wet Season and Dry Season)

16

Hospital Waste Management

Infectious Wastes are dispose to the Incineration Process

Daily Medical Waste about 1 ton

Sharp Wastes are dispose to the Deep Well Process

Industrial Zones In Yangon City

➢Industrial Zones in City	= 24 Number
➢Total Factories	= 3562
➢Garments	= 126
➢Foodstuff	= 334
➢Chemical	= 56
➢Iron and Melting	= 519
➢Cold Storage and Fish Processing	= 45
➢Paper and Cardboard	= 105
➢Distillery	= 9
➢Forest Product	= 148
➢Public Use Goods	= 709
➢Others	= 1511

【Reference materials : Presentation by YCDC】

Daily Waste Generated of Industrial Zones

Sr No	Industrial Zone Location	No. of Zones	No. of Factories	Collected	Remark
1	East Dagon	1	41	3	Food and byproduct of sites
2	North Dagon	1	95	11	"
3	Dagon Seikam	2	94	4	"
4	South Dagon	3	2356	13	"
5	North Okkalapa	2	342	57	"
6	South Okkalapa	1	85	0.4	"
7	Thaketa	1	123	3	"
8	Mingalardon	2	40	6	"
9	Shwe Pyi Thar	4	249	6	"
10	Hly Thar Yar	7	137	6	"
	TOTAL	24	3562	109.4	

On Call System
Waste collected = 109.4 Ton Per Day

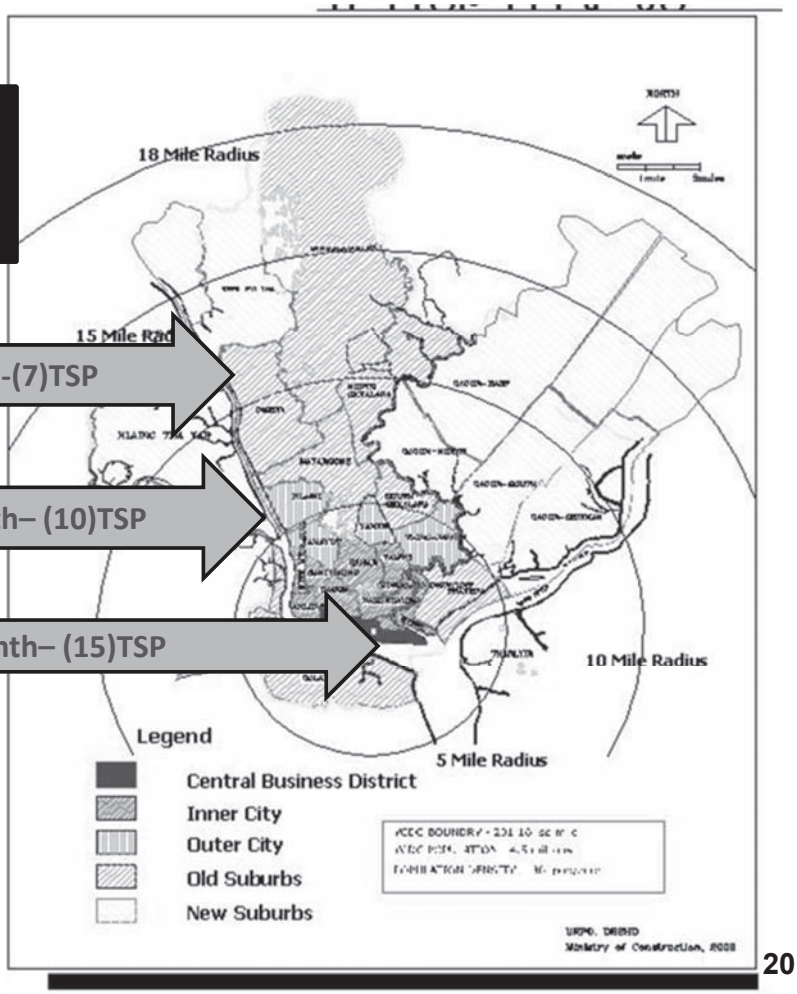
19

Monthly Fee of Household Waste Collection

Satellite (300) kyat per month-(7)TSP

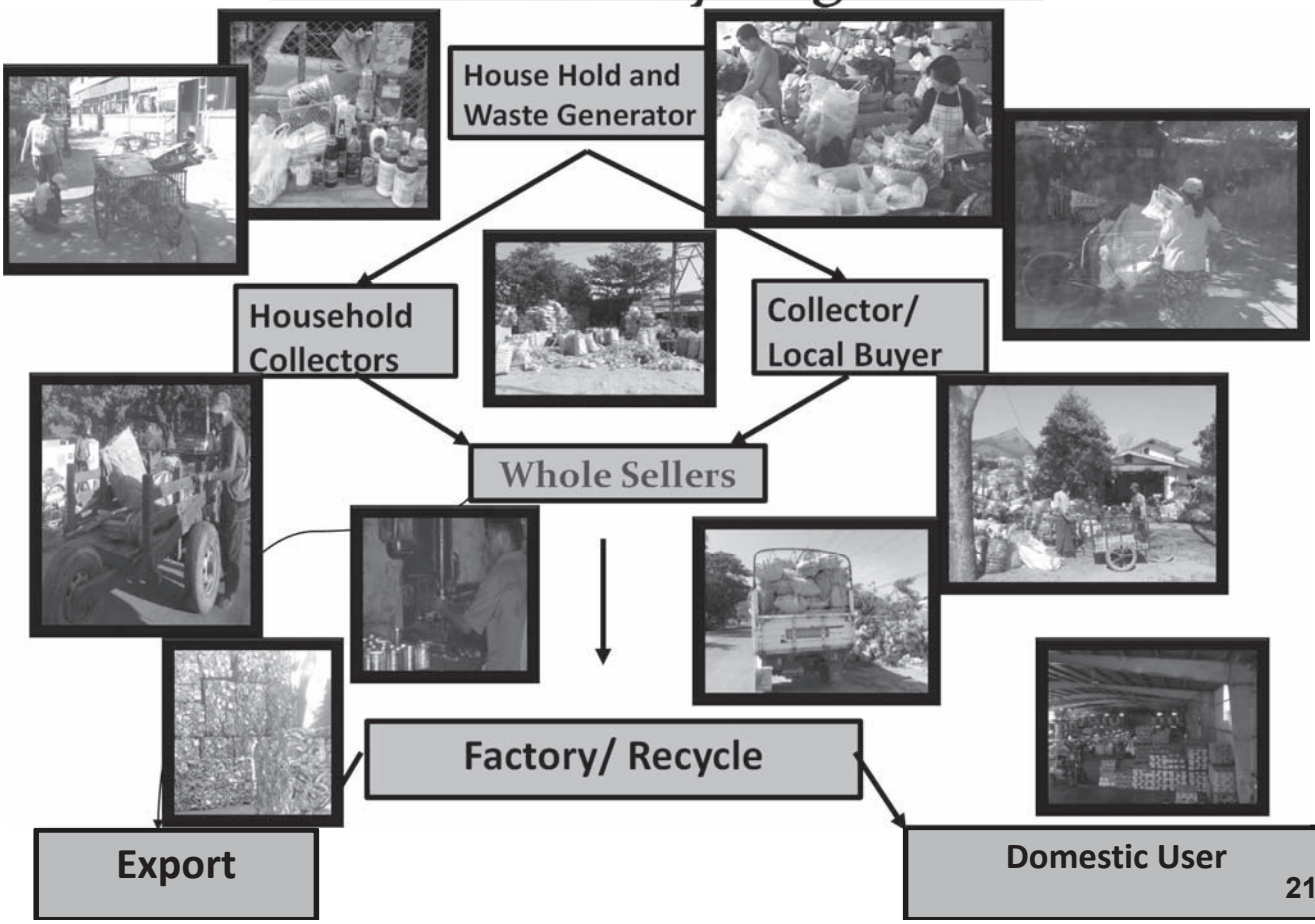
Sub-Urban (450) kyat per month– (10)TSP

CBD- (600) kyat per month– (15)TSP



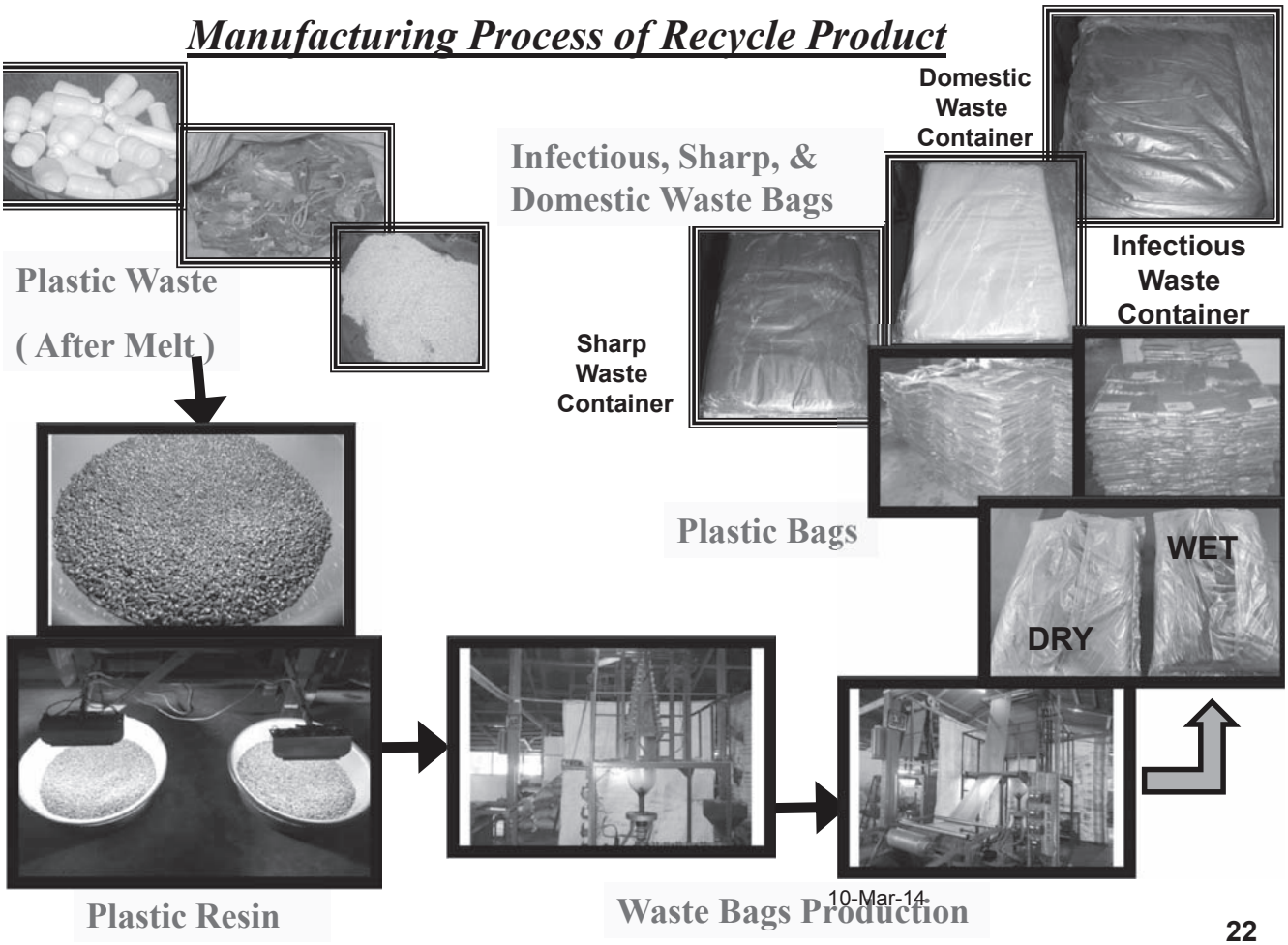
20

Structure of Recycling Market



21

Manufacturing Process of Recycle Product



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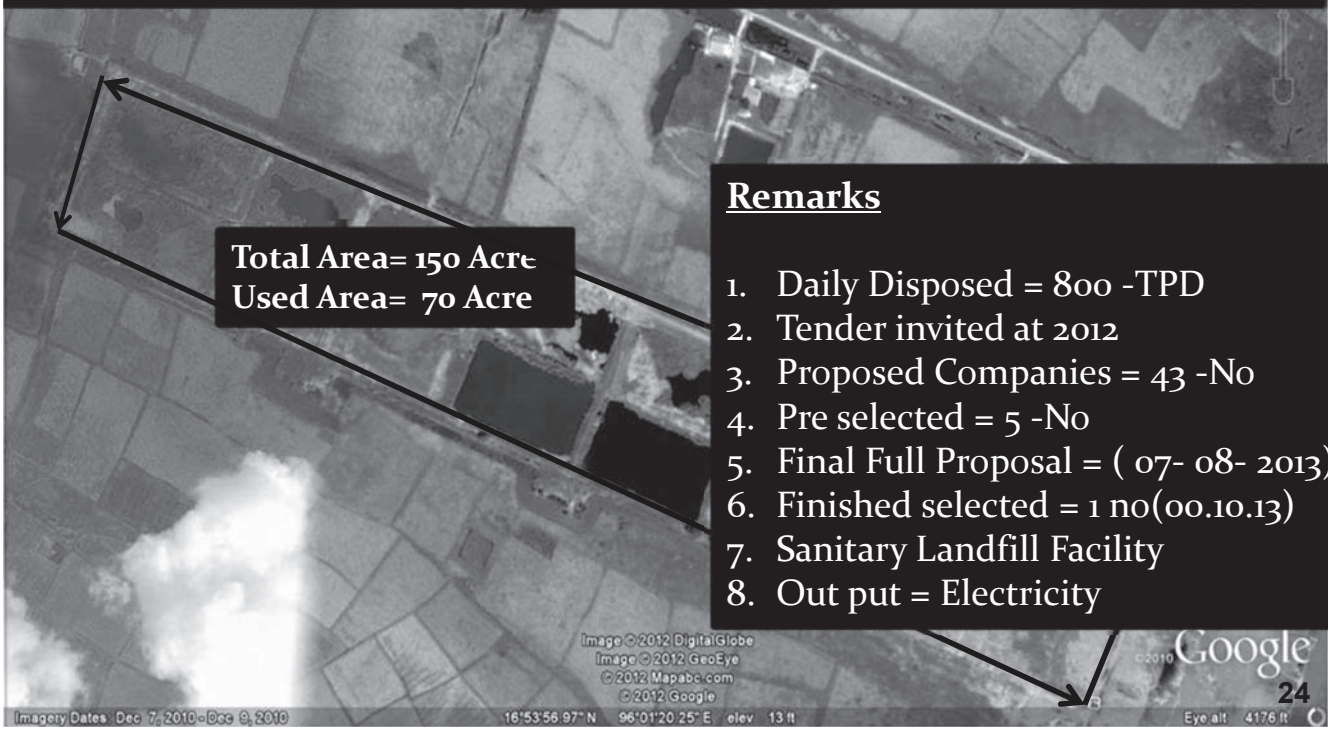
Recycle and Reuse Materials; Direct to Whole Sale Local Buyers ; Data Base on 2012

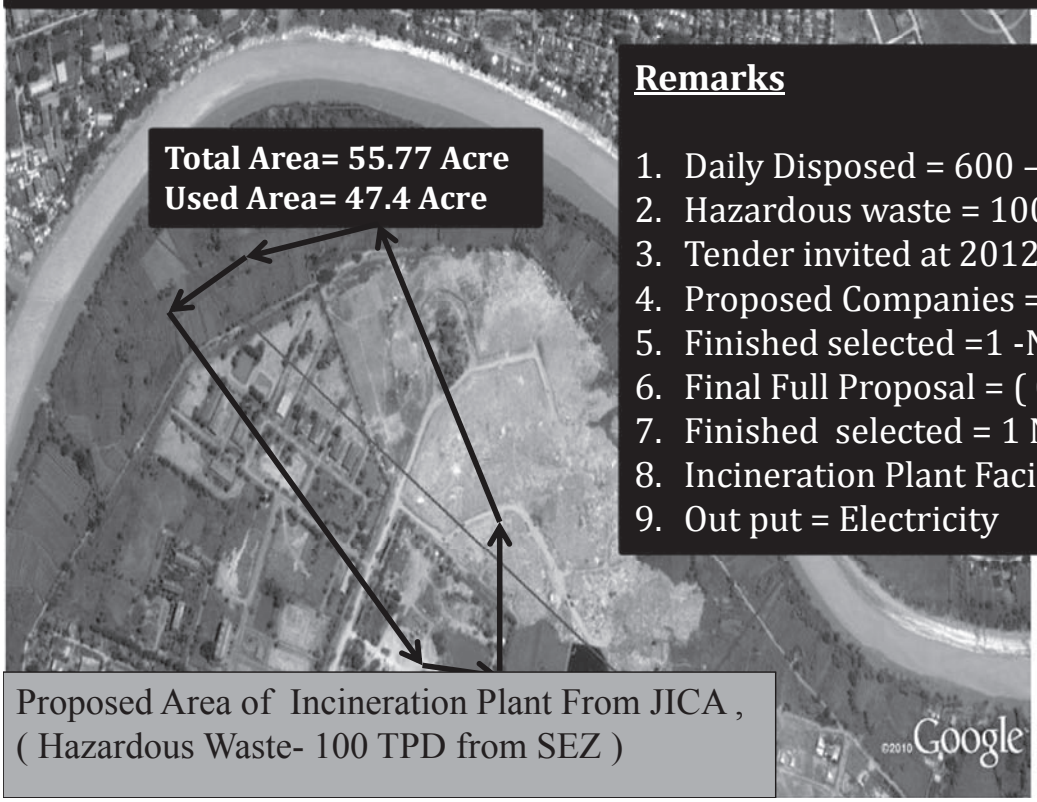
Particular	Weight (T)	Unit
Plastic	5.1	Ton
Paper	8.94	Ton
Cardboard	11	Ton
Leather	.1	Ton
Iron	0.5	Ton
Metal	0.3	Ton
Copper	0.3	Ton
Lead	0.1	Ton
Glass	40.5	Ton
Tin Can	5.1	Ton

Recycle Waste Generated = 85.84 - TPD

Htainbin Final Disposal Site, Tender Invited, Propose Location of (800) TPD Can dispose Domestic Waste of YCDC area, Sanitary Landfill Facilities, Bio-Gas to Electricity or CNG



Htawe Chaung Final Disposal Site
Tender Invited, Propose Location of (600) TPD



Proposed Area of Incineration Plant From JICA ,
(Hazardous Waste- 100 TPD from SEZ)

Remarks

1. Daily Disposed = 600 –TPD(domestic)
2. Hazardous waste = 100 - TPD
3. Tender invited at 2012
4. Proposed Companies = 43 -No
5. Finished selected =1 -No
6. Final Full Proposal = (07- 08- 2013)
7. Finished selected = 1 No, (05-10-2013)
8. Incineration Plant Facility
9. Out put = Electricity

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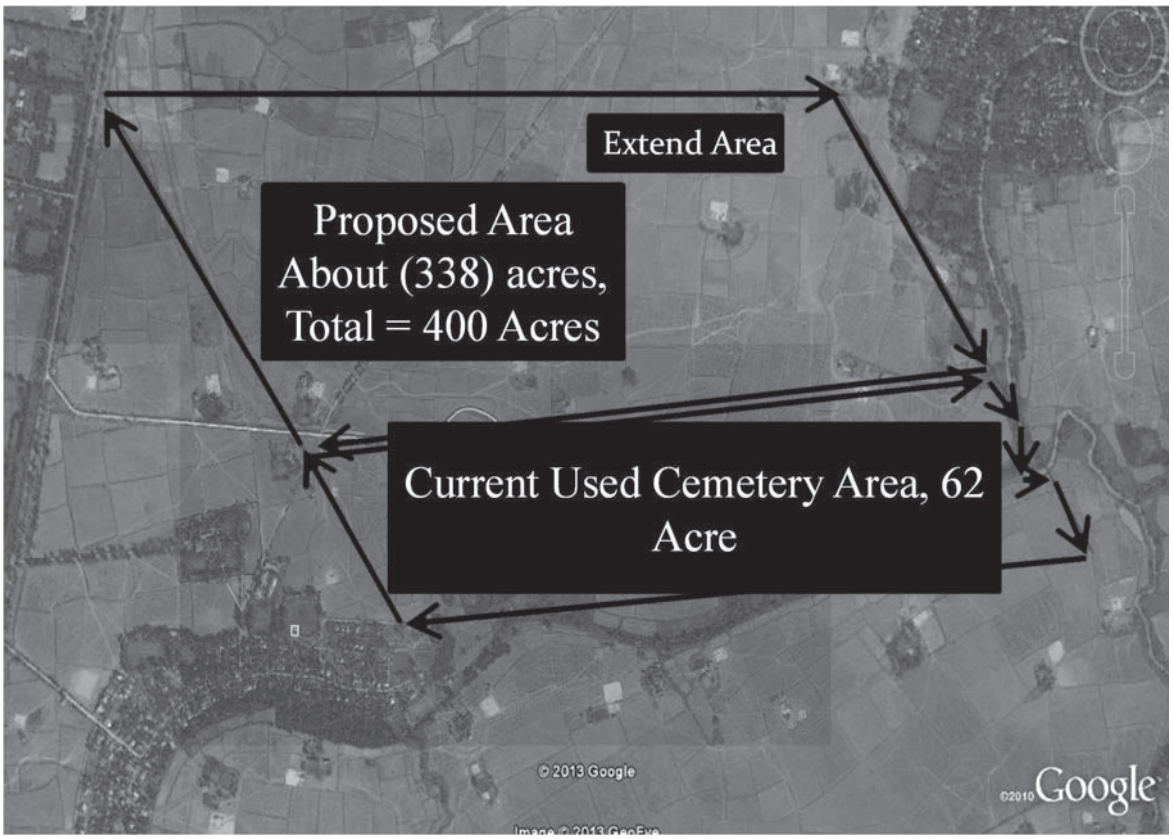
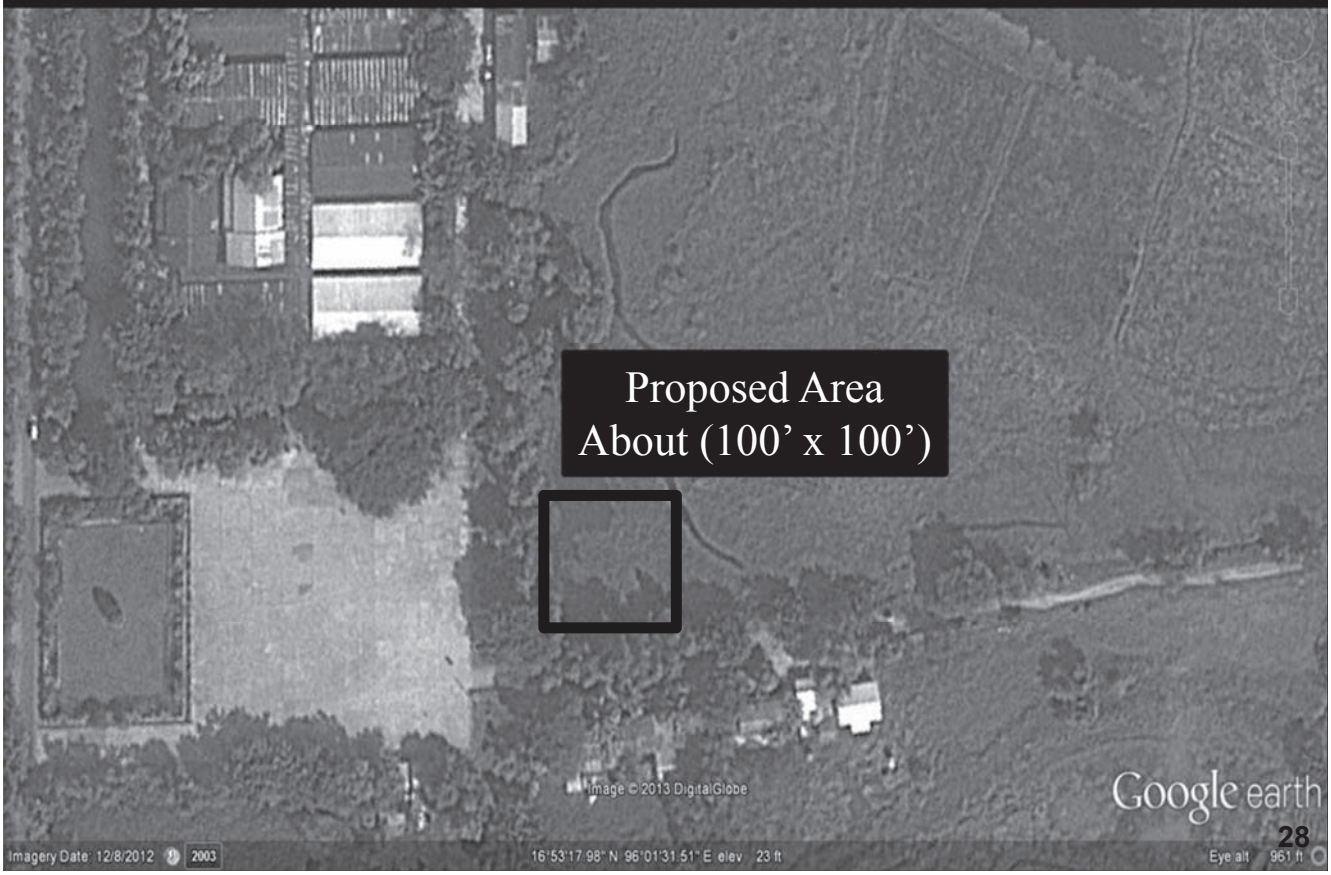
Dala Final Disposal Site



26

Kyisu Final Disposal Site

Htainbin Cemetery, Medical Waste Propose Location

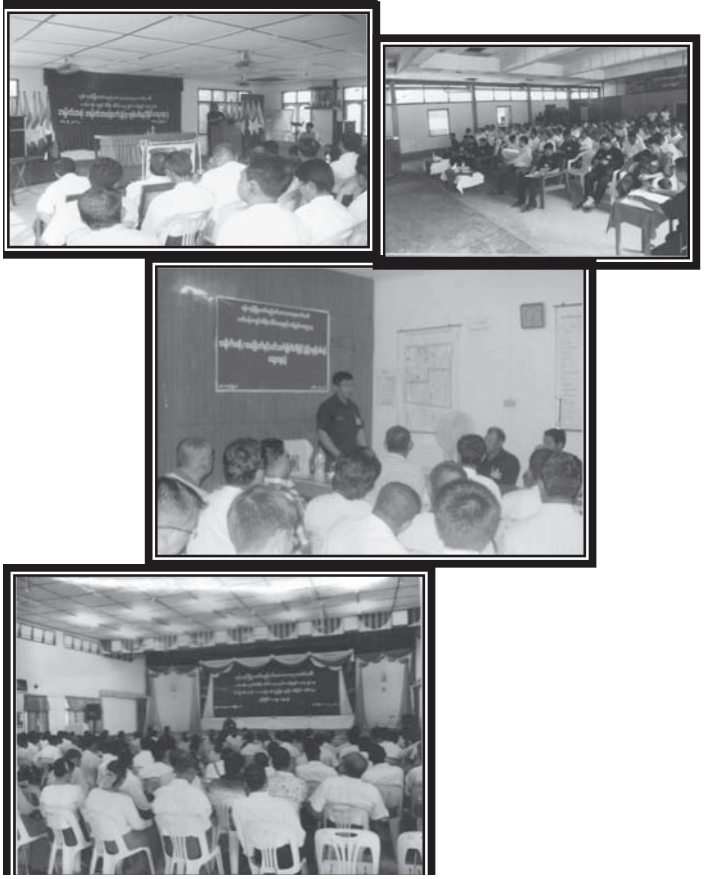


【Reference materials : Presentation by YCDC】

Public Awareness program

3Rs Activities

School Awareness program



29

Key Finding and Main Issues in Solid Waste

1. **Lack of Detailed Planning of SWM**
2. **Inefficient Waste Collection System**
3. **Old Equipment for Waste Collection and Transportation.**
4. **Improper Final Disposal**
5. **Unclear Enforcement of Hazardous/Infectious Waste Management**
6. **Weakness of SWM Registration**

10-Mar-14

30

Policy and Goal

- To research and develop on clean air, clean land, clean water.
- To integrate the action plans for ambient and indoor air quality monitoring and upgrading.
- To update the legislative system for EIA practices .
- To enhance the techniques on “Waste To Energy” WTE processes.
- To promote greater awareness of environmental and health risks from poor environmental planning and management.
- To upgrade the city green clean and healthy livable.

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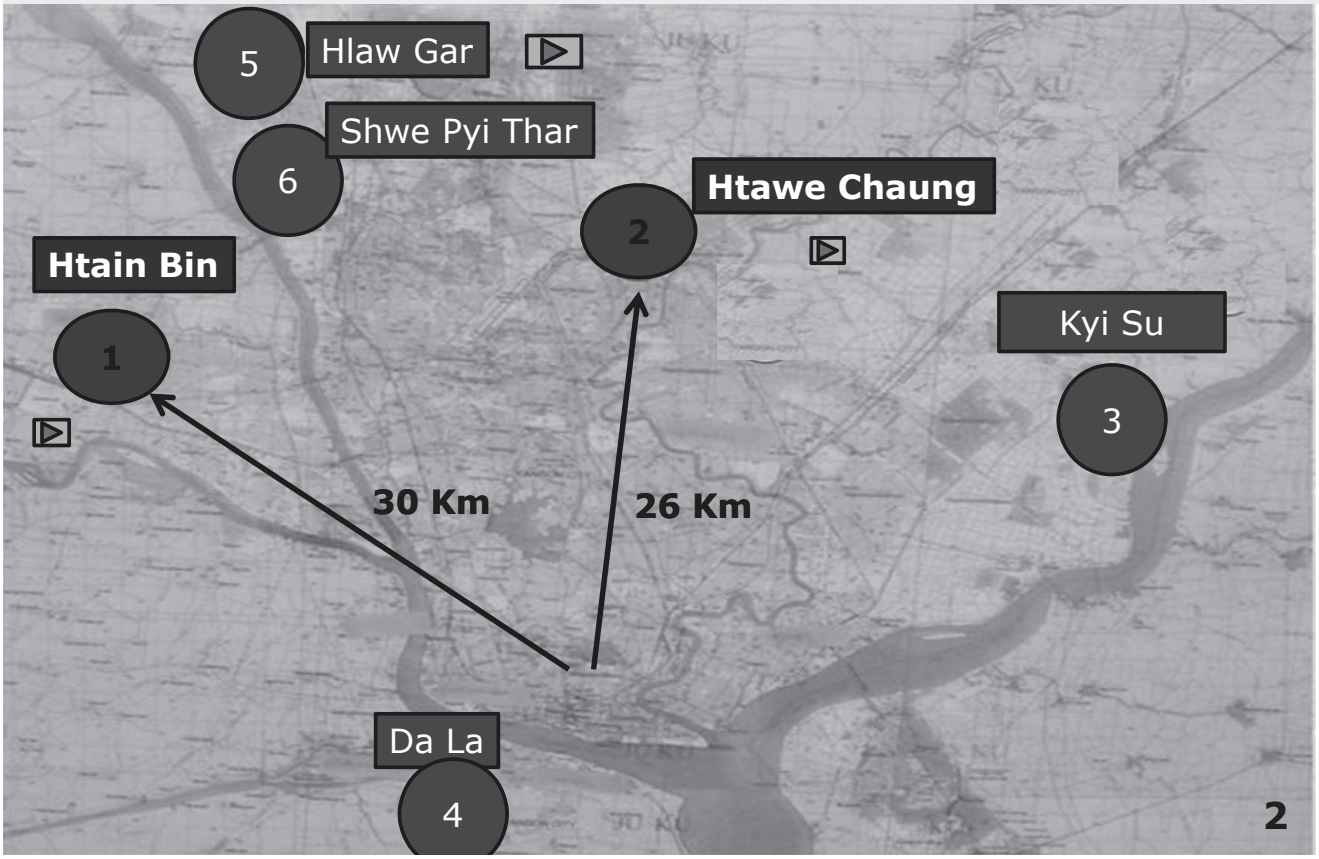
Thank You

Integrated Solid Waste Management: Towards Low-carbon Waste Management in Yangon - Myanmar

Nirmala Menikpura, PhD
Sustainable Consumption and Production (SCP) Group
Institute for Global Environmental Strategies (IGES)

Open Dumping is the Major Disposal Method in Yangon



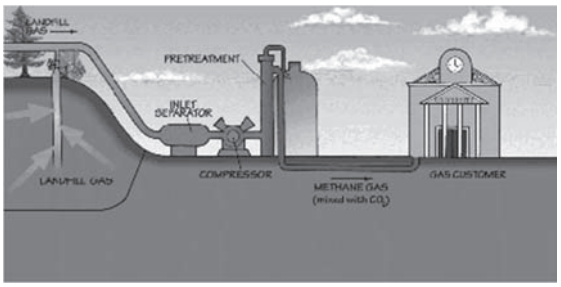
Present Situation of Waste Management in Yangon

- ❑ This is the biggest open dumpsite in YCDC
- ❑ 847 tonnes of incoming waste is disposed per day

Dumpsite at HtainBin

Future

- PCDC is planning to implement a landfill gas-to-energy recovery plant to replace this open dumpsite



3

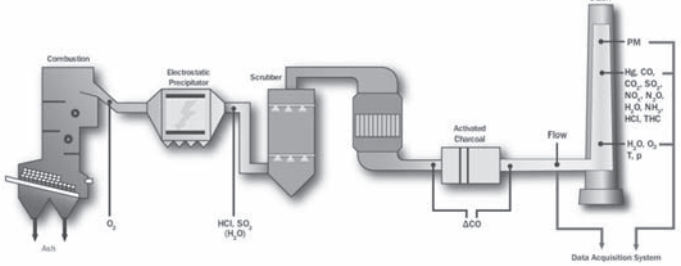
Present Situation of Waste Management in Yangon

- ❑ This is the second biggest open dumpsite
- ❑ 612 tonnes of incoming waste is disposed per day

Dumpsite at Htwei Chaung

Future

- YCDC is considering installation of waste-to energy incineration plant.



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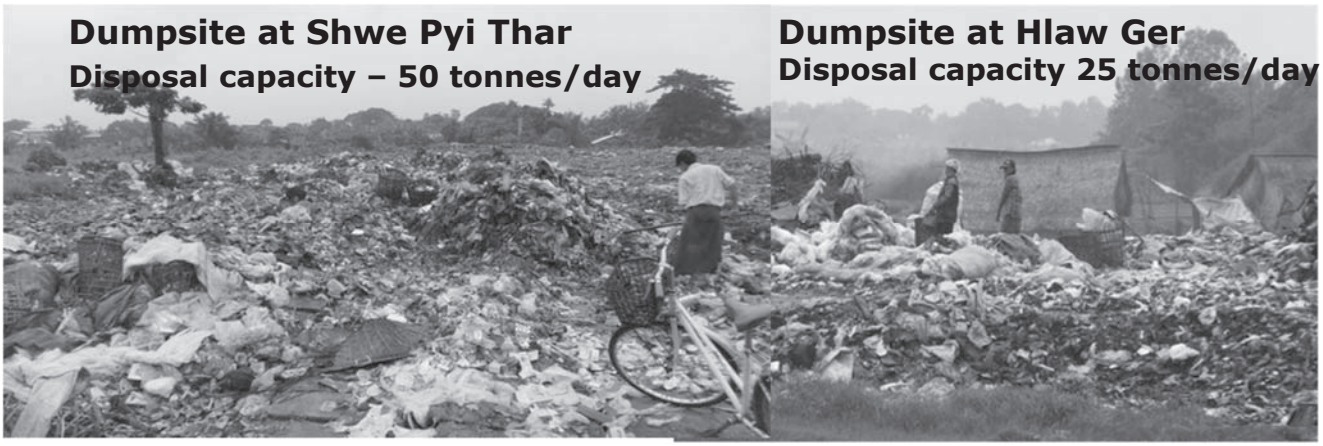
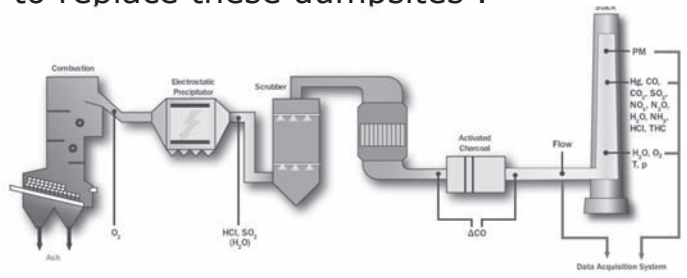
Present Situation of Waste Management in Yangon



Future

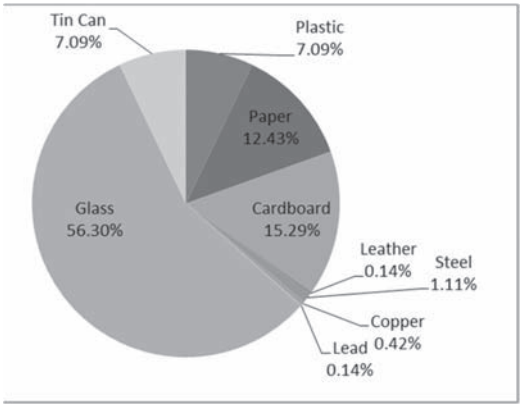
- YCDC is considering installation of small incineration (without electricity production) plants to replace these dumpsites .



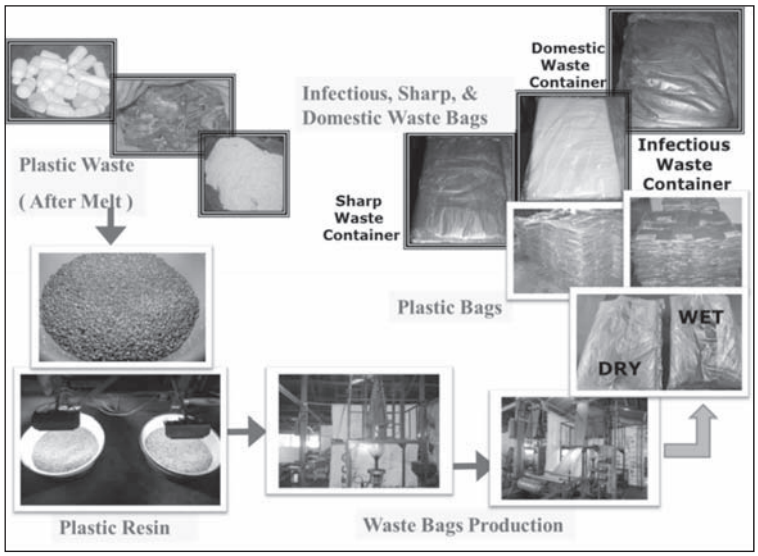
5

Situation of Waste Recycling in Yangon

- ❑ According to Yangon City Development Committee (YCDC) 86 tonnes/day generated waste is recycling
- ❑ Valuable recyclables are stored at household level and sell to the nearby junkshops
- ❑ YCDC is also running a small-scale plastic recycling plant and green and blue plastics bag is produced using the waste plastic.



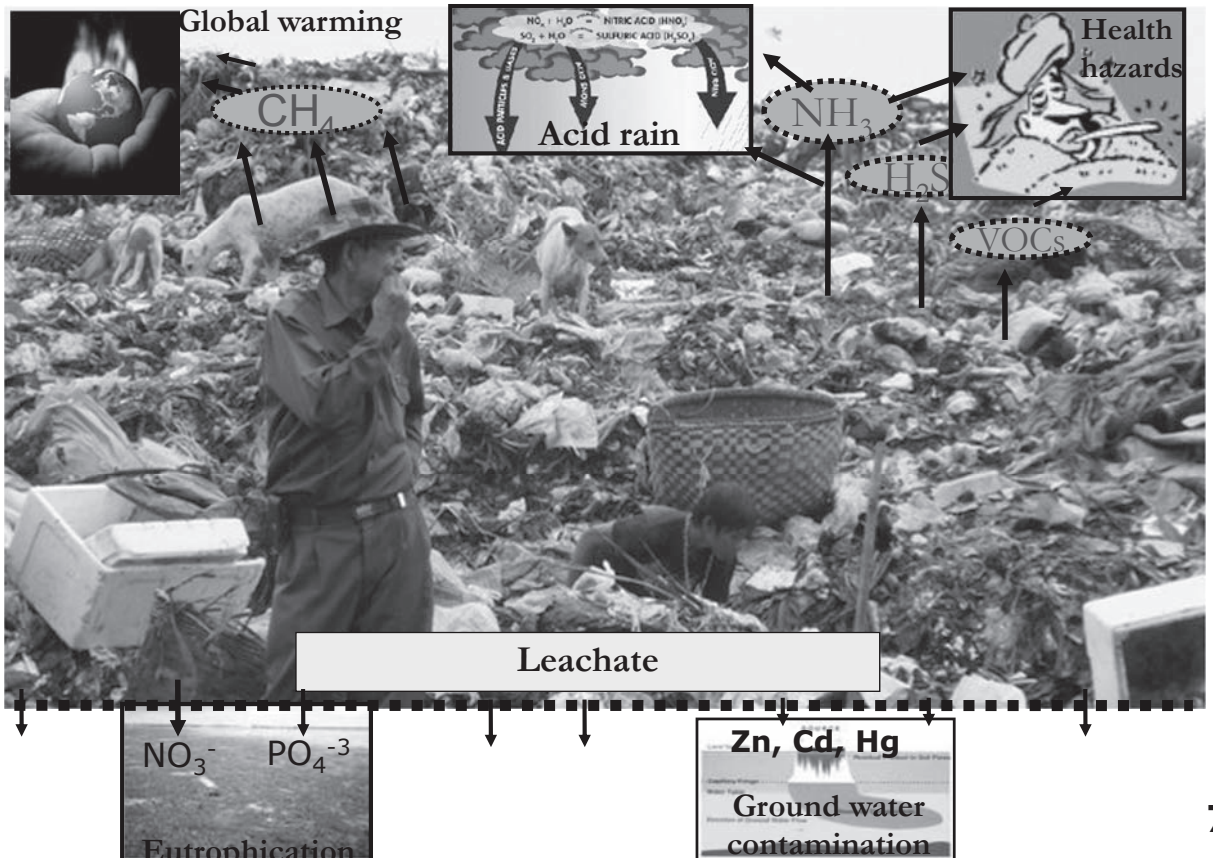
Composition of recyclables in Yangon



Plastic recycling activities at YCDC

6

Environmental Damage and Health Issues from Current Waste Management in Yangon



7

Climate Impact from Current Waste Management in Yangon

- **IGES GHG calculation tool** was used to estimate the climate impacts from current waste management in Yangon

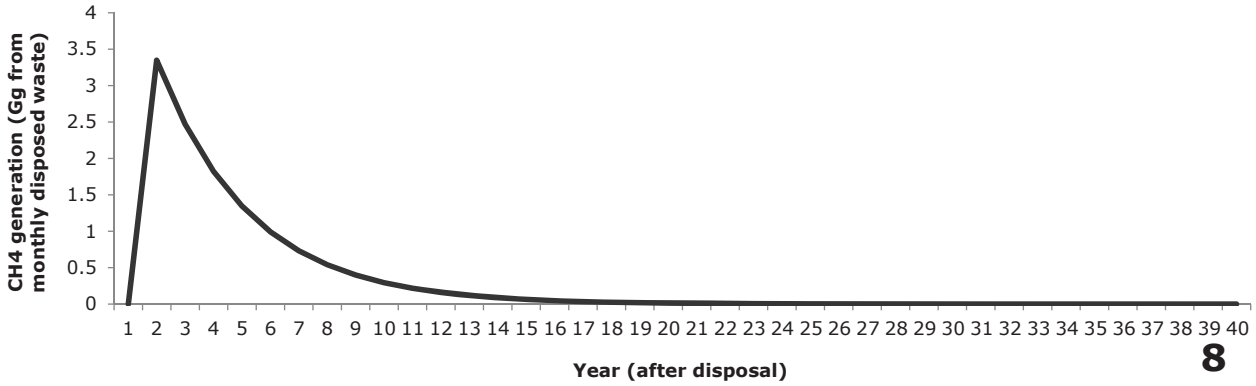
GHG emissions from Waste Transportation

YCDC uses 128,704 L diesel and 900 L of gasoline for waste transportation

GHG emissions from transportation	7.51	kg of CO2-eq/tonne of waste
Monthly GHG emission from transportation	**349**	tonnes of CO2-eq/month

GHG emissions from open dumping

Emission of CH_4 from open dumping	22.88	kg of CH_4/tonne
Direct GHG emission from mixed waste open dumping	480.48	kg of CO2-eq/tonne of mix waste
GHG emission from open dumping from monthly disposed waste	**22,342**	Tonnes of CO2-eq/month



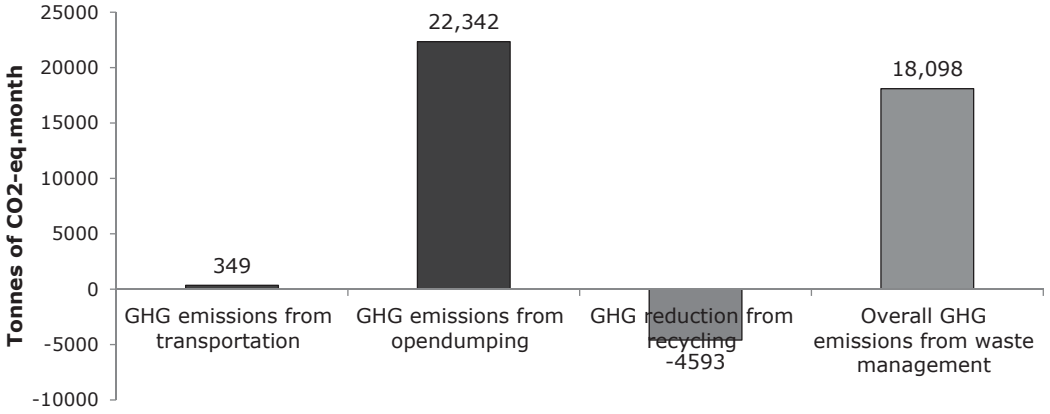
8

Climate Impact from Current Waste Management in Yangon

GHG emissions from recycling activities in Yangon

Direct GHG emissions from recycling	866.42	kg of CO2-eq/tonne of mixed recyclables
Avoided GHG emissions from recycling via materials recovery	2646.79	kg of CO2-eq/tonne of mixed recyclables
Net GHG emissions from recycling (life cycle perspective)	-1780.37	kg of CO2-eq/tonne of mixed recyclables
Monthly total GHG reduction from recycling	**-4,593**	**Tonnes of CO2-eq/month**

Overall GHG emissions from waste management in Yangon

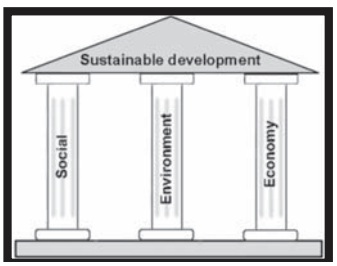


9

Is the Current Waste Management in Yangon Sustainable?

- The conventional practice of 'collection and disposal' is unsustainable in term of resource inefficiency, environmental impacts and socio-economic impacts
  - •Difficulties in finding suitable landfill sites/dumping sites
  - •Large costs associated with collection and disposal
  - •Recovery of resources (material and energy) is very low and so on

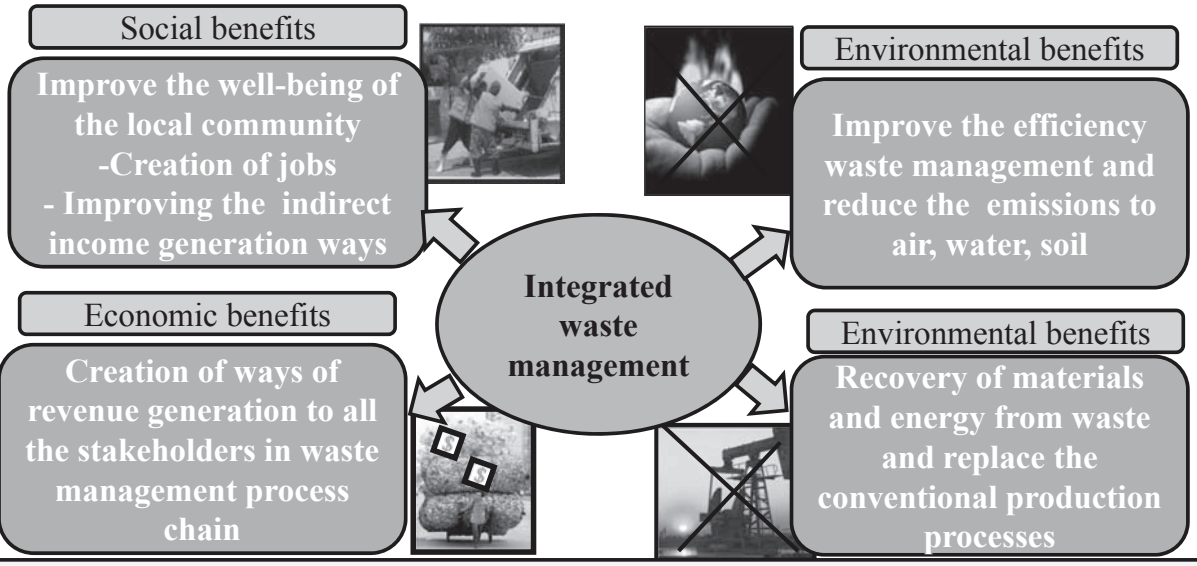
- To overcome these drawbacks **development of sustainable solid waste management methods is crucial**



10

Integrated Solid Waste Management: A Practical Solution Towards Sustainable Waste Management

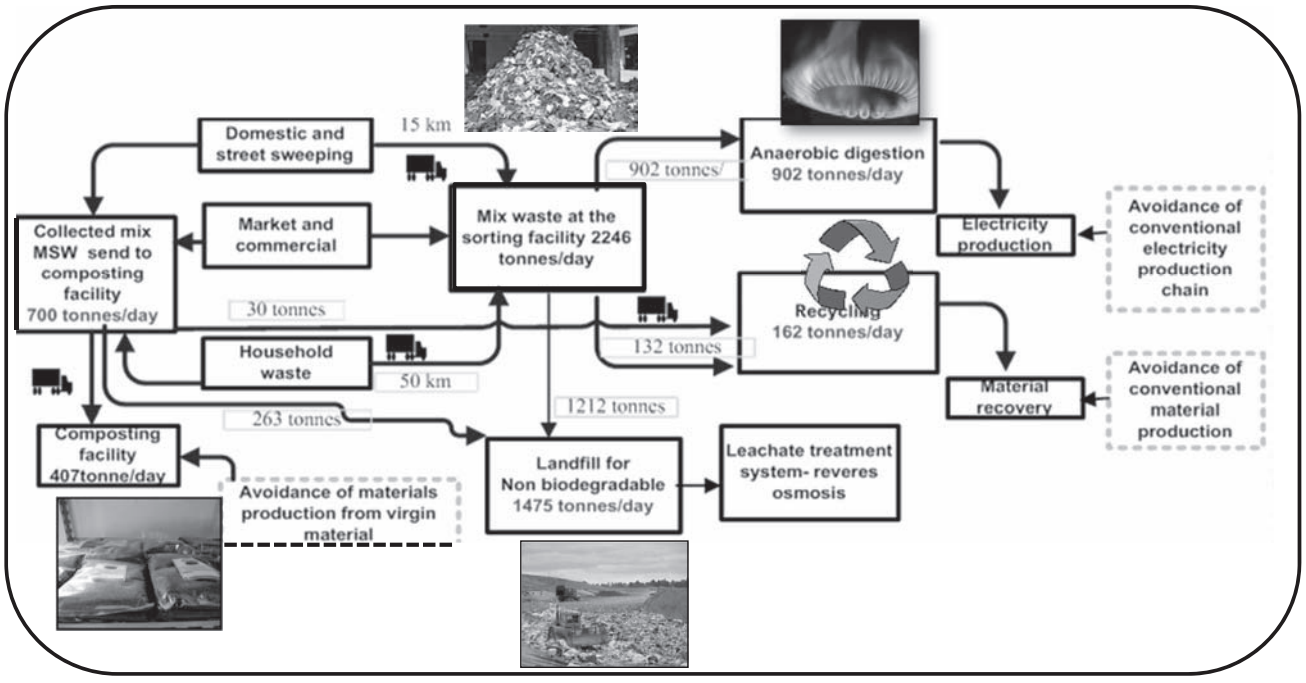
•ISWM would be the most promising approach to solve the waste management problems since it provides multiple benefits from waste



•These benefits from ISWM can be achieved by selecting and adapting the best suited technologies to a particular municipality

11

Integrated Solid Waste Management (ISWM): A Practical Solution Towards Sustainable Waste Management



Intended integrated system for Kolkata Metropolitan, India
(Source: Menikpura, PhD thesis, 2011)

12

Integrated Waste Management: Towards Low Carbon Waste Management

A case study Muangklang Municipality, Thailand

- The Muangklang Municipality is located in Rayong Province (190 km from East Bangkok)
- It has a total of 13 communities and covers 14.5 km^2
- The registered population within the Municipality -17,200 (Dec 2010)
- This municipality has initiated an integrated waste management system as a sustainable solution by incorporating effective waste collection and transportation service, waste sorting facility for recovery of recyclables, anaerobic digestion facility, composting facility, raising some farm animals to feed organic waste and so on

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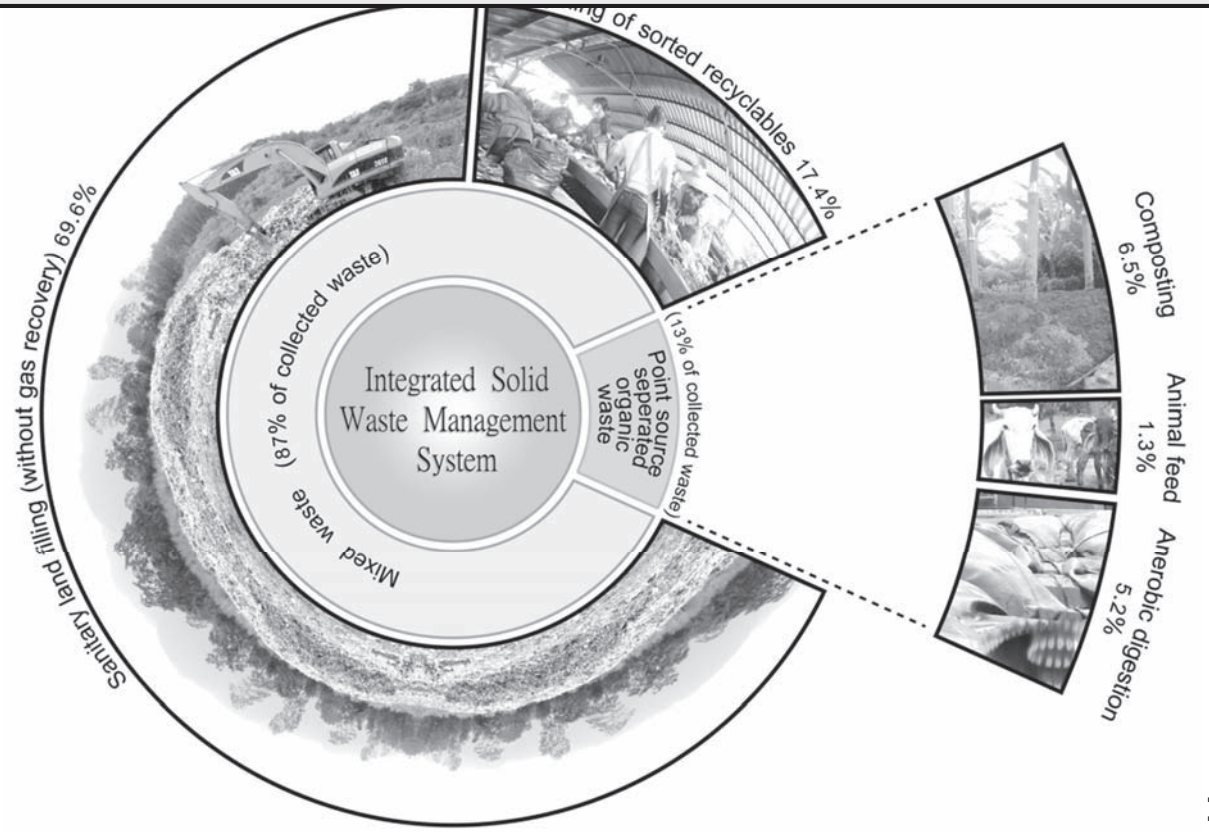
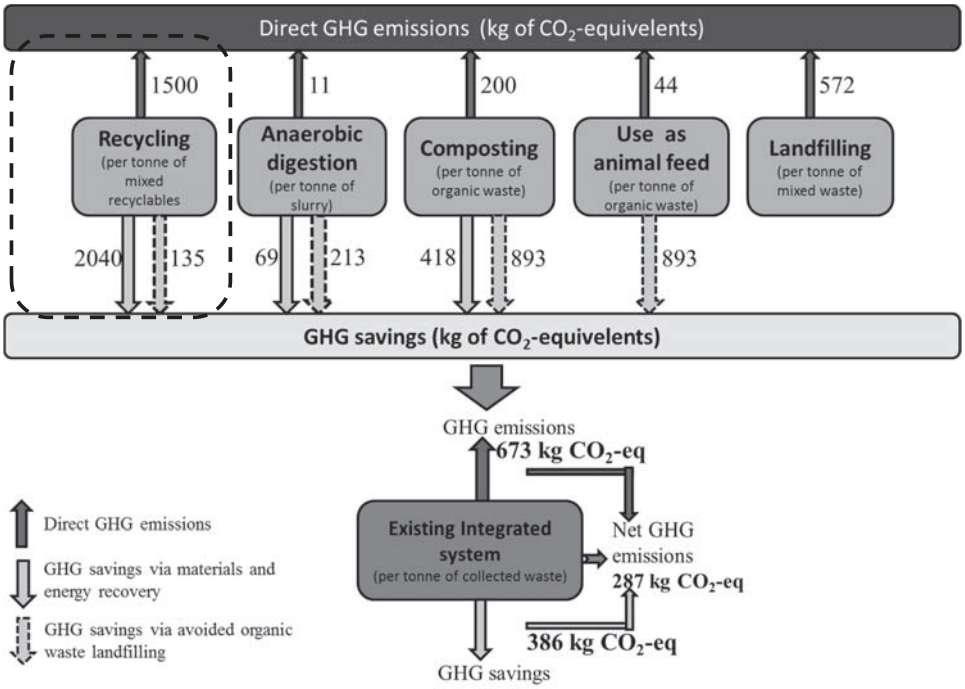
Existing Integrated System in Mungklang Municipality, Thailand



14

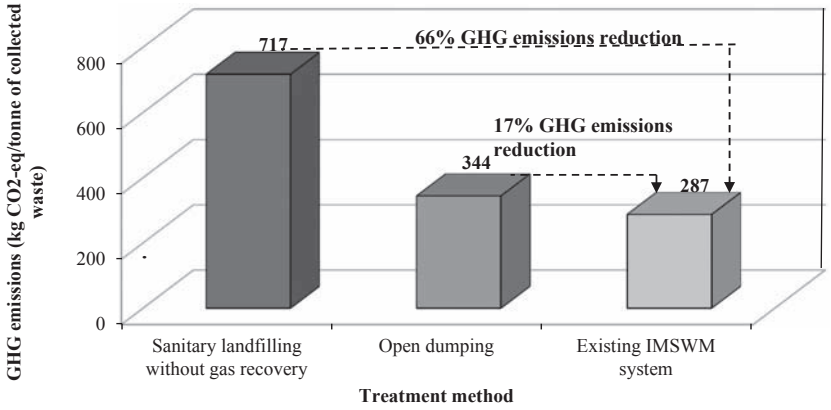
GHG Emissions and Savings Potential from Individual Technologies and Integrated System



•Net GHG emission from the integrated system is still positive due to high fraction of waste landfilling (69.6%)

15

GHG Emission Reduction from Existing Integrated System as Compared to the BAU Practice



•This integrated system achieved a considerable reduction in GHG emissions by utilising only 30% of collected waste for resource recovery

•Development of integrated systems would be a local initiative that could make meaningful contributions to global climate-change mitigation

•In addition there is a high potential for obtaining socio-economic benefits via integrated waste management

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Summary: Towards Sustainable Waste Management in Yangon

- Landfill gas-to-energy recovery and incineration would be the two major technologies in the intended waste management system in Yangon.
- To enhance the efficiencies:

  -Careful planning is very important in the designing phase to avoid the failure that may happen after the implementation

  -Composition and the moisture content of the waste can be greatly effected on the efficiency of the incineration plant. Pre-treatment would be necessary

  -Development of proper recycling scheme in Yangon would contribute for significant GHG reduction and then to attain the target of low carbon city

- For long term sustainability, development of appropriate integrated systems, which designed for maximum resource recovery would be the key driving force towards greenhouse gas mitigation as well as for getting maximum economic and social benefits from waste management in Yangon

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THANK YOU VERY MUCH FOR YOUR ATTENTION

Nirmala Menikpura, PhD

Sustainable Consumption and Production (SCP) Group

Institute of Global Environmental Strategies (IGES)

E-mail: menikpura@iges.or.jp

IGES
Institute for Global Environmental Strategies

3. Research on the potential of off-grid renewable energy in Myanmar

A research on the application of off-grid renewable energy sources in Myanmar was conducted in partnership with The Energy and Resources Institute (TERI) of India. A range of renewable energy sources, including solar, wind, biomass and hydropower were analysed, as well as their possible delivery models of in off-grid environment.

3.1 Executive summary

With a total area of 676, 578 km², Myanmar is the largest country in Southeast Asia and borders Bangladesh, India, China, Lao PDR and Thailand. The total population of Myanmar is around 61 million, spread across 14 states and divisions. With regard to the electricity access situation, IEA statistics indicate that overall 49% have access to electricity in Myanmar. The rural electrification scenario is further dismal, with only around 29% of the rural population having access to electricity. In absolute terms, almost 25 million people were living without the electricity in 2011 in the country. While Myanmar is reportedly focusing on hydro power and gas based power to boost energy supply in the country, renewable energy, especially solar, wind, and biomass, can play a major role in enhancing electricity access through decentralized options. As an off-grid solution, its significance in creating energy access is vital for Myanmar that faces challenges such as geographical constraints as well as limited financing.

With this background, TERI with support from IGES, Japan conducted a technical assessment study, focusing on cleaner and sustainable options for electricity production and distribution in Myanmar to enhance electricity access especially in the rural areas of the country. The study further aimed to provide a road map and recommend ways and means for disseminating renewable energy based distributed generation systems and suggest delivery model(s) and implementation arrangements, taking experiences South Asia. In addition to the above, the study also attempted to explore possible scope of capacity building support and possibility of engaging Japanese private entities using Joint Crediting Mechanism (JCM) promoted by the Japanese government. The methodology adopted for the study consisted of extensive review of literature, a mission to Myanmar to meet key stakeholders and learn from their experiences about the local situation in the electricity sector, data compilation, analysis and preparation of the road map based on the analysis.

The literature survey and discussion with key stakeholders indicate that the development of electricity infrastructure in Myanmar has been low, with only small percentage of the country connected to power grid. The central region of Myanmar has predominant grid connection, especially the areas on both sides of the highway from Yangon to Mandalay. The national power grid

network covers only 5.3% of the country's 62,218 villages, whereas 20.5% villages are electrified by off-grid means, leaving around 74% of the villages un-electrified. The areas with lowest electrification ratios are: Rakhine (6%), Ayeyarwaddy (9%), west of Yangon in the Ayeyarwaddy delta; and Tanintharyi (9%) in the southeast. On the other hand, the urban areas of Yangon City has the highest electrification ratio (67%), followed by Nay Pyi Taw (54%), Kayar (37%), and Mandalay (31%). While the average grid access rate was less than 50 villages per year during the 2003 to 2008, it is now being done rapidly (average 800 villages per year). As per verbal consultation with MOLFRD during the TERI Mission, it is reported that 22% of the electrification in the country is through grid electricity, 59% is through diesel based generators in villages, 10% through small-hydro power, 6% is through biomass gasifier and only 3% is through solar power. The per capita energy consumption grew from 45 kWh per capita in 1987 to 99 kWh in 2008 and is currently around 121 kWh per capita as compared to consumption of over 879 kWh per capita in India and nearly 680 kWh per capita in Indonesia.

The off-grid is taken forward by both government and private sector, through a network of diesel generators and small hydro power plants. Renewable energy technologies mainly solar and biomass gasification (rice husk based) are also used in the off-grid areas. Many donor funded projects have also been installed, mainly based on solar PV. The equipment for solar PV, especially panels are mainly imported from China, Japan and Korea. Apart from this, off-electrification efforts are also being carried forward by village level committees by raising fund from amongst themselves or by local private developers, who set up biomass gasification or diesel based micro power plants to provide electricity services in a particular territory. It is reported during the TERI mission that various bilateral and multilateral organizations have also funded rural electrification activities by setting-up battery charging station, community based solar PV plants etc.

The study also attempted to assess the availability of renewable energy resources using secondary sources such as NASA satellite weather database and various research publications from peer reviewed journals. The resource assessment indicate that most of the region in Myanmar receive an abundant and reliable solar radiation ranging between 4.4 – 5.2 kWh/m2/day all the year round. The country is rich in biomass resources such as woody biomass as well as agricultural waste (rice husk) and can potentially produce about 1,000 MW of power from the available biomass resources. The wind energy is abundantly available in the hilly regions of Chin and Shan States, western region, costal region and some central parts of the country. The average wind speed in most of these locations varies in between 2 – 4.2 m/s at 10 m hub height with literature indicating a gross potential for 360.1 TWh of wind energy per year. There is potential for Solar-Small Wind Turbine hybrid power projects in the country especially in areas such as Akyab, Arakan, Mergui and Ye. There is

also immense opportunity for solar/wind - biomass hybrid and solar- wind-biomass hybrid power projects. Further, Myanmar is topographically endowed with abundant hydropower resources due to numerous river systems that are found throughout the country. The potential for micro-hydro is around 29 MW and that for small hydro projects is about 168 MW.

While currently the electricity situation in the country may not be encouraging, the Government of Myanmar is strongly committed to achieving Universal Access to Electricity with the goal to achieve atleast 50% coverage by 2016 and 80% coverage by 2030. In the short term, the Ministry of Electric Power proposes to cover around 4793 villages with electricity grid by 2016. On the other hand, the Ministry of Livelihood, Fishery and Rural Development (MOLFRD) has made provision of electrification of an additional 1300 villages through off-grid technologies by end of the 2015. A Rural Electrification and Potable Water Resource Committee, led by the MOLFRD, has been established in 2013 through a Presidential Decree, where one of the mandate is to promote renewable energy for rural electrification in complimentary to grid electrification. A Myanmar National Electrification Plan is currently being prepared and is supported by the Energy Sector Management Assistance Programme of the World Bank. In addition, the ADB is also supporting implementation of grid connected and off-grid renewable energy in phases.

Based on the situation analysis and resource assessment study, it can be said that different technical and delivery models of off-grid electrification have to be undertaken, depending on the local socio-economic situation of state/region, in addition to the grid based electrification efforts to achieve the objective of universal access to electricity by 2030. Some of the models which can be attempted in the country includes among others, Standalone Charging Station Model and Solar Charging Station with DC micro-grids in medium to low density areas with poor affordability to pay, Mini-grids for densely populated areas with potential for productive load and Solar Home Systems for isolated and sparsely populated areas.

To achieve the above objectives and for success of any electricity access program, it is also important to have the government's commitment in creating an enabling environment, which includes having a clear cut policy framework and milestones, systems for defining and enforcing appropriate standards, financial support mechanisms and support for capacity building. Some of the policy measures which are expected to assist in scaling up the dissemination of renewable energy interventions for enhancing electricity access in off-grid areas are:

- Coordinated approach for scaling up off-grid interventions
- Innovative financing of off-grid projects
- Adoption of international standards on technologies

- Regulation of the off-grid sector
- Establishment of service and training centres
- Multi stakeholder capacity building & collaborative research
- Regional Cooperation for transfer of technology and knowledge
- Harnessing NGOs' experiences for policy support activities

With the objective of setting up potential demonstration projects with Japanese engagement, the study suggests that Rakhine, Sagaing and Tanintharyi could possibly be considered for the demonstration project(s). One cluster (4-8 villages per cluster or a township) from each of these regions could be identified, in consultation with the local regional government, for preparing the feasibility report. The stakeholders' workshop, organised in Yangon on March 4, 2013, was also consensus in suggesting that village clusters in Sagaing state should be considered for demonstration project implementation as logistically it will be easier to manage projects in Sagaing, the people are most vulnerable with poor economic condition and do not have access to electricity and there is availability of different type of renewable energy resources in the state. Based on the analysis and experience from projects implemented in South Asian countries, a project developer led institutional model (with either single resource driven standalone or a hybrid technology based mini-grid project) has been conceptualised for implementation as the demonstration project. The detail analysis of the suggested model, taking inputs from different stakeholders such as probable project developer in Myanmar, Regional Governments, MOLFRD, MOEP, Financial Institutions in Myanmar and IGES, can be done as phase 2 of this project. Accordingly, a concrete model can be developed for delivery of electricity services in off-grid regions of Myanmar.

3.2 Stakeholders' Consultation Workshop

Agenda:

Stakeholder Consultation Workshop on Off-grid Electricity Access in Myanmar

March 04, 2014,

Myanmar Engineering Society Building, Hlaing Universities Campus, Yangon, Myanmar.

This half-day workshop is being organized as part of the ongoing research study on off-grid delivery options titled "*Delivering energy access through clean energy in Myanmar – A technical assessment for off-grid energy supply*". The project is executed by TERI, New Delhi with support from Institute for Global Environmental Strategies (IGES), Japan. Myanmar Engineering Society (MES)**.** The objectives of the study are to:

- Undertake a technical feasibility assessment for identifying alternative technical and delivery model, especially through solar and biomass energy, for enhancing rural electricity access in Myanmar;
- Provide a road map and recommend ways and means for disseminating renewable energy based distributed generation systems and suggest delivery model(s) and implementation arrangements, taking experiences from India and South Asia.

The aim of this workshop is to present the findings from the research study to key stakeholders in the rural electricity sector in Myanmar and to brainstorm for developing the off-grid electricity sector road map for the country.

Program Schedule

09.00 – 09.30: Registration (with tea/coffee)

10.00 – 10.10: Welcome Remarks – Mr U Win Khaing, President, Myanmar Engineering Society

10.10 – 10.30: Presentation on Joint Crediting Mechanism and Objectives of the study: Mr Kenta Usui, Policy Researcher, Institute for Global Environmental Strategies (IGES), Japan

10.30 – 11.00: Presentation on the off-grid study and its findings by Mr Ankit Narula, Research Associate, TERI, New Delhi

11.00 – 12.30: Moderated Discussion

Chair: Dr Win Khaing Moe, Director General, Myanmar Scientific and Technological Research Department, Ministry of Science & technology, Union Govt. of Myanmar

Co-Chair: Mr U Thoung Win, Vice President Myanmar Engineering Society

12.30 – 13.30: *Lunch and Wrap up*

Summary:

A stakeholders' workshop was organised in Yangon on March 4 to present the findings from the research study to key stakeholders in the rural electricity sector in Myanmar and to brainstorm for developing the off-grid electricity sector road map for the country. The workshop was organised in association with the Myanmar Engineering Society and was attended by around 18 key experts form the rural electricity sector. TERI professional made a presentation on the project and thereafter the participants contributed to a lively discussion. The comments of some of the key participants are produced in below:

The introductory remarks began with Mr Khaing, President of Myanmar Engineering Society, sharing that the government of Myanmar has the objective of electrifying 75% of households by 2030. The government is planning to electrify 4500 villages with its funds and more villages to be electrified by way of grants and other assistance. He opined that rural electrification in Myanmar is a vital task to be achieved under poverty alleviation program, for which community based projects need to be devised. These projects will not just be beneficial in economic terms but also good from sustainability point of view and will be formulated in such a way that they could be linked to other activities in villages embedding livelihood and thus enhancing greater participation. He also opined that women should be made a vital constituent of such projects to help achieving a goal of women empowerment. Further, Mr. Khaing threw light on the need of telecommunication development which will promote electrification in their rural area of operation. In all of this, a need to evolve

micro financing was also felt to support in achieving the above mentioned goals.

Subsequently, while taking part in the round table discussion, Mr. Khaing further reflected on the coordination problems between the ministries working for the same developmental project and a grave requirement for the adequate practices on minimum resource estimation. Further, he stated that Myanmar government is taking assistance from Thai government to carry out detailed on-ground renewable energy resource estimation. However, Myanmar government must undertake detail studies to evaluate the assessments made by private parties on renewable energy before going ahead and also there is a need of correlating the studies and specifying clear objectives of the studies taking place by the government.

He also shared that currently, Myanmar Engineering Society (MES) is doing a household survey for their energy requirement with GESS which has drawn some vital information and MES feels that government should also intervene in it as this information would be of significant value to the national repository. Also, it was further discussed that National Energy Management Committee (NEMC) will decide on the ministry which will look into rural electrification in future.

Mr. Kenta Usui of Institute for Global Environmental Strategies (IGES) highlighted the working of JCM (Joint Crediting Mechanism) and future prospect of Myanmar being a signatory to it. JCM provides financial assistance and latest technologies meant for providing clean and efficient energy systems or services to the nations working on climate change mitigation measures. Myanmar government instituted a committee in December 2013 to formulate strategies to control climate change. However, climate change as an issue is not a priority for Myanmar government as its greenhouse gas emission is negative but the government feels that these strategies will attract benefits of using renewable energy, which will help in curbing indoor air pollution and hence Japanese JCM was thought as a prospective mechanism. So far JCM has 10 countries as its signatories and Japanese government are planning to double such agreements in future and expecting Myanmar as a soon-to-be signatory. Once signed-up for JCM, a committee shall be constituted which will have members from both Japan and Myanmar to work jointly on the schemes meant for the purpose.

Col Thoung, head of the renewable energy working group in Myanmar Engineering Society and a member of NEMC reflected upon the discussion of putting rural electrification under the Ministry of Electric Power (MOEP) and extracting out that responsibility from the Ministry of Livestock, Fishery and Rural Development (MOLFRD). This discussion gave rise to skepticism in the minds of few concerned that MOEP may not be able to look after the rural electrification on a same scale as it

looks after other areas such as grid extension and power plants under its arena. The discussion further stressed upon the need for effective renewable energy assessment in the country.

Mr. Aung Myint,General Secretary of Renewable Energy Association, Myanmar talked about the need to encourage private participation (such as IPPs – independent Power Producers, SPPs – Small Power Producers, and VSPP – Very Small Power Producers) in renewable energy based projects. He stressed on the government requirement to build strategic guidelines in order to channelize the assistance from the funding organizations, such as ADB and UNDP, to support and build their plans. He also said that there are many government installed mini-grids in the country which are in bad condition and either not efficient or not functioning. The government and related organizations needs to work on capacity building and up-gradation to have efficient mini grids. This can be done through implementing on-ground trainings, teaching mini-grids to locals of Myanmar and technicians. For this purpose, a proposal can be built and submitted to JICA. Public-Private Partnership (PPP) has proved to be an extremely successful mechanism in developing renewable energy systems/services in many countries and thus should be tried in Myanmar.

Mr. Myo Myint from Earth Renewables Pvt Ltd, opined that the manufacturing of solar PV systems in Myanmar can be initiated as cheap labour is available and the government can reduce the cost of solar PV systems. There are many investors interested in investing in the solar energy sector, if government is willing to help. There are households in Myanmar installed with Solar Home Systems (SHS). However, consumers often buy low quality solar panels due to lack of awareness. To deal with this situation, NGOs can play an important role with the help of a system where NGO collects money from the user and the company installs the system and both government and NGO ensures the quality of the system.

Like, under a program for village electrification by ADB and the World Bank, 400 villages were chosen as pilot projects for installation of SHS and battery charging stations. In this project, the regional government coordinated with villages to invest their money and the quality, design and technical aspects were decided among ADB and the government. In this program, 10% funds came from regional govt., 40% from user and 50% from ADB.

Ms. Aye san Dar Myo from Electricity Supply Enterprise under MOEP highlighted the importance of extensive and effective research and development (R & D) in the country regarding renewable energy sector. For this purpose, the government should also collaborate with university and research institutions to enhance the scale of R & D. Also, to understand the ground reality regarding the demand and actual requirement of the people, government should focus on studies supplemented

with surveys.

Participant List

S. No	Name	Organization
1.	Dr Sew Alyint	Myanmar Engineering Society
2.	Goe Pyae Aung	Myanmar Engineering Society
3.	U Aung Myint	Renewable Energy Association Myanmar
4.	U Aung Aung Thwin	Ministry of Industries
5.	U Sein Aung	Ministry of Electric Power
6.	Ankit Narula	TERI, India
7.	Daw Than Than Lin	Myanmar Engineering Society
8.	Dr Aye San Dar Myo	YESB, Ministry of Electric Power
9.	Dr Su Su Win	EP, YTA
10.	Dr Than Law Htune	EP, YTD
11.	U Sein Lin	Directorate of Industrial Planning
12.	U Myo Mynt	Earth Renewable Energy Co Ltd
13.	U Aung Thet Paing	ESRE GM : Myanmar Engineering Society
14.	Daw Gya Laing Tin	Department of Electric Power
15.	U Tin Maung Cline	-
16.	Uttun Naing Aung	Kaung Kyaw San Group of Companies
17.	Col Thoung Win (Retd.)	Myanmar Engineering Society
18.	U Win Khaing	Myanmar Engineering Society
19.	Kenta Usui	IGES, Japan

Delivering energy access through clean energy in Myanmar - A technical assessment for off-grid energy supply

Technical Lead

The Energy and Resources Institute (TERI)

Research Collaboration

Institute for Global Environmental Strategies (IGES)

Ankit Narula
The Energy and Resources Institute (TERI)
ankit.narula@teri.res.in

Structure of Presentation

- About TERI
- Objective of the study
- Situation analysis of rural electricity sector
- Renewable energy resources in Myanmar
- Roadmap for off-grid electrification in Myanmar

What is TERI

- A not-for-profit research & development and policy think tank;
- Established in 1974 in New Delhi;
- More than 1000 professionals, with centers spread across 5 cities in India; Overseas presence in London, Washington DC, Tokyo, Dubai and Addis Ababa

Working Areas

- Energy (inc. RE) & Power
- Regulatory practices
- Habitats and transport
- Environment
- Water and NRM
- Climate policy
- Bio technology
- Social Transformation

Objective of the Study

- Undertake feasibility for identifying alternative technical and delivery models, especially through solar and biomass energy;
- Provide a road map for renewable energy based rural off-grid electrification program for Myanmar;

This workshop aims to present the study findings to key stakeholders of Myanmar and brainstorm for developing the off-grid electricity sector road map

Methodology

- Extensive review of Literature
- Scoping Mission to Myanmar (20-28 Nov, 2013)
- Meeting with key stakeholders (Met 24 experts)
- Data analysis
- Stakeholder workshop (4th March 2014)

- About TERI
- Objective of the study
- Situation analysis of the rural electricity sector
- Renewable energy resources in Myanmar
- Roadmap for off-grid electrification in Myanmar

Profile of Myanmar

	Myanmar	Cambodia	Laos	Thailand	Indonesia	India
Total population (million)	61	15	6.5	66.8	246.9	1237
Electrification rate (%)	49	31	63	88	73	75
Total population without electricity (million)	24.7	10	2.2	8	63	293
Rural electrification rate (%)	28	16	51	82	56	67
Per capita electricity consumption (kWh)	121	144	NA	2,335	639	879
GDP per capita ($)	1,126	944	1,369	5,775	3,557	1,516
HDI rank	149	138	138	103	121	136

Source: IEA ,2012; UNDP, 2013; PIDS, 2013; MOSPI, 2013; UNSTATS, 2012

Electricity situation in Myanmar

- More than 70% of rural population depends on diesel lamps, batteries or candle for lighting (typical expense US$ 9-12 per month)
- National power grid covers only 4.5% of the villages; 23% by off-grid means
- Grid covers mostly central part of Myanmar along the highway from Yangon to Mandalay

Number of villages in Myanmar	62,218
Electrified villages (grid connected)	4520
Electrified villages (off-grid)	14,195
Un-electrified villages	43,503

Source: MOEP, 2013;

Region wise electrification

State/Region	Percent Electrified	No of Villages		
		Grid electrification	Off-grid	Un-electrified
Kayar State	41	53	42	416
Mandalay Region	35	738	189	2313
Mon State	31	254	318	628
Kachin State	26	1	283	2295
Bago Region	23	309	2070	2416
Kayin State	23	46	79	1938
Sagaing Region	**22**	624	3060	2295
Chin State	**16**	-	326	1026
Ayarwadi Region	**10**	343	2992	8602
Shan State	**9**	374	786	13424
Tanintharyi Region	**9**	573	1611	2588
Rakhine State	**6**	-	1033	2827

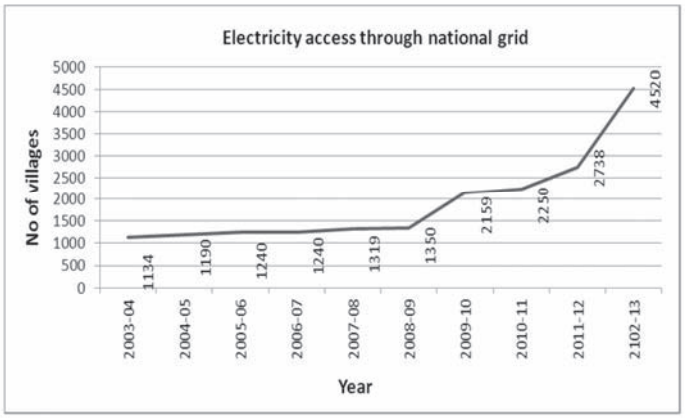
Source: MOEP, 2013;

Source: Palang Thai, 2013

Electricity Tariffs

- Grid connected tariff:
  - 35 kyats (3.6 US Cents/kWh) & per kWh for residential, municipal users and
  - 75 kyats (9 US cents/kWh) for public industry and enterprises.
  - Tariff reportedly to be increased to 50 kyats (5.15 US Cents/kWh) for residential (if consumption exceeds 100 kWh) and 150 kyats (15.4 US Cents/kWh) for public industry and enterprises (if consumption exceeds 5,000 kWh)
- Off-grid:
  - Private Power Providers:
    - Diesel: 200 to 500 kyats/kWh (US$ 24 – 60 cents) or 2,000 kyats/point/month (US$ 2.5).
    - Gasifier: 200 – 700 kyats/kWh (US$ 24 – 85 cents) or 1,000 kyats/point/month (US$ 1.2)

Trend of electrification in Myanmar



Source: MOEP, 2013

- 50 villages per year from 2003-08
- 800 villages per year is being currently electrified (since 2009)
- Considering the current trend, it may take 50 years to electrify all the villages
- Considering the electrification target by 2030, the rate of electrification will have to be increased to 2600 villages per year
- RE based Off-grid options thus have a very big role to play because of:
  - Low gestation period
  - Can use locally available resources, which are in plenty in Myanmar

Experiences of Off-grid Electrification in Myanmar

- Government Supported Projects:
  - Small hydro (1 kW to 10 MW power plants): 32 small and mini hydro plants installed by ESE. Regional govt. – 17 mini/29 micro/6 pico hydro plants. Irrigation dept. installed 870 kW hydor projects.
  - Diesel generators: 645 plant by MOEP (77.6 MW) electrifying 312 villages.
  - Biogas: Power generation from biogas up to 19 MW
  - Solar & wind: 116 kWp & 519 kWe resp. (by 2009)
    - SPV based community battery charging station in collaboration with Yoma bank & Energy Planning Dept.
    - Demo projects with assistance from NEDO, MOEP, MSTRD & Dept. of Physics
    - System installed in schools & institutes with assistance
    - Wind turbines installed at Technological University (Kyaukse), Govt. Technical High School (Ahmar) etc.

Experiences of Off-grid Electrification in Myanmar – Cont'd

- Privately Operated Projects: Diesel, hydro, solar & biomass gasifier
  - 2 to 5 kW hydro systems installed for own use and supply
  - Solar based home systems (SHS), battery charging, water pumping, resorts etc. installed
  - 50 to 75 Wp SHS in villages; comes at US$ 300 to 500
  - Many SPV companies: Earth Renewables, Sunlabob, Bennu-Solar, Proximity Designs etc
  - Around 1,096 biomass gasifier operating (as on 2010) based on wood chips & rice husk for electrification.

Experiences of Off-grid Electrification in Myanmar – Cont'd

- Donor funded projects:
  - Hydro power, solar PV and biomass gasifier
  - SPV based charging stations are installed
  - Many operating on VEC model in Sagaing, Mandalay, Ayarwaddy, Shan & Mon states
  - ADB, UNDP, UNIDO etc. have funded these projects

Targets for electrification

- Grid connected

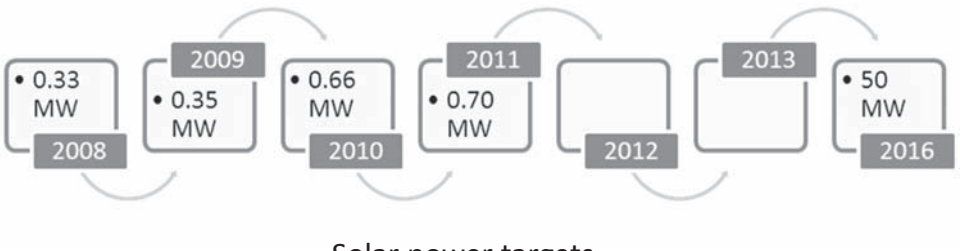
Term	Projected Population (million)	Required Generation (GWh)	Target for Rural Electrification (%)
2011-12	60.44	10,444	27
2012- 16	63.14	17,797	34
2016-21	66.69	32,874	45
2021-26	70.45	60,132	60
2026 -31	74.42	111,100	80

	2013-14	2014-15	2015-16
Villages	3575	4116	4793

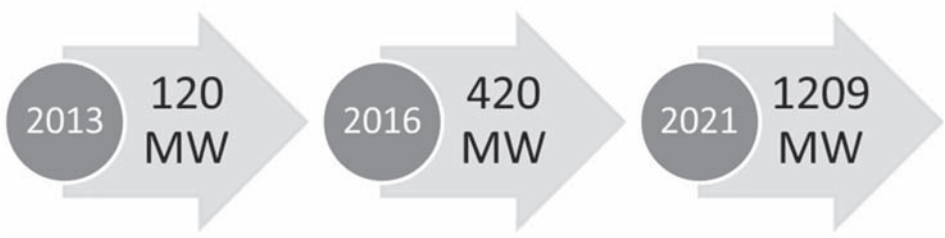
- Off-grid:
  - MOLFRD will electrify 1300 villages by 2014-15

RE Achievement & Target

Wind power targets



Solar power targets



Source: Khaing, 2013

Issues and Challenges

- Multiple ministries involved in rural electrification – may lead to non clarity in roles , thereby project execution
- While long term target for grid extension and installed capacity exist, Only short term target for off-grid electrification
- Tariff imparity – this may slow the process of off-grid electrification
- Uncertainty in policy framework - private sector may not be willing to invest in off-grid options unless there is clarity on the long term returns from the project

Challenges in RE based off-grid electrification

- Technical:
  - Lack of regulations, codes, standards etc.
  - Lack of trained human resources to scale up off-grid
  - Waste disposal from gasifier
  - Limited R&D
- Financial:
  - Limited funds
  - Lack of proper financing mechanisms/rural energy financing market do not exist
- Institutional:
  - Complicated framework
  - Communication & coordination

- About TERI
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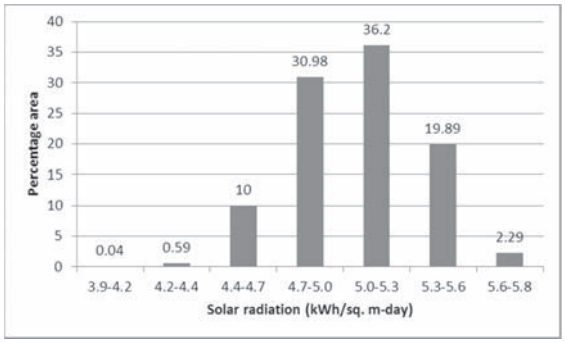
- **Renewable energy resources in Myanmar**
- Roadmap for off-grid electrification in Myanmar

Solar Resource

- Annual average daily solar radiation between 4.4 – 5.2 kWh/m^2/day
- Central portion receives highest radiation. Other regions also receive adequate solar radiation
- Total potential: 51973 TWh/yr.

Source: Janjai et. al. 2013

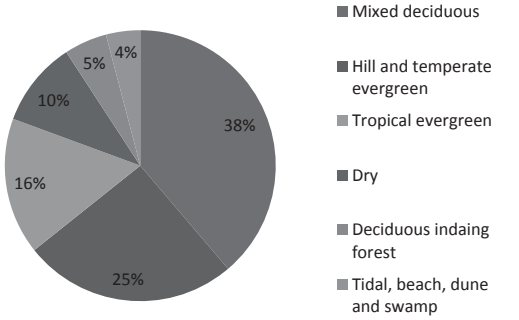


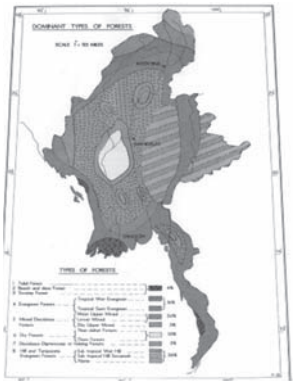
Source: Adapted from Khaing, 2013

Biomass Resource

Type	Quantity (million ton/year)	Power generation potential (MWe)
Rice Husk	4.40	60 – 70
Lumber waste	1.50	15 – 25
Bagasse	2.10	25 – 35
Molasses	0.24	1 – 1.5
Livestock waste	34.4	--
Woody Biomass	5,256	300 - 400

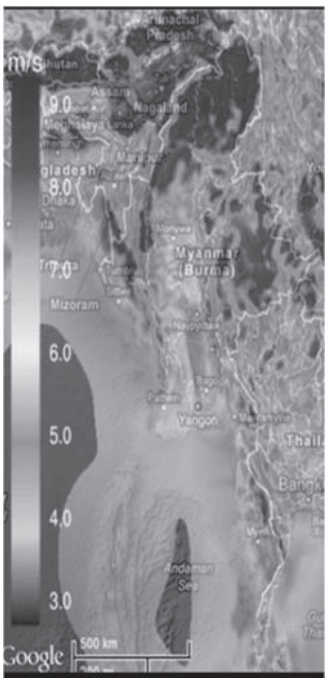
MES, 2012; TERI, 2014





Wind Energy Potential

- 2930 MW: Mon state, Kayin state, Thanintharyi region, Shan state, Kaya state
- 1102 MW: Chin state, Rakhaing state, Ayeyawaddy region and Yangon region
- Overall potential of 360.1 TWh



Source: MOEP, 2012

Small/micro hydro Power Potential

- Small/micro hydro potential
- World bank estimates 100,000 MW potential for the country
- ESE installed 33 MW SHP in addition to 6.51 MW installed by other agencies

State and division	Micro hydro capacity (1 kW to 1 MW)			Small hydro capacity (1 to 10 MW)	
	Number of projects	Projects capacity (MW)		Number of projects	Projects capacity (MW)
Kachin State	17	5.33		14	48.18
Chin state	11	3.48		2	2.8
Shan state	35	10.64		24	63.9
Sagaing state	5	0.806		3	13.3
Mandalay division	3	0.65		2	6.25
Magway division	1	0.1		2	11
Rakhine state	6	1.915		-	-
Kayah state	2	0.158		-	-
Bago division	4	1.89		-	-
Kayin state	3	0.864		1	3
Mon state	5	1.248		-	-
Taninthayidivison	9	1.706		2	19.5
Total	101	28.787		50	167.93

Source: MOEP, 2006

Challenges – RE resource assessment

- Technical:
  - Inadequate ground measured resource data
  - While many organisation has independently done resource assessment studies, all information have not been compiled and available at a central depositary
  - Validation of satellite based data is required

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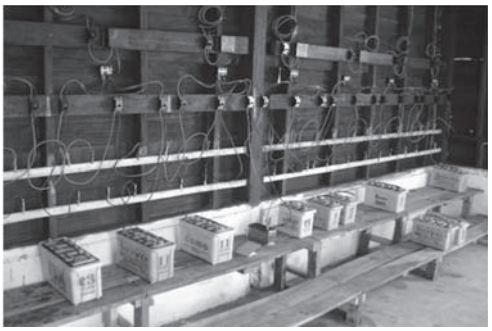
Technical and delivery model

- Decentralized/stand-alone interventions
- Centralized mini-grids (solar, gasifier, MHP, hybrid)
- Multiple delivery models, depending on local conditions
  - Village Energy Committee
  - Entrepreneurial approach/Private Sector led
  - Micro financing of stand-alone products

Stand-alone charging station

- Suitable for areas where purchasing power is low (Ref. LaBL, India);
- Demand is only limited to lighting & mobile phone charging;
- Fee for service model (user pay for the service and not buy the product)
- Typically 50-100 lanterns/batteries
- Given to village entrepreneur on down payment and installment (financed by local bank)
- Percentage of revenue to repay loan and rest as income
- It is already prevalent in some areas, hence may be easy to implement
- Local bank financing may be required for infrastructure set up



Charging station with DC micro-grid

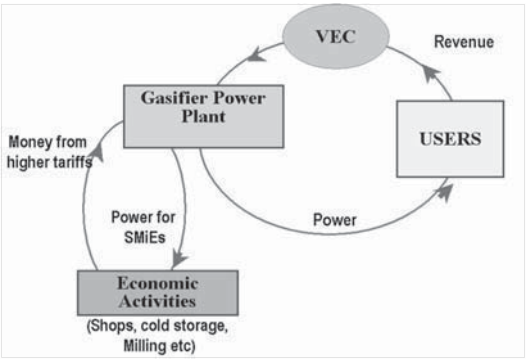
- Combination of SCS and DC micro-grid, Suitable for high density areas -only suitable for lighting load & mobile charging facility
- Micro-grid supplies power from central plant to households using DC distribution line
- For low density areas, line losses will be high, so not suitable
- Fixed connection – LED based light to 20-60 houses
- Fee-for-service: renting lanterns and/or weekly/daily fees for fixed lights –Local enterprise can have option for mobile charging, selling LEDs, and efficient cook stoves, act as energy hub
- Local bank financing may be required for infrastructure set up

Green Mini-grids (AC)

- Suitable for densely populated areas; Mandalay, valley of Ayeyarwady river, Sagaing, Bago etc.
- Can provide both lighting and power productive appliances (full range of rural services)
- Architecture similar to conventional grid
- Can be based on Solar PV, biomass gasifier, hybrid system of solar, biomass, wind and/or diesel

Delivery Model

- Both community based or private sector led implementation based on local conditions
- In VEC model, active participation of local community is central
- However, experience from India shows beneficiary payment is poor in many places because of poor paying capacity
- Integrating livelihood with residential services (Electricity supply for commercial activities)



Mini-grids – Cont'd

- Private model – major role of district government, local bank with nodal ministry to train and select local developer
- Energy Service Provider (ESP) Model or BOOM can be tested in not-so-remote villages, with large population
- District level project developer or rural energy service company taking lead in clustering villages
- Responsible for system the engineering, installation, operating and maintenance
- VEC act as regulator and set tariff, biomass price, redress grievance

Mini-grids – Cont'd

Summary of transactions between key entities in the ESP model

S. No.	Entities	Offers	To	Expects in return	Instrument
1	SHGs	Fuel	ESP	Payment for fuel supply (for biomass projects only)	Biomass price set by VEC
2	ESP	Electricity	Consumer	Payment of electricity	Tariff set by project developer in consultation with VEC
3	Consumer	Payment	Developer (through ESP)	Reliable Electricity	Connection Agreement
4	OEM	AMC	Developer	Payment	AMC agreement
5.	ESP	Payment	Developer	Services and training	Lease Agreement

Viability of mini-grids – Rule of Thumb

For mini grids with total load ranges > 100 kW

(a) Estimated number of potential connections (N) in the community, and
(b) Average distance of the rural community from the centralized grid (D).

If N/D < 2 connections/km – then grid extension is not likely to be viable
If N/D > 30 connections/km – then the grid extension is likely to be viable

For mini grids with total load ranging >10kW

Calculating the total number of connections (N) within 500 m radius from the rural community centre where the plant is situated.

If N>100 – the grid could be a viable option. Viability would also depends on load density
If N<100 – in this case, it'll be challenging to sustain an adequate level of O&M as well as efficient cash management over time.

Solar Home Systems (SHS)

- Suitable for sparsely populated
- Flexible as per individual's demand; can vary from 10 to 200 Wp
- Supply power only for lighting, DC fans, TV etc.
- Price varies between US$ 120 To 160 for 100 Wp systems
- Solar LED home lighting much cheaper: US$ 100-300
- Consumer financing model, similar to IDCOL, Bangladesh, with loan at 12-15% per annum for 2-3 years will help in scale up

Recommendations

- Coordinated approach
  - Have a department under MOEP for rural electrification for grid connected as well as off-grid development may lead to better outcomes
  - Develop Master plan for rural electrification, focusing on both grid and off-grid options
  - Single window service for private developers/ concessionaire approach
  - Aspect of best applied technology. Off-grid plants can be integrated with national grid when grid reaches such areas avoiding technology obsolescence (e.g. China)

Recommendations – Cont'd

- Financing
  - A key challenge in scaling-up and up gradation of projects.
  - Mainly rural areas have high upfront cost
  - Designated Financial Institution who can promote micro financing of SHS, lanterns etc. to consumers and also lend to village entrepreneurs/ private developers at low cost of capital
  - This may be done through:
    - Designated financial institution to generate low cost of capital -assistance from ADB, JICA, World Bank etc.
    - Central bank of Myanmar can have lower interest rate for clean energy project esp., energy access projects
    - The designated institution to partner with regional cooperatives, MFI & NGOs in states/regions for energy access financing
    - Organize training for local financing institutions regarding technology, standards/quality assurance, business model etc.
    - Reduced tax on RE equipment imports & promotion of local manufacturing through technology transfer (e.g. India, Japan, etc.) to keep the product cost low

Recommendations – Cont'd

- Adoption of International Standards
  - Important for both end-consumers and enterprises
  - LED lamps available. Electronics more prone to expiry
  - Performance oriented technical specifications
  - Incorporate environment component in the standards.
  - IEC standards should be adopted

Recommendations – Cont'd

- Establish Service Centers
  - Experience indicate product sale without provision for service may not yield desired results in developing countries
  - Need for after sales service after technology diffusion
  - Training centers for responsive maintenance and training technicians (involve Technical Universities and Tech Schools, spread over entire Myanmar)
  - Bilateral/multilateral support can be tapped in this regards

Recommendations – Cont'd

- Multi-stakeholder capacity building
  - Training workshops (in-country) for stakeholders across value chain of RE and energy access like government authorities, vendors, manufacturers, implementers, research org. & financing agencies.
  - Arena for exploration, sharing knowledge, success stories etc.
  - Exposure visits to successful off-grid electricity access project in South & South-east Asian countries for various stakeholders –
  - Capacity building for researchers on data collection, standards, methodologies etc.

Recommendations – Cont'd

- Transfer of technical knowledge
  - Patents and IPR concerns may hamper in acquiring technologies
  - Transfer of knowledge around technical know-how to assemble SHS, lanterns, pico-hydro systems etc.
  - E.g. Reference circuit designs of technologies to be transferred to manufacturers

Recommendations – Cont'd

- Harness NGO experience for policy advocacy
  - In Myanmar NGOs plays a critical role
  - NGOs mainly restricted to service delivery and less on policy advocacy
  - NGOs have better experience about rural dynamics and energy issues
  - Training/Exposure visits for NGOs along with Government officials for policy learning from other countries (e.g. Indian Solar Mission, Thailand Rural Electrification Program) - Can IGES assist?

Potential demonstration projects

S. No.	State/Division	Status of Electrification	Wind resource (m/s)	Solar resource (MJ/m²/day)	Biomass resource	Technology option
1	Tanintharyi	Poorly electrified	7-8 (Good/Average)	15-16 (Average)	Evergreen/ Deciduous forest	Solar-wind hybrid Mini-grids
2	Sagaing	Poorly electrified	3-4 (Poor)	15-17 (Average/Good)	Evergreen/ Deciduous forest/rice husk	Biomass based Mini-grids
3	Rakhine	Poorly electrified	7-8 (Good/Average)	15-16 (Average)	Evergreen/ Deciduous forest/rice husk	Solar-wind hybrid Mini-grids

Points of discussion

- Feasibility of location & technology
- Delivery models for scale up (Community vs. Private)
- Involvement of local partners (such as MES, others) – what type of involvement

4. Organising working group of low-carbon Myanmar

In order to accelerate JCM project formation in Myanmar, “Low-carbon Myanmar Working Group” has been organized with participation from local governments, private firms and other related institutions. The WG meetings were organized three times in Tokyo. In addition, some members of the WG participated in the 3rd Myanmar Green Economy Green Growth Forum.

4.1 1st Meeting

Organizer: Institute for Global Environmental Strategies (IGES) Date: 14:00 – 17:30, 31 July 2013, Wednesday Venue: 4th floor meeting room, Japan Press Center Building

Draft agenda

14:00 - 14:10	Opening remark（Ministry of the Environment, Japan）
14:10 - 14:30	Self-introduction by participants
14:30 - 15:00	Latest status of Joint Crediting Mechanism (JCM) and Yangon project（IGES）
15:00 - 15:30	Current status of the environment in Myanmar（IGES）
15:30 - 16:30	Overview of waste management practice in Yangon（IGES） Discussant: JFE Engineering Discussant: Tokyo Metropolitan Government
16:30 – 16:45	Tea break
16:45 – 17:15	Overall discussion
17:15 - 17:30	Wrap-up and next steps（IGES）
17:30	Closing（IGES）

4.2 2nd Meeting

Agenda

Organizer: Institute for Global Environmental Strategies (IGES)
Date: 14:00 – 16:30, Wednesday, 26 December 2013
Venue: 4th floor meeting room, Nippon Press Center Bldg.
2-2-1 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011

14:00 - 14:15	**Opening remarks** - Tomoki Uematsu, International Cooperation Office, International Strategy Division, Global Environment Bureau, Ministry of the Environment of Japan
14:15 - 14:20	**Introduction of participants**
14:20 - 14:50	**Latest trends of climate change policies in Myanmar** (Kenta Usui, Climate change and Energy area, IGES) - High-level Committee on climate change in Myanmar - Climate change in the context of Green Economy Green Growth (GEGG) conference - How Japanese firms and local government can harness climate change-related opportunities in Myanmar - Q&A
14:50 - 15:20	**Report from IGES- Yangon City Development Committee (YCDC) joint workshop on waste management** (Nirmala Menikpura, Researcher, Sustainable Consumption and Production Area, IGES) - Waste management policies in Yangon - Q&A
15:20 -15:30	**Tea Break**
15:30 - 16:00	**Latest trends in Joint Crediting Mechanism and project formulation in Yangon** (Kazuhisa Koakutsu, Climate and Energy area, IGES) - JCM and latest trends - Project formulation in Myanmar - Q&A
16:00 -16:30	**Overall discussion and information sharing**

16:30	**Close**

4.3 3rd Meeting

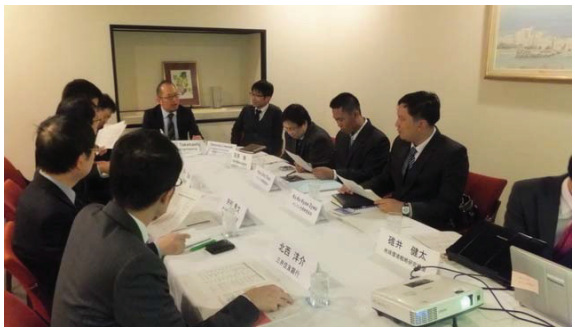
Organizer: Institute for Global Environmental Strategies (IGES)

Date: 13:00 – 15:30, Tuesday, 25 February 2014

Venue: Restaurant Pavillon, Fukoku-seimei Bldg,.
2-2-2 Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011

Agenda

12:00 - 13:00	**Lunch**
13:00 - 13:10	**Opening remarks** - MOEJ/IGES
13:10 - 13:20	**Introduction of participants**
13:20 - 14:00	**Current situation of waste management and other environmental issues in Yangon** Presented by Yangon City Development Committee Pollution Control and Cleansing Department (YCDC-PCCD)
14:00 - 14:30	**Energy policies in Myanmar** Kenta Usui, Researcher, Climate change and energy area, IGES
14:30 -15:00	**Other presentations (tbc)**
15:00 -15:30	**Overall discussion and information sharing**
15:30	**Closing**
16:00 – 17:30	**Bilateral meetings with YCDC staff**




Ko Ko Kyaw Zyaw
井村 秀文

4.4 Participation to the 3rd Green Economy Green Growth (GEGG) Forum

The 3rd Green Economy and Green Growth Forum took place on 20-22 November 2013. The Forum was opened by U Thein Sein, the President of Myanmar, and was attended by 14 other Ministers of Myanmar. The Forum spent three days – one in Nay Pyi Taw and two in Yangon – discussing the "water-energy-food nexus", highlighting the importance of cross-sectoral and integrated policy-making for governing these critically important resources.

On Day 2, IGES organised a parallel session entitled "Positioning Water-Energy-Food Nexus in Practice: Regional Cooperation for Myanmar Resource Sustainability", which welcomed three speakers from Myanmar, three from Thailand and India, and three from Japan. The Japanese speakers included representatives from the City of Kitakshushu, JFE Engineering, and JICA.

Session summary

The parallel session addressed "practical solutions to address the water-energy nexus" and "The role of regional cooperation to ensure resource security in Myanmar" and delivered the following four key messages.

- *Overarching national policy and coordination mechanisms are needed in Myanmar*
  Given the cross-cutting nature of environmental concerns and regional diversity in Myanmar, the need for overarching national policies was emphasised. These include land use policy (MOECAF), energy policy (Myanmar Engineering Society), and green national development plans (IGES). Speakers also stressed the need to establish mechanisms to coordinate multiple authorities to work on cross-cutting environmental concerns (Food security working group and IGES).

- *Technology plays a critically important role, but needs to carefully reflect the local context*
  The important role of technologies was emphasised by many speakers, including some who introduced specific technologies to address the water-energy-food nexus in Myanmar. These include waste-to-energy incineration plants (JFE Engineering) and photovoltaic solutions for rural electrifications (TERI). In addition, speakers noted that technologies need to carefully reflect the local context and enabling conditions. One example put forward was that cellphones may not fully function in places where electricity is not available (TERI).

- *Climate change poses both challenges and opportunities for Myanmar*
  The cases of recent mega-scale typhoons in the Philippines, and Cyclone Nargis, which occurred five years ago in Myanmar, demonstrate that the impact of climate change is a considerable threat to Myanmar. Furthermore, given Myanmar's dependency on hydroelectric power, climate induced seasonal changes to

water availability may negatively affect energy supply (IGES). At the same time, the current level of greenhouse gas emissions by Myanmar is negative. There may be opportunities for Myanmar to harness the increasing scale of climate change finance, including the Japanese Joint Crediting Mechanism, for Myanmar's sustainable development (IGES).

- *Regional cooperation in Asia can assist Myanmar's pursuit of green growth.*
  Several speakers noted possible options for regional cooperation with Myanmar. These include city-to-city cooperation with the Japanese City of Kitakyushu, off-grid technology cooperation with Indian TERI, a capacity development programme with the Thai Greenhouse gas Management Organisation, and a Low-carbon development partnership with Japan. North-south cooperation can play a role in providing incremental cost to finance green growth as well as advanced technologies. South-south cooperation may also play an important role in addressing issues that are specific to developing countries, such as rural electrification.

Session Agenda

"Positioning Energy- Water- Food Nexus in Practice: Regional Cooperation for Myanmar Resource Sustainability."

Final Agenda

11:00-11:20	Opening - Opening remarks by Hideyuki Mori, President, IGES - Honourable guest speech by Dr Rajendra K. Pachauri, Chair, The Intergovernmental Panel on Climate Change (IPCC) and Director General, The Energy and Resources Institute (TERI)
11:20-12:00	Introduction: - Towards Myanmar's Green Leapfrog Development: Opportunities and Challenges with focus on Energy and Water sectors: Ikuho Miyazawa, Policy Researcher, Integrated Policies for Sustainable Societies Area, IGES - Resources sustainability in Myanmar: Lessons from integrated assessment of water-energy nexus in neighbouring countries: Dr. Bijon Kumer Mitra, Policy Researcher, Natural Resources and Ecosystem Services Area, IGES Discussion
12:00-13:00	Lunch break
13:00-15:15	Part 1: Practical solutions to address the water-energy nexus: Chair: Hideyuki Mori, President, IGES Presentations: - Opportunities of clean energy solutions in Myanmar and in the region: Dr. U Win Khaing, President, Myanmar Engineering Society - Smart city: Ms. Keiko SASAKI, Director, Kitakyushu Asian Center for

	Low Carbon Society, Office for International Environmental Strategies, Environment Bureau, City of Kitakyushu - Implication of nexus approach for food security in Myanmar: Dr Ohnmar Khaing, Coordinator, Food Security Working Group (FSWG) - Waste to Energy with elaborate planning: Mr. Kuribayashi Kenji, JFE Engineering Yangon Office Discussion
15:15-15:30	Break
15:30-16:50	Part 2: The role of regional cooperation to ensure resource security in Myanmar Chair: Peter King, Senior Policy Advisor, IGES Bangkok Office Presentation: - Regional cooperation under the framework of Joint Credit Mechanism (JCM) : Policy Researcher, Mr. Kenta Usui, Policy Researcher, Climate and Energy Area, IGES - Capacity building for low-carbon growth in ASEAN: Mr. Satoshi Iemoto/ Dr. Jakkanit Kananurak, Capacity Building and Outreach Office Thailand Greenhouse Gas Management Organization(JICA/TGO) - Opportunities of providing off-grid energy solutions in Myanmar and in the region : Mr. Debajit Palit, Associate Director and Fellow, Lighting a Billion Lives Programme, Social Transformation Division, TERI Discussion
16:50	Closing - Hideyuki Mori, President, IGES

Detailed Note:

In the opening remarks, Mr. Hideyuki Mori, the president of IGES, stressed the importance of considering and addressing positive synergies and negative trade-offs between EWF nexus in the context of Myanmar's pathways towards green growth, and mentioned that experiences to be shared from Japan and other countries in the region would be helpful in this sense.

Dr Rajendra K. Pachauri, Chair, The Intergovernmental Panel on Climate Change (IPCC) and Director General, The Energy and Resources Institute (TERI) emphasized the importance of taking into account the culture of the society as Asia has a particular culture, which could be a good driving force of green growth unlike the Western culture of overconsumption. In this sense, local culture could be more reflected in national planning and implementation of green growth. He also stressed the importance of creating skills through proper education at multi-levels (from local to national) for accelerating Myanmar's efforts to achieve green growth.

In introduction, Ms. Ikuho Miyazawa, Policy Researcher at IGES, presented the analysis of the current status of environmental conditions and institutional frameworks based on the IGES Working Paper 2013-4, and recommended 1) to mainstream the idea of green growth in Myanmar's

development planning, 2) to strengthen environmental-related bodies such as the high-level coordination body for green growth, and 3) to learn from and working with neighboring countries through south-south cooperation.

Dr. Bijon Kumer Mitra, Policy Researcher at IGES, introduced the lessons from Thailand and India on the water-energy nexus and suggested the following 5 points including; 1) long term energy supply might get negatively affected due to lack of water and energy sector investment can be jeopardized, 2) it is important to consider spatial distribution of water resources for selection of Go and No Go areas in future power plant construction planning, 3) Diversification in energy fuel mix reduce risk of water shortage induced blackout as well as environmental impacts, 4) End-use efficiency improvement has potential to complement significant volume of water for other users, 5) In general, water abundant country like Thailand and Myanmar may not face water shortage for electricity generation. However, climate induced seasonal change of water availability may negatively affect energy supply. The questions are raised regarding difficulties of addressing regional cooperation as it is often driven by the needs of neighboring countries (i.e. energy exportation, water management, and illegal logging etc), as well as the way of non-spatial cooperation.

Co-Chair, U Win Hlaing, DG of MOECAF, concluded that the government of Myanmar is currently in the process of drafting integrated energy policy through a series of dialogue with relevant stakeholders to tackle multiple challenges of access, affordability, and efficient use of energy and water.

Session Part 1 focused on how to implement the concept of the nexus in practice regarding specific issues such as clean energy, waste management, food security, and smart city. Dr. U Win Khaing, President, Myanmar Engineering Society, presented the current status of national policy and institutional reforms in energy sector and opportunities of clean energy solutions in Myanmar and the region, and stressed that there are many potentials in Myanmar to improve access to energy, energy efficiency, and renewable energy including solar and wind power, hydropower, biomass etc, but needs proper policies, institutions, and capacity building.

Ms. Keiko SASAKI, Director, Kitakyushu Asian Center for Low Carbon Society, Office for International Environmental Strategies, Environment Bureau, City of Kitakyushu, introduced the its experiences in overcoming sever environmental pollutions in the 1960s and current activities on smart city, emphasizing the importance of partnership between residents, local government, and private enterprises, as well as a holistic approach to address not only environmental problems but also human development. She particularly stressed it is crucial to conduct a series of dialogues with

local residents to ensure their ownership.

Dr Ohnmar Khaing, Coordinator, Food Security Working Group (FSWG) presented the implication of nexus approach for food security in Myanmar and the importance of addressing sustainable use of land. She suggested that it is indispensible to pursue a systems-based preventive approach to ensure food security through national coordination mechanism, multi-stakeholder dialogue, strategies to create issue based networks, sustainable use of water and energy, and centralize regional governance.

Mr. Kenji Kuribayashi, JFE Engineering Yangon Office, shared the company's activities on waste to energy through incineration with elaborate planning in other countries in Asia and planed activities in Yangon region, stressing that the power generation will contribute to stabilize power supply in residential area nearby and lower risks of unexpected environmental impacts.

Part 2 discussed the role of regional cooperation to ensure resource security in Myanmar. Mr. Kenta Usui, Policy Researcher, Climate and Energy Area, IGES, presented the current status of Myanmar in terms of its GHG emission and its impact on climate change and its implications for regional cooperation under the framework of Joint Credit Mechanism (JCM). He pointed out that Myanmar's current level of GHG is negative, it does not make sense to reduce current level of GHG emission. Instead, Myanmar can harness increasing flow of climate finance to benefit its own sustainable development.

Mr. Satoshi Iemoto, JICA Expert, and Dr. Jakkanit Kananurak, Director of Capacity Building and Outreach, Thailand Greenhouse Gas Management Organization (TGO) jointly introduced capacity building activities for low-carbon growth in ASEAN through Thailand Greenhouse Gas Management Organization(JICA/TGO) and Climate Change International Training Center (CITC). The three steps of TGO/CITC were introduced; 1) design of the training course, implementation, and share the knowledge with ASEAN countries.

Finally, Debajit Palit, Associate Director and Fellow, Lighting a Billion Lives Programme, Social Transformation Division, TERI, shared the lessons from India on off-grid energy solutions and its implications for Myanmar and in the region. He emphasized that off-grid energy solution is a good practice of benefitting community, but need to carefully consider and design based on difference local contexts.


Third GEGG Forum
THIRD GREEN ECONOMY GREEN GROWTH FORUM
THE NEXUS OF ENERGY - WATER - FOOD
For
Greening and Cooperation
20th November 2013


Third GEGG Forum
PARALLEL SESSIONS
(2.2)


Third GEGG Forum
PARALLEL SESSIONS
(2.2)


Joint Committee to assure flexibility
Joint Committee
Project participants
Third Party Entities

GREEN ECONOMY GREEN GROWTH-MYANMAR(not-for-profit) ASSOCIATION
35B-15, New University Avenue, Bahan Tsp, Yangon, Myanmar.

30 December 2013

FINAL EXECUTIVE SUMMARY

THIRD GREEN ECONOMY GREEN GROWTH, GEGG FORUM
Energy – Water – Food
Nexus
----- For Greening & Cooperation -----
Moving Forward and Faster

NAY PYI TAW (Myanmar International Convention Center) &
YANGON (Diamond Jubilee Hall, Yangon University)
REPUBLIC OF THE UNION OF MYANMAR
20 TO 22 NOVEMBER 2013

Organized By: GEGG Myanmar (Not for Profit) Association.
In Collaboration with The Ministries of: Environmental Conservation & Forestry, Focal Ministry for GEGG Forum; National Planning and Economic Development; Education; Energy; Science and Technology; Culture; and Myanmar Engineering Society; Association of Myanmar Architects; National Economic and Social Advisory Council, NESAC
Supported by: Tun Foundation, Environmental & Economic Research Institute, Yangon Media Group, Max Myanmar Group & Ayeyarwady Foundation, First Myanmar Investment Co. Ltd, Zaykabar Co. Ltd, Myanmar, Government of Norway, Government of Sweden, Government of Japan, United Nations Development Programme
In Partnership with: UNDP Myanmar Country Office and Regional Resource Center, Bangkok, Thailand, UNEP International Environmental Technology Center, Osaka, Japan, UN Convention to Combat Desertification Global Mechanism, Rome, Italy, The Smithsonian Institution, USA, WWF, Stockholm Environment Institute, Stockholm & Bangkok, Institute for Global Environmental Strategies, IGES, Hayama, Japan, The Norwegian Energy Farm, Norway, Thailand Greenhouse Gas Management Organization (Public Organization), TGO, Bangkok, Thailand, Yokohama National University, Yokohama, Japan and UNEP regional Office for Asia Pacific

SUMMARY HIGHLIGHTS & RECOMMENDATIONS

THE FIERCE URGNECY OF HOW& NOW!

Outstanding Support

The Opening Statement was delivered by H.E. U Thein Sein, President of the Republic of the Union of Myanmar, attended by H.E Dr. Sai Muak Kham, Vice President, 13 Union Ministers, 7 Deputy Ministers , 1 Regional minister, 10 Director Generals, 10 Regional Representatives.
Greetings were given by Prof, Dr Emil Salim, Chairman, Council of Advisors to the President, Indonesia and Ms Julie Jacobsen Takahashi, Charges d'Affaires, Royal Norwegian Embassy, Myanmar.
The President, Vice President, and Union Ministers viewed the winning Exhibitions of Affordable Green Myanmar Homes Design, Cartoons and Photographs of Natural Resource and Environment, and stayed back for Coffee and met with speakers and participants.

- 282 diverse participants registered with the Ministry for Environmental Conservation and Forestry for the Nay Pyi Taw Segment on 20 November, held at the Myanmar International Convention Center. The participants included Members of People's Assembly, the Diplomatic Corps; UN and International Organizations; Private Sector, NGOs, Media, Academia.
- The Yangon Segment held at Yangon University's Diamond Jubilee Hall was opened by H.E U Myint Swe, Chief Minister and attended by the Speaker of the Yangon Region Government Parliament and 5 Regional Ministers.
- 363 and 399 equally diverse participants registered on 21 and 22 November respectively.
- Over half of all registered participants were women..
- A large number of participants attended the Nay Pyi Taw and Yangon segment, but did not register. At the Summary/Concluding Session in Yangon on Friday 22 November, a head count indicated 185 participants remained.
- The Third GEGG Forum received outstanding Myanmar private sector support. These included complimentary air transport from Nay Pyi Taw to Yangon, coach transport in Nay Pyi Taw and Yangon, dinners, lunches and coffee/tea breaks, and the use of the Myanmar International Convention Center in Nay Pyi Taw.
- In Yangon, the Ministry of Education and Yangon University made available the University Diamond Jubilee Hall Plenary Room and six break out rooms for the Parallel Sessions.
- A large number of volunteers from MoECaF and from the organizations of GEGG Myanmar Association Board members provided the indispensable logistic support.
- A CD-Rom disc containing all the Third GEGG Forum presentations was provided every participant.

These are also available in the GEGG-Myanmar (Not for Profit) Association website: www.geggmyanmarassociation.com.

The Table below shows the Profile of registered Participants at the Third GEGG Forum

PRESIDENT	1
VICE-PRESIDENT	1
CHIEF MINISTER	1
UNION MINISTERS	13
REGIONAL MINISTERS	5
DEPUTY UNION MINISTERS	7
DIRECTOR-GENERALS	10
Nay Pyi Taw (20 Nov) Registered	282
Yangon (21 Nov) Registered	363 (Women 125)
Yangon (22 Nov) Registered)	399 (Women 150)
Yangon 22 Nov Concluding Session (Head count)	185
MEDIA	21
SPEAKERS National	38 (10 Women)
SPEAKERS International	105 (22 Women)

- A Design Contest for Green Affordable Myanmar Homes, in collaboration with the Association of Myanmar Architects, Myanmar Engineering Society; a Greening Cartoon and a Photography Contests were also organized for the Third GEGG Forum. Sponsors were contributions by GEGG Members and the Tun Foundation. The Winners received their prizes at the Nay Pyi Taw Lunch on 20 November and in Yangon.
- At the Lunch, the establishment of two Centers of Excellence for Green, Sustainable, Resilient, Smart, CoE GSRS, in Yangon and Mandalay Regions was announced. These will be part of a network of CoE GSRS to increase awareness, demonstrate, train and build capacity to accelerate green economy and green growth, that will take into account the prevailing ecological, economic, social, and cultural norms and practices. The Centers will have Consortiums of National and International Partners.
- A shared and common refrain from the Third GEGG Forum is the imperative need for implementation, with focus on HOW.

  One of the Parallel Session summed up the message “The Fierce Urgency of HOW”
- The Third GEGG Forum succeeded in increasing awareness of the importance of the Nexus of Energy-Water-Food, their inextricable linkages, the multi-faceted interventions available to foster greater integration and coherence for increasing greening and sustainability.
- The three High-level Roundtables Dialogue on Policy, Strategy, Cooperation, Financing and Investment that were held at Nay Pyi Taw, provided insights on the critical determinants for greening and growing the economy, providing a pathway for

sustainable development and importantly poverty eradication, as stated in the Opening Statement of the President.

- The Roundtables were chaired by H.E U Win Tun, Union Minister of Environmental Conservation and Forestry; H.E. Dr U Ko Ko Oo, Union Minister of Science and Technology; and Mr. Putu M. Kamayana, Head, ADB Extended Mission in Myanmar.
- The two Plenary Panels, Chaired by H.E Prof. Dr Emil Salim (Indonesia) and Prof Joakim Öjendal (Sweden), and 12 Parallel Sessions in Yangon on the 21 and 22 November focused on how Science, Technology, Management, Governance, Data, Information and Capacity Building
- These Sessions by 105 international speakers (22 Women) and 38 national speakers (10 Women), the discussions and questions and answers, provided in-depth knowledge and experience for a range of Nexus Green and Sustainability applications, with substantive Recommendations, summarized and highlighted below.

Summary Recommendations

(1) A coherent strategic framework, such as a national green development plan or strategy, is needed. A strategic framework would enable concerted and systemic action to be integrated in development policy, planning and implementation across the water-energy-food security nexus.

(2) Capacity building in biodiversity conservation and natural resource management is needed across sectors including government, academia, and civil society. Strategies should include increasing and diversifying training opportunities, expanding academic curriculum, outreach to communities local to protected areas and the general public, engaging private and corporate partners, improving communication across and among sectors, with the goal of institutionalized conservation capacity building within MoECaF and other ministries for sustainable and long-term capacity building.

(3) Biodiversity databases can help decision makers avoid critical tipping points or mitigate disasters.

(4) Increase application of science and technology to improve conservation and management of natural resources, wild life and endangered species. Remote sensing and geospatial tools are some of the technologies.

(5) In considering transformational technologies for built systems, include materials using bio-mimicry and nano-technologies.

(6) Sustainable Land Management, SLM, is critical to make progress towards a green economy. One of the most significant natural capital assets is productive land and fertile soil. It is central to the nexus that links energy, food, water, and environmental health in an interdependent loop. It is a vital resource for the provision of essential ecosystem services such as ensuring food security, regulating hydrological regimes, providing energy as well as conserving biodiversity, cycling soil nutrients, and storing carbon.

(7) Land use policies should balance community forestry opportunities and high-value non-timber forest product areas with other options for land conversion.

(8) Reduce negative impacts of waste on public health, air, water and soil, by setting a roadmap to assist governments and stakeholders to formulate a national waste strategy, as well as an integrated waste management system at the city level. Some of the main components of the national waste strategy involve international cooperation on technology support and capacity building, designing policies and institutional framework such as an action plan to control water quality, and creating opportunities for options to turn waste into a resource.

(9) Protected Areas (PAs) are cornerstones of biodiversity conservation, but in isolation cannot sustain future biodiversity and human communities. The primary sustainability mechanism is a well-designed PA network, integrating management of land and seascape sectors.

(10) Promote and support innovative natural resource use such as participatory forest and mangrove management, indigenous/endemic species restoration, ecological agriculture and non-tillage farming, agroforestry and multi-cropping agriculture, micro-hydro power generation, labelling schemes for ecological agriculture products and bio-filtering for drinking water,

(11) Long term national planning and strategies are needed and must take into account the fact that small stakeholders are very vulnerable to both climate change and reform strategies.

(12) Facilitate the decentralization of ecosystem and natural resource use management to local communities while ensuring macro-level enabling policies and their compliance.

(13) As infrastructure is being built up, there is an imperative need for the public sector to very consciously make the ‘right choices’ and also ensure that procurement processes are geared towards procuring high quality and high efficiency technologies. This ‘role-modeling behavior’ will make a huge impact and serve as a catalyst for much broader adoption.
(14) Involve government, industry and local community partners as early as possible in infrastructure projects and provide knowledge & information sharing in multi- directions.

(15) There is an important need for a coordination mechanism between the public, private and local sector.

(16) Need for Demand-side management planning to better manage the timing of consumer energy use, public awareness campaigns, setting energy efficiency standards for buildings and appliances,

(17) Consider an Energy Efficiency Revolving Fund offering credit lines—initially at no interest—to local banks so that they could provide loans for energy efficiency projects,

and other business to address the lack of awareness of the benefits of energy-efficient technologies or the upfront investment challenges for energy efficient projects.

(18) The national Power Development Plan is vital for upgrading the existing grid. It could be strengthened by including a priority action plan on decentralized mini-grids powered by renewable energy.

(19) Prepare a Report on key issues on development of BioEnergy , including establishment of an Energy Farm, and Center of Excellence.

(20) The role of the financial system is central to accompany the green growth, but changes are needed in the sector to make this happen. It is essential to engage more representatives from the financial industry (e.g. accountants, bankers, etc.) in upcoming GEGG Forums.

(21) Myanmar should prepare a comprehensive and holistic capital market development plan to be implemented in stages over a period of time. It should include: an education programme for retail investors; developing domestic institutional investors including; pension programmes, various savings products (e.g. mutual funds), life insurance etc; establishing strong supporting infrastructure including; adopting international standard accounting policies and practices, transparent legal and enforcement frame work etc.

(22) Foster enabling mechanisms to encourage responsible companies that invest in communities and promote sustainable development

(23) Myanmar Chairing ASEAN in 2014 provides an important opportunity to increase intra and inter-regional cooperation in pursuit of green growth.

(24) Increase Nexus thinking and application that involves interaction between resources, sectors, actors and scale, strengthen (i) communications: transparency and openness, fostering trust, (ii) dialogue: ongoing discussions and negotiations between key stakeholders (as long as one talks, anything is possible), and (iii) governance: rule-based legitimate political decisions, carried out from capable and recognizable institutions.

The 47 page Final Report with the Agenda and Abstracts; and the Parallel Sessions Programme with the List of Speakers, their presentation topics and recommendations are available in the GEGG (Not for Profit) Association website: www.geggmyanmarassociation.com.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Strategies