

First Workshop on the Development of National Waste Management Strategy for Myanmar

in collaboration with

Ministry of Natural resources and Environment Conservation (MONREC) of the Government of Myanmar, the United Nations Environmental Programme (UNEP) and the Institute for Global Environmental Strategies (IGES)

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Prepared

by

Environmental Quality Management (EQM)

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ACRONYMS/ABBREVIATIONS

| | |
|------------|---|
| 3Rs | Reduce, Reuse, Recycle |
| ADB | Asia Development Bank |
| AIT RRC.AP | Asian Institute of Technology Regional Resource Centre for Asia and the Pacific |
| CDCs | City Development Committees |
| CSOs | Community Services Organizations |
| DISI | Department of Industrial Supervision and Inspection |
| DWIR | Directorate of Water Resources and Improvement of River Systems |
| ECD | Environmental Conservation Department |
| EIA | Environmental Impact Assessment |
| EPC | Energy performance certificate |
| ESM | Environmentally sound management |
| GDP | Gross Domestic Product |
| HW | Hazardous waste |
| INGOs | International Non-Government Organizations |
| JICA | Japan International Cooperation Agency |
| KOICA | Korea International Cooperation Agency |
| MCDC | Mandalay City Development Committee |
| MOALI | Ministry of Agriculture, Livestock and Irrigations |
| MOC | Ministry of Constructions |
| MOE | Ministry of Educations |
| MOH | Ministry of Health |
| MOI | Ministry of Industry |
| MONREC | Ministry of Natural Resources and Environmental Conservation |
| MRG | Mandalay Regional Government |
| MSWMS | Municipal Solid Waste Management System |
| MOTC | Ministry of Transportation and Communication |
| NDC | Nay Pyi Taw Development Committee |
| NGOs | Non-Government Organizations |
| NHW | Non-hazardous waste |
| O&M | Operations and Maintenance |
| ODA | Official Development Assistance |
| ODS | Ozone-depleting substance |
| PCBs | Polychlorinated biphenyl |
| SLF | Sanitary landfill |
| USEPA | United States Environmental Protection Agency |
| WtE | Waste to energy |
| YCDC | Yangon City Development Committee |

Workshop Report on the Development of National Waste Management Strategy for Myanmar

1 Report on the management of National Level Workshop

1.1 Background

Myanmar's first *Workshop on the Development of National Waste Management Strategy*, organized in collaboration with the Ministry of Natural Resources and Environment Conservation (MONREC) of the Government of Myanmar, the United Nations Environment Programme's International Environmental Technology Centre (UNEP-IETC) and the Institute for Global Environmental Strategies (IGES) – Centre Collaborating with UNEP on Environmental Technologies (CCET) brought together national and local policy makers, public waste management providers and related stakeholders to provide technical inputs towards formulating a waste management strategy at the national level.

Myanmar has been facing considerable challenges in the management of solid waste due to increasing income and consumption levels, population growth in urban areas, and lack of effective waste treatment and disposal options. In this regard, the country's Environmental Conservation Law was established and enacted in 2012 with the objective of enabling the implementation of the Myanmar National Environmental policy; Environmental Conservation Rules have been also been developed for the implementation of the Law. According to the prescription of environmental conservation law and rules, the development of national and local waste management strategies is urgently needed.

This workshop focused on identifying current waste management gaps and challenges to inform the preparation of a national strategy based on a holistic waste management approach covering waste in all forms (solid waste, liquid waste / wastewater, and gaseous emissions), in accordance with the intention and capacity of the respective national and local governments.

1.2 Planning meeting before the workshop

In preparation for the workshop, consultation meetings were held with the national and municipal governments, including the Environmental Conservation Department (ECD) of MONREC, City Development Committees (Yangon, Mandalay and Nay Pyi Taw) and the CCET to discuss the organization and agenda for national level dialogue on waste management.

The main outcomes of these meetings included:

- Further understanding on the holistic waste management approach by public waste management providers with commitments to improve current waste management practice
- Development of program agenda for the National level workshop

1.3 Quick study

A quick study/baseline report based on inputs and discussions with City Development Committees was prepared to review and assess the current waste management gaps and challenges at the national and municipal levels.

The findings of the study will serve to provide basic information for drafting the national level waste management strategy with a view to address waste issues in a holistic and integrated manner.

1.4 Selection of target audience / participants, venues

A number of participants including both government and non-governmental organizations involved in waste management were invited to the workshop. There were fifty-two (52) local participants and sixteen (16) international participants (refer to Annex I).

1.5 Workshop methodology

(i) Policy maker' presentation (Minister's speech)

At the opening ceremony, H. E.U Ohn Win, Union Minister of MONREC, delivered a speech emphasizing the importance of the workshop for developing Myanmar's national waste management strategy. The main contents of the speech are outlined below.

Representatives from UNEP, IGES-CCET

Participants from the related Ministries

Participants from NGOs

Distinguished Guests, Ladies and Gentlemen

- This workshop will highlight collected baseline data on waste which will be used to establish milestones for the future activities aimed at formulating national and city level waste management strategies and action plans, which address all issues of waste in a holistic and integrated manner. In addition, the workshop will focus on options for developing monitoring and feedback mechanisms with a view to review the strategy and action plan on a regular basis and receive necessary approvals.
- Currently, MONREC is undertaking necessary actions for signing the Record of Discussion-(RoD) between the Environmental Conservation Department and IGES- CCET to implement this waste management project.
- Myanmar is working to promote industrial, rural and urban development at different levels. Accordingly, we need to protect our citizens' health and the environment against adverse impacts that may result from poor management of hazardous wastes and chemicals.
- The main challenges for solid waste management in Myanmar include population growth, increased income and consumption levels in urban areas, lifestyle changes and lack of effective treatment and disposal options.
- For this reason, the Environmental Conservation Law, as well as rules and action plans are urgently needed for supporting the development of both national and local waste management strategies.
- This workshop will consider environmentally sound waste management including drivers behind growing waste generation, used towards identifying a vision and mission for the country based on principles of the 3Rs, setting appropriate targets and guiding the implementation of a national waste management strategy that also serves to tackle some of the main development challenges facing Myanmar.
- The assessment used to inform this workshop analyzes the extent and effectiveness of the current waste treatment system and how it might be modified to comply with a future national waste management strategy. In this respect I sincerely hope that the project will

support the existing activities of City Development Committees and work to strengthen the capacity of all concerned stakeholders.

- Experts from IGES-CCET will support participants and provide necessary technical guidance, advice and recommendations to MONREC on any matter pertaining to the implementation of the Project.
- In closing, it is important to add that knowledge sharing, specifically with a view to develop our capacities and capabilities is a critical first step, so we rely on your substantive inputs and comments to assist in the design of a holistic waste management strategy and action plan for the sustainable development of our country.

(ii) Participants' Presentations

Presentations by MONREC, as well as Nay Pyi Taw, Mandalay, and Yangon City Development Committees highlighted main issues and challenges related to waste management in Myanmar both at the national and municipal levels. In addition, international experts from UNEP, IGES and others presented on international experiences with regard to waste management as well as the primary objectives associated with developing a national waste management strategy, including developing guidelines, setting targets, ensuring policy coherence, and coordinating stakeholder inputs and concerns, among others.

(iii) Group Discussions

Following the presentations, participants were organized into three groups based on their experience working with in different waste management fields (namely, solid, liquid and industrial waste). Group discussions served as a participatory exercise for examining waste issues and challenges and identifying potential interventions for consideration in proposed action plans (see Annex III).

(iv) Workshop materials /resources

- Presentations (please refer to Annex VI)
- Moderators, facilitators and interpreter assisted in guiding group discussion
 - IGES personnel led the workshop as moderators
 - 3-4 facilitators experienced with waste management assisted the participants
 - One interpreter communicated the workshop proceedings in Myanmar language

(v) Field visit to the centralized waste water treatment plant at Nay Pyi Taw

Nearly all participants visited a Nay Pyi Taw wastewater treatment plant constructed in 2006, the plant serves one hundred and ten (110) households in Wunnatheikdi township of a total population of approximately ten thousand (10,000) people. Up to 75,000 gallons of wastewater (both black and grey) can be treated per day utilizing a slow sand wastewater treatment system.

There are a total of eight (8) tanks used in this process:

- (1) Inlet water
- (2) Screening by grid chamber
- (3) 2 aeration ponds
- (4) Sedimentation pond (Under tank- stone at about three feet, and sand at one foot)
- (5) Two Processes
 - (i) Mechanical treatment
 - (ii) Biological treatment (algae- micro-organisms- physically, chemically, and biologically-treated)
- (6) Chlorination

- (7) Oxidation pond
- (8) Effluent

In terms of monitoring and evaluation, the following parameters are regularly assessed:

Physical Parameters

- (1) pH
- (2) Turbidity
- (3) Electrical conductivity

Chemical Parameters

- (1) BOD
- (2) COD
- (3) Manganese
- (4) Iron
- (5) Calcium
- (6) Total alkalinity
- (7) Total hardness
- (8) Total coliform

1.6 Main challenges identified and lessons learned

Apart from some minor logistical issues, such as having to accommodate additional participants due to the strong interest of national and local governments, no significant challenges were identified that impeded the delivery of the workshop.

1.7 Discussion proceedings

The workshop discussions will be used to inform the preliminary strategy outline which is practically applicable for implementing the national waste management action plan.

1.7.1 Solid waste management group discussion

U Than Htut (MCDC), U Min Maw, U Aung Aung Lay (ECD, Yangon), Dr. Myat Thaw Htet (PCCD) and Dr. Lwin Lwin Oo Hlaing (MOH) led group discussion on the current status of the solid waste management system in Myanmar. The following issues were discussed:

- In terms of **policies and regulations** pertaining to solid waste management, the weaknesses of current enforcement mechanisms and need for introducing the principle of polluter pays were highlighted.
- In terms of Myanmar's **institutional framework**, presently there is no linkage and coordination between the ministries and departments which are working on issues of solid waste management
- Regarding the **current technology and infrastructure**, Myanmar's waste collection system is in large measure defined by scheduled vehicle collection, and use of vermicomposting technology. However, a major constraint in utilizing these technologies effectively is the lack of sufficient labor supply.
- With regard to **financial mechanisms**, YCDC, MCDC and NCDC make use of individual revenue sources as well as taxes collected from the community.

- On the issue of **stakeholder participation**, the participation of public authorities is recognized as a key driver in implementing waste management; national and municipal governments are expected to disseminate information of the importance of waste segregation among local communities.
- **Concerning goals and keys strategies**, making use of the waste management hierarchy was proposed as an important intervention. It was agreed that devising strategies over a fifty (50) year time period may be too ambitious; a 30 year plan was instead selected with the greater aim of achieving zero waste at the community level. As the first step, the target of reducing waste by twenty percent (20%) over a five (5) year time frame was suggested. In order to meet these goals, the promotion of waste segregation is regarded as an crucial strategy.

In order to achieve the overall goal of zero waste, improvements in all stages of the waste cycle, including collection, transportation, transfer stations, and final treatment site were considered in the following manner:

| | |
|-------------------------|--|
| <u>Collection</u> | Door-to-Door (bell ringing and music oriented warning system) Road site dust bin collection Haul container collection |
| <u>Transportation</u> | Optimize current practices by reorganizing the transportation system |
| <u>Transfer station</u> | Reduce waste received at transfer stations by promoting enhanced sorting of selected materials (about 10%) for purposes of reuse and recycling Improving transfer and transport of waste to the final disposal site |
| <u>Disposal</u> | Promoting the development of sanitary landfills/ incineration plants (Waste-to-Energy) |

1.7.2 Liquid waste management group discussion

In this group, Dr Tin Aung Win (ECD), U Wai Lwin (YCDC), U Sein Lwin (DWIR, MOTC), Daw Sein Htike Thu (MOC), U Hein Latt (ECD), Daw War War Thein Dep:of Agriculture, Daw Thin Thin (ECD), Daw May Kyi Khaing MOI (DISI), Daw Aye Cho Cho Zaw (ECD) participated in discussion focusing on gaps in wastewater management at different sectoral levels.

On the issue of **regulations and policies on liquid waste management**, the general lack of public awareness regarding existing regulations following IFC and WHO guidelines, weaknesses associated with enforcement of the law and poor coordination between ministries were evaluated.

Concerning the **institutional framework governing wastewater management**, MONREC/ECD and CDCs were understood as comprising the main institutional focal points. In addition, other ministries such as the Ministry of Transportation and Communication, Ministry of Construction (responsible for overseeing the installation municipal drainage pipes), Ministry of Industry, Ministry of Education/ Department of Research and Innovation, and Ministry of Agriculture, Livestock and Irrigation are considered to be the most important institutions.

Regarding **technology and infrastructure**, all group members agreed that the weak capacity of existing human resources constitutes some of the main technology challenges, as exemplified by the lack of an effective storm water management system across the country.

On the issue of **financial mechanisms**, limited funding and lack of tax collected to address wastewater management issues were identified as major gaps. Streamlining government budgets

(i.e., making use of grants, loans or earmarks), as well as the importance of cooperating with international organizations in order to receive technical assistance were discussed.

In terms of **stakeholder participation**, the responsibility of CDCs and ECD/MONREC for promoting wastewater management was emphasized. The importance of awareness raising and public training programs for the public was discussed with factory owners, NGOs / INGOs and CBOs identified as the most important stakeholders.

On **guiding principles and strategies**, action plans (Annex III), were considered in relation to the following action items:

- *Adoption of 3R principles on waste management*
- *Access to clean water*
- *Compliance with national environmental quality guidelines*
- *Adoption of best international environmentally-sound management practices*
- *Promotion of stakeholders' participation*
- *Increasing resilience to climate change*
- *Establishing an institutional mechanism for cooperation and collaboration*
- *Promoting incentives and disincentives for enforcement of the law*
- *Establishing new financial mechanisms based on revenues generated from implementing the polluter pays principle*

Furthermore, U Wai Lwin (YCDC) explained YCDC's future plans:

- Establishing a systematic centralized sewage and domestic wastewater treatment system for Yangon by upgrading the existing system for 4 townships and downtown areas in line with the findings of a feasibility study conducted by JICA in 2013-2014.
- Proposing a centralized treatment system for the entire 33 townships in Yangon by dividing 8 zones.
- Proposing the implementation of small scale treatment plants to be in future construction particularly among tall buildings above 3 floors
- Installing a storm water treatment system in different areas of Yangon City
- Establishing small scale sewage treatment plants for 8 zones of under the authority of YCDC as a stopgap measure before implementing a systematic centralized sewage and domestic wastewater treatment system

1.7.3 Industrial waste management group discussion

In this group, U Aung Nanda (MSDES), U Bawi Kyone (YCDC), Mr.Chuzo Nishizaki (IGES), Mr. Palash Kumar Saha (SINTEF) led discussions concentrating on the following issues:

Regarding **regulations and policies on industrial waste management**, the need for strengthening of existing laws and revising regulations was highlighted as a major obstacle in the way of ensuring good environmental practices are followed by factories as well as certifying that proper evaluation and monitoring are conducted by respective government departments

Concerning the ***institutional framework*** for industrial waste management, YCDC's authority in prohibiting noncompliance among industries was explained. Limitations of the industrial zone management committees to manage improper waste management, as well as a poor monitoring and inspection, absence of cooperation between departments were discussed; in addition, concerns that improving industrial waste management may have a negative impact on GDP growth were evaluated.

Looking at ***technology and infrastructure***, the need to upgrade outdated technology of industries, limitations in the application of industrial waste management practices due to cost and the challenges involved with strengthening existing infrastructures was pointed out. In this regard, one concern raised repeatedly was that the costs associated with treatment of industrial waste are too high for many factories to afford. Gaps in waste management systems were assessed including the current practice of zones being designated by the Housing Department and serviced by CDCs, which impedes effective coordination. In addition, the lack of use of EIA in the development of industrial zones was highlighted.

In terms of ***financial mechanisms***, collection fees are currently subsidized and not calculated on relevant data and figures. The use of incentives in encouraging proper waste management among industries was also evaluated.

In terms of ***stakeholder participation***, the lack of private sector involvement in industrial waste management and low awareness of the public about the need for industrial waste management were considered as major issues.

Concerning **Guiding Principles**, the following items were considered:

- *Adoption of 3Rs principles in waste management*
- *Access to clean water*
- *Compliance to the National Environmental Quality (Emissions) Guidelines (2015,December)*
- *Adoption of best international practices/ environmentally sound management practices*

Identification of goals and key strategies

All six (6) stages of industrial waste management namely segregation, collection, transportation, treatment, final disposal and recycling of wastes were targeted for the action plans (Annex V). Short term (5 years) and long term (10 years) plans were defined accordingly.

1.8 Outcome

The workshop provided an effective forum for engagement between national and city level officials, affording the opportunity for knowledge sharing on current waste management practices in Myanmar and discussion on future collaboration on designing and implementing the national waste management strategy with associated targets and action plans.

1.9 Potential future improvement

- Condensing workshop materials, including presentation documents for participants' ease of reference
- Further incorporating gaseous emissions data (as it becomes available) into the workshop discussion
- Disseminating workshop evaluation surveys with a view to better understand participants' perception of the workshop
- Circulating a communique document on key priorities and outcomes of the workshop among participants that will be finalized during the event

- Organizing a working group comprised of members from ECD/MONREC and City Development Committees and following up to advance the development of the national strategy, in line with the objectives of the workshop

2 Report on the substantial outcomes from the National workshop leading to the development of the strategy

2.1 First Workshop on the Development of National Waste Management Strategy, Nay Pyi Taw

The following report was prepared based on discussion proceedings and outcomes of the workshop as well as relevant information from the quick study survey conducted with ECD/MONREC and respective City Development Committees (Yangon, Mandalay and Nay Pyi Taw).

2.1.1 WASTE MANAGEMENT - Overview/ WHERE ARE WE NOW

MONREC is the main institutional body responsible for setting a framework for waste management at the national level. Similarly, all major cities across Myanmar are administrated by City Development Committees that are responsible for providing municipal waste management services. In the context of this workshop, Yangon City Development Committee (YCDC), Nay Pyi Taw City Development Committee (NCDC) and Mandalay City Development Committee (MCDC) provided feedback and inputs on the development of a national waste strategy for Myanmar.

Accordingly, there exist a number of relevant laws and bylaws with respect to industrial waste at the municipal level. However, it has been observed that a small percentage of industries properly manage their wastes at final disposal sites. Furthermore, collection fees are inadequate for ensuring efficient collection service.

2.1.1.1 Yangon

(i) Domestic waste

According to 2016 data, total waste generation and generation rates are 1,981 tons/day and 0.4 kg/cap/day respectively. Currently the pre treatment of the waste is not practiced and open dumping is widely conducted. 86 tons/day of generated wastes are being recycled which fall under the general categories of plastic, tin, aluminum, bottles, iron, glass and textiles, among others however there is no detailed data available at present.

Total staff members who are responsible for waste collection include 39 officers, 180 permanent workers, and 4,000 working authorities, respectively, together with 300 trucks (2ton/4ton /7ton/12ton) for waste transportation.

Although technical support and investment have come to upgrade the municipal waste management particularly in Yangon, these plans are not still successful because of rejection of the public due to high cost than of the existing practice.

(ii) Industrial waste

There is no characterization of the industrial wastes which are approximately 150 tons per day.

(iii) Hospital waste

In terms of hospital wastes, total wastes are 84-88 tons per day. Among them, infectious wastes comprise 0.5 tons per day which are incinerated; sharp wastes make up 0.2 tons per day which are buried in concrete wells. Hospital waste is categorized as follows:

- Yellow color (infectious waste)
- Red color (sharpening and syringes, needles, etc)

Wastes are collected once a day for special clinics and once or twice per week for polyclinics. Industrial waste generation in Yangon is 150 tons/day and some of wastes are recycled on site and then on-call waste collection is carried out.

(iv) Hazardous waste

These types of wastes are required to be incinerated comprising 121.07 tons/year and submerged wastes are 33.7 tons/year, respectively.

(v) Liquid waste

Domestic waste water is released into the YCDC--operated drainage sites and then to the nearest water body. For 6 downtown districts, sewage wastes are drained into Than let sun pond. YCDC reports that it is currently only capable of serving roughly 4.3% of the city population in terms of sewage waste. For other towns, septic tank wastes are transported by vacuum trucks. In addition, domestic waste water treatment (WWTP) is conducted by way of activated sludge process which is thereupon is used as fertilizer. Approximately 3.25million gallons are being disposed to Yangon River as treated water per day.

Table 2.1 The current waste generation in Yangon along with capacity (2016 data)

| Total domestic waste generation/ Waste generation rate/ Recycled waste | Industrial waste | Hospital waste | | | Hazardous waste | |
|--|--------------------------|----------------------------|------------------|------------------|------------------|----------------|
| | | Total | Infectious | Sharp | Incineration | Submerged |
| 1,981 tons/day/ 0.4 kg/cap/day/ 86 tons/day | 150 tons/day | 84-88 tons per day | 0.5 tons per day | 0.2 tons per day | 121.07 tons/year | 33.7 tons/year |
| Liquid waste (Domestic) generation | 3.25 mg per day | | | | | |
| Office staff | Permanent workers | working authorities | Trucks | | | |
| | | | 2 ton | 4 ton | 7 ton | 12ton |
| 39 | 180 | 4,000 | Total 300 | | | |

2.1.1.2 Mandalay

(i) Domestic waste

According to 2016 data, total waste generation and rate of generation are 896 tons/day and 0.64 kg/per capita/per day respectively. For waste transportation, there are 211 trucks; tricycles number 179, carts make up 322 and vehicles comprise 77. There is no pre-treatment of waste before being sent to final disposal sites. Current waste treatment facilities in Mandalay are listed as follows:

- 1 Landfill (engineered landfill) - 450 tons/day at Kyar Ni Kan (Northern Part of Mandalay)
- 1 Landfill (engineered landfill) -300 tons/day at Thaug Inn Myout Inn (Southern Part of Mandalay)
- 1 Incinerator (currently not operational) - 30 tons/day at Thaug Inn Myout Inn (Southern Part of Mandalay)
- 1 Anaerobic Digester - 30 tons/day (Pilot Project for Rural Areas)
- 1 Incineration pit at Kyar Ni Kan (Northern Part of Mandalay for Medical Waste Only)

(ii) Industrial waste

Industrial waste collection is currently conducted on an ad hoc basis, and no data available on this type of waste

(iii) Hospital waste

Hospital waste generation in Mandalay comprises 2.135 tons/day, of which infectious waste comprises 0.9 tons /day, sharps waste comprises 0.05 tons day and miscellaneous waste total 0. 3 tons /day, respectively. The wastes released from large hospitals and clinics are collected day-to-day, with the wastes from small clinics consolidated with the large ones. All clinical wastes are incinerated in the incineration pit located in Kyar Ni Kan except larger biological wastes which are being incinerated at cemeteries. Expired medicines are buried as a special case under classification by MCDC and the Ministry of Health.

(iv) Hazardous waste

There is no data available for the hazardous waste.

(v) Liquid waste

Total domestic waste water generation is 15,000 m³ / year. The industrial waste water is about 500 - 2,000 m³/day.

Table 2.2 The current waste generation in Mandalay along with capacity (2016 data)

| Total domestic waste generation/ Waste generation rate/ Recycled waste | Industrial waste | Hospital waste | | | Hazardous waste | |
|--|------------------------------|--------------------|---------------------------------|-------------------|-----------------|-----------|
| | | Total | Infectious | Sharp | Incineration | Submerged |
| 896 tons/day/ 0.64 kg/cap/day/ | not available | 2.135 tons per day | 0.9 tons per day | 0.05 tons per day | not available | |
| Liquid waste | | | | | | |
| | Domestic waste water | | Industrial waste water | | | |
| | 15,000 m ³ / year | | 500 -2,000 m ³ /day. | | | |
| Trucks | | | | | | |
| | Tricycle | Carts | Vehicles | | | |
| 211 | 179 | 322 | 77 | | | |

2.1.1.3 Nay Pyi Taw

(i) Solid waste

According to current data, total wastes in Nay Pyi Taw make up approximately 160 tons per day and per capita waste generation is 0.517 kg/day. Waste collection systems are comparable to the other cities. A total of 56 staff members are responsible for waste collection and 33 trucks are used for waste transportation. There is no pretreatment of waste and final disposal is being carried out by open dumping.

(ii) Industrial Waste

Currently, as it is a new city, there are no industrial wastes from factories which can be accounted for at the present time.

(iii) Hospital waste

There is no hospital waste generation data available as of yet. According to NCDC, medical wastes are collected separately and disposed in the same area used for domestic waste disposal. There is no pre-treatment and no special incineration pit for hospital waste. Only biological wastes are incinerated in the cemeteries with the approval of doctors.

(iv) Hazardous waste

There is no data available for the hazardous waste.

(v) Liquid waste

There is a centralized waste water treatment system currently running for the households located in the city. However, no data is available on liquid waste generation at present.

Table 2.3 The current waste generation in Nay Pyi Taw along with capacity (2016 data)

| Total domestic waste generation/ Waste generation rate/ Recycled waste | Industrial waste | Hospital waste | | | Hazardous waste | |
|--|-------------------|----------------|------------|-------|-----------------|-----------|
| | | Total | Infectious | Sharp | Incineration | Submerged |
| 160 tons/day/ 0.517kg/cap/day/ | No data available | | | | | |
| | | | | | | |
| Staff members | Trucks | | | | | |
| 56 | 33 | | | | | |

2.1.2 Existing policy and regulations

2.1.2.1 National Level

- National Government Policy (1994)
- Environmental Conservation Law (March, 2012)
- Environmental Conservation Rules (June 2014)
- Environmental Impact Assessment procedures (Dec, 2015)
- National Environmental Quality and Emissions Guidelines (Dec, 2015)
- Hazardous Waste Management

2.1.2.2 Yangon

- The Yangon Civil Development Law 2013
- The City of Yangon Development Law (1990) TM
- The Underground Water Act (1930)
- The Water Power Act (1927)
- The City of Yangon Municipal Act (1922)
- The Yangon Water -work Act (1885)

In addition, City and Township Development Committees promulgated the solid waste disposal and collection by -law providing the legal basis at the local level

2.1.2.3 Mandalay

- MDCD Law 2015, January 12
 - MDCD Environmental Conservation and Cleansing bylaws 2015, May 14
 - The City of Mandalay Development Law (2002) TM

2.1.2.4 Nay Pyi Taw

- The Nay Pyi Taw Development Law (2009)
- NDC Pollution Control and Cleansing Department by laws
- NDC Water and Sanitation Department Bylaws

2.2 INTRODUCTION TO THE STRATEGY

2.2.1 Presentation of the strategy

Based on the group discussion, the main responsible bodies tasked with developing the national strategy were identified as follows:

- Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC)
- Nay Pyi Taw City Development Committee (NCDC)
- Yangon City Development Committee (YCDC)
- Mandalay City Development Committee (MDCD)
- Ministry of Transportation and Communication
- Ministry of Industry
- Ministry of Electricity and Energy
- Ministry of Education/ Department of Research and Innovation/ Institutes and Universities
- Ministry of Agriculture, Livestock and Irrigation
- NGOs an INGOs
- Private Sector
- Community
- Media

2.2.2 Mission Statement

These are the summary of all statements conveyed by each discussion group.

- To develop and upgrade holistic waste management system
- To achieve the green, clean and healthy environment through inclusive development
- To enable harmonization between social, economic and environmental dimensions of sustainable development
- To promote circular economy (cleaner products)
- To participate more people in planning and implementation

2.2.3 Vision Statement

“Sustainable, Green, Clean and Healthy Environment towards a Brighter Future for Myanmar”

2.3 STRATEGY DEVELOPMENT – THE PROCESS (Solid Waste)

2.3.1 Identification of critical stakeholders

The ministries and governmental organisations listed below were selected as the main stakeholders based on their direct or indirect involvement in waste management.

Direct involved stakeholders including ECD (MONREC), YCDC, NCDC and MCDC have specified roles associated with the development and implementation of the waste management strategy, especially with regard to information sharing at the national level.

Based on the above information, the following ministries, institutes and organisations will be involved in the development process of National Waste Management Strategies and Action plans. These respective organisations will have their own roles to play in this process agenda as well as in the design of respective action plans.

- Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC)
- Nay Pyi Taw City Development Committee (NDC)
- Yangon City Development Committee (YCDC)
- Mandalay City Development Committee (MCDC)
- Union Attorney General Office
- Ministry of Planning and Finance
- Ministry of Education (science and technology)/ Department of Research and Innovation/ Institutes and Universities
- Ministry of Industry
- Ministry of Electricity and Energy
- Ministry of Health
- Ministry of Transportation and Communication
- Ministry of Agriculture, Livestock and Irrigation
- NGOs an INGOs
- Private Sectors
- Community

A key lesson learned was that horizontal cooperation and collaboration between these organisations can have major impacts on development of waste management strategies at the local levels, as well as the implementation of action plans after receiving official authorization.

The projects listed below are related to the waste management services which are now being developed in the capitals.

- Waste to Energy project in Yangon
- Large Scale Waste Water Treatment Plant in Yangon (for 6 townships)

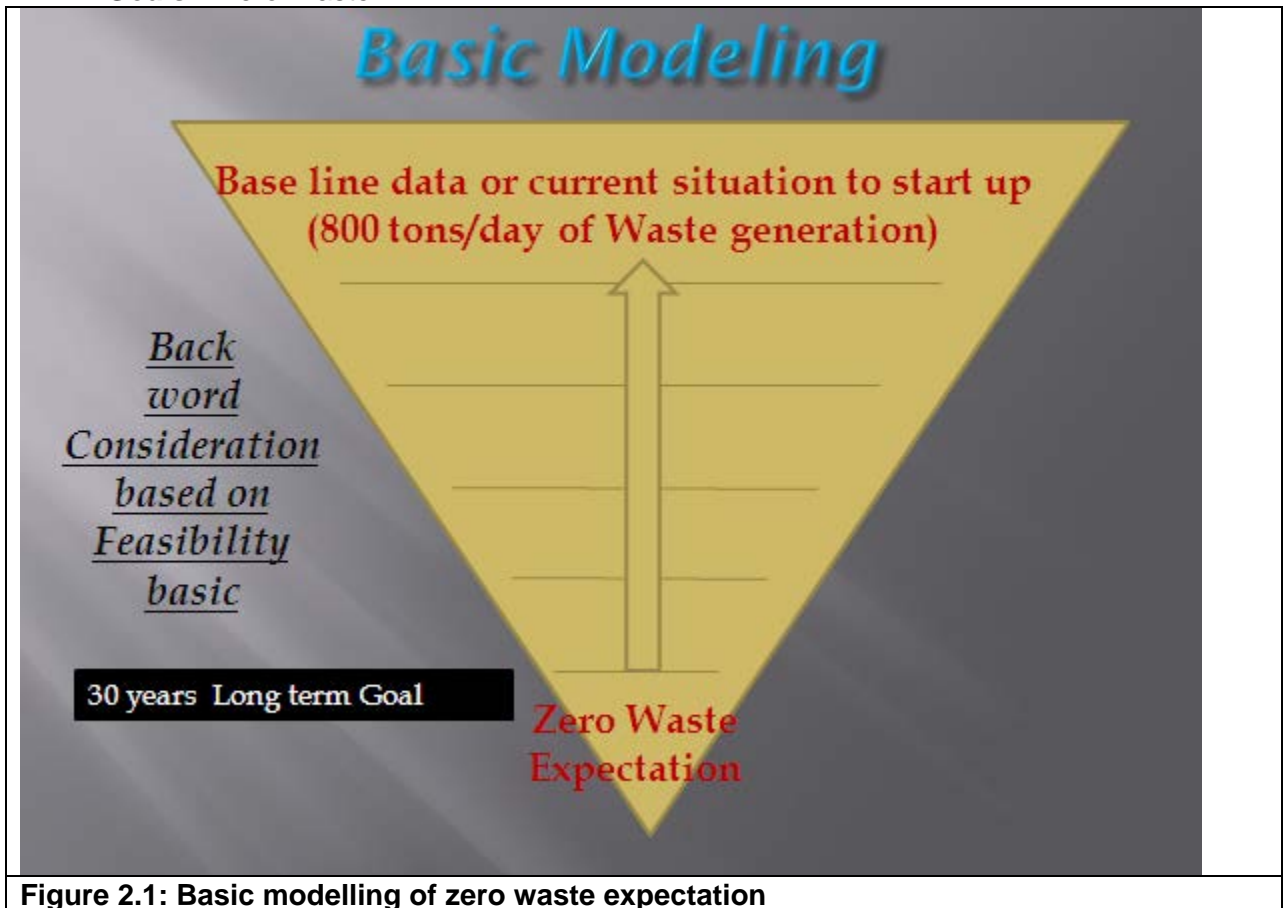
- Small scale centralized waste water treatment plant in Nay Pyi Taw
- Plan for waste water treatment plant in Mandalay

At the same time, it is necessary to establish a strong institutional framework to review service delivery, efficiency as well as sustainability. This will involve conducting periodical internal assessments, monitoring, and reviews etc.

2.4 HOW TO MOVE FORWARD

2.4.1 Setting national goals, objectives and targets

2.4.1.1 Goals – Zero Waste



2.4.1.2 Target –To Reduce Waste Generation by 20 percent within 5 year of time frame (short time)

Specific Targets

(1) Solid waste

- By 2020, 10% of wastes requiring treatment are addressed
- By 2030, 25% of wastes requiring treatment are addressed
- One waste-to-energy incineration plant is established in Yangon/Mandalay by 2020
- One sanitary landfill established following USEPA or other equivalent standard in Yangon and Mandalay by 2030
- By 2020, 10% of wastes diverted from final disposal (such as Sanitary Land filled and incineration facilities) for recycling and recovery operations

- By 2030, 25% of wastes diverted from final disposal (such as Sanitary Land filled and incineration facilities) for recycling and recovery operations

(ii) Liquid waste

- Up to 50% of the households are connected to centralized wastewater treatment
- Up to 20% of the storm water waste management within the period of 2016-2040
- Up to 10% of the Gray Water Management from the household in Yangon Areas,

(III) Industrial waste

- Establishing a regulatory framework
- By 2020, 50% of the total number of industries in Myanmar have started segregating hazardous, non-hazardous and general waste
- By 2020, 60% of all segregated hazardous, non-hazardous and general waste is collected
- By 2030, 75% of the total number of industries in Myanmar have started hazardous, non-hazardous and general waste
- By 2030, 75% of all segregated hazardous, non-hazardous and general waste is collected
- By 2020, separate transportation fleets for hazardous and non-hazardous wastes and solid/sludge and liquid wastes are established
- .

Annex (I)

Table 1. The list of local participants attended 1st National Workshop for Developing National Strategies in Nay Pyi Taw

| No | Name | Position | Organization/ Department | Contact no ./email address |
|----|---------------------|---------------------|------------------------------------|--|
| 1 | U Than Htut | Assistant Director | MCDC | 9.43160683/ koshwethanhtut@gmail.com |
| 2 | U Aung Aung Lay | Assistant Director | YGN/ ECD | 09-32106543 |
| 3 | U Zaw Lay Win | L/H | YTU | 09-5047299 |
| 4 | Dr. Lat Lat Tun | AP | YTU | 09-420111922 |
| 5 | Daw Khin Win | Lecturer | YTU | 09-43053158 |
| 6 | Daw Aye Cho Cho Zaw | DSO | CDE, Env. Section (Thilawa SEZ) | 095404952/ ayechochozaaw@gmail.com |
| 7 | U Bawi Kyone | deputy Director | YCDC | 09-5502787 |
| 8 | U Wai Lwin | ACE/YCDC | Sanitation YCDC | 09-5053946 |
| 9 | U Zayar Aung | Technician | Eco.Lab(ALARM) | 09-977962996 |
| 10 | Dr.Khin Aye Tue | Scientist | DRI | 09-425021094/ khinayetue@gmail.com |
| 11 | Daw Sein Htike Thu | D.S.E | DUHD, MOC | 09448543756/ seinhtikethu@gmail.com |
| 12 | U Aung Nanda | MD | MSDES | 09-5160905/ nanda@m.scte.com |
| 13 | Daw Thiri Aung | Project Coordinator | UNDP | 09-793104879/ thiri.aung@undp |
| 14 | U Win Naung | Director | UAGO | 09-5370987 |
| 15 | Daw Aye Aye Lwin | SO | PD | 09-448544090 |
| 16 | U Zaw Tun Aung | AD | ECD | 09-5261122 |
| 17 | U Mg Mg Lwin | DyD | Planning Dept | 09-420726288 |
| 18 | Daw Moh Moh Naung | DyD | FERD | 09-250637015 |

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|----|------------------------|---------------------|-----------------------------------|---|
| 19 | Daw Thin Thin | SO | ECD | 09-964621101 |
| 20 | Daw May Kyi Khaing | Deputy Director | MOI(DISI) | 067-408379 |
| 21 | U Sein Lwin | DyD | DWIR,MOT | 09-5404894 |
| 22 | Dr.Tin Aung Win | AD | ECD,MONREC | 09-256122123 |
| 23 | Daw War War Thein | DD | Dep:of Agriculture | 09-2033583 |
| 24 | U Soe Myint | DGM | MOEE,MOGE | 09-264821535 |
| 25 | U Hnin Oo | Assistant Engineer | Dep:of Mine | 09-256026518 |
| 26 | Dr.Lwin Lwin Oo Hlaing | DD | DOMS,MOHS | 09-5173967 lwinlwinoohlainq17265@gmail.com |
| 27 | U Kyaw Zin | AD | Eng Dpt (under supply) | 09-420747831 |
| 28 | Dr.Myat Taw Htat | Deputy Director | PCCD(NPT DC) | 09254080544 myattaw@gmail.com |
| 29 | U Min Maw | Director | PCD.ECD | 067431320 minmawforester@gmail.com |
| 30 | U Hein Latt | SO | ECD | 067-431321 |
| 31 | Daw Seint | D.S.O | ECD | 09-448540481 |
| 32 | Daw Myat Su Yee | D.S.O | ECD | 09-43038154 |
| 33 | Daw Khin Myo Sat Aye | D.S.O | ECD | |
| 34 | Daw Thi Tar Nwe | D.S.O | ECD | |
| 35 | Daw Yin Yin Mar | D.S.O | ECD | |
| 36 | U Tin Myo Aung | D.A.S.O | ECD | |
| 37 | Daw Thin Thant Shwe | D.S.O | ECD | |
| 38 | Betty Ni Ni Chan | Project Coordinator | JICA Expert Team Water Management | 09-25028151/ elizabethnini@gmail.com |
| 39 | Daw Kyi Kyi Myint | project coordinator | POE project | kyikyi.env@gmail.com |
| 40 | U Saw Win Maung | Deputy head of Dep | YCDC | 95051742 |

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|----|--------------------------|------------------------------------|-------------|--|
| 41 | Dr Aung Myint Maw | ACE | YCDC | 95187854 |
| 42 | U Win Htin | Chairman | MIA/ MCIA | 95123833 |
| 43 | U Sein Htoon Linn | DDG | ECD | 067431323/ linn.seinhtoon@gmail.com |
| 44 | Dr Ohnmar May Tin Hlaing | Environmental consultant | EQM | ohnmarmay@gmail.com |
| 45 | Daw Thiri Tin Htut | Associate Environmental Consultant | EQM | thiritinhtut@gmail.com |
| 46 | Daw Phyo Thet Khaing | Associate Environmental Consultant | EQM | jujuenge@gmail.com |
| 47 | U Khin Zaw Win | Associate Environmental Consultant | EQM | khinzawwinglobe@gmail.com |
| 48 | UThiha Htut | Technician | EQM | |
| 49 | U Soe Pyae Tun | Technician | EQM | |
| 50 | Win Sithu | Technician | EQM | |
| 51 | Dr.Phyo Naing Zay | Consultant | E-Guard | 09-5065232/ phyo.mc@gmail.com |
| 52 | U Aung Kyi | Sales Manager | Golden Dowa | kyburma@gmail.com |

Table 2.The list of international participants at 1st National Workshop for Developing National Strategies in Nay Pyi Taw

| No | Name | Position | Organization/ Department | Contact no./email address |
|----|-----------------------|-------------------|--------------------------|--|
| 1 | Mushtaq Ahmed Memon | Programme officer | UNEP | MUSHTAQ.MEMra@UNEP.org |
| 2 | Kazunobu Onogawa | Director, IGES | IGES | |
| 3 | Dr D.G.J. Premakumara | Senior researcher | IGES | premakumara@iges.or.jp |
| 4 | Matthew Hengesbugh | Policy researcher | IGES | hengesbugh@iges.or.jp |
| 5 | ShiKo Hayashi | Project Manager | IGES | hayashi@iges.or.jp |

| | | | | |
|----|-------------------|-------------------------|-----------------------------------|--|
| 6 | Chuzo Nishizaki | IGES Fellow | IGES | chuzosan@iges.or.jp |
| 7 | Yuko Tsuda | Senior staff | City of Kitakyushu | yuuko-tsuda01@city.kitakyushu.lg.jp |
| 8 | Jun Yamamoto | Managing Director | Golden Dowa | yamamoti@golden.desm.com |
| 9 | Satoshi Morjimoto | Engineer | Dowa Eco-system | morjimos3@dowa.co.jp |
| 10 | Kozo Sakaguch | Senior Env. Engineer | E&E solutions (Dowa) | k-sakaguchi@eesol.co.jp |
| 11 | Tomoko Tuchi | Senior Env. Engineer | E&E solutions (Dowa) | t-tauchi@eesol.co.jp |
| 12 | Itaru Okuda | Leader | JICA Expert Team Water Management | okuda-it@n-Koev.jp |
| 13 | Nariko Sakoraz | PFA | JICA | 95034812 |
| 14 | Dr Kare Helge | Chief Scientist | SINTEF | |
| 15 | Palash Saha Kumar | Researcher | SINTEF | palash.saha@sintef.com |
| 16 | Puneeta Mallielia | Observer (Hotel guest) | India | puneeta_krm@yahoo.com.in |

Annex (II)

Final program

First National Workshops for Developing the National Waste Management Strategies in Myanmar

Ministries of Natural Resources and Environmental Conservations/ Environmental Conservation Department

UNEP

IGES Team

Participants from different ministries /City Development Committees/Institutes and NGOs
Environmental Quality Management Co. Ltd Team members

Target: First approach of holistic waste management system in Myanmar (National Level)

Date: 13-15, June, 2016

Venue: Grand Amara Hotel (Naypyitaw)

Objectives

The first national/ city workshops for developing national/ city waste management strategies in Myanmar aims:

- To assess the extent and effectiveness of Myanmar's present waste management system, identifying constraints and areas for improvement at the national and city levels with a view to achieve an enhanced level of performance;
- To guide the formulation of draft national/ city level waste management strategies and action plans that addresses waste issues in a holistic and integrated manner, including by establishing a supportive institutional framework, proposing appropriate policy interventions, and addressing the awareness and training needs of the various stakeholders involved;
- To establish the necessary monitoring and feedback mechanisms for periodically reviewing the strategy and action plan and submitting the final version for approval by the responsible authorities.

Programme for the national workshop in Nay Pyi Taw, 13-15 June 2016

In the workshop, it has been discussed about the issue on current situation of waste issue in Myanmar. Besides, it has been focused on group discussion and it was divided into three group, which are discussion group for solid waste, discussion group for liquid and discussion group for industrial wastes in Myanmar from different sectors.

Day 1, 13 June 2016

It is divided into 2 different sections

Section (1) Opening Ceremony

08:30-09:00 Registration

09:00-09:10 – Welcome message from MONREC by U Ohn Win, Minister of MONREC

09:10-09:20 Welcome message from UNEP/IETC by Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme

- 09:20-09:30- Presented the introduction to workshop by Mr. Kazunobu Onogawa, Director of IGES-CCET
- 09:30-09:40- Presented the Introduction of the Holistic Waste Management by UNEP/IETC by Dr. Mushtaq Ahmed Memon, Programme Officer, International Environmental Technology Centre, United Nations Environmental Programme
- 10:00- 10:05 – Photos sections
- 10:05- 10:15 –Refreshment (tea break)

Session 2: Discussions on Current Situation and Identification of Gaps

- 10:15- 10:45- National overview of waste management by MONREC (solid waste, liquid waste and gasses by U Min Maw, Director, Pollution Control, ECD, MONREC
- 10:45-12:00- Presented about the city overview of waste management by Yangon by Current Situation of Solid Waste Management in Yangon City by Dr. Aung Myint Maw, Assistant Chief Engineer, Yangon City Development Committee (YCDC) Naypyitaw,
- Solid Waste Management System in Naypyitaw, Dr. Myat Taw Htat, Deputy Director, Naypyitaw City Development Committee (NCDC)
- Urban Environmental Sanitation Processing Systems in Myanmar, Kyaw Zin, Assistant Director, Department of Engineering (Water Supply & Sanitation), Naypyitaw City Development Committee (NCDC)
- Overview on Solid Waste Management in Mandalay City, Than Htut, Assistant Director, Cleansing Department, Mandalay City Development Committee (MCDC)
- Mandalay on current situation of solid waste, liquid waste and gasses by the representatives of YCDC, NDC and MCDC by

12:00-12:30- Lunch Break.

- 13:00-13:20- Presentation of the Summary Finding of the potential and key challenges in waste management based on the quick study of CCET by Matthew Henges baugh, Policy Researcher, IGES
- 13:20-13:30 Master Plan for Hazardous Wastes in Myanmar, Kare Helge Karstensen, Chief Scientist, Foundation for Scientific and Industrial Research, Norway (SINTEF)
- 13:30-15:00- Group discussions focused on (1) Discussion and Identification of Gaps (2) Data availability, (3) Technology, (4) Policy, (5) Institutional (6) Financial and (7) Stakeholder Involvement in wastes management issues in Myanmar.

15:00- 15:15 – Refreshment (Tea Break)

15:15- 17:45- Site Visit to Waste Water Treatment Facility in Nay Pyi Taw

Day (2) 14 Tue June 2016

Session 3: Development of Draft National Strategy

- 08:30-09:00 - Registration time.
- 09:00-09:10- Reflection of the Day (1) and present of final list of key gaps by the representatives D.G.J. Premakumara, Senior Researcher, IGES

09:10-09:30- Introduction to the National and City Waste Management Strategies by Mr. Shiko Hayashi, Programme Manager, IGES

09:30-10:00- Sharing the experience of waste management in Tokyo and its collaboration with YCDC in improving the solid waste management (challenge and opportunities by Shiko Hayashi, Programme Manager, IGES

10:00- 10:15- Refreshment (Tea Break)

10:15-11:30- Group Discussion focused on mission statement, vision statement, and guiding principles for respective groups.

11:30- 12:00 Group Presentations

12:00- 12:30 Lunch Break

13:00 – 13:30 Experience of waste water management in Japan and others by Mr. Chuzo Nishizaki, Fellow, IGES,

13:30- 14:00- Industrial/ Hazardous waste management in industrial development zone (Thilawa SEZ) by Mr. Yamamoto, Representative, Golden DOWA Eco-system Myanmar Co., Ltd.

14:00-14:15 - The issue of explanation on how to make target setting by Dr. Mushtaq Ahmed Memon, UNEP

14:15- 15:15 Group Discussion on Identification of goals, objectives and targets by each respective group

15:15- 15:45 Group Presentation and Consensus Building on the goals, objectives and targets

15:45- 16:00 Tea Break

16:00- 17:30 Group Discussion related with discussion and identifications of strategic actions by each respective group.

Day 3 15 Wed, June 2016

08:30-09:00- Registration time

09:00–09:30- Group Presentation and Consensus Building on the strategic actions

09:30- 09:40- How to prepare the action plan by Dr. Mushtaq Ahmed Memon, UNEP Representative of UNEP/IETC

09:40- 10:30- Group Discussion (Discussion and Development of Action Plan: Action/ Stakeholder Responsibility/ Time/ Budget) by respective group.

10:30-10:45 Tea Break

10:45-11:15 Group Presentation and Consensus Building on Action Plan

11:15- 12:00- Conclusion and Way Forward by U Min Maw, Director (ECD)

Annex (III)

ACTION PLAN

Based on the above, the following national action plan can be considered:

Table 3. Action plan for solid waste management

| Strategies | Action Plan | | Target/ Performance indicators | Responsible Agencies | Budget | Timeframe |
|-------------------------------------|---|---------------------|--|---|---|-------------|
| | Actions | Detailed Activities | | | | |
| Reduction of solid waste generation | To Reduce 20% of Waste Generation within 5-30 year of time frame (short time frame & long time frame) | Collection | Upgrade the collection system Door to Door (bell ringing and music oriented warning system) Road site dust bin collection Haul container collection | CDCs Business community Stakeholder | Support by the state budget and ODA (official development assistance) | (2016-2040) |
| | | Transportation | Optimized by rearranging the transportation system | | | |
| | | Transfer station | Reduced by sorting (about 10%) for reuse and recycle Transfer and transport to the final disposal site | | | |
| | | Disposal | 2 potential Landfills Waste to Energy | | | |
| | | Finance | To be considered with regard to rate of garbage collection fees | | | |

Table 4. Action plan for wastewater management

| Key Strategies | Targets to be achieved (more measurable) | Key Actions (More Practical) | Responsible Agencies or persons | Expected Budgets | Time frame |
|---|--|---|--|------------------|---------------------------------|
| Strategy (1) Urban and Sub-urban Centralized Wastewater Treatment System (Sewerage and Domestic Wastewater Treatment System) | Up to 50% of the households must have Centralized Wastewater Treatment Plant | Establish Sewage and Domestic Wastewater Systematic Centralized Treatment System for Yangon City, by upgrading the existing situation of Sewage Centralized Treatment System for 4 townships represented to downtown areas of Yangon. According to the results of Feasibility Study by JICA since 2013-2014. Proposing Centralized Treatment System for the whole 33 townships in Yangon by dividing 8 zones. | City Development Committees Relevant Ministries – MOC, MOHS, MONREC, Industrial Zone Management Committees Factory Owners NGOs / INGOs Community Based Organizations | - | Within the period of 2016- 2040 |
| Strategies (2) Urban and Sub-urban Centralized Gray Water Treatment System | Up to 20% of the storm water waste management within the period of 2016-2040 | Implementation Small Scale Treatment Plants to be applicable by proposing in the construction process by implementing Small Scale Treatment Plants for Tall Buildings which have above 3 floors | City Development Committees Relevant Ministries – MOC, MOHS, MONREC, NGOs / INGOs Community Based Organizations | | 2016- 2040 |

| | | | | | |
|--|--|--|---|--|------------|
| Strategy (3) Storm water management system Tall Buildings over 3 stories (Parameters – BOD, COD, SS) | Up to 10% of the Gray Water Management from the household in Yangon Areas, | Installing Storm Water Treatment System at the different areas of Yangon City Establishing Small Scale Sewage Treatment Plant for 8 zones of Yangon City Committee Area before implementing Sewage and Domestic Wastewater Systematic Centralized Treatment System for 8 zones | City Development Committees Relevant Ministries – MOC, MOHS, MONREC, NGOs / INGOs Community Based Organizations | | 2016- 2040 |
|--|--|--|---|--|------------|

Table 5. Action plan for Industrial waste management

| Action | Type of Action | Responsibility | Budget | Time-frame |
|--|------------------------------|--|--------|------------|
| (i) Segregation of industrial waste | | | | |
| Drafting of waste classification and hazardous waste framework | Regulatory/ Institutional | Waste generators, Service providers, Regulatory, Government, NGOs, Research/Academia, Recycling sector | X \$ | 2016-2020 |
| Adoption of Basel convention for import and export of wastes | Regulatory/ Institutional | Regulatory, Government, Service Providers, Recycling sector | X \$ | 2016-2020 |
| Awareness campaigns in industries for waste segregation | Social | Waste generators, Regulatory, Government., NGOs, Research/Academia | X \$ | 2016-2020 |
| Facilitation in waste segregation, | Technical and Financial | Waste generators, Service providers, | X \$ | 2016-2020 |

| | | | | |
|---|------------------------------|--|----------------------|--------------------------|
| including provision of appropriate containers for HW and NHW and solid/sludge and liquid wastes- Initiate from industrial zones in Yangon and Mandalay | | Government | | |
| Facilitation in waste segregation, including provision of appropriate containers for HW and NHW and solid/sludge and liquid wastes-extend to industries outside industrial zones and remote areas | Technical and Financial | Waste generators, Service providers, Government | X \$ | 2020-2030 |
| (ii) collection of industrial waste | | | | |
| <u>Action</u> | <u>Type of Action</u> | <u>Responsibility</u> | <u>Budget</u> | <u>Time-frame</u> |
| Formulate a plan for collection- Time, Frequency and Type of Vehicles for collection of HW, NHW and General Wastes | Technical | Waste generators, Service Industry | X \$ | 2016-2020 |
| Tendering for waste collection to Private parties from industrial zones in Yangon and Mandalay | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Finalization of a private party for collection of HW, NHW and General wastes from industrial zones in Yangon and Mandalay | Financial and Regulatory | Waste generators, Service providers, Government. | X \$ | 2016-2020 |
| Assessment of need for waste collection from industries outside of the industrial zones in other regions of Myanmar (centralized collection mechanism with transfer station- Hub and Spoke logistics model) | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |

| Enforcement of the Polluters Pays Principle | Regulatory | Waste generators, Service providers, Government | X \$ | 2016-2020 |
|---|--------------------------|---|---------------|-------------------|
| Tendering for waste collection to Private parties from other parts of Myanmar (centralized collection mechanism with transfer station- Hub and Spoke logistics model) | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government., Research/Academia | X \$ | 2020-2030 |
| Finalization of a private party for collection of HW, NHW and General wastes | Financial and Regulatory | Waste generators, Service providers, Government. | X \$ | 2020-2030 |
| (iii)Transportation of industrial waste | | | | |
| Action | Type of Action | Responsibility | Budget | Time-frame |
| Formulate a plan for transportation - Time, Frequency and Type of Vehicles for transportation of HW, NHW and General Wastes (considering physical state of wastes) | Technical | Waste generators, Service Industry | X \$ | 2016-2020 |
| Tendering for waste transportation to Private parties from industrial zones in Yangon and Mandalay | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government., Research/Academia | X \$ | 2016-2020 |
| Finalization of a private party for transportation of HW, NHW and General wastes from industrial zones in Yangon and Mandalay | Financial and Regulatory | Waste generators, Service providers, Government. | X \$ | 2016-2020 |
| Enforcement of the Polluters Pays Principle | Regulatory | Waste generators, Service providers, Government. | X \$ | 2016-2020 |

| Assessment of need for waste transportation from industries outside of the industrial zones in other regions of Myanmar (centralized collection mechanism with transfer station- Hub and Spoke logistics model) | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
|--|--------------------------|---|---------------|-------------------|
| Tendering for waste transportation to Private parties from other parts of Myanmar (centralized collection mechanism with transfer station- Hub and Spoke logistics model) | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government., Research/Academia | X \$ | 2020-2030 |
| Finalization of a private party for transportation of HW, NHW and General wastes | Financial and Regulatory | Waste generators, Service providers, Government. | X \$ | 2020-2030 |
| (iv) Treatment of industrial waste | | | | |
| Action | Type of Action | Responsibility | Budget | Time-frame |
| Analysis of composition and assessment of volume of waste | Technical and Govt. | Waste generators, Service Industry, , Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| ESM and technical guidelines for treatment of wastes | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Technical and Economic Feasibility for different waste treatment options- also include a business model considering tipping fee (polluter pays principle) after assessment of various costs such as fixed costs, running costs (O&M) and other contingencies | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Enforcement of the Polluters Pays Principle | Regulatory | Waste generators, Service providers, Government | X \$ | 2016-2020 |

| | | | | |
|--|--------------------------|--|------|-----------|
| Small pilot project on waste treatment in Yangon/Mandalay | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Detailed Procurement -Construction project for waste treatment in Yangon/Mandalay | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government | X \$ | 2020-2030 |
| Replication of EPC- to make centralized treatment facilities for Big cities and other cities | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government | X \$ | 2020-2030 |

(v) Final disposal of industrial waste

| Action | Type of Action | Responsibility | Budget | Time-frame |
|---|--------------------------|--|---------------|-------------------|
| Analysis of composition and assessment of volume of waste | Technical and Regulatory | Waste generators, Service Industry, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| ESM and technical guidelines for final disposal of wastes- On Sanitary Landfill designs, Incineration designs, Operation and Maintenance | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Technical and Economic Feasibility for different waste disposal options- also include a business model considering tipping fee (polluter pays principle) after assessment of various costs such as fixed costs, running costs (O&M) and other contingencies | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Enforcement of the Polluters Pays Principle | Regulatory | Waste generators, Service providers, Government | X \$ | 2016-2020 |

| Detailed Procurement-Construction project for SLF and Incineration in Yangon/Mandalay | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
|--|--------------------------|--|---------------|-------------------|
| Detailed Procurement-Construction project for waste treatment in Yangon/Mandalay | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government | X \$ | 2016-2020 |
| Replication of EPC- to make centralized Disposal facilities for Big cities and other cities- At least the techno-economic feasibility studies | Technical and Regulatory | Waste generators, Service providers, Regulatory, Government | X \$ | 2020-2030 |
| (vi) Recycling of industrial waste | | | | |
| Action | Type of Action | Responsibility | Budget | Time-frame |
| Analysis of composition and assessment of volume of waste | Technical and Regulatory | Waste generators, Service Industry, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| ESM and technical guidelines for recovery (cement kiln co-processing, for example) and recycling of wastes | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Technical and Economic Feasibility for different waste recovery/recycling options- for example, WtE plants, Cement Kiln co-processing, Recycling of batteries/Used Oil etc- include a business model considering take back systems | Technical | Waste generators, Service providers, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Pilot scale demonstrations or trial runs in cement kilns (for example) for recovery of | Technical | Waste generators, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |

| | | | | |
|---|----------------------------------|---|------|-----------|
| materials and heat value from wastes or for destruction and recovery efficiencies of hazardous chemicals (pesticides, ODS, PCBs etc) | | | | |
| Ensure that major cement companies start utilizing wastes - 1-2% of thermal substitution rate | Technical and Regulatory | Waste generators, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Social inclusion of informal recycling sector | Social and Regulatory | Waste generators, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Create awareness on 'Extended Producers Responsibility' for key industries- Battery manufacturing, Paint Manufacturing etc | Technical, Social and Regulatory | Waste generators, Regulatory, Government, Research/Academia | X \$ | 2016-2020 |
| Ensure that major cement companies start utilizing wastes - 3-4% of thermal substitution rate | Technical and Regulatory | Waste generators, Regulatory, Government, Research/Academia | X \$ | 2020-2030 |
| Social inclusion of informal recycling sector- The persons involved in recycling in recognized by Government, And Industry (civil society?) | Social and Regulatory | Waste generators, Regulatory, Government, Research/Academia | X \$ | 2020-2030 |
| Establish 'Extended Producers Responsibility' for key industries- Battery manufacturing, Paint Manufacturing etc- Including supply chain | Technical, Social and Regulatory | Waste generators, Regulatory, Government, Research/Academia | X \$ | 2020-2030 |

Annex (IV)

Group Photos



Minister's speech



UNEP presentation



IGES presentation



Participants



Group discussions



Group presentation



Site visits

IGES and ECD wrap up conclusion

Annex (V)

Presentation Materials (attached)

Overview of Waste Management in Myanmar

Min Maw
Director
Pollution Control Division
Environmental Conservation Department

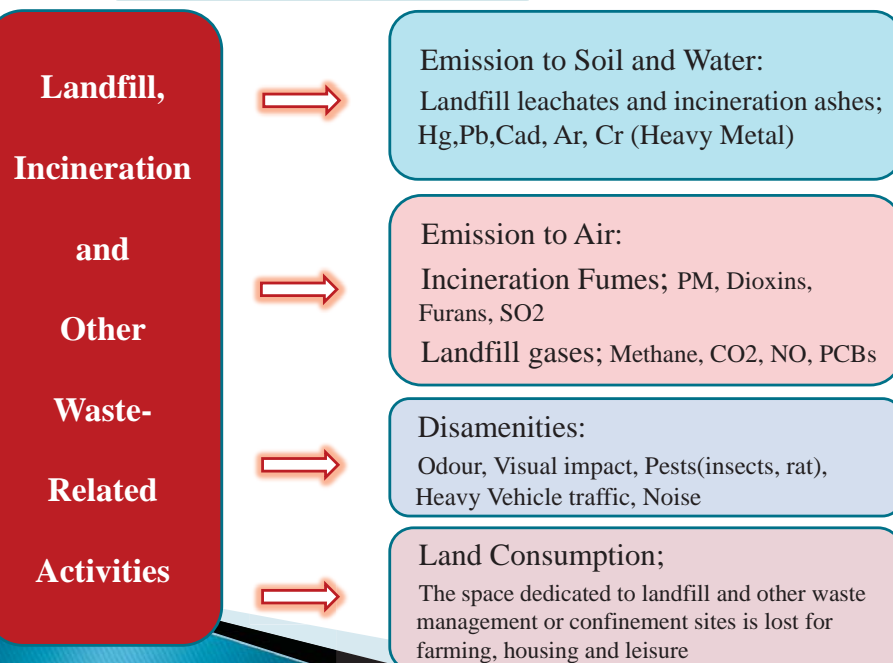
13-6-2016

Nay Pyi Taw

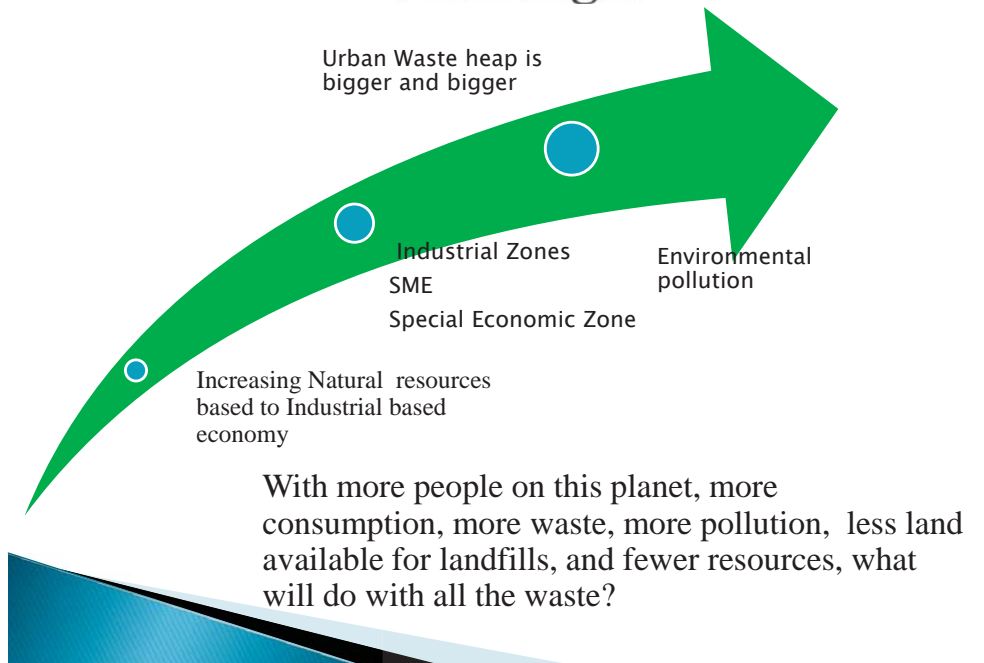
Presentation Outlines

- ▶ Waste and Environment
- ▶ Challenges
- ▶ Priority areas of environmental concern
- ▶ Waste Management Initiatives
- ▶ Policy, Law, Rules, Procedure and Guidelines on Environmental Conservation
- ▶ Legislation on Waste Management
- ▶ Prescriptions of Waste Management in ECL and ECR
- ▶ Needs and Gaps
- ▶ Way Forward

Waste and Environment



Challenges



Priority areas of environmental concern

- ▶ Air Quality
- ▶ Water supply, Sanitation and Hygiene
- ▶ Solid and Hazardous Waste
- ▶ Toxic chemical and hazardous substances
- ▶ Climate change, Ozone depletion and ecosystem charges
- ▶ Contingency planning, preparedness and response in environmental health emergencies



Source: National Environment and Health Action Plan:

Waste Management Initiatives

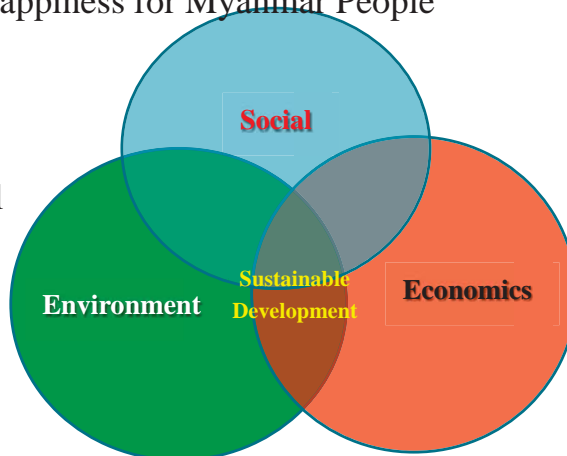
Myanmar Agenda 21 (1997) identified four program areas, waste related areas such as:

- Improve the solid waste management programme
- Promote environmentally sound management of toxic chemical and hazardous wastes



Waste Management Initiatives in National Strategy for Sustainable Development

- **Harmony among 3 pillars**
- **Vision:** Wellbeing & Happiness for Myanmar People
- **Mission:**
 - (a) Keep the city Clean
 - (b) Make the City Beautiful
 - (c) Enjoy the Peaceful Life



Waste Management Initiatives in NSDS

- To develop public awareness and promote community involvement
- To connect with other ASEAN countries for identification and dissemination of cleaner prod technologies
- To promote environmentally sound waste mana 3R
- To encourage private investment in solid waste management services
- To formulate a solid waste management master plan and guidelines and priority on big cities



Environmental Policy, Law, Rules, Procedure and Guidelines

- ▶ Environmental policy (1994)
- ▶ Myanmar Agenda 21 (1997)
- ▶ National Sustainable Development Strategy- NSDS (2009)
- ▶ Environmental Conservation Law (2012)
- ▶ Environmental Conservation Rule (2014)
- ▶ Procedures for Environmental Impact Assessment (2015: Dec)
- ▶ Environmental Emission Quality Guidelines (2015:Dec)



Legislations on Waste Management

- ▶ The Yangon Work Act (1885)
- ▶ The City of Yangon Municipal Act (1922)
- ▶ The Water Power Act (1927)
- ▶ The Underground Water Act (1930)
- ▶ The City of Yangon Development Law (1990)
- ▶ The Development Law (1993)
- ▶ The City of Mandalay Development Law (2002)
- ▶ The Nay Pyi Taw Development Law (2009)
- ▶ Chemical Safety law



Environmental Conservation Law ;ECL

Article 7

- ▶ Prescribing environmental quality standards
- ▶ Specifying categories and classes of hazardous wastes
- ▶ Prescribing categories of HW that affect present/long run
- ▶ Treatment of solid wastes, effluents and emissions
- ▶ Installing environmental friendly equipment to reduce pollution
- ▶ Controlling the wastes in accord with env sound method



ECL Continued

Article13;

- Ministry shall maintain a comprehensive monitoring & implement with relevant Ministries and organizations
- (b) transport, storage, use, treatment and disposal of pollutants and hazards substances in industries
 - (c) Disposal of wastes come from exploration, production and treatment of minerals, industrial raw materials and gems



ECL(Continued)

Responsibilities of project proponent/ business owner for reducing environmental impact

Article14. A person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards.

Article15. The owner or occupier of any business, material or place which causes a point source of pollution shall install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it is impracticable, it shall be arranged to dispose the wastes in accord with environmentally sound methods.



ECL (Continued)

Responsibilities of project proponent/ business owner for reducing environmental impact

Article16 A person or organization operating business in the industrial estate or business in the SEZ or category of business stipulated by the Ministry:

- is responsible to carry out by contributing the stipulated cash or kind in the relevant combined scheme for the environmental conservation including the management and treatment of waste;
- shall contribute the stipulated users' charges or management fees for the environmental conservation according to the relevant industrial estate, SEZ and business organization;
- shall comply with the directives issued for environmental conservation according to the relevant industrial estate, SEZ or business.



ECL (Continued)

Article 17,

The Ministry shall, for the **management of urban environment** advise as may be necessary to the relevant Government departments and Government organizations, private organizations and individuals in carrying out the following matters in accord with the guidance laid down by the committee:

(d) Management of wastes;



Environmental Conservation Rules

Rule 41;

Ministry shall determine categories and classes of HW, in accord with the relevant Government department or organization, which may come out from producing or using chemical or hazardous material in their various work.

Rule 42;

Ministry shall promote the establishment of facilities or centers for the treatment of solid/liquid waste and emissions contains poisonous & hazardous materials.



Environmental Conservation Rules Continued

Rule 43; The Ministry:

(c) may adopt necessary better measures relating to the maintenance, store, transport and destruction of solid waste in coordination with the relevant Government departments and Government organizations;

(d) may adopt manners for cleaner production mechanisms and recycling of natural resources and wastes in industries and businesses.



Environmental Conservation Rules Continued

Rule 44;

Department shall prepare the categories and classes of HW, come out from producing or using chemicals or other hazardous materials with the guidance of Ministry.

Rule 45;

Department shall inspect whether or not the businesses which are responsible for establish waste treatment facility or center under rule 42, comply with the stipulations in respect of waste treatment and carry out, and submit in accord with the guidance of the Ministry.



Environmental Conservation Rules Continued

Section 46; Department shall -

- To prepare terms and conditions for treatment of effluent zones and others necessary areas & buildings.
- To prepare to confiscation, storing, keeping, measures, transport, import/ export of disposed HM by advance technology and submit to the Ministry.
- To implement & measures adopted by the Ministry for the betterment of the destruction store and transport of solid waste.
- After inspecting, report to the Ministry for cleaner production mechanism & recycling of natural resources and wastes.



Needs and Gaps

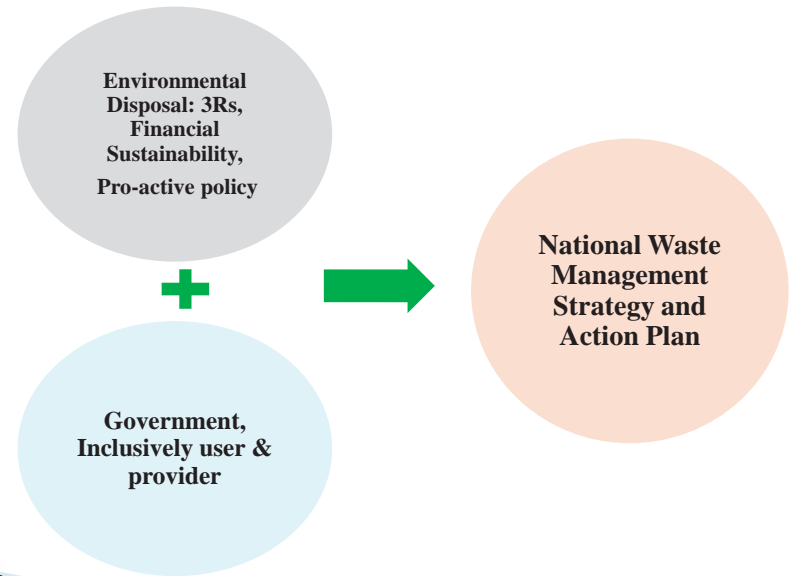
- Specific Rules, Regulation and Guidelines
- National Waste Management Strategies Framework Formulation
- Comprehensive Monitoring System
- Environmental Laboratory
- Technology
- Coordination Mechanism and Institutional Strengthening
- Financial Mechanism
- Party of Minamata, Rotterdam Convention



Way Forward



- ▶ To formulate legislation framework on Hazardous waste and master Plan
- ▶ To formulate waste management guidelines and priorities
- ▶ To set Sectoral laws and polices concerning with waste management
- ▶ To implement the waste management as a priority area in environmental concerns
- ▶ To promote the regional and International cooperation
- ▶ To conduct environmental awareness by raising



Happiness versus Consumption

Are high consumption, therefore high waste production, societies happier?

Do you really want to minimizing waste?

Happy throwing away, Mr and Mrs Consumer?



Thank you For your Attention

HOLISTIC WASTE MANAGEMENT APPROACH FOR ECO TOWNS



Mushtaq Ahmed MEMON, Ph.D
Programme Officer
 International Environmental Technology Centre (IETC)
 Division of Technology, Industry and Economics (DTIE)
 United Nations Environment Programme (UNEP)



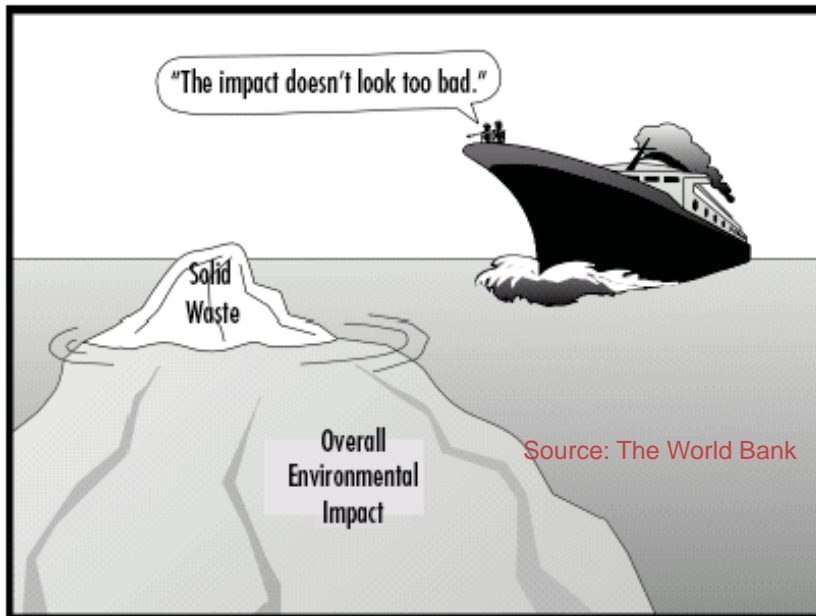
OVERVIEW

- Why waste?
- A holistic approach!
- UNEP support
- National and City Waste Management Strategies Guidelines



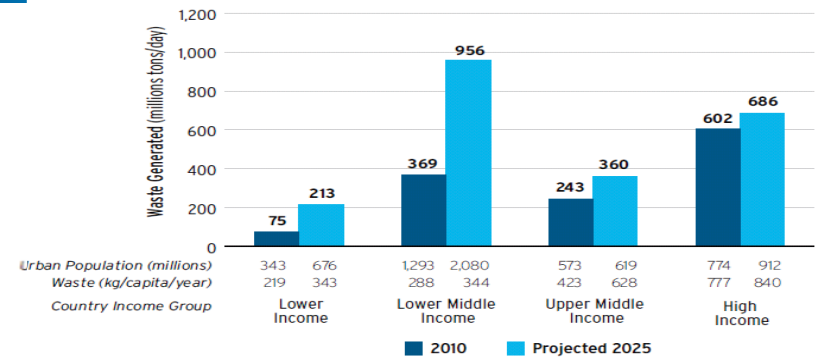
3

Challenge # 1: Waste Generation



Waste generation levels (1)

Current global MSW generation levels are approximately 1.3 billion tonnes per year, and are expected to increase to approximately 2.2 billion tonnes per year by 2025. This represents a significant increase in per capita waste generation rates, from 1.2 to 1.42 kg per person per day in the next fifteen years.



Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management
 United Nations Environment Programme
 Division of Technology, Industry and Economics
 International Environmental Technology Centre

4

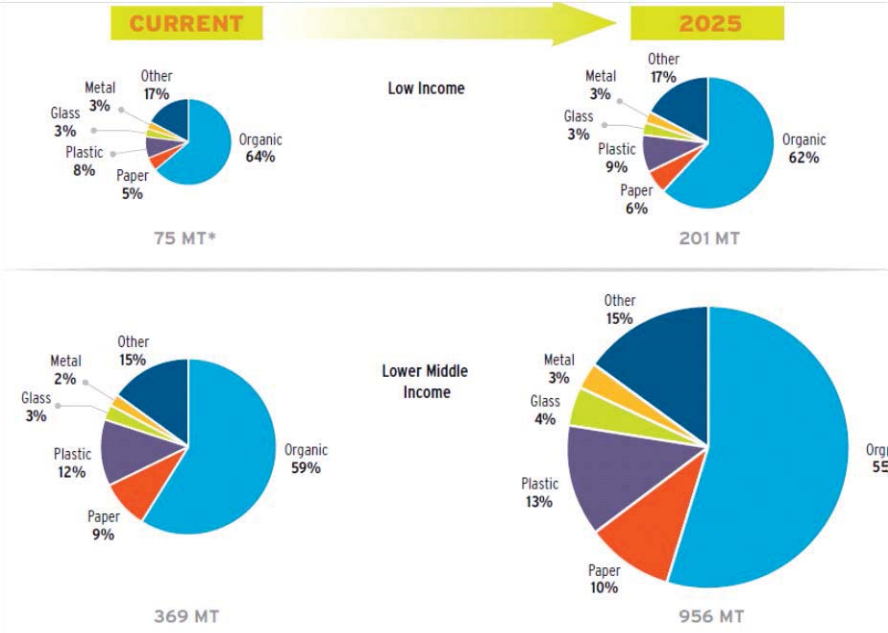
4

Waste generation projections

| Region | Current Available Data | | | Projections for 2025 | | | |
|--------------|-----------------------------------|----------------------------|------------------|-----------------------------|-----------------------------|----------------------------|------------------|
| | Total Urban Population (millions) | Urban Waste Generation | | Projected Population | | Projected Urban Waste | |
| | | Per Capita (kg/capita/day) | Total (tons/day) | Total Population (millions) | Urban Population (millions) | Per Capita (kg/capita/day) | Total (tons/day) |
| AFR | 260 | 0.65 | 169,119 | 1,152 | 518 | 0.85 | 441,840 |
| EAP | 777 | 0.95 | 738,958 | 2,124 | 1,229 | 1.5 | 1,865,379 |
| ECA | 227 | 1.1 | 254,389 | 339 | 239 | 1.5 | 354,810 |
| LCR | 399 | 1.1 | 437,545 | 681 | 466 | 1.6 | 728,392 |
| MENA | 162 | 1.1 | 173,545 | 379 | 257 | 1.43 | 369,320 |
| OECD | 729 | 2.2 | 1,566,286 | 1,031 | 842 | 2.1 | 1,742,417 |
| SAR | 426 | 0.45 | 192,410 | 1,938 | 734 | 0.77 | 567,545 |
| Total | 2,980 | 1.2 | 3,532,252 | 7,644 | 4,285 | 1.4 | 6,069,703 |

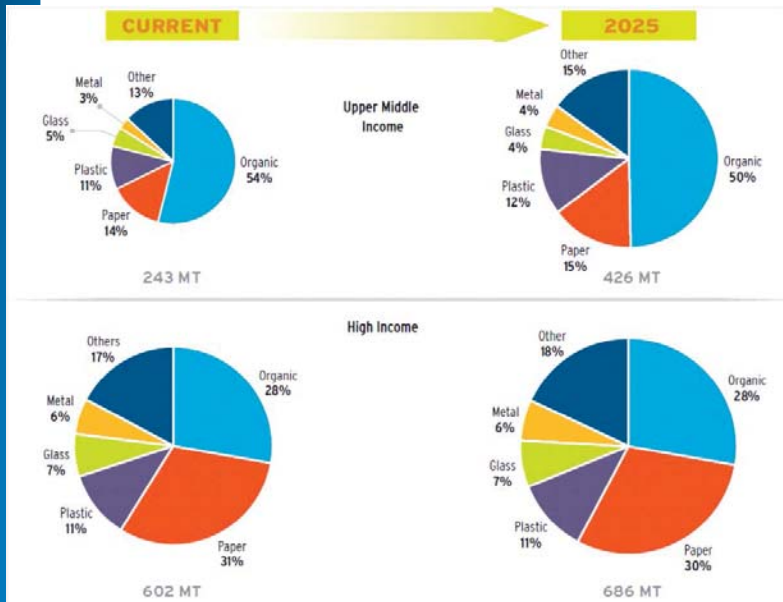
Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management

Waste composition (1)



Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management

Waste composition (2)



Source: Current data vary by country.
*Total annual waste volume in millions of tonnes

Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management

UNCOLLECTED AND UNTREATED WASTE

Half of the world population without sound waste management



Source: World Bank



(RE)EMERGING WASTE STREAMS

Increase in hazardous waste and other (re)emerging waste streams



Source: World Bank



Water and sanitation Wastewater and sludge

| Year | Population | | | Water Supply Coverage (%) | | | | Sanitation Coverage (%) | | | | | | | |
|--------------------------|-----------------|--------------|--------------|---------------------------|--------------------------|-----------------|--------------------------|-------------------------|----------------------|-----------------|----------------------|-----------------|----------------------|-----------------|----------------------|
| | Total ('000) | Urban (%) | Rural (%) | Total Access | Household Connections | Total Access | Household Connections | Total Access | House Connections | Total Access | Sewer Connections | Total Access | Sewer Connections | Total Access | Sewer Connections |
| Asia and the Pacific | 1990 8,268,921 | 33 | 67 | 74 | 38 | 95 | 70 | 64 | 22 | 34 | 13 | 70 | 33 | 16 | 2 |
| | 2002 8,888,218 | 39 | 61 | 82 | 43 | 94 | 73 | 75 | 24 | 49 | 16 | 75 | 37 | 33 | 3 |
| East and Northeast Asia | 1990 1,348,962 | 33 | 67 | 74 | 55 | 99 | 85 | 62 | 40 | 32 | 10 | 71 | 28 | 12 | 1 |
| | 2002 1,802,315 | 42 | 58 | 80 | 64 | 94 | 92 | 70 | 43 | 50 | 20 | 73 | 43 | 33 | 3 |
| North and Central Asia | 1990 215,178 | 65 | 35 | 91 | 71 | 96 | 86 | 82 | 42 | 82 | 64 | 92 | 83 | 63 | 26 |
| | 2002 217,858 | 63 | 37 | 91 | 72 | 98 | 90 | 79 | 40 | 79 | 63 | 90 | 84 | 59 | 26 |
| Pacific | 1990 26,672 | 70 | 30 | 89 | 67 | 100 | 93 | 63 | 6 | 90 | 54 | 99 | 77 | 69 | 0 |
| | 2002 31,828 | 73 | 27 | 87 | 69 | 99 | 92 | 53 | 8 | 87 | 55 | 98 | 75 | 57 | 0 |
| South and Southwest Asia | 1990 1,281,183 | 28 | 72 | 71 | 21 | 90 | 56 | 64 | 7 | 23 | 9 | 58 | 29 | 9 | 1 |
| | 2002 1,850,605 | 31 | 69 | 85 | 26 | 94 | 54 | 80 | 13 | 39 | 10 | 69 | 27 | 25 | 3 |
| Southeast Asia | 1990 488,926 | 32 | 68 | 73 | 14 | 91 | 37 | 65 | 3 | 48 | 2 | 67 | 6 | 39 | 0 |
| | 2002 588,612 | 41 | 59 | 79 | 23 | 91 | 45 | 70 | 8 | 61 | 3 | 79 | 7 | 49 | 0 |

Source: Figures derived from data in Meeting the MDG drinking water and sanitation target: A mid-term assessment of progress. WHO and UNICEF. 2004. United Nations, New York.

Source: <http://www.adb.org/Water/Indicators/MDG-7/Table-02.pdf>

Challenge # 2: Severity of Impacts



- Severe health impacts particularly on communities in the vicinity of dumpsites.
- Pollution of surface and sub-surface water bodies due to leachate contamination.

Payatas, Philippines



Nairobi, Kenya

- Air pollution from emissions of spontaneous combustion in dumps.
- Adverse impacts on fauna and flora.

Challenge # 3: Increasing Costs

OECD countries:

Municipal waste – USD120 billion/year
Industrial waste – USD150 billion/year

Developing countries:

20-50% of recurring budget of municipalities is spent on solid waste management, although only 50% of urban population is covered. In low-income countries collection alone drains 80-90% of total waste management budget.

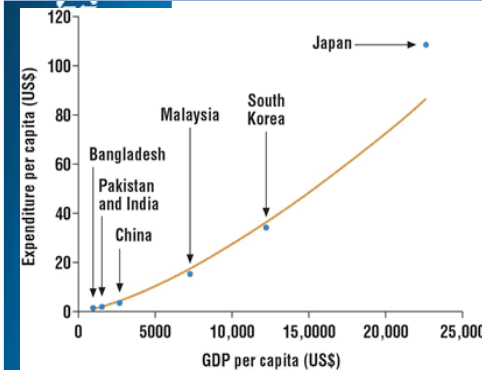


Figure 16: Municipal Urban Waste Services Expenditures

| City, Country | Year | Per Capita Expenditure on SWM (US \$) | Per capita GNP (US \$) | % GNP Spent on SWM |
|-------------------------|------|---------------------------------------|------------------------|--------------------|
| New York, USA | 1991 | 106 | 22,240 | 0.48 |
| Toronto, Canada | 1991 | 67 | 20,440 | 0.33 |
| Strasbourg, France | 1995 | 63 | 24,990 | 0.25 |
| London, England | 1991 | 46 | 16,550 | 0.28 |
| Kuala Lumpur, Malaysia | 1994 | 15.25 | 4,000 | 0.38 |
| Budapest, Hungary | 1995 | 13.80 | 4,130 | 0.33 |
| São Paulo, Brazil | 1989 | 13.32 | 2,540 | 0.52 |
| Buenos Aires, Argentina | 1989 | 10.15 | 2,160 | 0.47 |
| Tallinn, Estonia | 1995 | 8.11 | 3,080 | 0.26 |
| Bogota, Colombia | 1994 | 7.75 | 1,620 | 0.48 |
| Caracas, Venezuela | 1989 | 6.67 | 2,450 | 0.27 |
| Riga, Latvia | 1995 | 6 | 2,420 | 0.25 |
| Manila, Philippines | 1995 | estimate 4 | 1,070 | 0.37 |
| Bucharest, Romania | 1995 | 2.37 | 1,450 | 0.16 |
| Hanoi, Vietnam | 1994 | predict 2 | 250 | 0.80 |
| Madras, India | 1995 | 1.77 | 350 | 0.51 |
| Lahore, Pakistan | 1985 | 1.77 | 390 | 0.45 |
| Dhaka, Bangladesh | 1995 | 1.46 | 270 | 0.54 |
| Accra, Ghana | 1994 | 0.66 | 390 | 0.17 |

(MacFarlane, 1998)

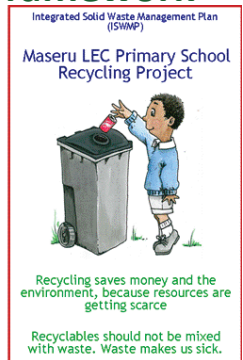
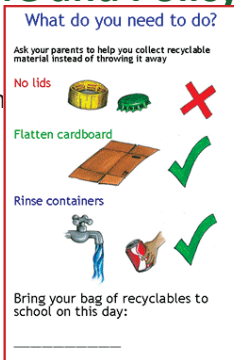
Challenge # 5: Lack of Political Priority

- Waste management and resource recovery still a low priority area
- Lack of national initiatives and fund allocation particularly in low-income countries
- Lack of comprehensive programme at national/local level



Challenge # 4: Limited Infrastructure and Policy Framework

- Rely on end-of-pipe solutions with focus on collection and disposal with coverage of collection is around 50%
- Safe disposal
 - 30% practised only in middle-income developing countries
 - 5% practised only in low-income developing countries
- Lack of extensive policy framework, especially to address emerging and re-emerging waste streams
- Limited implementation of policies at best in selected big cities



Gaseous emissions Waste related air emissions

THE AIR WE BREATHE

Air pollution rise in Indian cities between 2002-10, compared to other nations

| | |
|--------------|-------------|
| Bangalore | 34% |
| Pune | 27% |
| Hyderabad | 26.8% |
| Nagpur | 22% |
| Mumbai | 18% |
| Chennai | 13% |
| Surat | 12.5% |
| Ahmedabad | 12% |
| Kolkata | 11.5% |
| DELHI | 4.2% |

60 µgm-3
(micro grams per cubic metre of air) is India's national air quality standard.

Rise in air pollution

India's neighbours

| | |
|--------------------|------|
| Dhaka (Bangladesh) | 6.2% |
| Lahore (Pakistan) | 2.3% |
| Karachi (Pakistan) | 2.1% |

Elsewhere

| | |
|------------------|-------|
| Shanghai (China) | 13.7% |
| New York (US) | 13.0% |
| Seoul (S. Korea) | 9.5% |
| London (UK) | 5.6% |

Challenge #6: Climate Change and Air Pollution

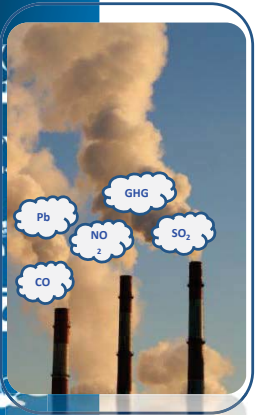
1. Rotten waste
2. Open burning
3. Landfills
4. Thermal treatment (e.g. incineration)
5. Biological treatment (e.g. composting)
6. Collection and transportation
7. Lost energy to offset fossil fuels



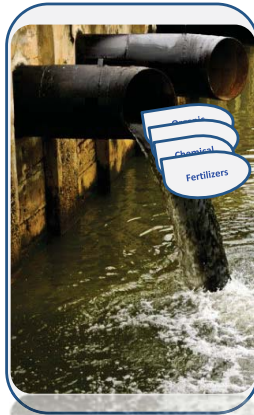
Source: <http://www.hindustantimes.com/india-news/newdelhi/india-tops-china-in-air-pollution-level-increase/article1-966208.aspx>



'Silo' Approach to Waste Management



Air Pollution



Water Pollution

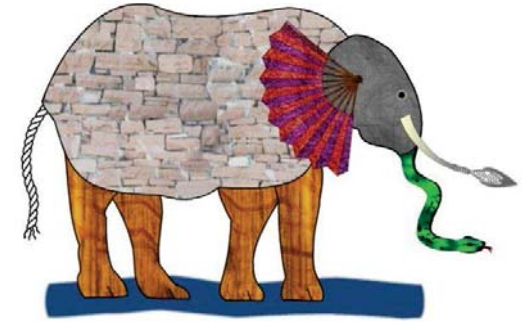


Soil/Land Pollution



From 'Silo' to 'Holistic' Approach to Waste Management

- Silo Approach facilitates the "Sector" Specific Specialist Technology Development
- It may be good for one stream or form of waste, but might not be the optimal solution
- **Holistic Waste Management** = Breaking the "Silo"
- **Holistic Waste Management** = Integrated Waste management + Interlinkages with waste forms
- **Holistic Waste Management** = putting the pieces together



Looking at the big picture can lead to a new way of seeing the problem.

Let us "see" the whole elephant.

Holistic Approach: Breaking the 'Silo'



Holistic Waste Management

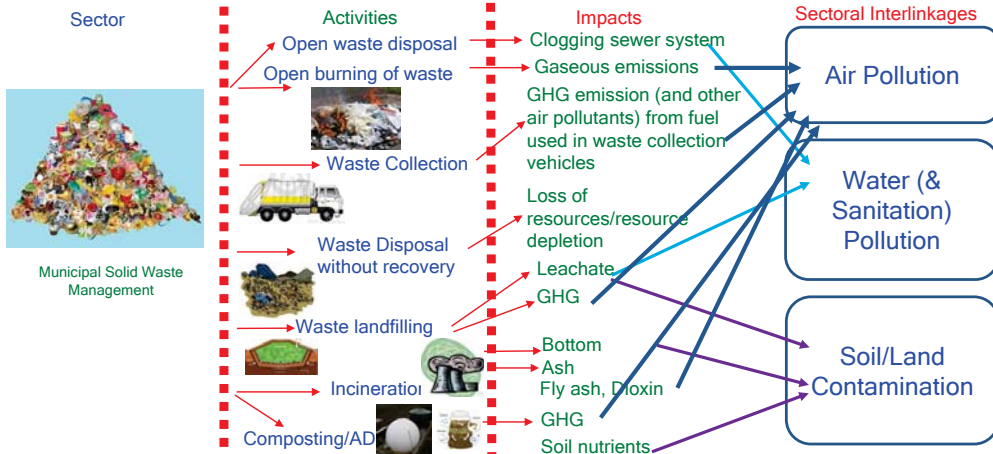
Holistic system approach here means the

Inter-sectoral waste interlinkages (solid, liquid and gaseous), and

Multi-media pollution issues arising from waste handling of one form or one waste sector



Holistic Waste Management



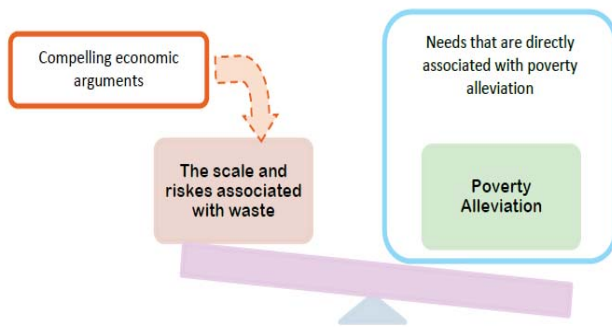
Solid, Liquid, Gaseous Nexus – Mercury waste

「水俣条約」採択 2013年10月10日 in 熊本



WHY SHOULD DEVELOPING COUNTRIES MAKE WASTE A PRIORITY ?

なぜ途上国は、廃棄物問題を優先的に取り組むべきなのか



The policy and budget attention in developing countries regarding waste management and other higher prioritized problems

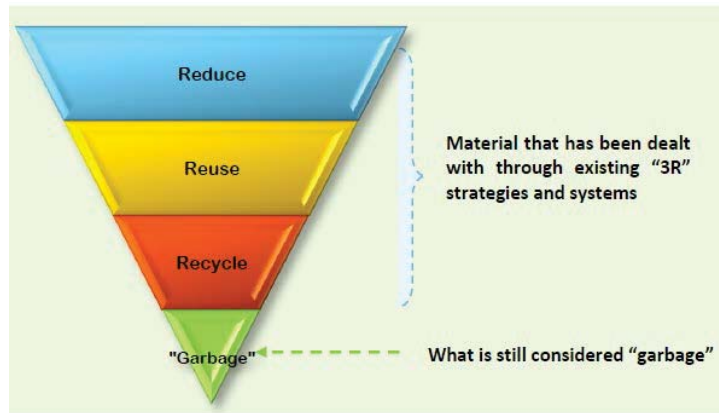
WHY SHOULD DEVELOPING COUNTRIES MAKE WASTE A PRIORITY ?

なぜ途上国は、廃棄物問題を優先的に取り組むべきなのか



IETC's task of urging countries to manage their waste better and to move from words to action in the development of more effective waste management systems

WASTE HIERARCHY AND 3R



Paradigm Shift

20th CENTURY

WASTE
MANAGEMENT

"How do we get rid of our waste efficiently with minimum damage to public health and the environment?"

21st CENTURY

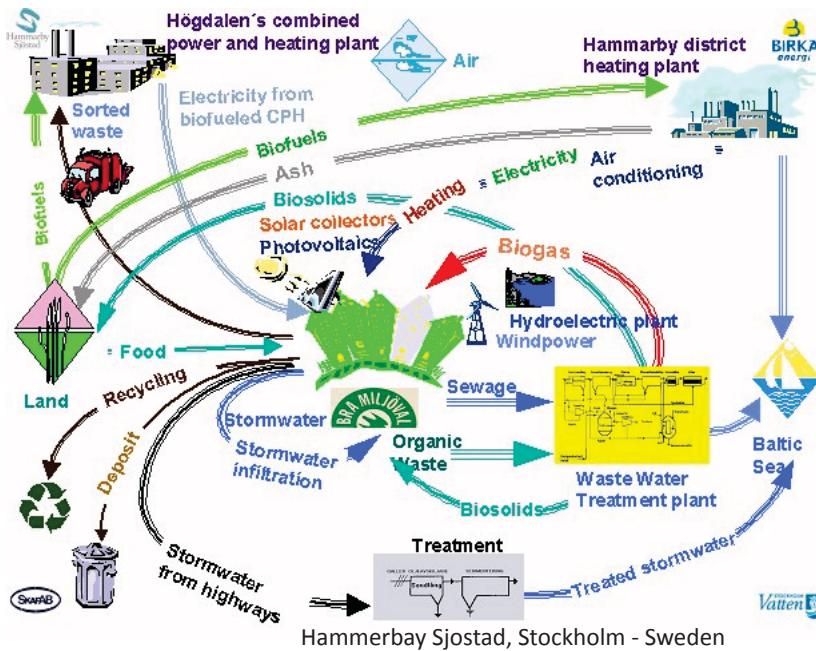
RESOURCE
MANAGEMENT

"How do we handle our discarded resources in ways which do not deprive future generations of some, if not all, of their value?"

Source: Dr. Paul Connett, Zero Waste, Power Point



CIRCULAR ECONOMY / 3R – CLOSING THE LOOP

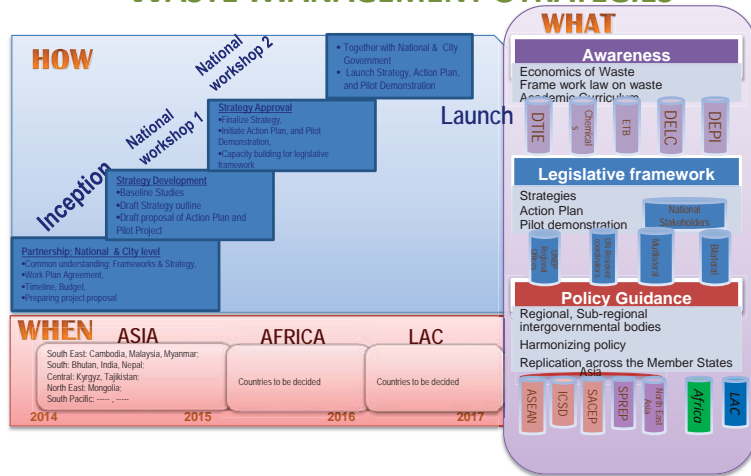


UNEP ITC: HOLISTIC WASTE MANAGEMENT

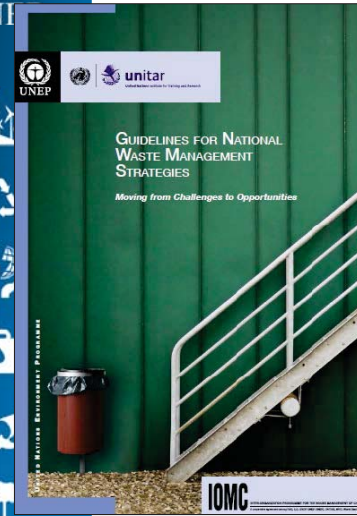
- Holistic approach to waste
- Waste → Resource (From linear to closed-loop material cycle)
- Promote Prevention Policies: Anchor 3R



IETC SUPPORT FOR NATIONAL AND CITY WASTE MANAGEMENT STRATEGIES



Guidelines for NWMS



- Provide a **conceptual and methodological framework** for national planning that countries may adapt to their particular circumstances.
- Establish a clear **rationale** for making waste management a national priority.
- The guidelines, while focused on **strategy development**, also encompasses **implementation, review and updating** of the strategy.

Guidelines for NWMS



Content

Part I – Introduction: context and overview

Part II – Challenges and opportunities in waste management

Part III – Considerations in developing a national waste management strategy

Part IV – A national waste management strategy: participative process

Annexes

Content of the guidelines

Part I:

- Presents the **background** on the guidance document and set up the scene for waste management
- Provides an **overview** of the content of the guidelines and reinforces the need for implementation of the strategy once developed
- Clarifies the **scope** of the guidelines – waste streams
- Presents the **waste management hierarchy** and other concepts as the cornerstones of waste management policy across the globe
- Outlines the **reasons** for a national waste management strategy



Content of the guidelines (cont)

Part II:

- Presents the **contributions of sound waste management** to sustainable development
- Details the **benefits** for each of the three **pillars of sustainability**: economic, environmental and social; and acknowledges the interactions among and between the pillars
- Outlines the **governance challenges**, recognizes the many interests from the different stakeholders and the need for policy and legislative infrastructure.



Content of the guidelines (cont)

Part III:

- Deals with **concepts and principles** related to waste management that will be drawn when developing the strategy
- Highlights the importance of inclusivity for **engaging the stakeholders**
- It reviews the **policy tools** centrally important to waste management
- Takes account of major **considerations influencing policy choices** involved in the process of strategy development, implementation and monitoring.



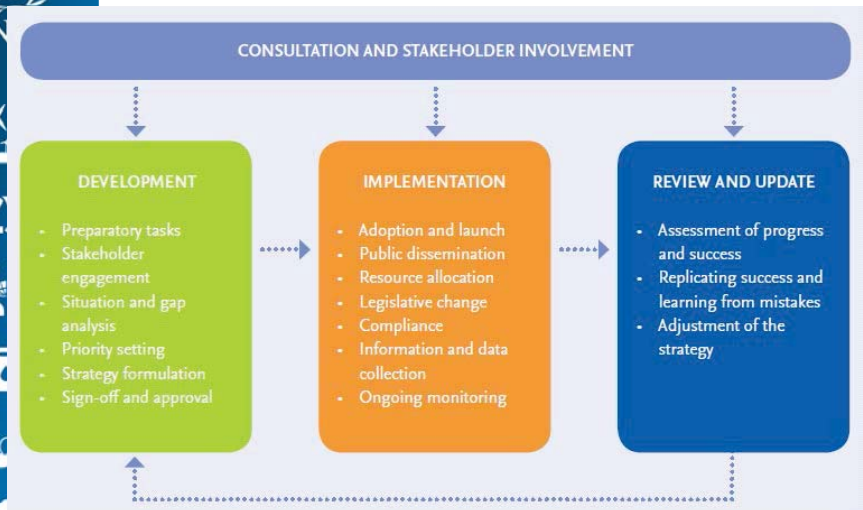
Content of the guidelines (cont)

Part IV:

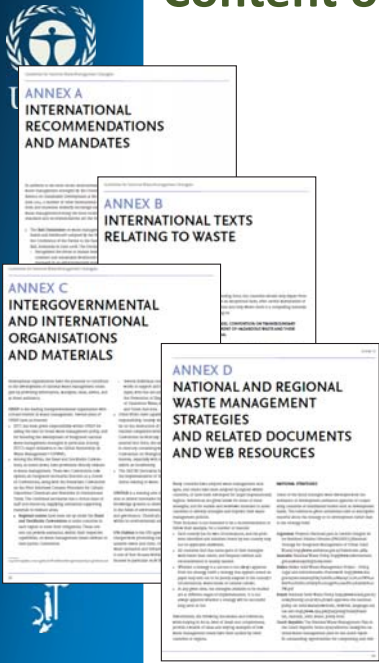
- Presents a **possible process** and defines the actions a country can take in order to develop a strategy, then to implement, review and update it.
- Ask a number of **questions** that countries may wish to consider as they developed their strategy.
- Raises **considerations** that the countries will need to take into account
- Identifies the **steps** that every country will have to go through



Content of the guidelines (cont)



Content of the guidelines (cont)



Annexes:

- **Annex A:** International recommendations and mandates
- **Annex B:** International text relating to waste
- **Annex C:** Intergovernmental and International organizations
- **Annex D:** National and regional waste management strategies and related documents and web resources

City Waste Management Strategy

Developing Integrated Solid Waste Management Plan Training Manuals

Volume 1

Waste Characterization and Quantification with Projections for Future

Compiled by



Training Manuals on How to Develop Integrated Solid Waste Management Plan

Part 2

Assessment of Current Waste Management System and Gaps therein

Compiled by



Extension of NWMS

- **Detailed baseline studies for implementation plan**
- **Target setting for tangible results**
- **Stakeholder engagement**
- **City Strategy and Action Plan**
- **Implementation**
- **Monitoring and review**

Training Manuals on How to Develop Integrated Solid Waste Management Plan

Part 3

Targets and Issues of Concern for ISWM

Compiled by



Part 4

ISWM Plan and Detailed Schemes

Compiled by



International Environmental Technology Centre
 2-110 Ryokuchi Koen
 Tsurumi-ku, Osaka 538-0036 Japan
 Tel : +81 (0) 6 6915 4581
 Fax : +81 (0) 6 6915 0304
 E-mail : ietc@unep.org
 Web: <http://www.unep.org/ietc>

Conclusion
 結論

**Partnership,
 Partnership and
 Partnership
 Thank You...**



Current Situation of Solid Waste Management in Yangon City

Presented by
Dr Aung Myint Maw
 Assistant Chief Engineer.
 YCDC.

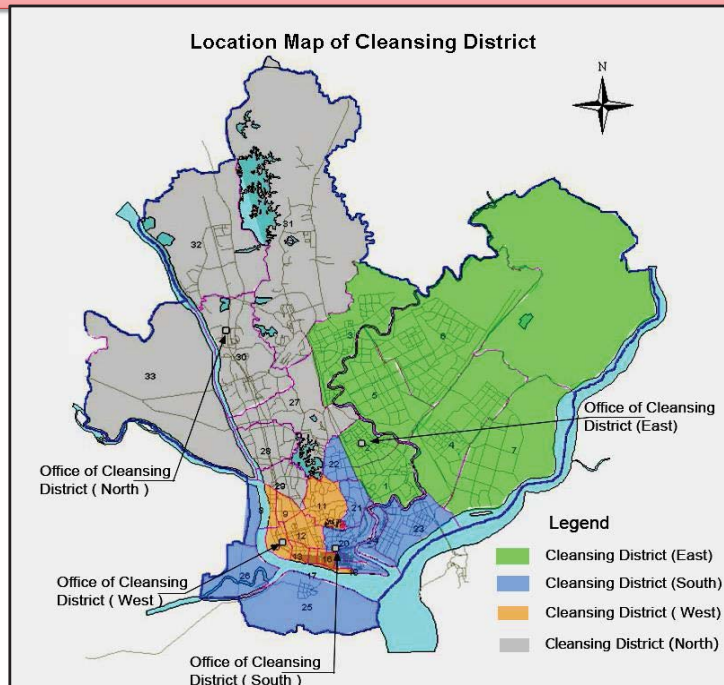
17-Aug-16

1

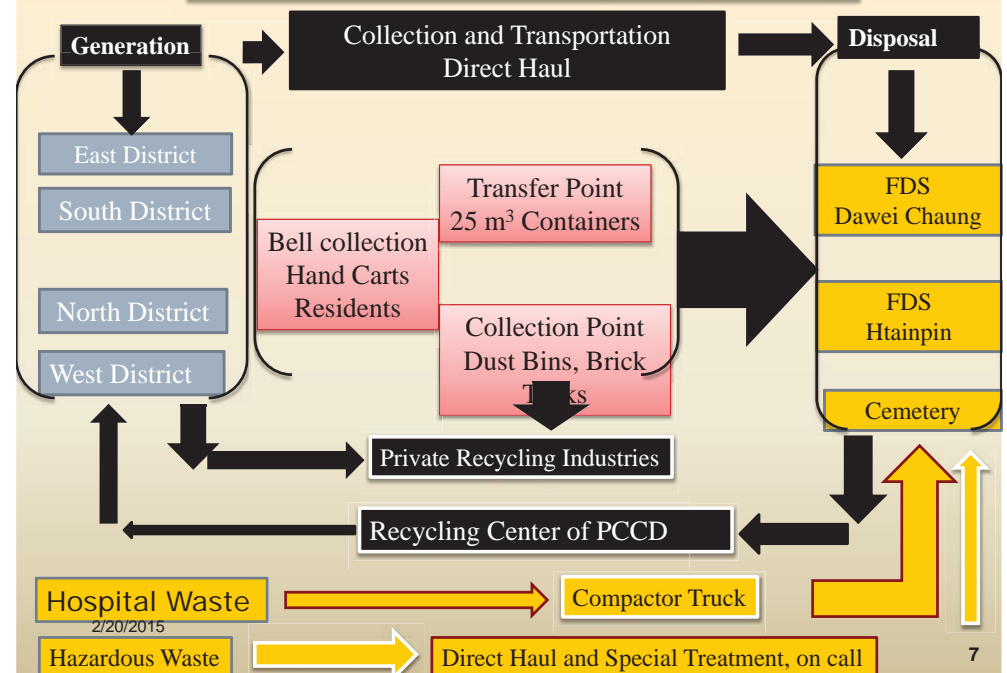
Profile

| | |
|---------------------------|--|
| Area | : The administrative boundary of YCDC, in 1985 (133.643 Sq-Miles) and now a day (292.426) Square Miles. |
| Population | : 6 million (2014) |
| Township | ; 33 Tps |
| Generation Rate | ; 0.41 Kg / Capita / Day |
| Household Waste Generated | : 2000 tons per day |
| Industrial Waste | :150 tons per day |

Area Map



Waste Flow in Yangon (2012)



7



Yangon People & House Hold Source Separation

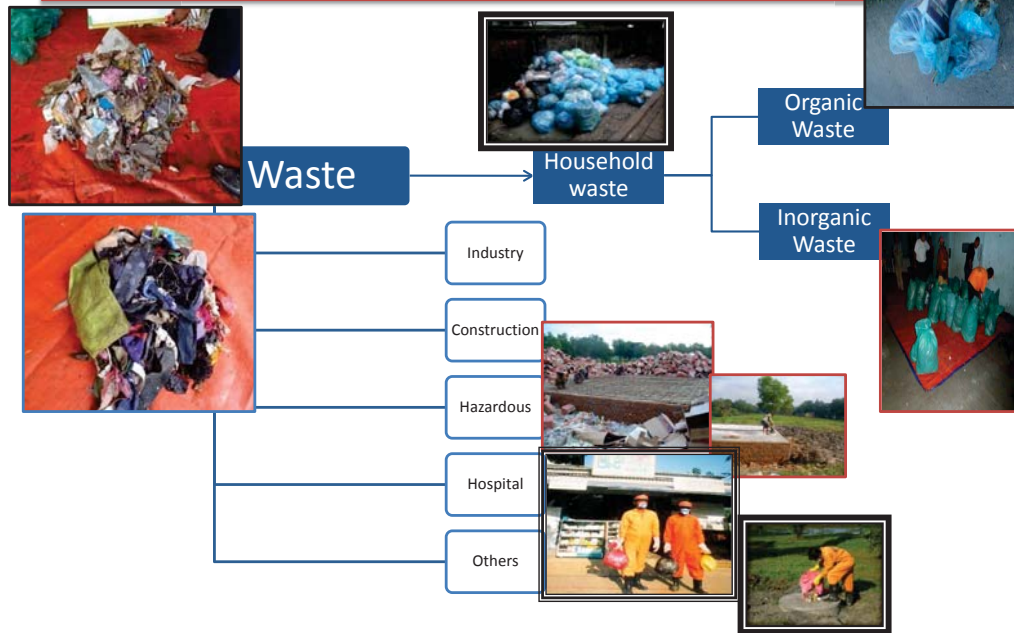


Dry Waste

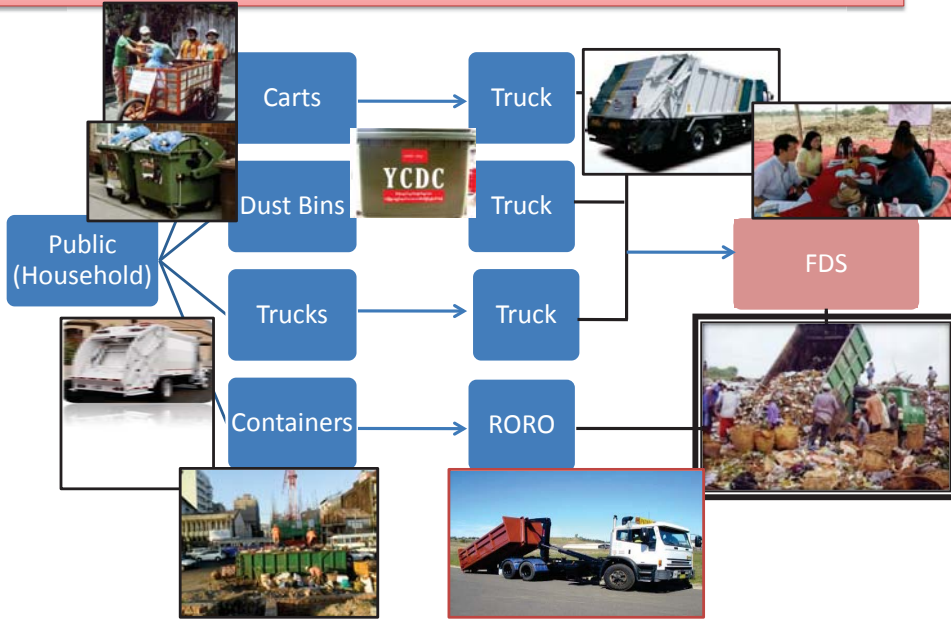
Wet Waste



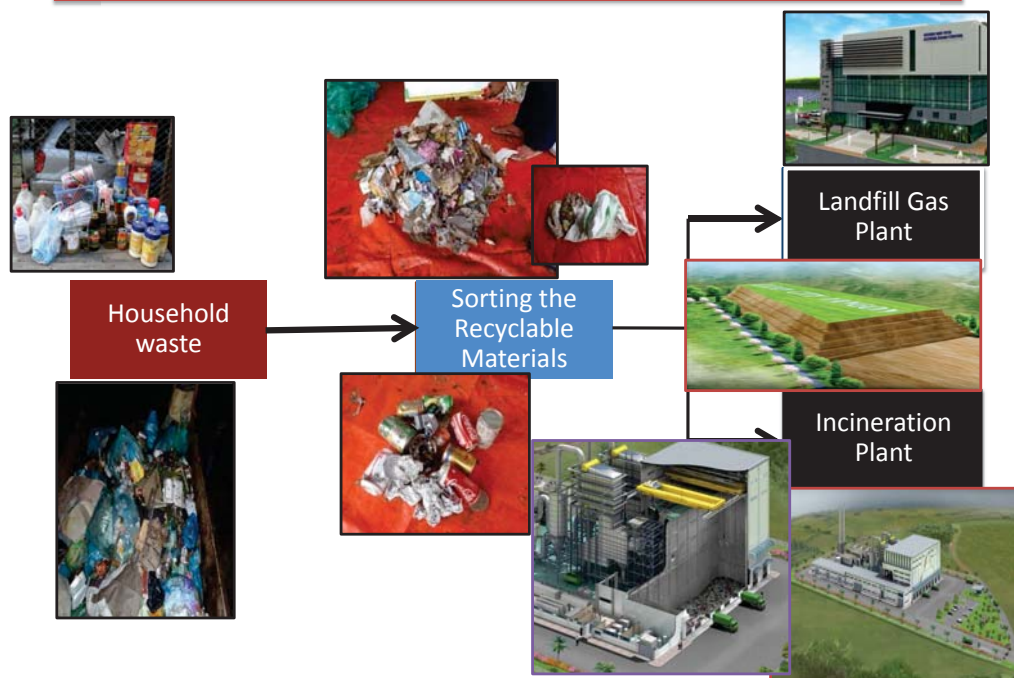
Waste Define in Yangon



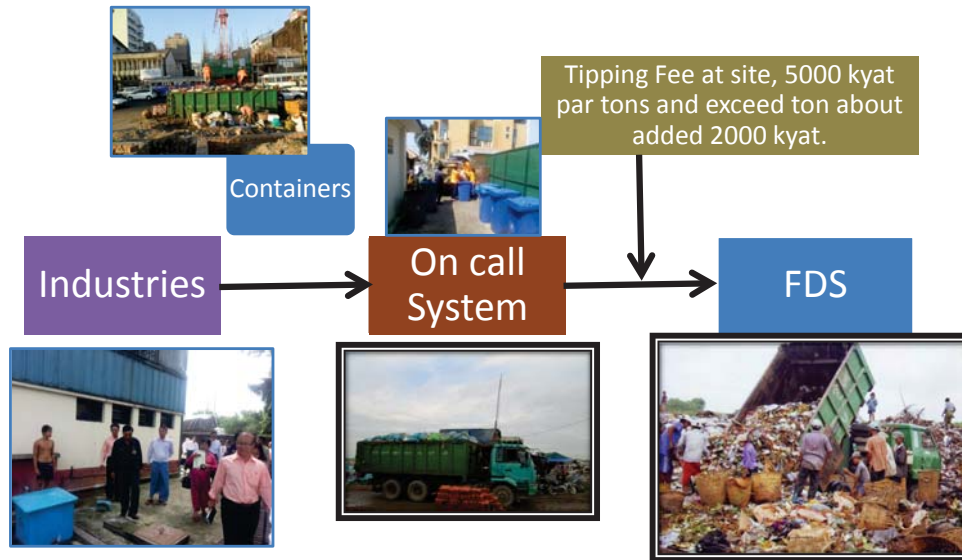
Collection and Transportation



Household Waste Management



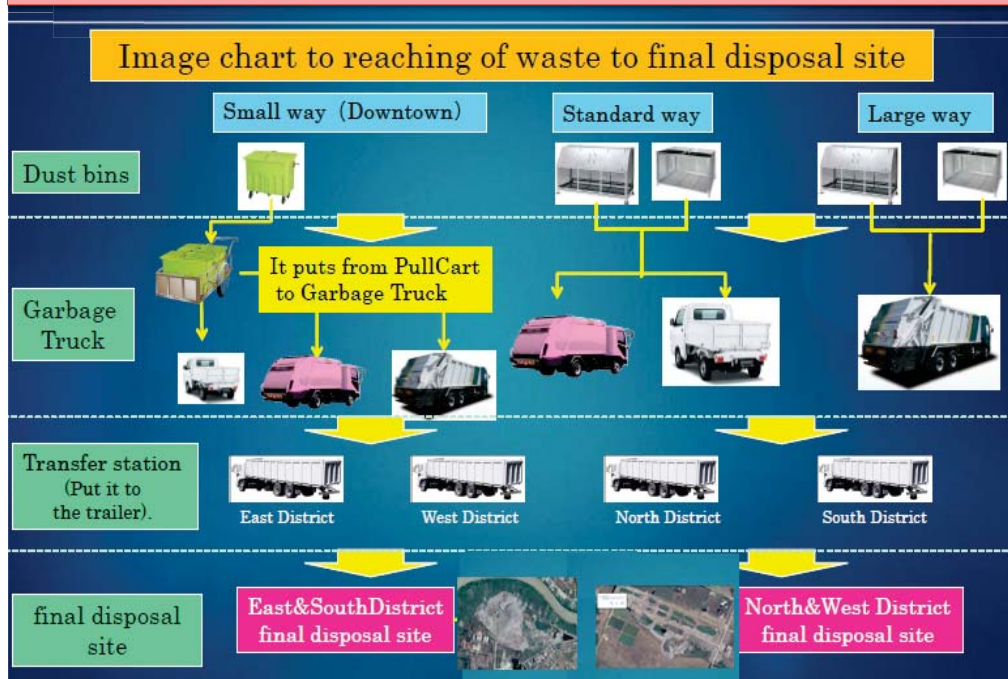
Industrial Waste Management



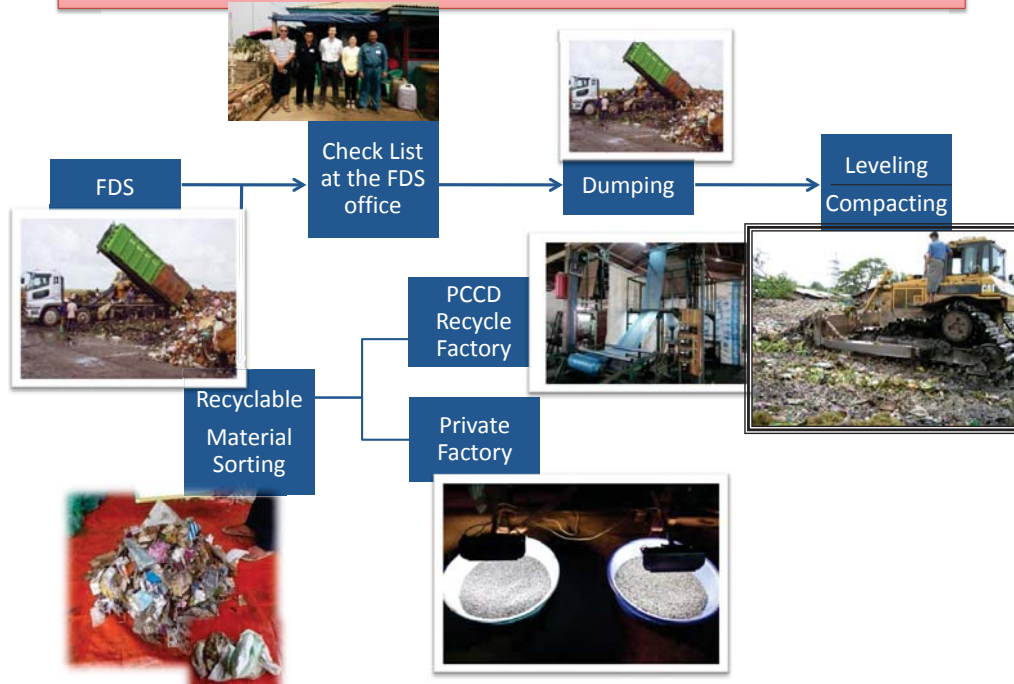
Structure of Recycling Market



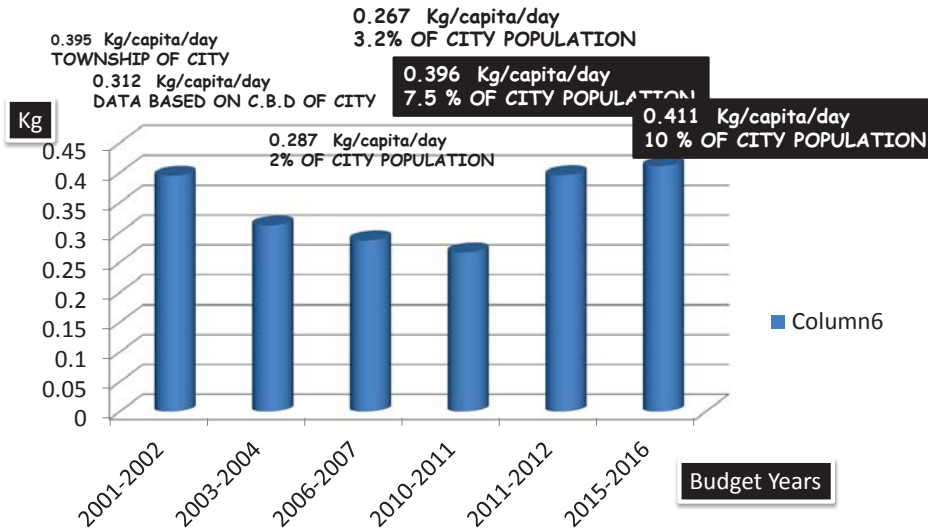
Integrated Solid Waste Management



Final Disposal Site Management



2015 - 2016 Generation Rate



2016-2017...Waste Generated = (2000) TPD

Yearly Waste Collected



Proposed SSIP site in Tawkyaukhalay for 60 tons per day of the waste in Shwe Pyi Thar Township

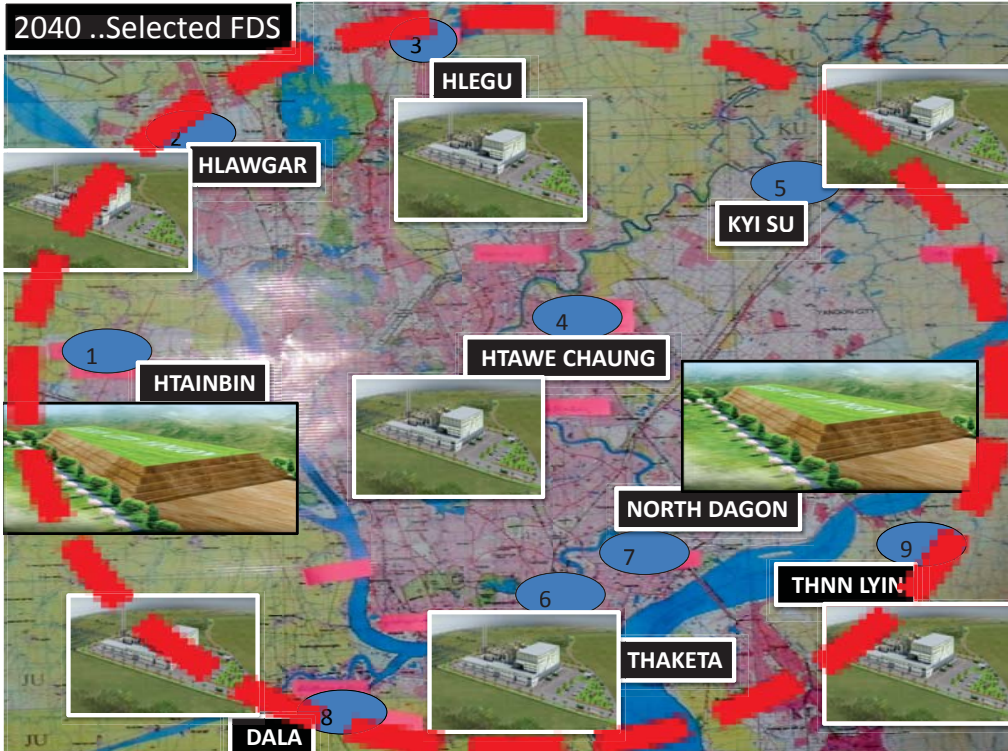


Proposed area for SSIP (15) acre

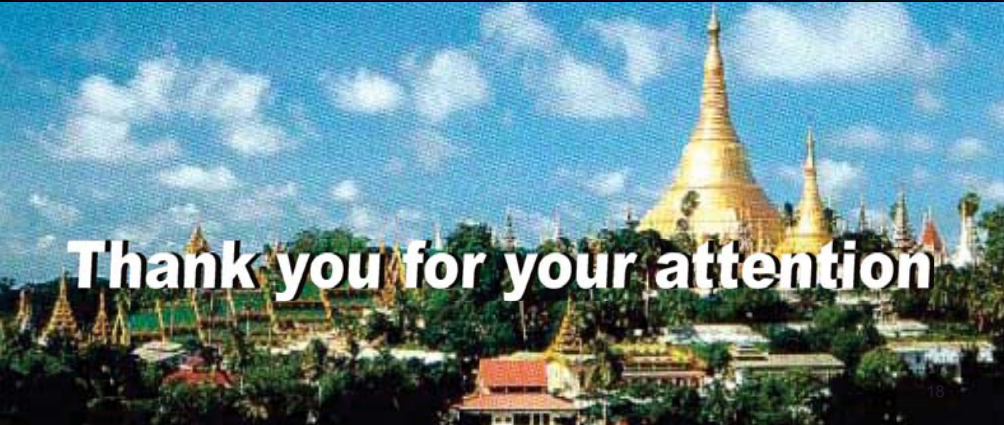
Existing Used Main (2) Final Disposal Sites & (4) Temporary Small FDS

| N O | 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 | 950 | Open Dumping |
| 2 | Htwei Chaung | 2001 | - | 147 - Acre Used-47.4 Ac | 800 | Open Dumping |
| 3 | Dala | 2003 | - | 1.3- Acre | 20 | Low Landfill Temporary site |
| 4 | Seikkyi Khanaung To | 2003 | - | 0.25 - Acre | 5 | Low Landfill Temporary site |
| 5 | Mingalardon | 2003 | - | 0.91 - Acre | 60 | Low Landfill Temporary site |
| 6 | Shwe Pyi Thar | 2005 | - | 1 - Acre | 60 | Low Landfill Temporary site |

Note: (1) Total capital investment about (16) million US \$,
 (2) YCDC allocated (8) which fixed (1.4) at 2015-2016, (6.6) at 2016-2017
 (3) Leap Frog program about (8) million, 3-year program from MoEJ.
 (4) Joint Crediting Mechanism about from MoFAJ, ongoing stage.



To Sustain Our Planet, Do Our Best



Thank you for your attention

ရေဆီ သန့်စင်စက်ရုံ ဝိုင်တထောင်မြို့နယ်



- စတင်တည်ထောင်သည် ခုနှစ် - ၂၀၀၃ ခုနှစ် ဧပြီလ (၁၂) ရက်
- တည်ဆောက်ပြုစု သည့် ခုနှစ် - ၂၀၀ ခုနှစ် ဇန်နဝါရလ (၁) ရက်
- နေ့စဉ်သန့်စင်ပေ ဝိုင်သည် ရေဆီ ပမာဏ - ၃.၂ ဂါလသန်
- တည်ဆောက်သူ - ရန်ကုန်မြို့တော်စည်ပင်သာယာရေး ကော်မတီ
- တည်နေရာ - လက်အောက်ရှိ မြန်မာအင်ဂျင်နယားများ
- Wastewater Treatment Process - သန့်လျက်စနစ် ဝိုင်တထောင်မြို့နယ်
- - Activated Sludge Process

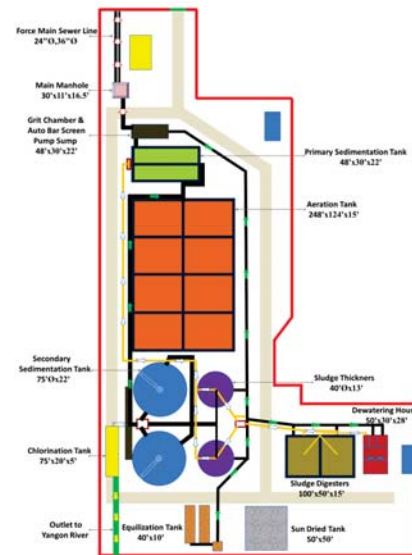
ရန်ကုန်မြစ်တစ်သို့ 24" ဝိုင် CI, 36" ဝိုင် CI မိလ္လာပိုက်လိုင်း များ ဖြင့် ရေဆီ များ တိုက်ရိုက်စန့်ပစ်ပူ (၂၀၀ - ၃၂၀ အထိ)



ရေဆီ သန့်စင်စက်ရုံ ဝိုင်တထောင်မြို့နယ် သန့်လျက်စနစ်



ရေဆီ သန့်စင်စက်ရုံ၏ Layout Plan နှင့် Design Criteria

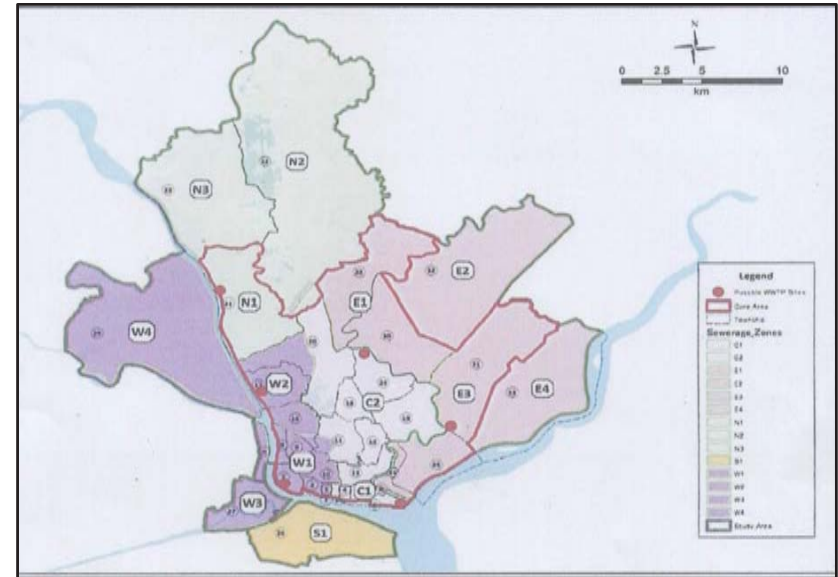


- Design Criteria:**
- Area of Plant - 5.56 acres
 - Design population - 300,000
 - Daily wastewater discharge - 14775 m³/day
 - BOD influent - 600mg / l
 - BOD effluent - 60 mg / l
 - Suspended solid influent - 700 mg / l
 - Suspended solid effluent - 40 mg / l

ရေဆီ သန့်စင်စက်ရုံ၏ Design Criteria

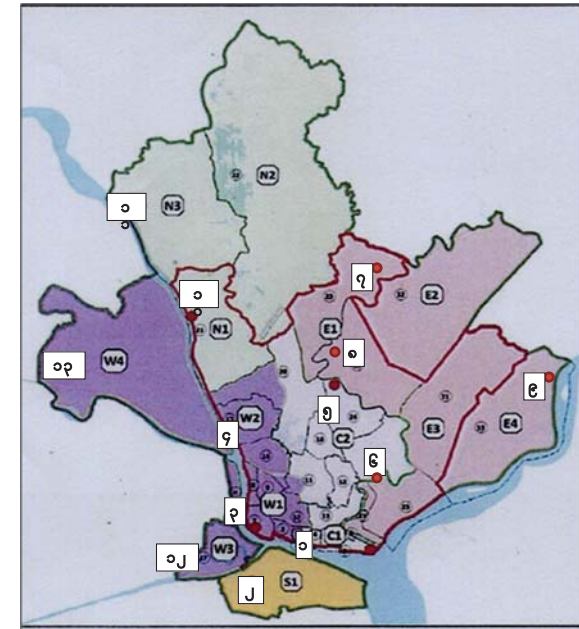
| Design Criteria | Design Case | Actual Case |
|--|---------------------------|----------------------|
| a. Area of plant | 5.56 Acres | Operation hour ½ day |
| b. Design population | 300000 | Operation hour ½ day |
| c. Daily wastewater discharge | 14775 M ³ /day | 2462 M ³ |
| d. Daily sludge discharge | 14 M ³ /day | 2.3M ³ |
| e. Yearly sludge | 5110 M ³ | 851 M ³ |
| f. Dried sludge | 1703 M ³ | 283 M ³ |
| g. Used fertilizer (30% treated N:P:K ratio) | -(50%)851 M ³ | 141 M ³ |
| h. Used landfill site | (50%)851 M ³ | 141 M ³ |

SEWERAGE ZONES AREA



SEWERAGE ZONES AREA

| Population, Wastewater Flow by Sewerage Zones | | | | | | |
|---|---------------------|-------------------------------|------------|-----------|----------------|---|
| Sewerage Zone | Population (person) | W. Flow (m ³ /day) | | Area (ha) | WWTP Area (ha) | Township |
| | | Daily Ave. | Daily Max. | | | |
| C 1 | 178,127 | 64,275 | 70,213 | 499 | 6.4 | Pazundaung, Botahtaung, Kyauktada, Pabedan |
| W 1 | 483,058 | 134,943 | 146,552 | 1,654 | 10.1 | Lannadaw, Latha, Dagon, a part of Bahan, a part of Kye Myin Daing, Ahlone, Sanchaung, a part of Kamaryut |
| C 2+E1 | 1,902,155 | 659,542 | 714,184 | 11,286 | 27.0 | a part of Bahan, Mingalar Taung Nyunt, Tamwe, South Okkalapa, Thingangyun, Yankin, a part of Mayangone, North Okkalapa, North Dagon |
| W 2 | 349,512 | 98,581 | 106,205 | 2,356 | 8.3 | Hlaing, a part of Kamaryut, a part of Mayangon |
| E 3 | 920,933 | 196,986 | 212,652 | 5,418 | 12.7 | Dawbon, Taketa, South Dagon |
| N 1 | 377,188 | 98,069 | 105,613 | 3,163 | 8.3 | Insein |
| E 4 | 399,111 | 77,827 | 83,814 | 4,202 | 7.1 | Dagon Seikkan |
| E 2 | 1,183,320 | 230,747 | 248,497 | 17,064 | 14.0 | East Dagon |
| N 2 | 906,748 | 235,755 | 253,890 | 12,783 | 14.2 | Mingaladon |
| N 3 | 514,954 | 100,416 | 108,140 | 5,271 | 8.4 | Shwe Pyi Thar |
| W 4 | 737,724 | 143,855 | 154,921 | 7,761 | 10.5 | Hlaing Tharyar |
| S 1 | 490,032 | 95,557 | 102,907 | 9,840 | 8.1 | Dala |
| W 3 | 74,419 | 24,187 | 26,047 | 1,485 | 3.5 | A part of Kye Myin Daing, Seikgyikhanaungto |
| Out of SZ | 2,241 | 582 | 627 | 117 | | Seikkan |
| Total | 8,519,522 | 2,161,322 | 2,334,262 | 82,899 | 138.6 | |



| စဉ် | ဒေသ | ပေါင်းစပ် အစီအစဉ် အကျဉ်းချုပ် |
|-----|---------|---|
| ၁ | C1 | ပန်းဆုံတန်း၊ ကြောက်တန်း၊ ဝိုင်းလှိုင်တန်း၊ ဝိုင်းလှိုင်တန်း၊ ဝိုင်းလှိုင်တန်း |
| ၂ | S1 | ဒလ |
| ၃ | W1 | လမ်းမတော်၊ လသာ၊ ဒဂုံ၊ ဗဟန်း၊ မြို့နယ်၊ တစ်လှည့်တစ်လှည့်၊ ကုသိုလ်ရေးနှင့် တစ်လှည့်တစ်လှည့်၊ အလုံ၊ စမ်းချောင်း၊ ကမာရွတ်မြို့နယ်၊ တစ်လှည့်တစ်လှည့် |
| ၄ | W2 | လှိုင်၊ ကမာရွတ်မြို့နယ်၊ တစ်လှည့်တစ်လှည့်၊ မရမ်းကုန်းမြို့နယ်၊ တစ်လှည့်တစ်လှည့် |
| ၅ | C2+ E1 | ဗဟန်းမြို့နယ်၊ တစ်လှည့်တစ်လှည့်၊ မရမ်းကုန်းမြို့နယ်၊ တစ်လှည့်တစ်လှည့်၊ တာမွေ၊ တစ်လှည့်တစ်လှည့်၊ သာယာဝတီမြို့နယ်၊ ရန်ကင်း၊ မရမ်းကုန်းမြို့နယ်၊ တစ်လှည့်တစ်လှည့်၊ ဗဟန်းမြို့နယ်၊ တစ်လှည့်တစ်လှည့် |
| ၆ | C2+ E1 | သာယာဝတီမြို့နယ် |
| ၇ | C2+ E1 | ဗဟန်းမြို့နယ်၊ မရမ်းကုန်းမြို့နယ် |
| ၈ | E1 + E2 | ဒဂုံမြို့သစ်(ဗဟန်းမြို့နယ်)၊ ဒဂုံမြို့သစ်(အရှေ့မြို့နယ်) |
| ၉ | E3 + E4 | ဒဂုံမြို့သစ်(အရှေ့မြို့နယ်)၊ ဒဂုံမြို့သစ်(အရှေ့မြို့နယ်) |
| ၁၀ | N1 | အင်းစိန် |
| ၁၁ | N3 | ရှုမဝမြို့နယ် |
| ၁၂ | W3 | ကုသိုလ်ရေးနှင့် တစ်လှည့်တစ်လှည့်၊ မရမ်းကုန်းမြို့နယ်၊ တစ်လှည့်တစ်လှည့် |
| ၁၃ | W4 | လှိုင်သာယာ |

| Sewerage Zone | Population Person | W Flow (M ³ /day) | Dried Sludge |
|---------------|-------------------|------------------------------|--------------|
| C1 | 178,127 | 64,275 | 7391 |
| W1 | 483,058 | 134,943 | 15518 |
| C2+ E1 | 1,902,155 | 659,542 | 75847 |
| W2 | 349,512 | 98,581 | 11337 |
| E3 | 920,933 | 196,986 | 22653 |
| N1 | 377,188 | 98,069 | 11278 |
| E4 | 399,111 | 77,827 | 8950 |
| E2 | 1,183,320 | 230,747 | 26536 |
| N2 | 906,784 | 235,755 | 27112 |
| N3 | 514,954 | 100,416 | 11548 |
| W4 | 737,724 | 143,855 | 16543 |
| S1 | 490,032 | 95,557 | 10989 |
| W3 | 74,419 | 24,187 | 2782 |
| Out of SZ | 2,241 | 582 | 67 |
| Total | 8,519,522 | 2,161,322 | 248551 |

Solid Wastes Management System in Naypyitaw by Naypyitaw Development Committee



Organization Chart of Nay Pyi Taw Development Committee

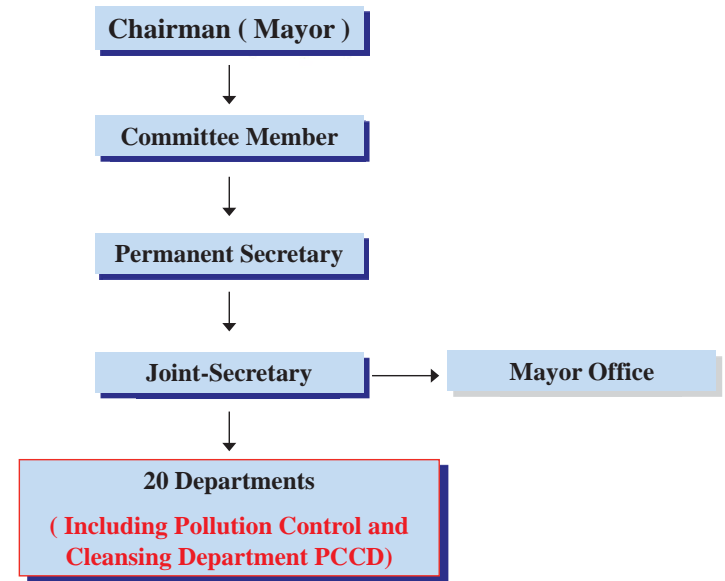
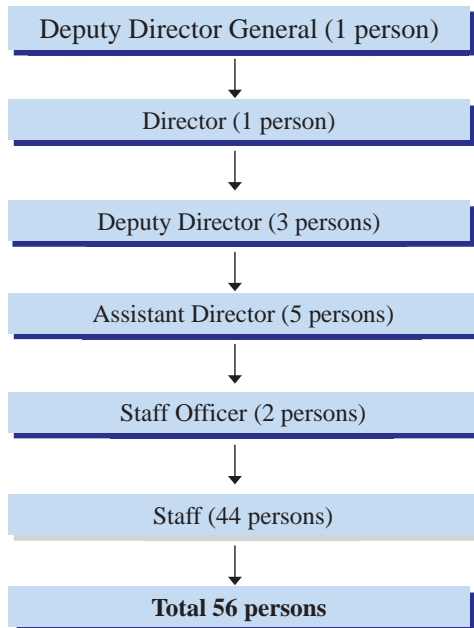


Chart of Pollution Control and Cleansing Department



Three Divisions in PCCD

1. **Cleansing Division**
 - Carrying out the sanitation works
2. **Pollution Control Division**
 - Carrying out the conservation of environmental issues
 - Carrying out the funerary matters
3. **Office Administration and Motor Transport Division**
 - Carrying out the waste collection and transportation works

1. Cleansing Division

- Carrying out the sanitation works
 - 164 labours in total
 - 14 work incharge
 - 135 work authority
 - 15 daily wages

2. Pollution Control Division

- Carrying out the conservation of environmental issues.
- Carrying out the funerary matters.
 - 3 Cemeteries
 - 34 employees in total

3. Office Administration and Motor Transport Division

- 6 Road Sweeper
- 20 Collection Vehicles
- 2 Garbage Tractors
- 1 Grass Mower
- 5 Trailers (tipper)
- 1 Lifan (Truck)
- 1 Dongfang
- 1 Extra-cab
- 19 Special Hearses
- 56 Vehicles in total

Road Sweeper



Collection Vehicles



Grass Mower



Garbage Tractors



Existing Solid Waste Management

- Using basically labour force
- Bell ringing method
- Limited collection of market wastes
- On call system
- Limited collection of hospital wastes and clinic wastes
- Collection method of indiscriminate disposal wastes
- Transported and disposed directly to six disposal sites

Bell Ringing Method



Market Wastes



Bell Ringing Method

- In the ringing system, a solid waste collection truck with one or two worker for handling waste moves along a predetermined route, at regular hours in making its daily rounds of collection and disposal.
- At the signal of the bell, the residents bring their waste containers to the vehicle.
- The handing workers load the waste on to the vehicle.
- When the truck is full, it takes of to the dumping site.

Limited collection of market wastes

- Decay easily wastes from markets, vegetables pieces are collected separately and generated to reuse the natural fertilizer by earthworm breed system.

On Call System

- Hotels, Supermarkets, Restaurants, Companies, Cinemas, Government Organization and offices pay the renting fees the collection vehicles fixed by our department when they need to collect the garbages separately.

Limited collection of Hospital wastes and Clinic wastes

- In Naypyitaw area, wastes are transported from hospitals and clinics by paying the fees for collection.

Sorting of Hospital and Clinical Wastes



Hospital and Clinical Waste Collection



Burning of Hazardous Wastes in Crematorium



Collection method of indiscriminate disposal wastes

- Residents of staff housing and wards discards the garbage on the sites of the streets why they cannot dispose for vary reasons when the collection vehicles come those where.
- For this conditions, responsible citizens inform to department, inspection by responsible officers from Pollution Control and Cleansing Department, so that we are collecting the indiscriminate disposal wastes once a week within housing and wards.

Indiscriminate disposal wastes



3. **Disposal Site No. 3**, Thirimandine Street (left site), Pobbathiri Township
 - Two Townships (Pobbathiri and Ottarathiri Townships)
 - about 8 tons per day
4. **Disposal Site No. 4**, near Hlay Khawin Mount, Pyinmana Township
 - Two Townships (Pyinmana and Zayarthiri Townships)
 - about 32 tons per day
5. **Disposal Site No. 5**, near Sankalay Old Cemetery, Lewe Township
 - One Township
 - about 17 tons per day
6. **Disposal Site No. 6**, Tatkone Old Cemetery, , Tatkone Township
 - One Township
 - about 19 tons per day

List of Cleansing Labours , Waste Collection Vehicles and Dumping Sites

(in Nay Pyi Taw area)

Cleansing Labours

- Cleansing labour have 164 persons

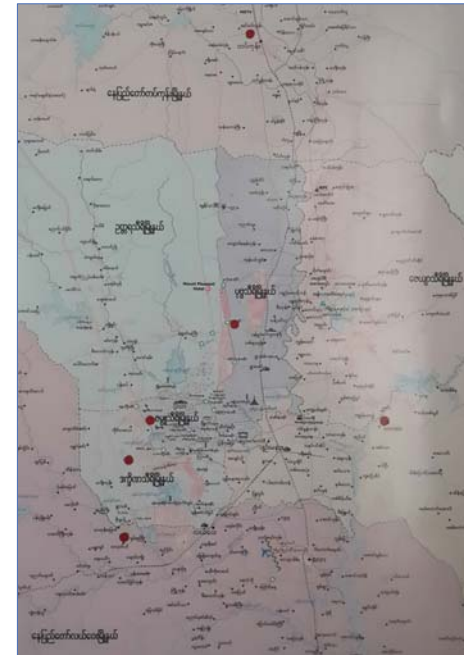
Waste Collection Vehicles

- Waste collection vehicles have 70 pcs
- Solid waste generation is estimated at about (160) tons per day.

Dumping Sites

1. **Disposal Site No. 1**, Acres 1000, Plot 9, Zabyuthiri Township
 - Two Townships (Zabyuthiri and Dekhinathiri Townships)
 - about 80 tons per day
2. **Disposal Site No. 2**, near Bugwe Old Village, Zabyuthiri Township
 - Two Townships (Zabyuthiri and Dekhinathiri Townships)
 - about 4 tons per day

Location Map of Disposal Sites



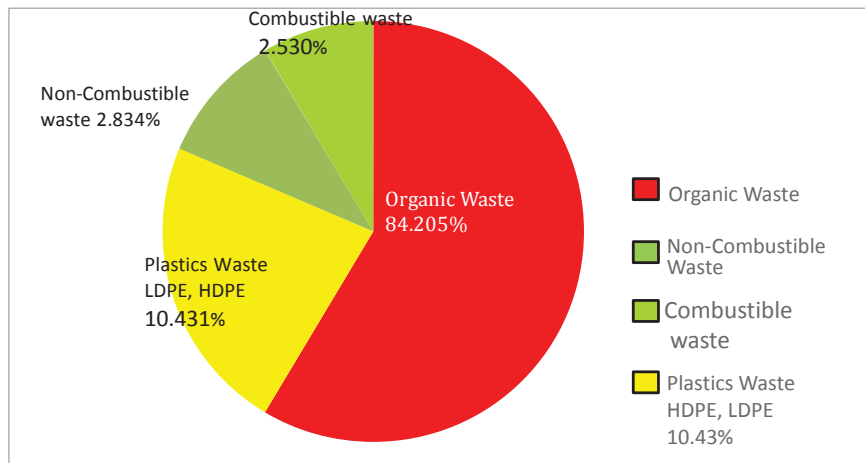
Disposal Site



Sorting of Domestic Solid Wastes at Disposal Site No.1



Compositions of Solid Waste



Waste Compactor



Earthworm husbandary



Conclusion

- NPTDC is principal agency responsible for operation of municipal services in city and is carrying out works for sanitation, tidiness, pleasantness, beautifying, greening and liveliness in NPT.
- Moreover, it has also frame works for the successful projects and intends to directly improve the living standards of the people in NPT.



Thank you for your kind attention




MYANMAR



Background Information

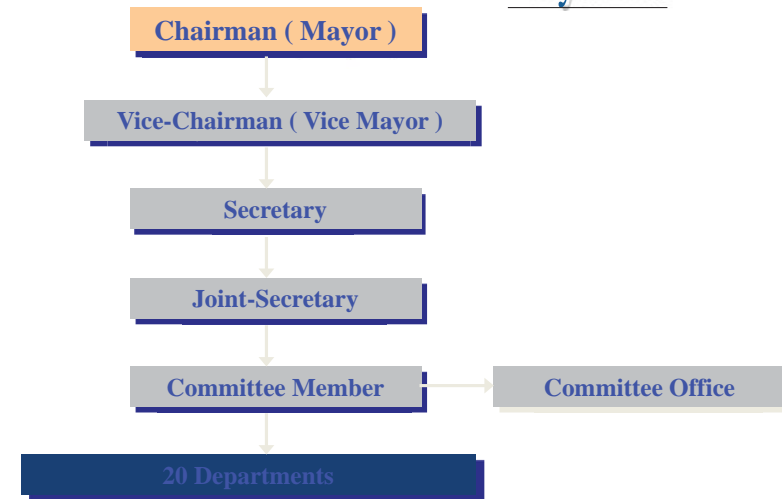
| | |
|----------------|---|
| Situated in | -South East Asia |
| Area | -261,228 square miles -677,000 sq km |
| East to West | -582 miles |
| North to South | -1275 miles |
| Climate | -tropical monsoon - (3 seasons) |
| Population | -56 Million |
| Density | -80 per sq km |
| Administrative | -14 states/divisions -66 Districts -325 Townships |



LOCATION OF NAYPYITAW

- An Administrative city of Union of Myanmar.
- Located between latitude 19° 18' and 20° 25' East longitude between 95° 25' and 96° 45'.
- Located 244 miles in the north of Yangon and 188 miles south of Mandalay.
- Center of Government is situated in Pyinmana Township under Pyinmana District within Mandalay Division.
- Consist of Pyainmana, Lewe and Tatkone townships which cover total area of 2724.75 square miles.
- Total population of these three townships are 923,608

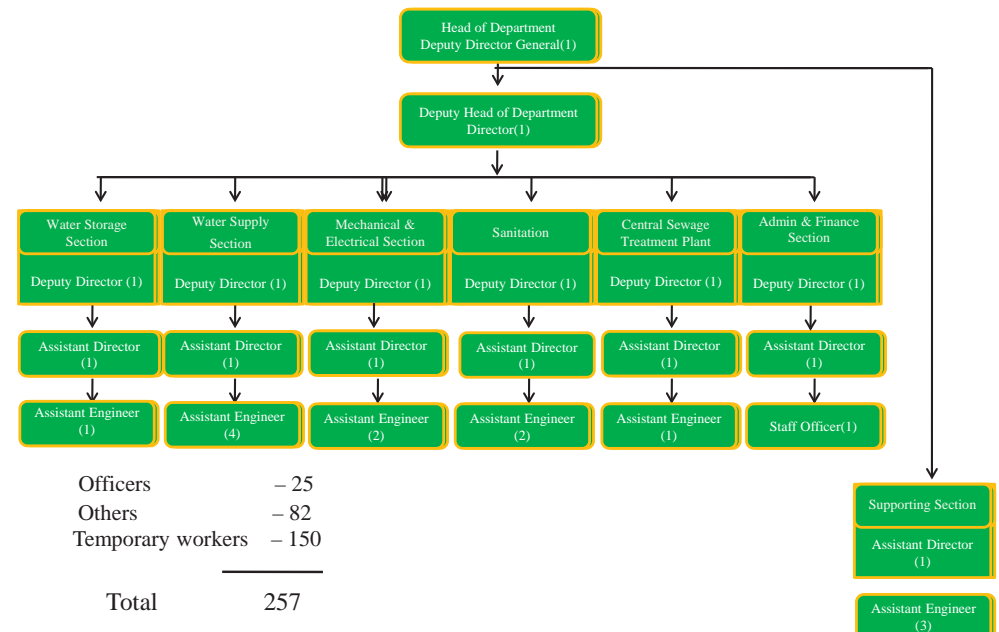
Organization Chart of NayPyiTaw Development Committee Myanmar



Twenty Departments of NayPyiTaw Development Committee

1. Department of Administration
2. Department of Budget and Account
3. Department of Inspection
4. Department of Coordination
5. Department of Assessors
6. Department of Revenue
7. Department of Market
8. Department of Veterinary and Slaughter House
9. Department of Pollution Control and Cleaning
10. Department of Engineering (Roads and Bridges)
11. Department of Engineering (Building)
12. Department of Engineering (Water Supply and Sanitation)
13. Department of Motor Transport and Workshop
14. Department of Store
15. Department of Gardens and Playground Parks
16. Department of Health
17. Department of Security and Discipline
18. Department of City Planning and Land Admin
19. Department of Public Relation and Information
20. Department of Production

Department of Engineering(Water Supply and Sanitation) Organization Chart



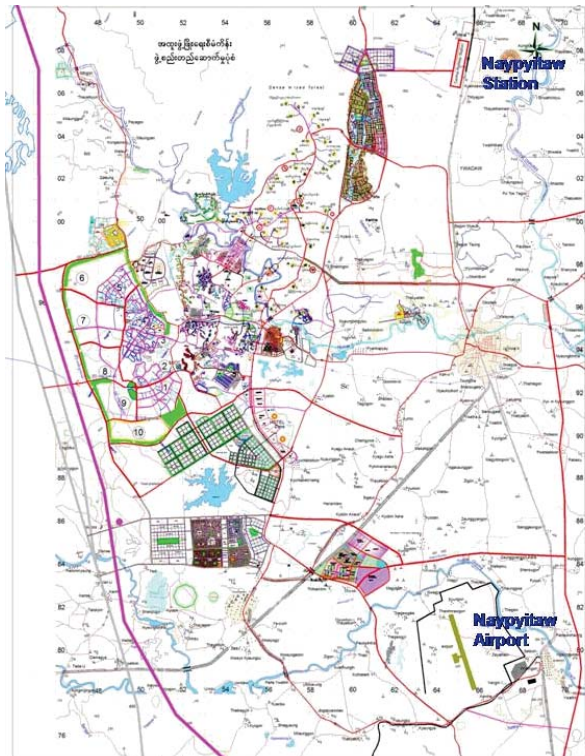
Functions and Duties of Department of Engineering (Water Supply and Sanitation)

- 1. Carrying out works for water supply
- 2. Carrying out works for construction and maintenance of Dams, reservoirs and pipelines
- 3. Carrying out works for sanitation and sewage treatment

NAYPYITAW DEVELOPMENT COMMITTEE Department of Engineering (Water Supply and Sanitation)

*Improvement of water supply and sanitation works for
NayPyiTaw City*

1. Water Storage Section
2. Water Supply Section
3. Sanitation Section
4. Sewage Treatment Plant
5. Electrical and Mechanical Section
6. Admin and Finance Section
7. Support Section



MASTER PLAN OF NAYPYITAW

• Sources of watersupply

- | | | |
|--------------------------|--------------------------|-------------------------|
| 1. Chaungmagyi Reservoir | 2. Yanaungmyin Reservoir | 3. Tinwa Reservoir |
| 4. Thayetshin Reservoir | 5. Bongwe Reservoir | 6. Taungpein Reservoir |
| 7. Myaukpein Reservoir | 8. Thapyezan Reservoir | 9. Chaungyauk Reservoir |

Clean water management and distribution system.

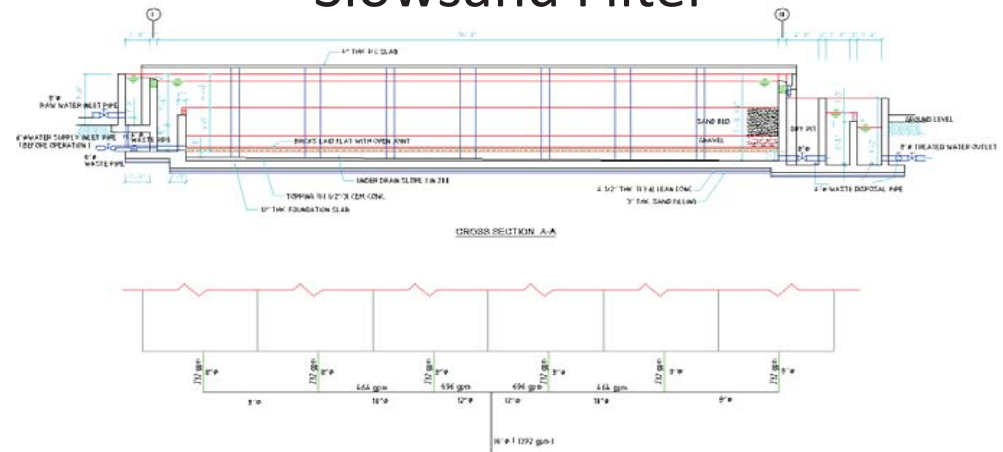
- Currently, water supply system of NayPyiTaw has capacity of 46363 m³/day,



WATER TREATMENT PLANT slowsand Filtration



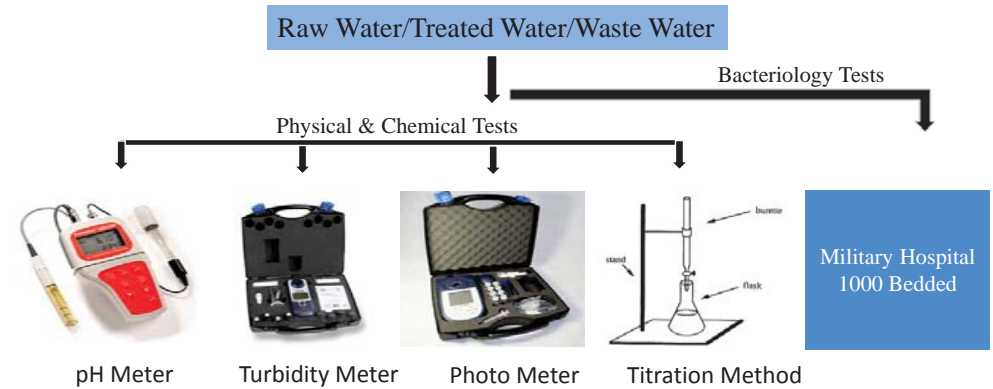
Slowsand Filter



WATER QUALITY OF CHAUNG MAGYI DAM

| | INFLUENT TO SLOW SAND FILTER | EFFLUENT FROM SLOW SAND FILTER |
|------------------|------------------------------|--------------------------------|
| PH | 8.14 | 7.42 |
| TOTAL HARDNESS | 92 | 86 |
| CALCIUM | 19.5 | 17.2 |
| MAGNESIUM | 10.38 | 10.32 |
| CARBONATE | NIL | NIL |
| BICARBONATE | 108 | 100 |
| TOTAL ALKALINITY | 108 | 100 |
| CHLORIDE | 105 | 88 |
| IRON | 0.043 | 0.01 |

Equipments for Water Quality Analysis

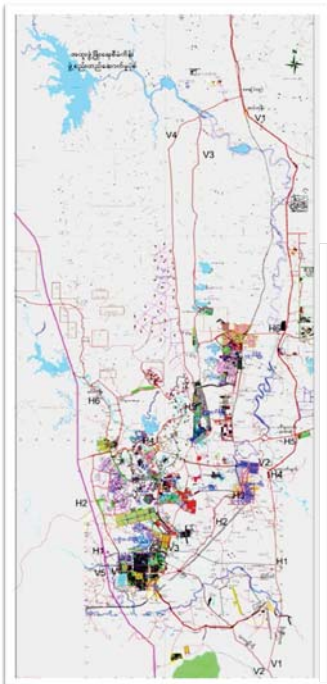
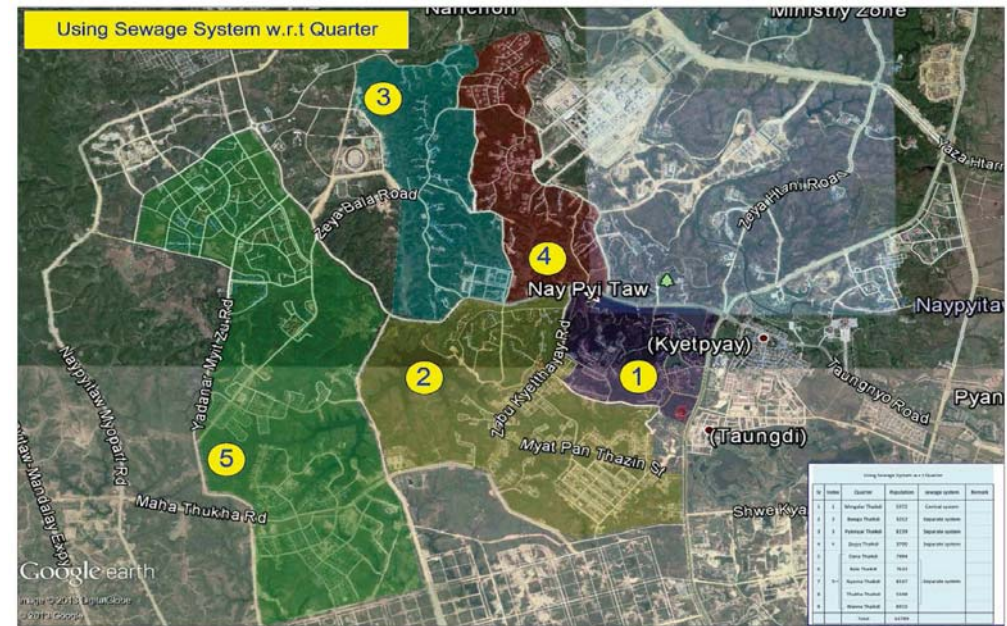


Naypyitaw City Development Committee

Department of Engineering (Water Supply & Sanitation)



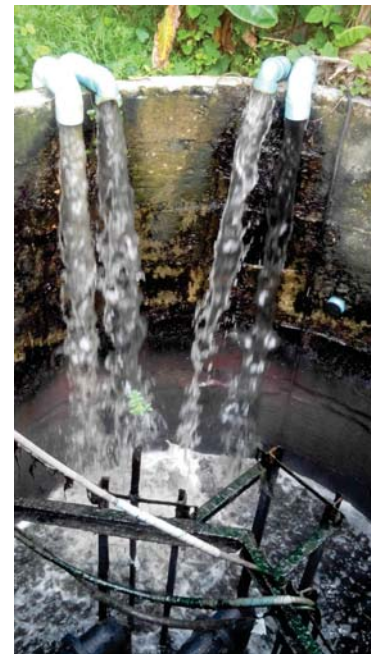
SEWAGE SYSTEM OF NAYPYITAW



SEWAGE SYSTEM OF NAYPYITAW MINGALARTHAIKDI QUARTER



COLLECTION SUMP FOR SEWAGE TREATMENT PLANT



SEWAGE TREATMENT PLANT IN NAYPYITAW

GRIT CHAMBER (INLET OF SEWAGE TREATMENT PLANT)



AERATION TANK OF SEWAGE TREATMENT PLANT



EQUALIZATION TANK FOR SEWAGE COLLECTION



AERATION TANK



TREATED WATER COLLECTION OR RETENTION POND



WASTE WATER TREATMENT PLANT IN NAYPYITAW



EXISTING SEWERAGE SYSTEM IN NAYPYITAW

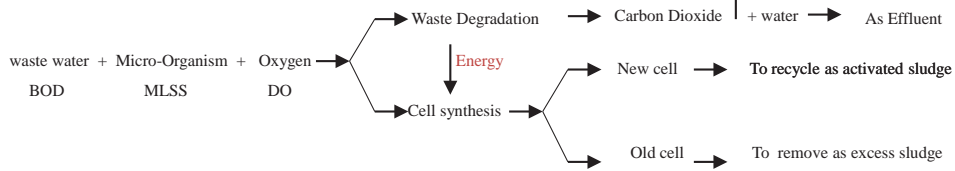
- 20% of NayPyiTaw (Myoma) people use sewage treatment plant (Aerobic System)
- 80% of NayPyiTaw (Myoma) people use Septic Tank (Anaerobic System)
- Sewage collection is combined system.
- Sewer pipes are directly connected with waste water treatment plant.

Naypyitaw Waste Water Treatment Plant

Population -10000
 Sewage Volume -1600Cum/day

Daily BOD Loading =1600 Cum/day X 250mg/Lit X 1 Kg X Lit / (1000mg X Cum)
 =400 Kg BOD /day

Basic Principle Of Biological Treatment Process



Oxidation And Synthesis



Endogenous respiration



Central Sewage Treatment System

1. Equalization Tank & Waste Water Transferring System
2. Grit Chamber and Fine screen
3. Aeration Tank & Aeration System
4. Sedimentation Tank & Sludge Recycling Pump
5. Chlorination Tank & Chlorine Dosing Pump
6. Sludge Digester & Transferred System
7. Sludge Drying Bed
8. Filtrate sump

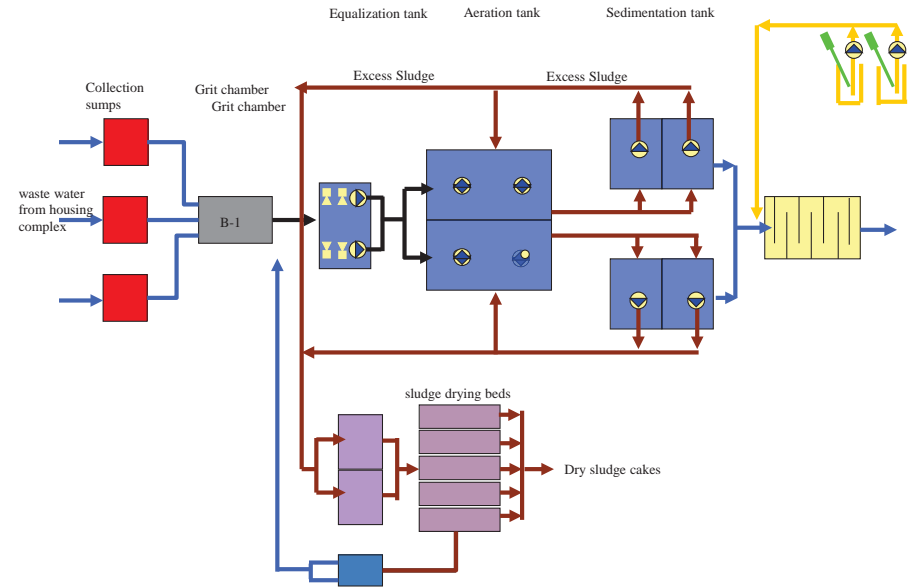
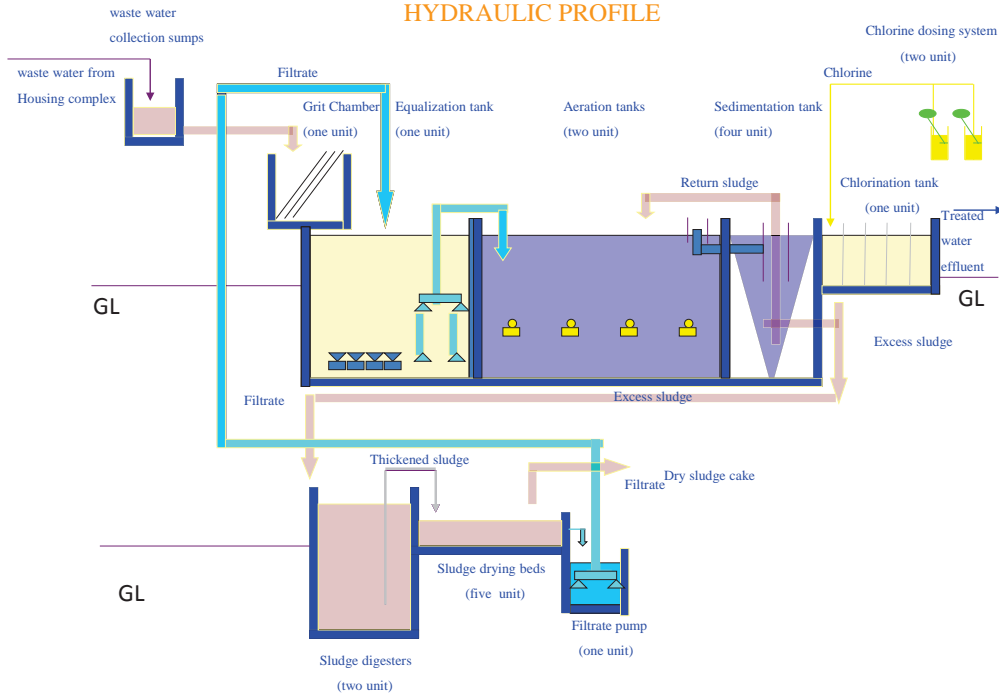
Proverities Of Wastewater inlet

| | |
|---------------------------------------|-----------|
| Biochemical Oxygen Demand (BOD,20* C) | 250mg/lit |
| Suspended Solids (SS) | 220mg/lit |
| Total Organic Carbon (TOC) | 160mg/lit |
| Chemical Oxygen Demand (COD) | 500mg/lit |

Proverities Of Treated Water

| | |
|---------------------------------------|----------|
| Biochemical Oxygen Demand (BOD,20* C) | 20mg/lit |
| Suspended Solids (SS) | 30mg/lit |
| Chemical Oxygen Demand (COD) | 60mg/lit |

HYDRAULIC PROFILE





SEPTIC TANK IN NAYPYITAW

Challenges

✦ Environmental Impact Assessment is still weak in water resources management.

✦ Ongoing rapid industrialization in cities, there are so many factories around urbanized areas

✦ It needs to control the problems of the direct discharge of wastewater from factories into rivers or streams

✦ Although there are many laws, acts, legislations and regulations related to water sector, most laws and acts for water sectors still need to be modified.

Sanitation

Inadequate disposal of human excreta and personal hygiene is associated with a range of diseases including diarrhea and polio.

Sanitary means of excreta disposal include flush toilets connected to sewage systems or septic tanks, other flush toilets and fly-proof latrines.

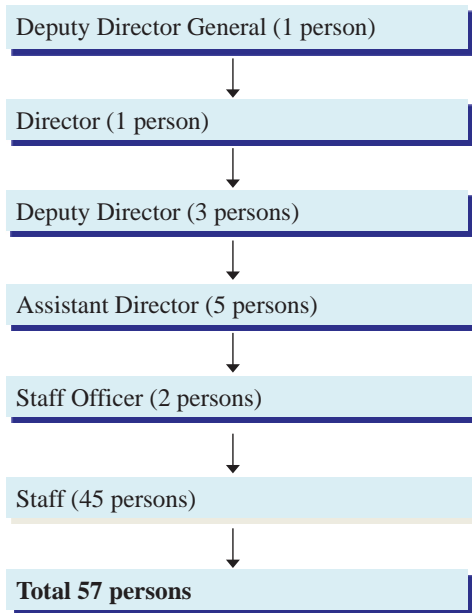
Regarding proportion of people with access to improved sanitation, Myanmar also strives for safe disposal of human excreta in both urban and rural areas.

Keeping the level of service in sight and the policy of narrowing the gap of disparity between the urban and the rural, a realistic target of 100 percent coverage sanitation was set for both the rural and urban areas

Conclusion

- Design, operation and management of wastewater treatment and sewage disposal play a key role in many aspects of the socioeconomic development process
- To succeed, careful attention must be given to the development of a comprehensive approach, partnerships, financial and organizational tools for effective implementation.
- The Government of the Union of Myanmar is endeavoring for the all-round development of the country, devoting huge amount of its own limited resources. Meanwhile, Myanmar is launching regional and international cooperation with full confidence.

Chart of Pollution Control and Cleansing Department



Current status of Solid Waste Management in Naypyitaw

- PCCD carries out the collection services by using collection vehicles and labours daily.
- The features of solid waste management are basically labour-intensive and collection methods practiced in Naypyitaw can be categorized into five types:
 - Bell ringing method
 - Limited collection of market wastes and other wastes
 - On call system
 - Limited collection of hospital wastes and clinic wastes
 - Collection method of indiscriminate disposal wastes
- Community participation is poor.
- Rewards and recognition have not yet started.

Bell Ringing System



Market Wastes



Hospital and Clinical Waste Collection



Burning of Hazardous Wastes in Crematorium



Indiscriminate disposal wastes



List of Cleansing Labours , Waste Collection Vehicles and Dumping Sites (in Nay Pyi Taw area)

Cleansing Labours

- Cleansing labour have 165 persons

Waste Collection Vehicles

- Waste collection vehicles have 58 pcs
- Solid waste generation is estimated at about (160) tons per day.

Dumping Sites

Disposal Site No. 1 - about 80 tons per day

Disposal Site No. 2 - about 4 tons per day

Disposal Site No. 3 - about 8 tons per day

Disposal Site No. 4 - about 32 tons per day

Disposal Site No. 5 - about 17 tons per day

Disposal Site No. 6 - about 19 tons per day

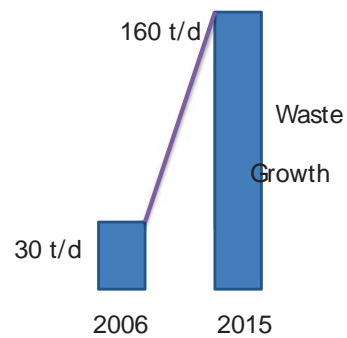
Location Map of Disposal Sites



Disposal Site



Solid Waste Challenge



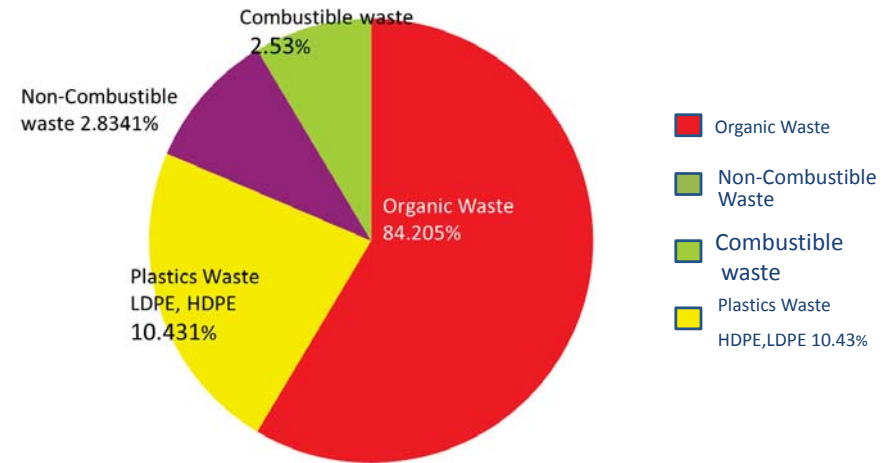
Data Collection, reporting and monitoring system

- About 160 tons of domestic solid waste is collected by collection vehicles in one day.
- The collected solid wastes are measured by weighing-sale. After that, the collected solid wastes are classified and remeasured by cleansing labours.
- The major problems with the current data collection are the discharging of domestic solid wastes without sorting.
- Moreover, public awareness and participation is very low. In addition to monitoring system of waste discharging and management system is very weak in Naypyitaw.

Sorting of Domestic Solid Wastes at Disposal Site No.1



Compositions of Solid Waste



Movements or Projects (domestic and international) of waste management

- NPTDC is principal agency responsible for operation of municipal services in city and is carrying out works for sanitation, tidiness, pleasantness, beautifying, greening and liveliness in NPT.
- Moreover, it has also frame works for the successful projects and intends to directly improve the living standards of the people in NPT.
- To increase the public awareness and participation on

domestic solid wastes segregation (organic wastes and miscellaneous wastes with dry) by awareness program.

- To produce organic fertilizer from organic wastes by composting machine (50~100 T/D).
- To classify miscellaneous wastes by segregation machine.
- To recycle plastics wastes from miscellaneous wastes by recycling machine (15~25T/D).
- To incinerate worthless wastes from miscellaneous wastes by incineration plant (50~100T/D).

Urban Agriculture in Nay Pyi Taw

Roundabout, Landscaping, Parks



Thank you for your kind attention



REPUBLIC OF THE UNION OF MYANMAR
Mandalay Regional Government
MANDALAY CITY DEVELOPMENT COMMITTEE



Overview on Solid Waste Management in Mandalay City

PRESENTED BY
Than Htut
Assistance Director
Cleansing Department
Mandalay City Development Committee

13th , June, 2016

Abstract

- Brief History of Mandalay
- Micro Environment of MSWMS
- Macro Environment of MSWMS
- Problem Statement
- Conclusion

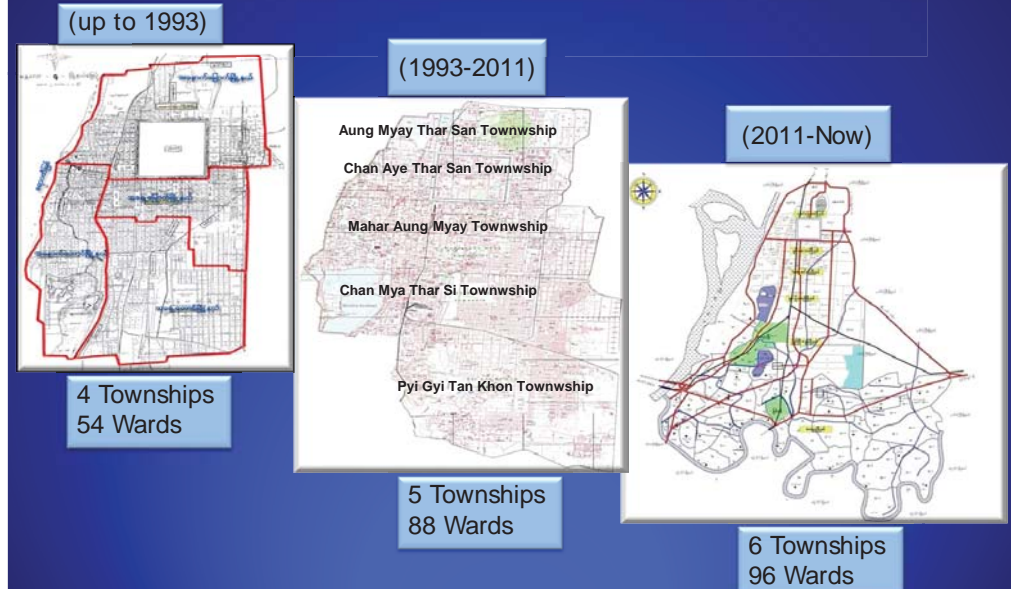
Brief History of Mandalay



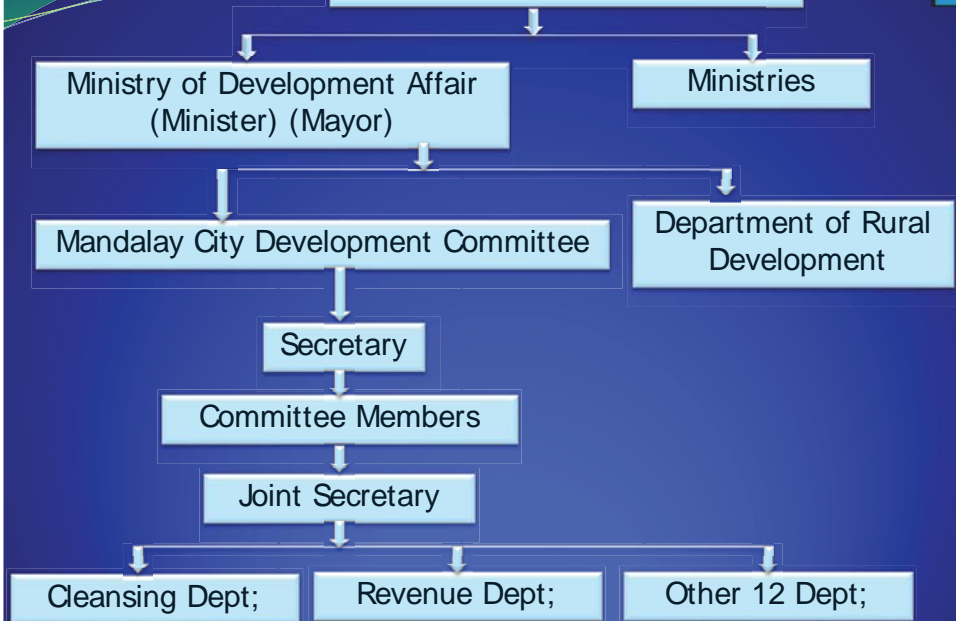
- Last Royal Capital of Myanmar
- The 2nd Last King of Konbaung Dynasty King Mindon
- Established in (1857-1859)
- In 2007, The 150th Anniversary of Mandalay City was held
- Now Our City is about 159 years old



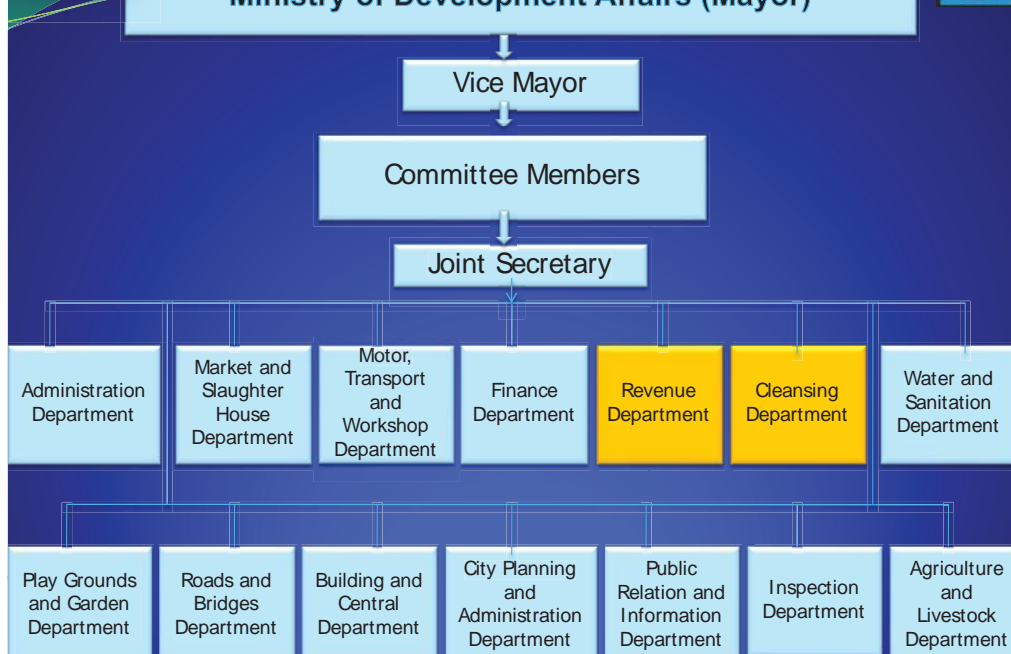
Extension of Mandalay City Territory



Mandalay Region Government



Minister of Regional Government, Ministry of Development Affairs (Mayor)



Micro Environment

Vision

- To keep the City Clean
- To make the City Beautiful and Pleasant
- To ensure the City Dwellers to enjoy the Pleasant lives

Micro Environment

Missions

- To manage the Municipal Solid Waste
- To maintain the Drainage System Cleaned
- To conserve the Urban Environment
- To take care the Public Health

Organizing Work Force

| TSP | Officer | Super visor | Work chart | Collec tor | Sweep er | Drain | Night | Total |
|----------|---------|----------------|---------------|---------------|-------------|-------|-------|-------|
| Aung Zan | 1 | 7 | 17 | 193 | 137 | 53 | 101 | 509 |
| Chan Zan | - | 10 | 7 | 162 | 155 | 67 | 117 | 518 |
| Mahar | 1 | 7 | 8 | 174 | 75 | 41 | 59 | 365 |
| Chan Se | 1 | 7 | 5 | 123 | 62 | 15 | 30 | 243 |
| Pyigyi | 1 | 7 | 4 | 125 | 64 | 23 | 40 | 264 |
| Amara | - | 3 | 1 | 73 | 54 | 22 | 27 | 178 |
| Total | 4 | 41 | 42 | 850 | 547 | 221 | 374 | 2078 |




Current Solid Waste Management System

Main Functions of SWM System

- On site Handling & Storage
- Collection
- Transportation
- Final Disposal
- Refuse Analysis



On Site Storage

- Communal Storage
- Household Storage
- Industrial Storage
- Medical Waste Storage
- Use Dustbin
- Temporary storage



Collection Facilities & System

- Door to Door Collection with bell ringing & song warning system
- Road sweeping & Collection
- Roadside dumping collection
- Inappropriate discharge dumping collection



350 Nos



179 Nos



180 Nos



167 Nos



31 Nos



20 Nos



7 Nos





Refuse Analysis & Measurement




- Solid waste composition is analyzed annually at Secondary Collection Points
- Waste collected per day is measured by daily weighing

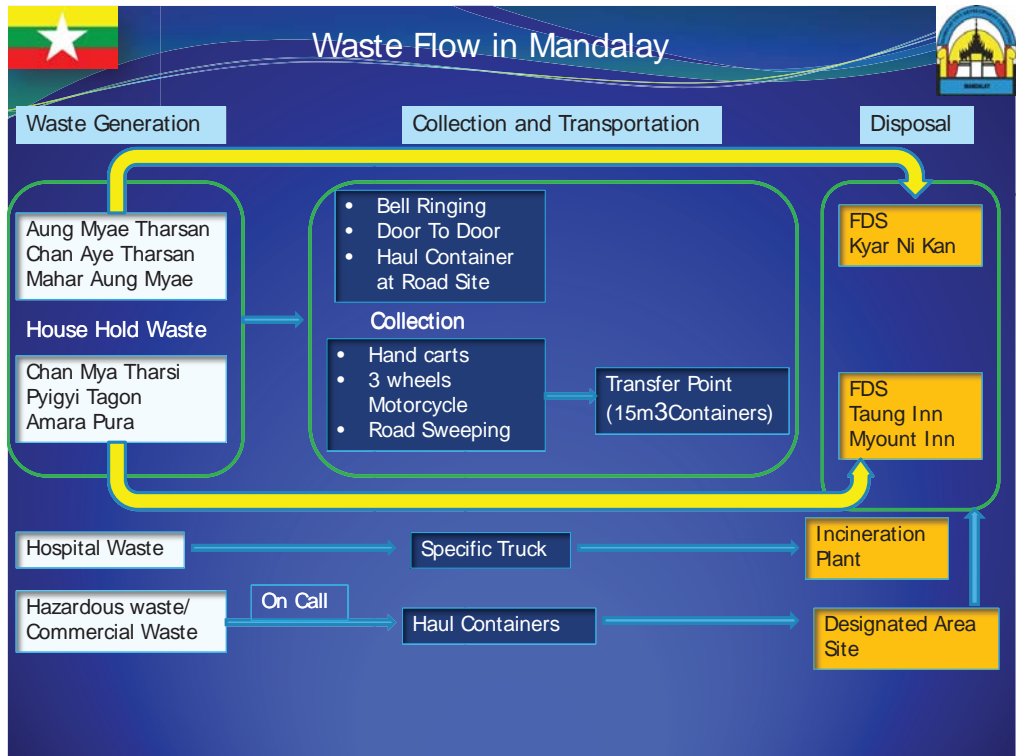




Current Solid Waste Composition

| Categories | Sep/2012 | July/2014 |
|----------------------------|----------|-----------|
| Plastic | 22.09% | 14% |
| Paper | 1.03% | 5.1% |
| Wood/Bamboo pieces | 17.68% | 3% |
| Rubber | 1.29% | 0.3% |
| Metal | 0.09% | 5% |
| Glass | 2.29% | 5.7 |
| Vegetables/leaves/ Kitchen | 37.36% | 55% |
| Drainage sludge/ Clay/dust | 17.80% | 8.3% |
| Clothes/textile | 0.37% | 3.6% |
| Total | 100% | 100% |



Collection System



Door to Door
Collection



Roadside
dumping &
Transfer
Collection



Final Disposal Site



Roadside and Pavement Cleaning



Roadside cleaning



Hospital Waste Management

State

- Ø Hospital - 9 Units Manage by Gov
- Ø Special Clinic- 24 Units
- Ø Dispensaries- 329 Units



Temporary Storage

- Specific Places
- Specific Bags
- Specific Containers



Types of Hospital Waste



- Infectious Waste Yellow Colour Plastic Bag
- Sharps Red Colour Plastic Bag
- General Waste Black Colour Plastic Bag
(Non-hazardous Household Waste)

The average daily hospital waste generations are as follows:

- Infectious Waste - 414 bags - 1780 kg/day
- Sharps - 100 bags - 46 kg/day
- General Waste - 136 bags - 309 kg/day
- Total waste generation - 2.135 Tons/day

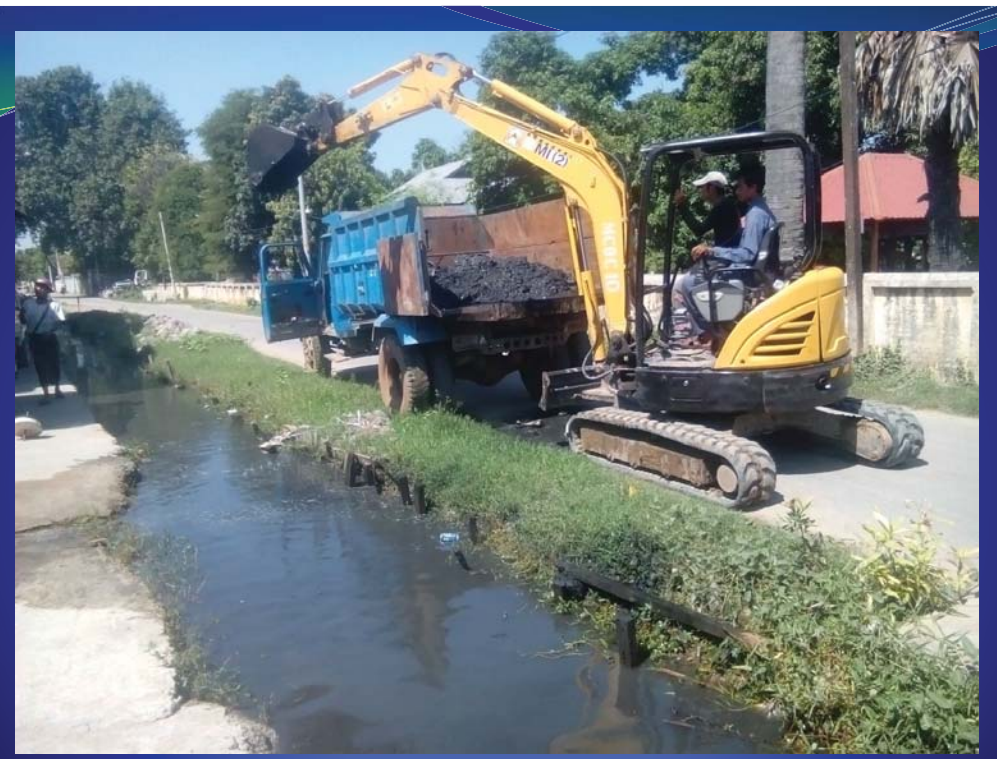


Transportation and Disposal



Main Drains

- Shwe Ta Chaung mile - 7.14
- Ngwe Ta Chaung mile - 4.7
- Mingalar Cannel mile - 0.96
- Colombo Cannel mile - 3.57
- Nadi Cannel mile - 5.78
- Payantaw Creek mile - 7.01
- Thingazar Creek - 2.95





Mandalay City

Comparative Statement of Cleansing Department By Year



| Year | Waste Collection Tons/day | Workers/Employee | Collection Vehicles | 3 wheel Motorcycle |
|------|---------------------------|------------------|---------------------|--------------------|
| 2005 | 259.93Tons | 911 | 71 Nos | - |
| 2006 | 288.06Tons | 1172 | 71Nos | - |
| 2007 | 277.34Tons | 1196 | 73Nos | - |
| 2008 | 262.75Tons | 1085 | 73Nos | - |
| 2009 | 281.46Tons | 1021 | 76Nos | - |
| 2010 | 473.61Tons | 1140 | 86Nos | 20 Nos |
| 2011 | 404.23Tons | 1083 | 116Nos | 90 Nos |
| 2012 | 550.54Tons | 1244 | 173Nos | 150Nos |
| 2013 | 779.04Tons | 1942 | 183Nos | 153Nos |



Existing Dump Sites



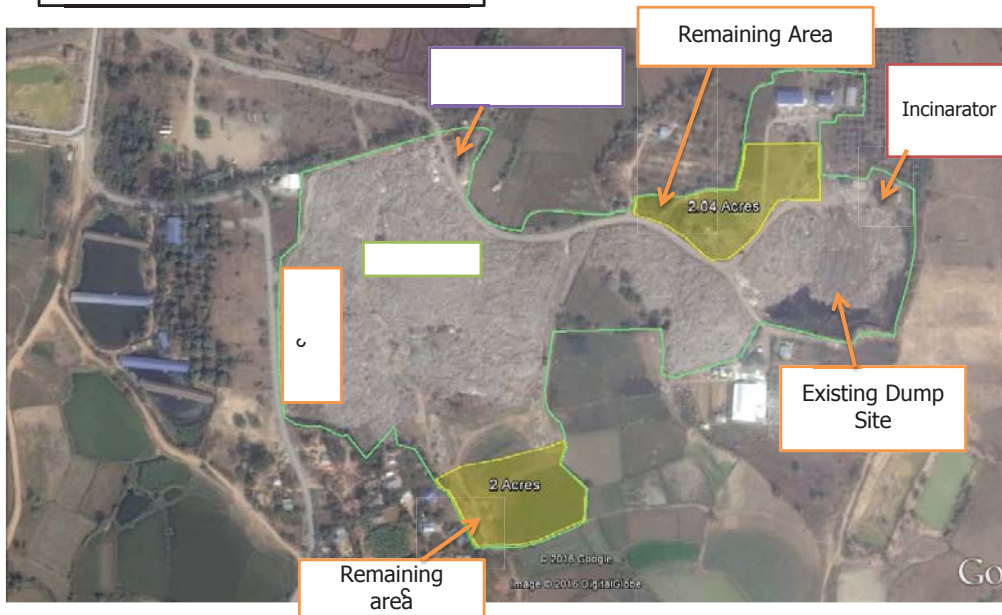
Kyar Ni Kan Disposal Site

- 17.5 km far from City Hall
- 12.5 Acres collected by purchasing from private owners.
- 450 Tons/day of MSW
- 1.Feb.2010 to 6.Jan.2012 is first time used and dumped 309600Tons of MSW.
- 24.Dec.2013 is the starting date of second time.

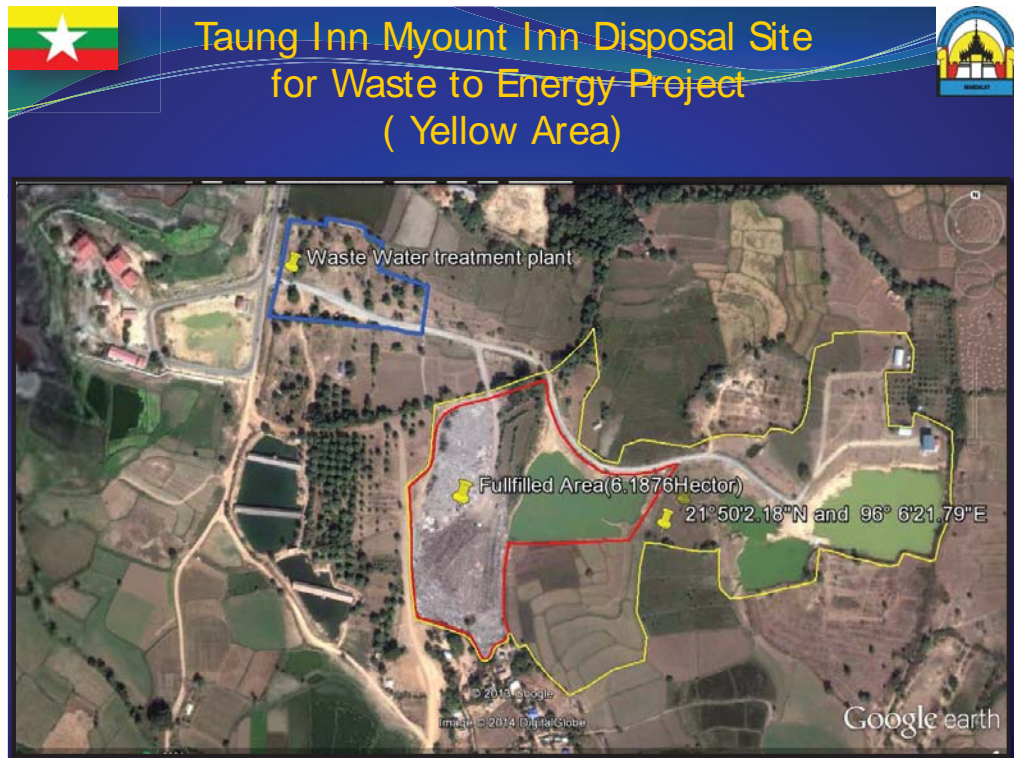
© 2013 Google
Map data ©2013 contributors
Google earth



South inn North inn Disposal site



33



Location of WTE Project and Nearby

- Southern Outpost of the City.
- Sauk Taw Wa Village, Amarapura Township
- Started at 2.2.2011
- 29.32 Acres for project area
- Organic Asia Group (Thailand) will be implement.
- 14.8 MW/h of electricity can be generate.

project site and nearby area

Macro Environment

• Population & Waste Generation

- | | |
|------------------------------|--------------------|
| 1. Population | 1.24 million |
| 2. Floating Population | 50,000 /day |
| 3. Household | 281818 |
| 4. Waste Generation | 0.64Kg/ capita/day |
| 5. Total Waste Generation | 793.6 ton/day |
| 6. Hospital Waste Generation | 2.13 ton/day |

Behavioral Factors

- Separate the waste before discharge.
- Re-usable & Recyclable Waste can be sold .
- Just final refuses remain to discharge.
- Some are weak in awareness to cooperate with MSWMS.
- Be used to in negligence discharge.
- Weak to obey the local rules in discharging.

Resource Recovery Business

Reuse & Recycle Waste Flow



Resource Recovery Business

- Recycle Paper Production
- Recycle Plastic Production
- Recycle Iron/Zinc/Metal Production
- Recycle Copper & Bronze Production
- Recycle Lead Production

- Reuse Bottle Market
- Reuse Plastic & Metal Export Market

Community Participations

- Weekly Donation Groups
- Youth Volunteers Groups
- Health and Social Service Groups



Meeting With Ward leaders and Community

Get to know the difficulties encountered by the community.
Negotiate the gaps in understanding of the Legislation by the public.
Public Participation in development works.



Activities for the Public Awareness

Educational Program for Waste Separation at Source



Essay Competition for Environmental Conservation and Solid Waste Management



Eco Model School Activities



MCDC choose 3 Basic Education High Schools as Eco-Model School,



Problem Statement

- Lack of public awareness and cooperation in SWMS.
- No practice in waste segregation.
- Weakness in fulfillment of transportation facilities.
- Insufficient budget allotment due to small amount of garbage tax.
- Lack of law enforcement on SWMS.
- Weakness in final disposal management.

Consequences

- Direct Health Hazard for workers
- Environmental contamination due to improper management of final disposal site.



National and Local Waste Management Strategies in Asia

Experiences and key challenges from Japan and the Philippines

Shiko Hayashi

Programme Manager, Sustainable City Group



1. Framework of national guideline and local solid waste management plan in Japan

Responsibilities of stakeholders for promoting sound waste management and recycling

National government

- ① To prepare a **guideline** for local governments to develop their **local solid waste management plan**
- ② To **collect information/data** about waste
- ③ To **develop a policy/regulations** based on the collected data
- ④ To promote **technology development** for waste treatment and recycling
- ⑤ To provide **technical and financial assistances** (e.g. subsidy) **to the municipalities** etc.

Local municipality

- ① To **develop a plan** of local solid waste management
- ② To promote citizens' **voluntary activities** with regard to the waste reduction
- ③ To take **necessary measures for proper treatment** of waste
- ④ To make efforts toward **efficient operation** in the implementation of waste management (e.g. capacity building of staffs, consolidate treatment/disposal facilities, develop operation techniques)

Citizens

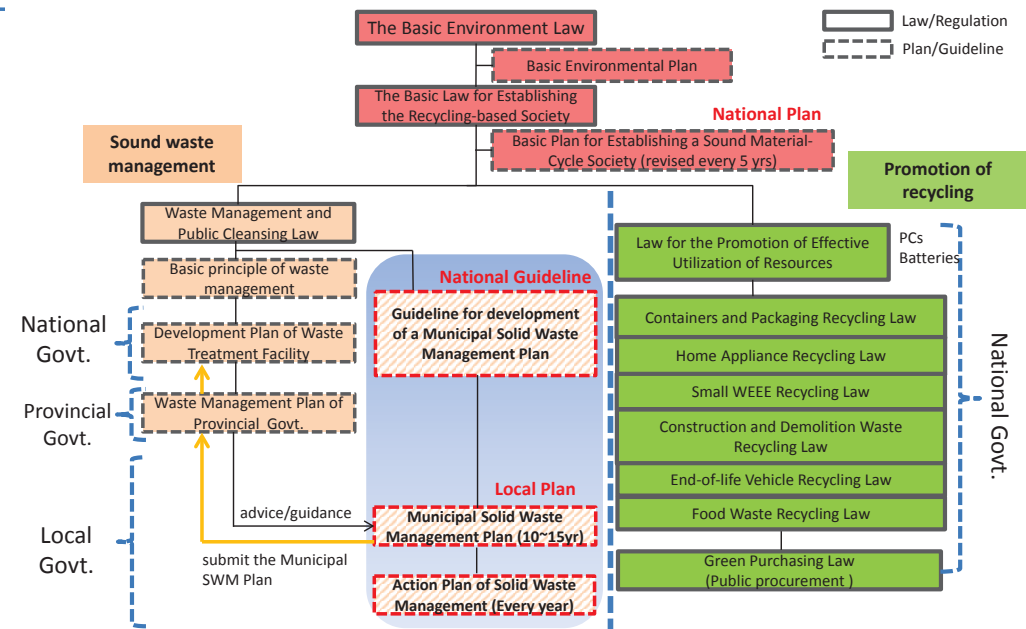
- ① To reduce waste generation (waste prevention)
- ② To implement source separation for waste disposal
- ③ To promote reuse of waste
- ④ To contribute to the reduction of waste and its proper treatment managed by municipalities

Business and Industries

- ① Disposer's responsibility to properly treat base on the disposer's responsibility
- ② Extended Producer Responsibility to improve the design of products, containers, etc. and to take-back and properly treat their end-of-life products

(Source: Waste Management and Public Cleansing Law in Japan)

Structure of national regulations associated with waste management and 3Rs in Japan



National target of 3Rs in Japan

set in the 2nd Basic Plan for Establishing a Sound Material-cycle Society (2008~: 5 years)

Effort Indicators (target year: FY2015)

1. Numerical targets

- [1] **Reduction** of municipal solid waste
 - (a) Total waste generation per capita/day → 10% reduction in 2005 from 2000-level
 - (b) Household waste generation per capita/day → 20% reduction
 - (c) Waste generation from business sector → 20% reduction
- [2] **Final disposal** amount of **industrial waste**
 - Reduction by 60% comparing to FY2000 level (e.g. 47% reduction in 2005)
- [3] **Citizens' awareness** of and **behavior** concerning 3Rs
 - Awareness: approx. 90%, Behavior: approx. 50%
- [4] Promotion of **recycling businesses**
 - Market-size will be doubled from FY2000 level (e.g. 1.3 times in 2005)

2. Other indicators monitoring a progress made by individual stakeholders

- [1] Percentage of customers not taking **plastic shopping bags**,
- [2] High-ranked (awarding) **municipalities in terms of 3R efforts**, and other indicators

Source: Ministry of Environment Japan

Basic concept of a Municipal Solid Waste Management Plan in Japan

- Hierarchy of waste management options
 - 1st. Prevention of waste generation at source (Reduce); 2nd. Reuse; 3rd. Recycle; 4th. Thermal recycle; 5th. Sound disposal of waste
- Promote regional (area-wide) waste treatment
 - Lower construction and maintenance costs due to an intensification of waste treatment facilities (e.g. waste collection/treatment beyond the border)
- Components to be assessed in the development of a MSW Management Plan
 - **Overall condition** of the municipality: demographics, industrial trend, a relationship with the development plan of the municipality
 - **Current conditions and issues** of waste management: waste flow, responsible stakeholders, performance of waste management and its evaluation, understanding the challenges.
 - **Trend of other municipalities** and central and provincial governments

Municipal Solid Waste Management Plan in Japan

• Waste Management and Public Cleansing Law (1970)

Chapter2: Municipal Solid Waste Management

Municipal Solid Waste Management Plan

Article 6

The **municipalities shall specified forth a definite plan for management** of municipal solid waste in their respective administrative areas (hereinafter referred to as a “**municipal solid waste management plan**”).

The **municipal solid waste management plan shall include the following matters** in regard to the management of municipal solid in their administrative areas according to the Ordinance of the Ministry of the Environment.

Components included in a Municipal Solid Waste Management Plan:

1. **Estimate of the volume** of municipal solid waste to be generated and that to be managed
2. Measures for **waste reduction (prevention)** of municipal solid waste.
3. **Categories** of municipal solid waste for **separate collection**.
4. Basic matters of **sound treatment of municipal solid waste** and the authorities/persons carrying out such management.
5. Matters concerning the improvement or construction of municipal solid waste **treatment facilities**.
6. **Other matters** necessary for the management of municipal solid waste.

Guideline for a Municipal Solid Waste Management Plan in Japan: Contents (No.1)

since 1977 (revised in 1993, 2008)

1. **Basic Principle**
 - Objective, relationships with other plan/regulation, targeted area
2. **Target year**
 - time period (10~15 years, the mid-term evaluation in every 5 years)
3. **Data management on waste generation and composition**
 - collect the current data on waste generation and composition
 - estimate the amount of waste generation per a person a day depending on population projection and future trend of industrial/business activities
4. **Roles of each responsible actors**
 - Local authority:
 - waste collection charge, introduction of source separation, promoting env. education and public awareness, instruction to large-volume generator, green purchasing etc.
 - Residents:
 - community-based collection system for recyclables, reduction of waste packaging etc.
 - Business entities:
 - prevention of waste generation at source (e.g. prevent excess packaging) etc.

Guideline for a Municipal Solid Waste Management Plan in Japan: Contents (No.2)

5. Waste treatment planning

- 5.1 Plan for waste reduction (prevention) and recycling
- 5.2 Plan for waste collection and transportation
- 5.3 Plan for intermediate treatment
- 5.4 Plan for final disposal

6. Categorization of a source separation

- categorize waste for separate collection
- keep residents informed to clean and separate recyclables

7. Waste treatment facility improvement and establishment

- setting a treatment capacity and a treatment method for each facility
- utilizing a subsidy for establishing the facility, promoting PFI etc.

8. Others

- Public awareness, education to residents on source separation, relationships with other municipal development plan etc.

Municipal Solid Waste Management Plan: Case in City of Kitakyushu

Population: about 1 million

1. Basic principle:

- Promoting **recycle-based society** (integration of 3Rs and green procurement)

2. Target year: 2001~ (10 years, reviewed in every 5 years)

3. Data management

- Target: waste generation (keep constant level of **49 million ton/year**), waste reduction (-5%), recycling rate (13%→**25%**)

4. & 5. Measurements

- Development of recycle systems for
 - waste papers,
 - food waste,
 - package waste,
 - home appliances,
 - green waste.
- Promotion of reuse
 - **exchange program** for used books and clothes etc.
- Promotion of **green purchasing** (e.g. public procurement)



Food waste recycle bin Composting at School



Recycle Plaza

Source: Kitakyushu City

MSWMP: Case of City of Kitakyushu (continued)

6. Categorization of a source separation and separate collection

- Regular separate collection with designated bags:

- 1) Combustibles,
- 2) Cans and glass bottles,
- 3) PET bottles,
- 4) Plastic containers and packages

- **Station collection:**

Cartons, trays, fluorescent tubes, metals (pan, pot etc.)

- **Community-based collection:**

waste paper (newspaper, card boxes, magazines)

Collection point

Designated bags

Station collection

Community-based collection for waste paper

7. Waste treatment facilities

- Incinerations (3),
- Landfill site (1),
- Recycling facilities (waste sorting for cans and bins: 3)

8. Promoting efficiently and satisfaction of residences

- Announcement of annual waste **management costs**, reduction of waste **collection costs**

9. Environmental Education

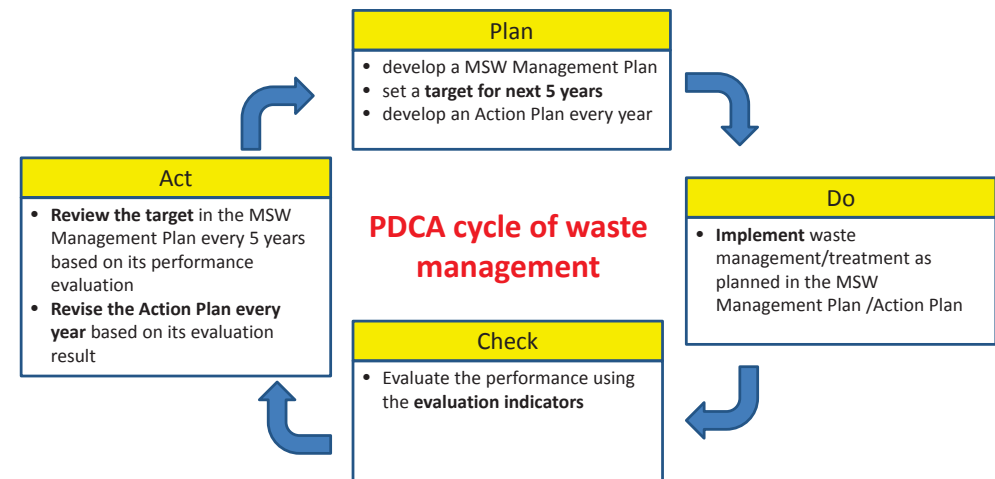
- Establishing **Env. Education center**,
- Env. Education at **school**, etc.



Source: Kitakyushu City

Management cycle of Municipal Solid Waste Management Plan in Japan

- Municipal Solid Waste Management Plan (long-term: 10~15 years)
- Action Plan for waste collection and treatment (every year)



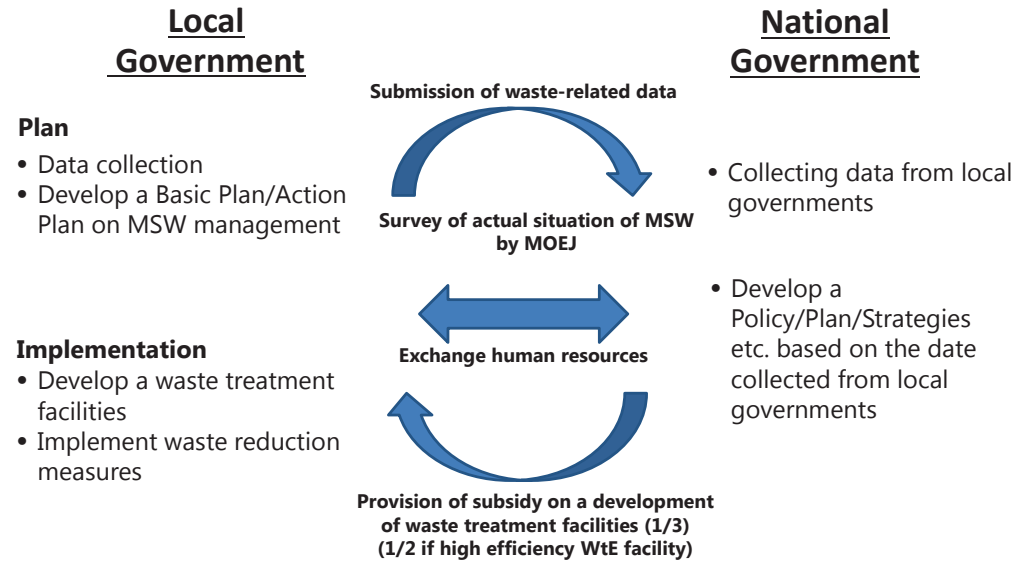
Indicators to evaluate the waste management performance

| Category | Objective to be measured | Indicator | Unit |
|--------------------------------------|---|---|------------------------|
| Establishing recycling-based society | Waste generation | Waste generation per person • day | kg/person • day |
| | Recycling rate | Recycling rate from waste | % (ton/ton) |
| | Thermal recycle | Energy recovery from waste | MJ/ton |
| | Final Disposal | Proportion of waste sent to landfill-site | % (ton/ton) |
| Prevention of global warming | GHGs emission | GHGs emission per a person a day associated with waste disposal | kg/person • day |
| Public service | Residents' satisfaction for waste treatment | Degree of Satisfaction of residents | — |
| Economy | Cost-effectiveness | Annual waste treatment cost per a person | JPN yen /person • year |
| | | Cost of recycling | JPN yen/ton |
| | | Cost of thermal recycling | JPN yen/MJ |
| | | Cost associated with waste reduction service | JPN yen/ton |

Initial set of data to be managed (yellow box pointing to 'Waste generation per person • day')

Data collection/management (red dashed circle around 'Waste generation per person • day' and 'Proportion of waste sent to landfill-site')

Relationship between National and Local Government in Japan



2. Framework of national guideline and local solid waste management plan in the Philippines

Philippines 3R Strategy and Experience: National and Local government relationship

Ecological Solid Waste Management Act of 2000 (R.A. 9003)

Article 1: Section 16. Local Government Solid Waste Management Plans

The **province, city or municipality**, through its local solid waste management boards, shall prepare its respective **10-year solid waste management plans** consistent with the national solid waste management framework..... shall be **reviewed and updated every year** by the provincial, city or municipal solid waste management board.



Framework of 10-years Solid Waste Management Plan

Ecological Solid Waste Management Act of 2000 (R.A. 9003)

Section 17. Components of the Local Government Solid Waste Management Plan

- | | | |
|--------------------------|---|--|
| Data | { | 1. City or Municipal Profile (background information on the city/municipalities) population, map, solid waste generation by source, inventory of existing facilities and capacities |
| | | 2. Waste characterization |
| | | 3. Collection and Transfer provision of properly designed containers, segregation, hauling and transfer, enforcement, training officers |
| | | 4. Intermediate Treatment methods and facilities |
| Collection/ Treatment | { | 5. Source Reduction program and economic incentives to reduce non-recyclable materials, replace disposable materials, reduce packaging, etc. |
| | | 6. Recycling types of materials to be recycled, methods for determining the category of waste to be recycled, new facilities and expansion of existing facilities needed to implement the recycling. |
| | | 7. Composting types of materials to be composted, methods for determining the category of waste to be composted, new facilities and expansion of existing facilities needed to implement the composting. |
| | | 8. Final disposal projection of the amount of disposal capacity needed to accommodate the solid waste generated. |
| | | 9. Education and public information educate and inform citizens about the source reduction, recycling and composting programs |
| | | 10. Special waste (household hazardous wastes) |
| Financing | { | 11. Resource requirement and funding (finance) description of the project costs, revenues, and source of funds |
| | | 12. Privatization of solid waste management projects indicate specific measures to promote the participation of the private sector. |
| | | 13. Incentive program providing incentives, cash or otherwise, shall encourage the participation of concerned sectors. |

Thank you.

Contact: hayashi@iges.or.jp

10 Year Solid Waste Management Plan: Case of Cebu City

Population: about 866,000 (2010)

1. Basic principle:

- Promoting ecological, integrated and sustainable solid waste management (integration of 3Rs and green procurement)

2. Target year: 2012 – 2020 (10 years, reviewed in every 5 years)

3. Data management

- Target: waste generation (reduction of landfill by 25% in 2020)

4. & 5. Measurements

- Promotion of waste separation at source
- Enforcement of no segregation and no collection policy
- Establish a Material Recovery Facility at barangay
- Promote recycling businesses through PPP
- Establish environmental education
- Strengthening institutional framework and capacity building

6. Waste treatment facility

- Landfill site (1)
- Central treatment facility (1)



Source: Cebu City

Japanese Experience of Wastewater Management

-Lessons learned from Japan-
IGES Fellow
Chuzo Nishizaki

Outline of my Presentation

1. Present State of Water Environment in Japan
2. Domestic Wastewater Treatment
3. Summary 1
4. Industrial Wastewater Treatment
5. Summary 2
6. Overall Summary



Kanzaki River
Osaka Prefecture

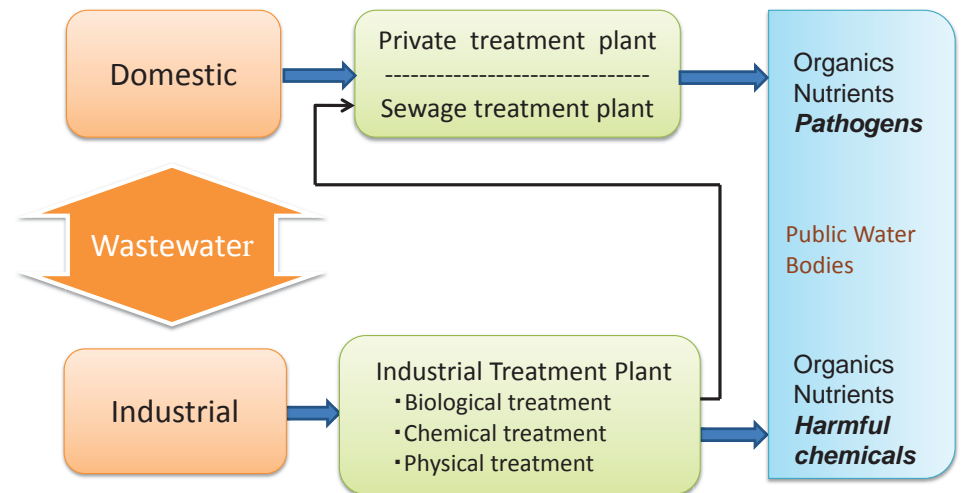
Pond (Tea Plantation)
Kyoto Prefecture

Osaka Bay
Osaka Prefecture

1. PRESENT STATE OF WATER ENVIRONMENT IN JAPAN

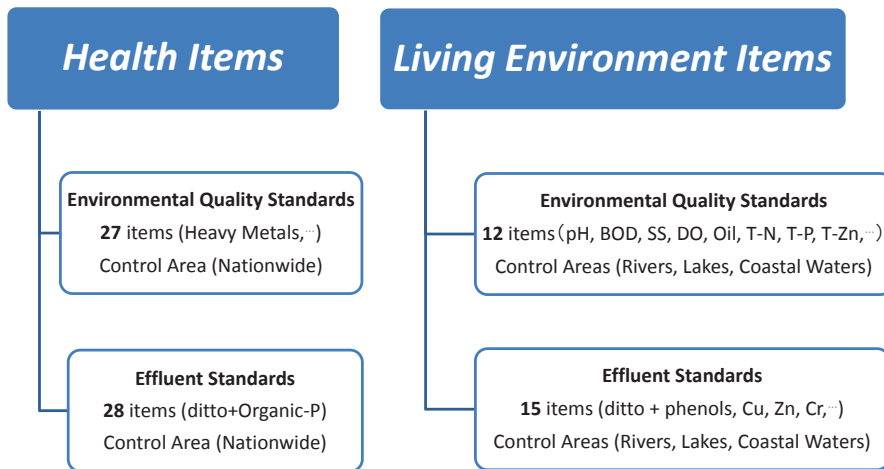
1. Present State of Water Environment

-Origin of the Pollutants-



1. Present State of Water Environment

-Legal Regulation for Water Pollution Control-



1. Present State of Water Environment

-Incompliance Rate of Environmental Quality Standards (EQSs)-

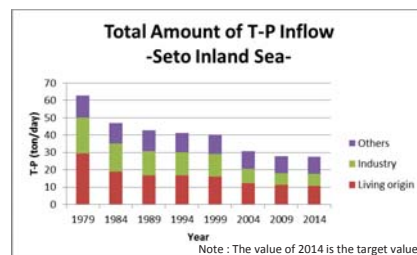
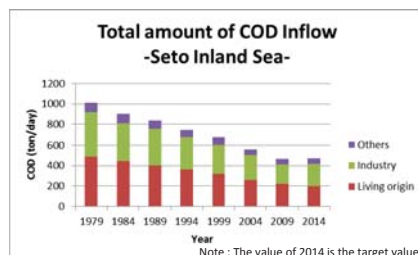
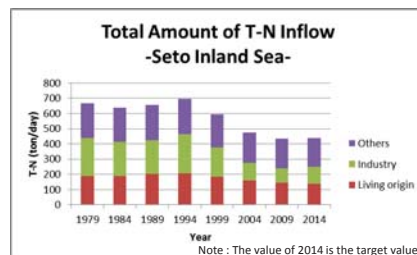
| Human Health Items in FY 2014 | | | | | | | | | |
|---|--|------|-------|-----|---------------|-----|-----------|------|-------|
| | Rivers | | Lakes | | Coastal water | | Sum Total | | |
| | A | B | A | B | A | B | A | B | B/A |
| Cd, T-CN, Pb, Cr ⁶⁺ , ... 1,4 Dioxane | 3902 | 45 | 400 | 1 | 1073 | 0 | 5375 | 46 | 0.009 |
| Living Environment Items in FY 2014 | | | | | | | | | |
| | C | D | C | D | C | D | C | D | D/C |
| | 7 items such as BOD, COD ... <i>T-coli</i> . | 2558 | 156 | 189 | 84 | 592 | 124 | 3339 | 364 |
| T-N, T-P | - | - | 121 | 60 | 151 | 16 | 272 | 76 | 0.279 |

Note : A=Number of monitoring points, B=Number of points exceeding EQS
 C=Number of water areas classified under EQS water types (areas)
 D=Number of water areas exceeding EQS water types (areas)

Source : White Paper (2014, MOE)

1. Present State of Water Environment

-Trend of Water Environment (Example : Seto Inland Sea)-



Source : Ministry of Environment ,2016



Toilet (Floating House)
Vietnam



Toilet
Indonesia

2. DOMESTIC WASTEWATER TREATMENT

Purpose of This Chapter

The purpose is to present a method for efficient and effective implementation of the domestic wastewater treatment.

2. Domestic Wastewater Treatment -Main Treatment Systems-



• Area wide improvement

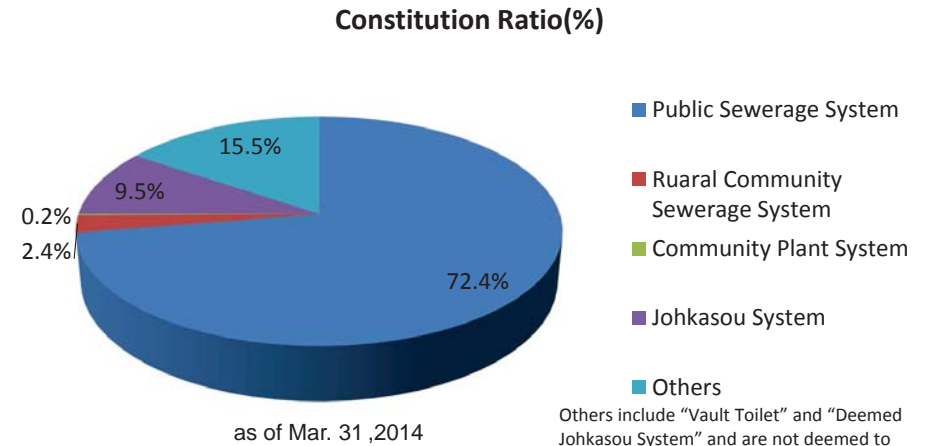


• Cluster improvement



• Individual improvement
• Additionally, it requires a sludge treatment system.

2. Domestic Wastewater Treatment -Ratio of Main Treatment Systems-



Source : "Domestic Wastewater Hygienic Treatment Ratio", MIC, 2014

2. Domestic Wastewater Treatment -Outline of Main Treatment Systems-

| System | Availability of flush toilet | Object to be treated | | Night soil or/and sludge treatment | Management entity | |
|--------------------------------|------------------------------|----------------------|------------|-------------------------------------|-------------------|-------------|
| | | black water | gray water | | installation | maintenance |
| Public Sewerage | ○ | ○ | ○ | incorporated | municipal | municipal |
| Rural Community Sewerage | ○ | ○ | ○ | incorporated | municipal | municipal |
| Johkasou (municipal type) | ○ | ○ | ○ | additionally required ¹⁾ | municipal | municipal |
| Johkasou (private type) | ○ | ○ | ○ | ditto | private | private |
| Deemed Johkasou (private type) | ○ | ○△ | × | ditto | private | private |
| Vault Toilet | × | ○ | × | ditto | private | private |

Note1) : These systems need night soil treatment additionally.

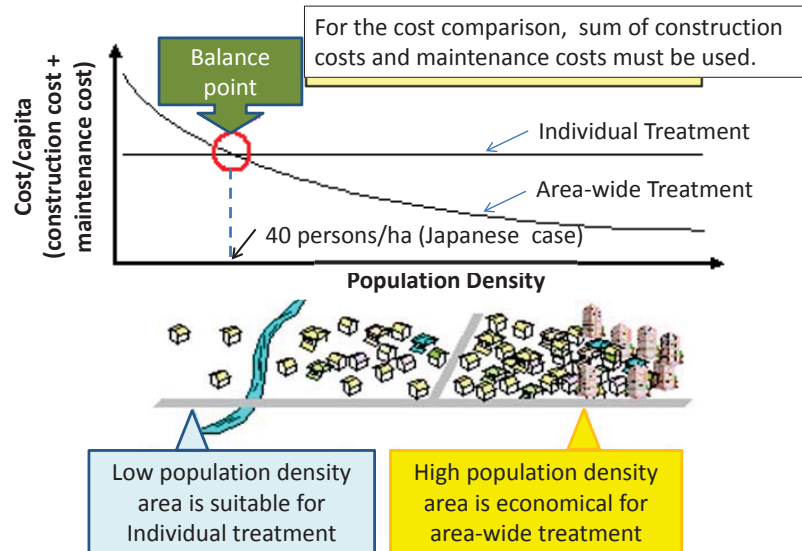
2. Domestic Wastewater Treatment -Comparison between Public Sewerage and Johkasou - (Legal and Financial System)

| System | Installation | | | Maintenance | |
|-----------------|--------------|-------------------------------------|--|---|---|
| | Establisher | Financial System | Legal System | Cost | Legal System |
| Public Sewerage | Municipal | Beneficiary's Contribution | • Sewerage Law | • Charge | • Sewerage Law |
| Johkasou | Municipal | Own Expense (10% of the base price) | • Building Standard Law • Johkasou Law • Structure Standards (Type Qualification) • Technical Standards • Certified Johkasou Installation Worker | • Charge • Cleaning • Utilities • Chemicals | • Johkasou Law Maintenance (≧3 times a year ^{*)} (Johkasou Operator) Cleaning (≧1 time a year) (Johkasou Desludging Technician) Periodic Inspection (≧1 time a year) (Johkasou Inspector) (Water Quality Inspection) |
| | Private | Own Expense (60% of the base price) | | • Maintenance • Legal Inspection • Cleaning • Utilities • Chemicals | |

Note*) : Frequency depends on the scale of Johkasou and its treatment method.

2. Domestic Wastewater Treatment

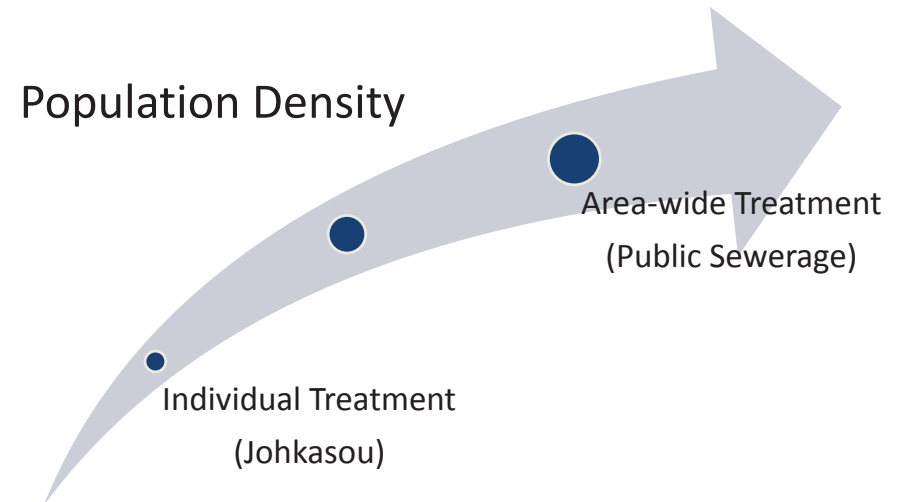
-Cost Comparison between Area-wide and Individual Treatment-



Source : MLIT

3. Summary 1

-Selection of Rational Domestic Wastewater Treatment-



4. Industrial Wastewater Treatment

-Effective Pollution Prevention Strategies-



Coagulation Tank



Settling Tank

4. INDUSTRIAL WASTEWATER TREATMENT

Purpose of this chapter

The purpose is to present a scheme for efficient and effective implementation of industrial wastewater regulations .

1. Specified Facilities

Facilities that may discharge polluted wastewater are specified by law.

- 103 facilities are specified now.

2. Standards

Environmental Quality Standards, Effluent Standards etc.

- “More strict standards” and “Local effluent standards for substances not regulated by the national uniform standards” in addition to the national regulation
- Total emission control standard (COD, T-N, T-P)

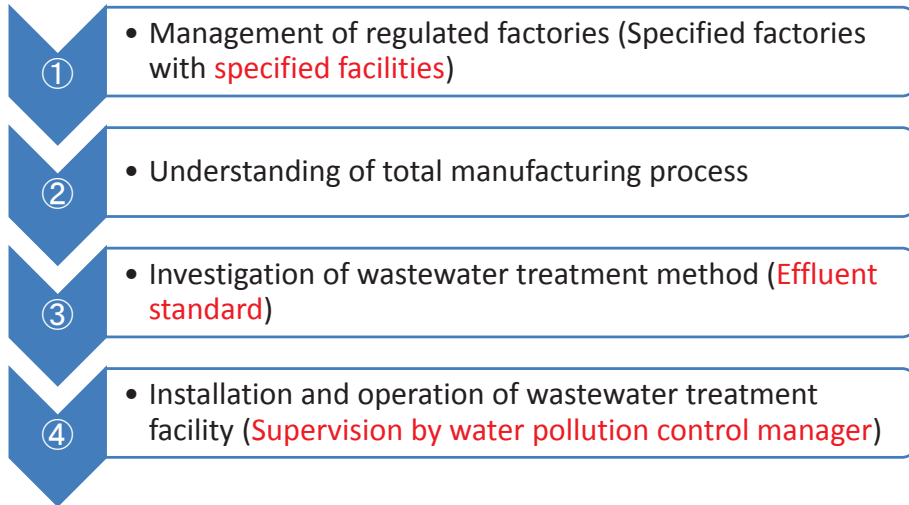
3. Pollution Control Manager

The installation of the pollution prevention system in the factory has been mandated by law.

- The main function of Pollution Control Managers is to supervise workers at the facilities to meet effluent standards for the wastewater.

4. Industrial Wastewater Treatment

-Regulation Process of Industrial Wastewater-



4. Industrial Wastewater Treatment

-Management of Regulated Factories-

(Examples : Specified factories)



Natural rubber manufacturing factory



Beer brewing factory



Dye house



Waste paper recycling factory

4. Industrial Wastewater Treatment

-Specified Facilities-

1. What are “Specified Facilities”?

Facilities to drain the water including the substances which might hurt the health of the person or which might bring harm for living environment into, and are designated in a Water Pollution Control Law Enforcement Order specifically.

2. Prior notification system of “Specified Facilities”

By requiring notification of specified facilities to businesses, local governments, the presence of a plant or workplace with specified facilities can be identified.

This is the first step of the regulations and guidance to the installation of wastewater treatment.

4. Industrial Wastewater Treatment

-Understanding of Total Manufacturing Process (Examples)-

1. Production process improvement

Harmful raw materials



Harmless raw materials

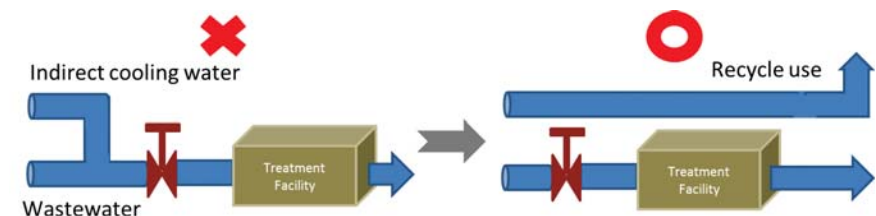
2. Water-saving (improving the way of washing)

Soak

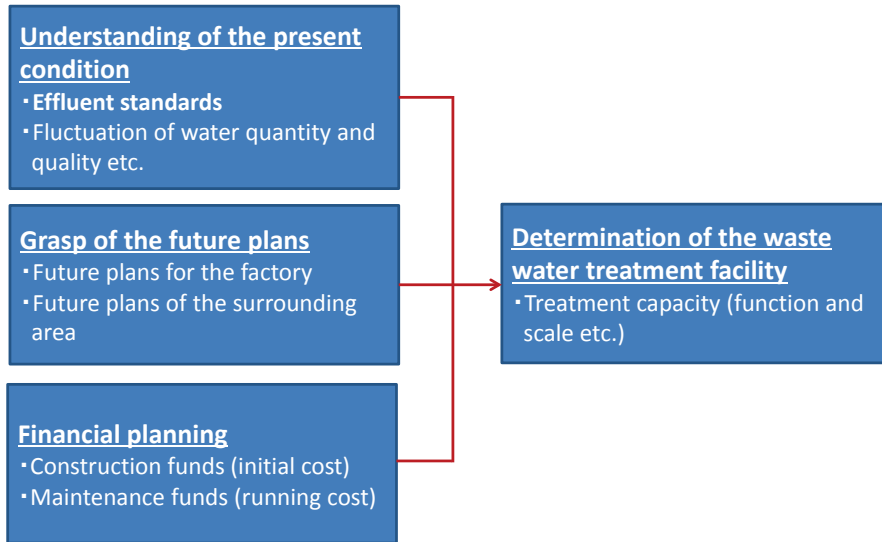


Spray

3. Separation and unification of the drain pipe



4. Industrial Wastewater Treatment -Investigation of wastewater treatment method-



4. Industrial Wastewater Treatment -Effluent Standards-

1. Effluent Standards

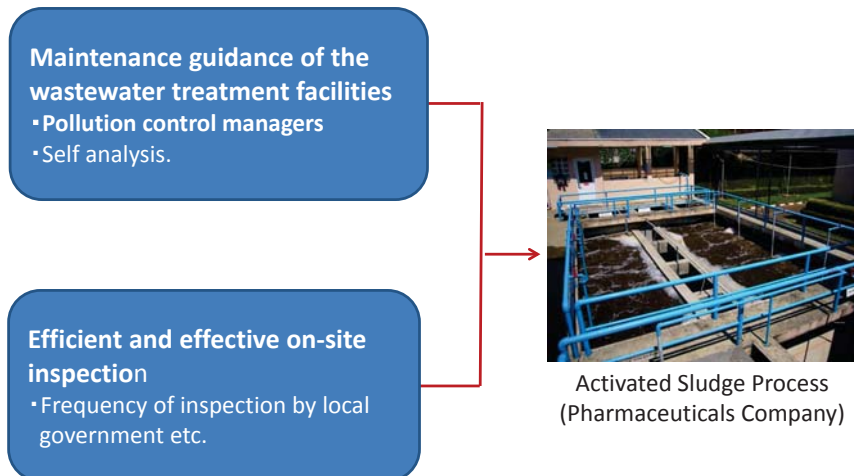
- ① Standards for protection of human health (health items...28 items+dioxin)
- ② Standards for conservation of living environment (Living environment items...15 items)

2. Tighter Regulations

- ① “Prefectural stringent standards” and “Local effluent standards for substances not regulated by the national uniform standards” could be provided by the local government.
- ② Factories within the designated area (Seto Inland Sea, Tokyo Bay and Ise Bay) must comply with the total emission control standards (COD,T-N,T-P) .

4. Industrial Wastewater Treatment

-Installation and Operation of Wastewater Treatment Facility-



4. Industrial Wastewater Treatment

-Pollution Control Managers System-

The main function of Pollution Control Managers is to supervise workers at the facilities to meet environmental standards for exhaust gas, wastewater, noise, etc.

Types of Pollution Control Managers (Water Pollution Control Managers)

| | | Drainage Volume | |
|----------------------------|-----|-------------------------------------|-----------------------------|
| | | ≦10,000 (m ³ /d) | ≥10,000 (m ³ /d) |
| Health Items ²⁾ | Yes | 2 nd grade ¹⁾ | 1 st grade |
| | No | 4 th grade | 3 rd grade |

Note

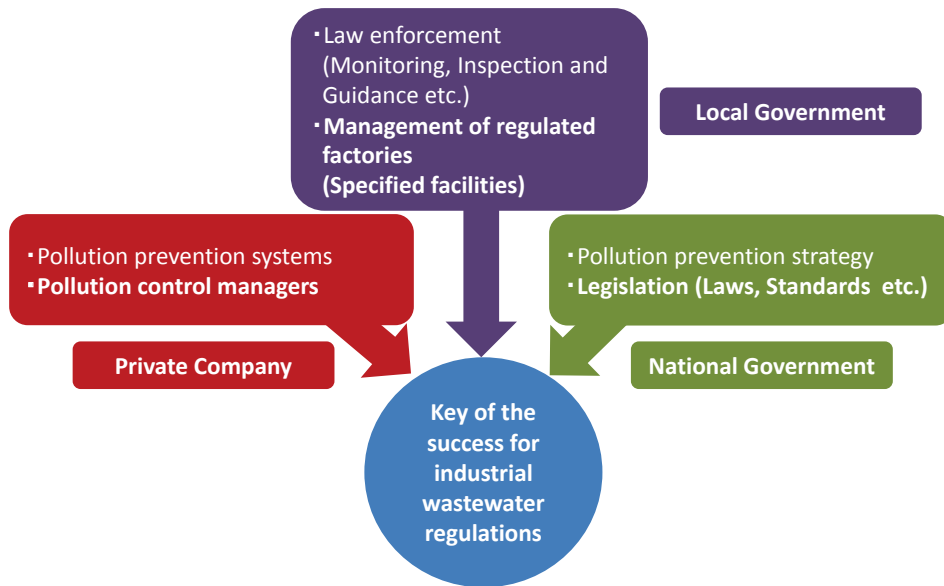
- 1) The facilities that permeate their effluent into underground are included here.
- 2) 27 items designated by the WPCL.

Specified Factories

| Industries | Facilities |
|--|------------------------------------|
| 1.Manufacturing (including processing) | 1.Generating soot |
| 2.Electric power supply | 2.Generating certain types of dust |
| 3.Gas supply | 3.Generating general types of dust |
| 4.Heat supply | 4.Discharging polluted water |
| | 5.Generating noise |
| | 6.Generating vibration |
| | 7.Generating dioxins |

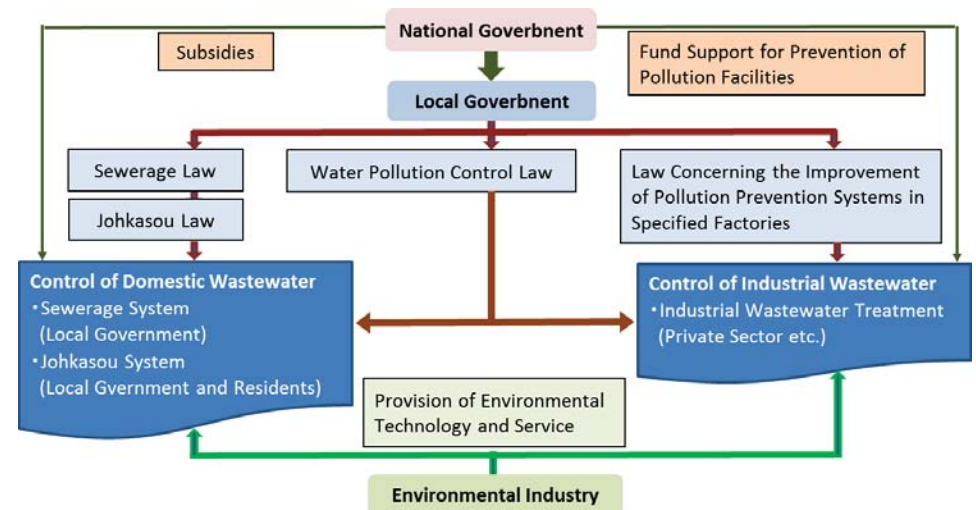
5. Summary 2

-Efficient and Effective Implementation Scheme-



6. Overall Summary

-Framework to Protect the Water Environment in Japan-



Thank you for your kind attention!



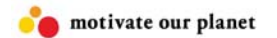
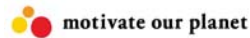
Japanese Garden
(Kyoto Imperial Gardens)

E-Mail : chuzosan@maia.eonet.ne.jp

Our Activities of New Waste Management facilities in Thilawa Special Economic Zone

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

JUNE. 14, 2016

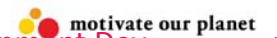
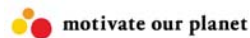


Contents

- Company Introduction
DOWA HOLDING GROUP
GOLDEN DOWA ECO-SYSTEM MYANMAR
- Case Introduction
Proper Hazardous Waste Treatment

Company Introduction

Our Organization



DOWA'S Environmental Business in Asia



5

Outline of GEM

Company Name :

GOLDEN DOWA ECO-SYSTEM MYANMAR CO.,LTD.(GEM)

Capital : 36 Million USD

Share Holder : DOWA ECO-SYSTEM 100%

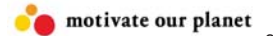
Board of Directors : 2 Persons (DOWA)

Employee : About 35 persons (at operation start)

Approval of Waste Management Business

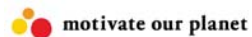
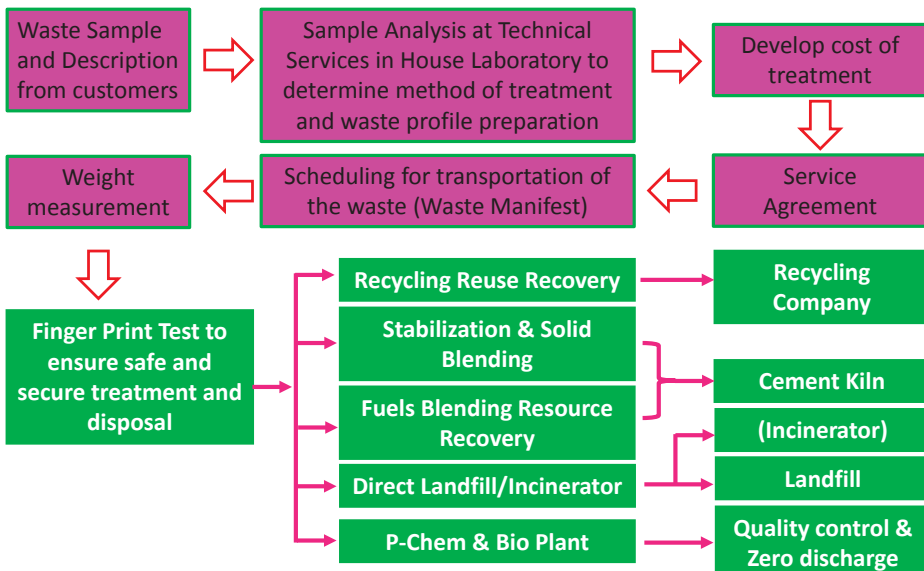
SEZ Management committee approved us to do waste management business.

EIA: Under the Environmental Impact Assessment procedures of Myanmar, We had done EIA of our business already.



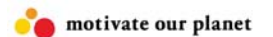
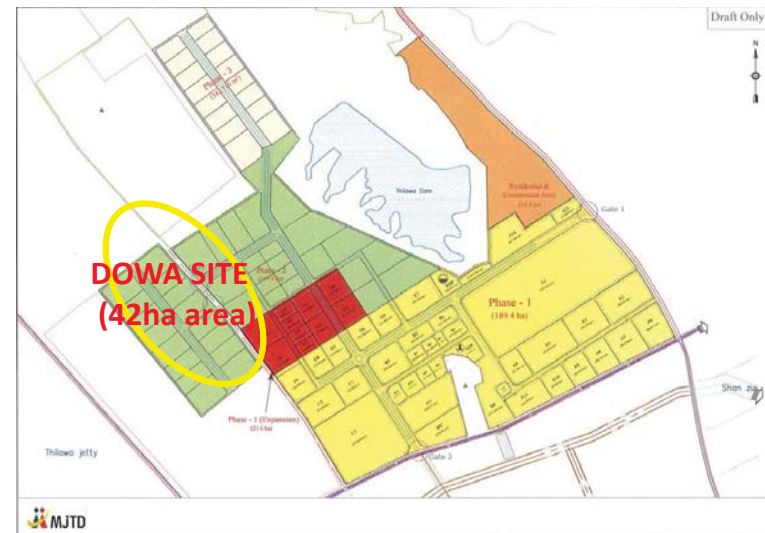
6

Waste Receipt Procedures



7

Location @ Thilawa SEZ



8

Contents of the Facilities

1. Controlled Secured Landfill (Phase -1)
 - Landfill Area 80mX80m X 2 Sites (**Haz and Non-Haz**)
 - Capacity 44,000m³(Non-Haz) 43,000m³(Haz)
 - (After closure of phase 1 site, we'll continually develop new area beside phase 1.)
2. Sorting/Stabilization Facilities
 - Size 24.5m X 44m X 10m
3. Waste water and Leachate water treatment Facility
 - Ability 35m³/Day
 - Treatment Method Biological Treatment +Flocculation
 - Pond Capacity 300m³ × 3
4. Office(with Lab.)
 - Size 16mX28mX3m
 - (ICP, Ion-chromatography ,Mercury analyzer ,Oil & Grease contents meter etc..)
5. Incinerator (will invest 2 year after = tentative)

Perspective Photo(2015 December)

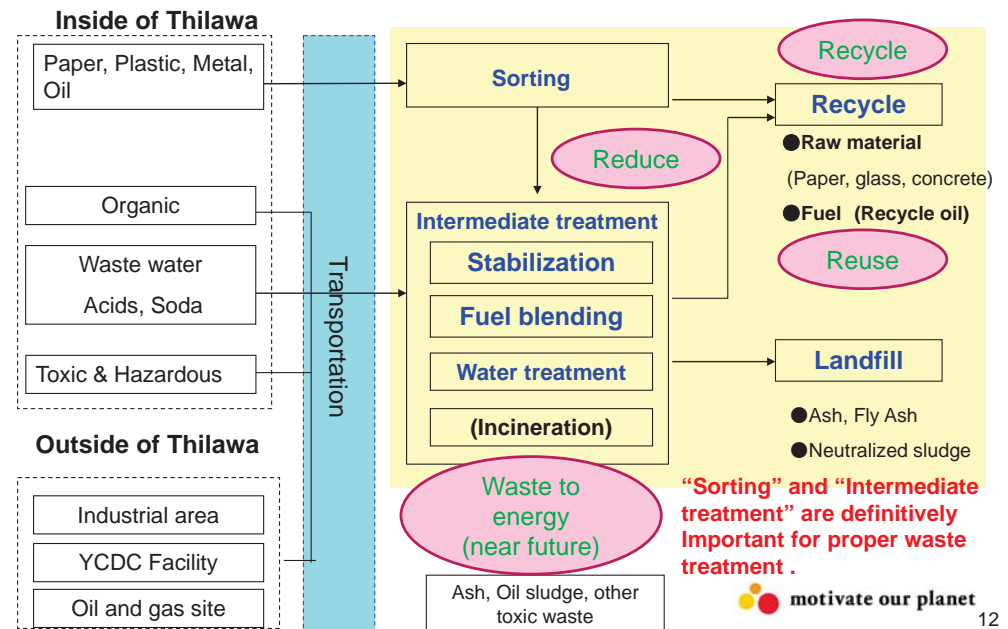


Perspective Image(Completion of Operation Phase)



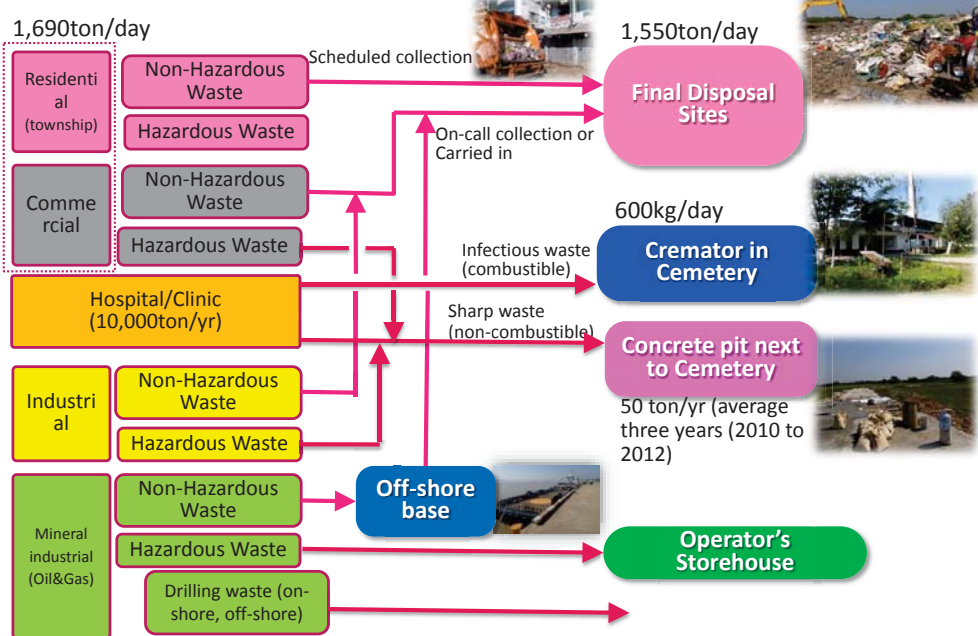
Our plan in Thilawa

We want to establish "Integrated Waste Treatment Facilities" ,not simply Landfill.

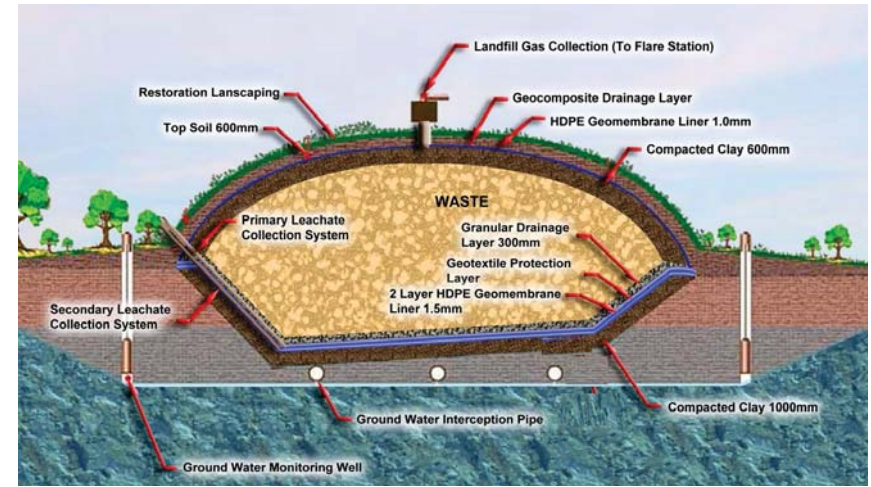


Waste Flow in Myanmar (Estimated by GEM)

case example: Yangon and surrounding areas



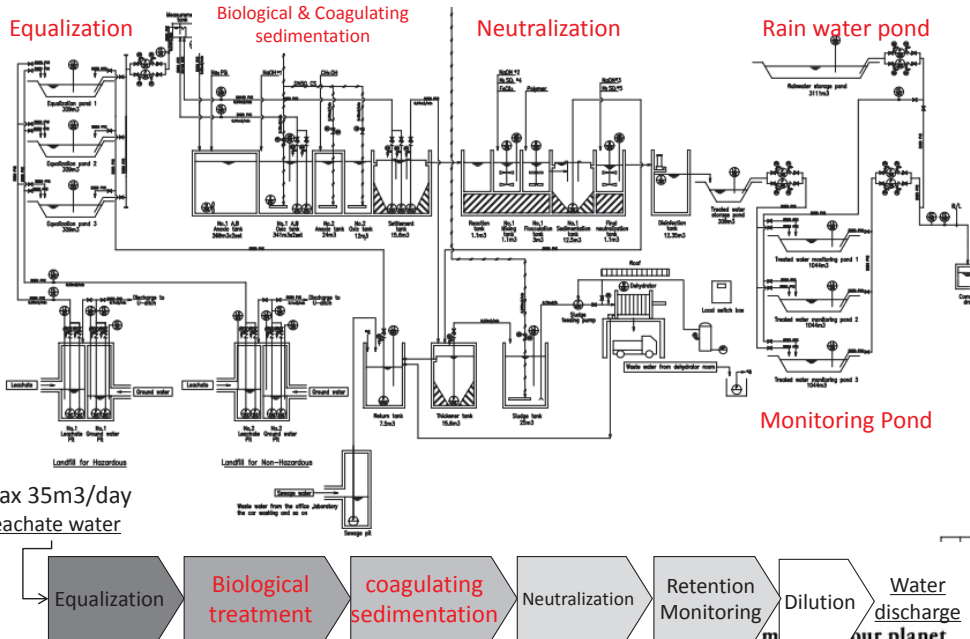
Landfill structure



The structure that has high ability to prevent from leak and entry is based on USEPA (US Environmental Protection Agency) regulation. USEPA regulation is actual standards of the world., our plan in Thilawa also apply to this standards. (Hazardous waste)

In our understanding, there are no facilities of this type in Myanmar. **motivate our planet**

Process of Water Treatment



Laboratory, classification of waste



Sampling



Check

- REACTIVE
- EXPLOSIVE
- INFECTIOUS
- TOXIC
- IN FLAMMABLE
- CORROSIVE
- Etc.

We identify a characteristic of wastes and classify. After that, we decide a treatment method.

Environmental Monitoring Plan

Water

Treated Water Monitoring

| Monitoring Item | Location | Frequency |
|--|---------------------------|-------------|
| pH, EC, DO, ORP | Discharge point (1 point) | Everyday |
| All parameters stipulated in the target level* | Discharge point (1 point) | Bi-Annually |

* Monitoring of Heavy Metals in Dust and Dioxin will be started when laboratory can analyze the parameters in Myanmar

Groundwater Quality Monitoring

| Monitoring Item | Location | Frequency |
|---------------------|---|-----------|
| pH, EC, water level | Pit for leak water checking (1 point) | Everyday |
| pH, EC, Color, Odor | Well to monitor leachate collection (1 point) | Monthly |
| pH, EC, Color, Odor | Well to monitor groundwater (1 point) | Quarterly |

- DOWA will be conducting regular monitoring of the water quality to ensure compliance of target effluent water quality at operation stage.
- Significant changes that exceeds the target level will be assessed to determine if further mitigation measures are needed
- Results will be submitted in a monitoring report to MONREC, TSMC, MJTD.

Environmental Incident and Measure

| Facility | Incident | Measure | Monitoring frequency |
|---------------|------------------------|--|---|
| Landfill | Odor | <ul style="list-style-type: none"> • Full sheets covering except minimum active area • Collection pipe and flare station | Monitoring at inside and outside of landfill site everyday |
| | Waste water (Leachate) | <ul style="list-style-type: none"> • Double layer sheets and long thickness clay • Water treatment facility | Checking water quality level of monitoring well every month |
| Incinerator | Exhaust gas | <ul style="list-style-type: none"> • Multiple treatment system for reduce Dxn's (combustion, quenching, filter) | Monitoring gas concentration level regularly |
| Storage House | Fire | <ul style="list-style-type: none"> • Separating flammable waste • Fire extinguish system | Watching for 24 hours by CCTV and sensor |

Basically, we observe the "Environmental, Health and Safety Guidelines" established by International Finance Corporation (World Bank Group).

Socialization

Community Health and Safety

- Hold the public consultation meeting
- Analysis on traffic accidents in surrounding area
- Health check services for residents living near GEM site



Health Check Service on 28 May 2016

Human Resources

- Employ the residents who live at near site
- Carry out periodic health checking for all employees

Donation

- School
- Monasteries etc.

Case Introduction

Proper Treatment of Hazardous Waste

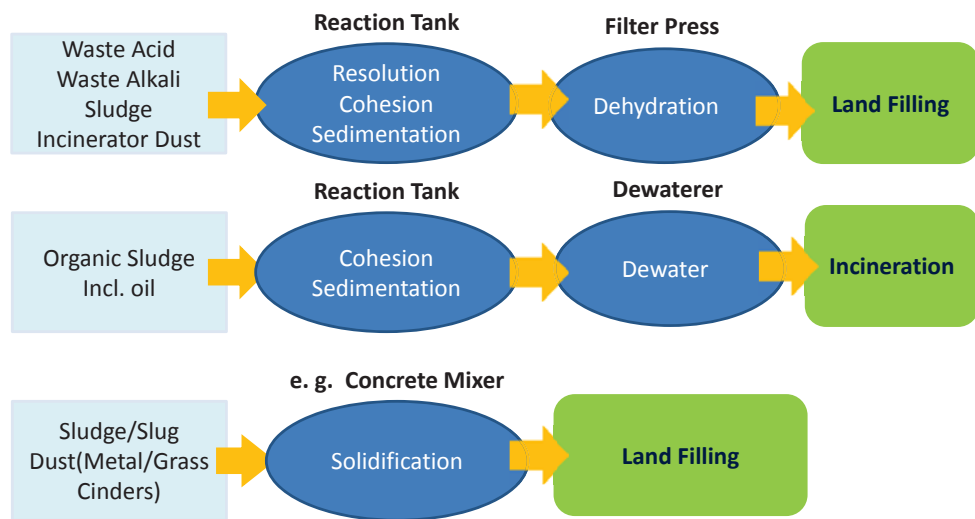
Classification of Hazardous waste in JAPAN

| Source | Type |
|--|---|
| Specially controlled general wastes ※ | Parts using PCB (ex, air conditioner, TV sets) |
| | Dust (collected by dust collecting device installed at a garbage incinerator) |
| | Infectious general waste |
| Specially controlled industrial wastes ※ | Waste oil |
| | Waste acid |
| | Waste alkali |
| | Infectious industrial wastes |
| | PCB contaminated substances |
| | Waste asbestos |
| | Other toxic substances (ex. something that contains DXNs, Heavy metals and chemical substances) |



※ It isn't called hazardous, but Specially controlled in Japan

Hazardous Waste Treatment flow (General)



Example of hazardous waste Treatment



Why treat as Hazardous?

Paint



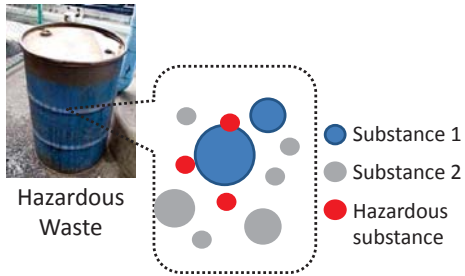
- Resin**: Main material of coating (Ex) epoxy resin
- Pigment**: Making color, thickness and for a rust-resistor
→ heavy metal (lead, chrome)
- Additional Agent**: For paint stabilizing and using easily

Battery

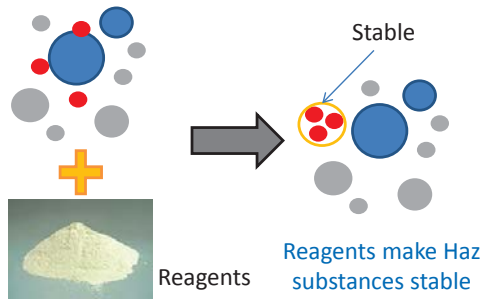


- Electrode**: → Lead
- ELECTROLYTE**: Dilute sulfuric acid (H2SO4)
- Body**: Plastics

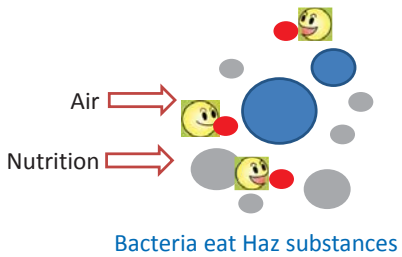
Treatment Mechanism



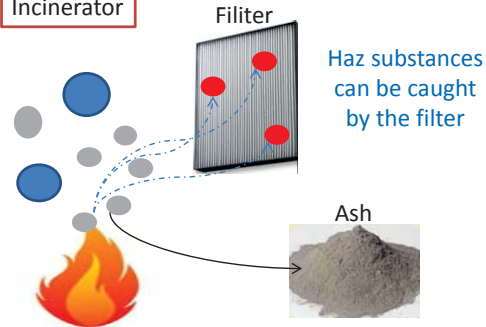
Stabilization and Solidification



Biological treatment



Incinerator



DOWA

- DOWA Group has the many experiences in treating of various types of the waste especially hazardous waste for over 30 years.
- Based on these experiences and technologies, we're convinced of our contribution to environmental protection in Myanmar.

Thank you for your attention!

Integrated Solid Waste Management Target Setting for ISWM

United Nations Environment Programme
Division of Technology, Industry and Economics

International Environmental Technology Centre
<www.unep.org/ietc/>



Target Setting

Mission/Vision
Statements

Social/Political
Agenda

Statements related with Waste Management, Public Health,
Environment, etc.

Draft of Quantitative & Measurable Targets for
Short-term & Long-term

Stakeholders' Consultations

Targets

International Environmental Technology Centre
<www.unep.or.jp/>



Principles for Target Setting

- ❖ To achieve a harmonious development among economy, society and environment;
- ❖ To achieve a consistent development between the city and rural construction;
- ❖ To achieve an integrated planning and a reasonable layout;
- ❖ Comprehensive programming the near future and far future targets;
- ❖ High level of start point and high technology;
- ❖ Realization of minimization, resource recovery and un-harmful disposal;
- ❖ Realistic targets based on local/national situation.

International Environmental Technology Centre
<www.unep.or.jp/>



Qualitative Targets

Short Term objectives (2010-2015)

- ❖ Construct an initial ISWM model on solid waste administration;
- ❖ Construct 1-2 demonstrative living districts with ISWM model;
- ❖ Construct a complete system for municipal solid waste treatment and achieve municipal solid waste minimization, resource recovery and un-harmful disposal;
- ❖ Construct a complete system for industrial solid waste treatment and achieve the aims of circulation, resource reduction and safe disposal.

Long term objectives (2015-2020)

- ❖ Construct a complete ISWM model on solid waste administration;
- ❖ Construct a modern system for municipal solid waste treatment, in which the urban and rural areas are considered together, the layout is reasonable and the resource is adequately utilized, realizing municipal solid waste minimization, resource recovery and un-harmful disposal of municipal solid waste;
- ❖ With the aim of ecological industry zone construction, construct the city as an ecological and modernized new city zone with a harmonious development among economy, society and environment

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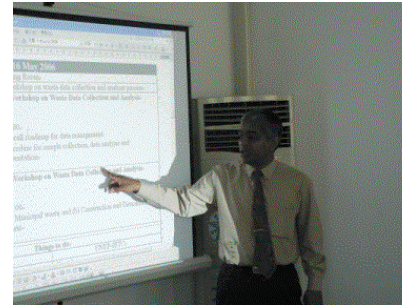
Quantitative Targets

Short term Targets (2010-2015)

- ❖ The collection rate of household solid waste above 60%; the un-harmful disposal rate achieve 80%; reduction rate achieve 10%; resource recovery rate achieve 50%;
- ❖ Comprehensive utilization rate of industrial solid waste above 80%; safe disposal rate of hazardous, medical and radio waste achieve 100%;.

Long term Targets (2015-2020)

- ❖ Achieve 100% environmentally sound treatment and disposal of municipal solid waste, collection rate of municipal solid waste above 90%; the un-harmful disposal rate achieve 100%; reduction rate achieve 50%, recovery rate achieve 90%;
- ❖ Comprehensive utilization rate of industrial solid waste above 85%; safe disposal rate of hazardous, medical and radio waste achieve 100%.



Thank You...

