Municipal Solid Waste Management in the Philippines

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1 Introduction

The Philippines like most developing countries in Asia and the Pacific Region faces more pronounced waste management challenges in urban metropolitan centres. As reported by World Bank in 2001, cities within Metro Manila generate almost 25 % of the country's total waste generation.

These challenges can be attributed to high population density that can bring about high levels of concentration and consumption of packaged foodstuffs and goods. Packaging materials are manufactured from raw materials that may contain non-environmentally acceptable products. There remains also a challenge to deal with disposable or throw-away products whose material components are non-durable and of single use. If these materials remain unmanaged, they can contribute to the severity of the present garbage problem in highly urbanized cities.

With a growing population and a rapidly increasing consumption coupled with increasing urbanization, three key trends characterize solid waste management issues in the Philippines—increase in shear volume of waste generated; change in the quality or make-up of waste generated; and the waste disposal methods.

2 Definition of Municipal Solid Waste

The existing law on ecological solid waste management which is the Republic Act 9003 of 2000 defines solid waste as all discarded household, commercial waste, non-hazardous institutional and industrial waste, street sweepings, construction debris, agriculture waste, and other non-hazardous/non-toxic solid waste.

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A. Pariatamby and M. Tanaka (eds.), *Municipal Solid Waste Management in Asia and the Pacific Islands*, Environmental Science and Engineering,
DOI: 10.1007/978-981-4451-73-4_14,

Unless specifically noted, the term "solid waste" as used in this Act shall not include:

a) waste identified or listed as hazardous waste of a solid, liquid, contained gaseous or semisolid form which may cause or contribute to an increase in mortality or in serious or incapacitating reversible illness, or acute/chronic effect on the health of persons and other organisms;
b) infectious waste from hospitals such as equipment, instruments, utensils, and fomites of a disposable nature from patients who are suspected to have or have been diagnosed as having communicable diseases and must therefore be isolated as required by public health agencies, laboratory wastes such as pathological specimens (i.e., all tissues, specimens of blood elements, excreta, and secretions obtained from patients or laboratory animals), and disposable fomites that may harbour or transmit pathogenic organisms, and surgical operating room pathologic specimens and disposable fomites attendant thereto, and similar disposable materials from outpatient areas and emergency rooms; and
c) waste resulting from mining activities, including contaminated soil and debris

3 Waste Generation and Composition of Solid Wastes

Table 1 was derived from the report by the secretariat of the National Solid Waste Management Commission (NSMWC/S) which shows the daily waste generation by tonnage of the 1,610 local government units by geographical region. The estimated volume was computed by multiplying the average waste generation per capita by the population of each region. The National Capital Region, where Metro Manila is located, recorded the highest waste generation rate of 0.71 kg/capita/day

4 Composition of Solid Wastes

The only data available on waste composition are the results of the waste analysis and characterization survey (WACS) conducted by the Asian Development Bank for Metro Manila in 2003. The WACS was conducted through the technical assistance project of ADB (Asian Development Bank-Metro Manila Solid Waste Management Project, 2002–2003.) specifically for the cities of Makati, Muntinlupa, Pasig, Valenzuela and Quezon City.

The Table 2 shows the results of the findings of the study. Waste generation rates ranged from 0.32 kg/capita/day in Valenzuela City to 0.63 kg/capita/day in Quezon City recorded the highest generation rate of 0.63 kg per capita while Valenzuela City had the lowest of 0.32 kg per capita.

Table 1 Estimated waste generation by region

Region	Daily estimated volume (in tons)	Yearly estimated volume (in million tons)
1	1,640.73	0.5989
2	1,056.57	0.3856
3	3,486.55	1.2726
4-A	3,979.52	1.4525
4-B	873.01	0.3186
5	1,803.51	0.6583
6	2,592.02	0.9461
7	2,501.34	0.9130
8	1,420.22	0.5184
9	1,336.21	0.4877
10	1,626.10	0.5935
11	1,745.25	0.6370
12	1,294.21	0.4724
13	849.26	0.3100
Cordillera Autonomous Region	595.79	0.2175
National Capital Region	8,257.17	3.0139
Autonomous Region of Muslim Mindanao	871.29	0.3180
Total	35,928.75	13.1140

Source NSWMC Secretariat, 2010

Table 2 Results of waste analysis and characterization survey

	Makati	Muntinlupa	Pasig	Valenzuela	Quezon city
Population	421,308	366,674	528,179	519,227	2,301,261
Waste generation average per capita (in kg)	0.57	0.60	0.53	0.32	0.63
Bulk density (avg. kg/cu.m.)	92	172	139	159	218
Moisture content (avg. % air dry)	41	29	33	67	38
Paper	14.7	10.2	12.4	11.3	14.1
Glass	2.4	3.1	5.0	1.4	3.4
Metals	2.7	3.9	11.6	3.1	3.6
Plastics	25.0	28.1	20.9	28.3	21.4
Food waste	32.6	29.1	23.1	38.0	39.9
Other organic	18.9	20.4	18.9	14.2	14.8
Other inorganic	3.5	5.0	6.7	2.2	2.4
Hazardous/special	0.2	0.2	1.4	0.6	0.4

Source ADB Study 2003

Figure 1 shows the composition of wastes from five Metro Manila (5) cities that were covered by the survey (WACS). It was observed that food and other organic wastes comprise about an average of 50 % of total waste generation in each city

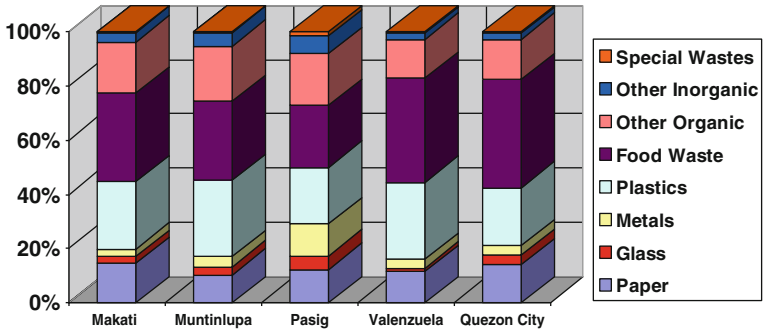

Fig. 1 Comparative waste composition data from five (5) Metro Manila cities. *Source* ADB Study 2003

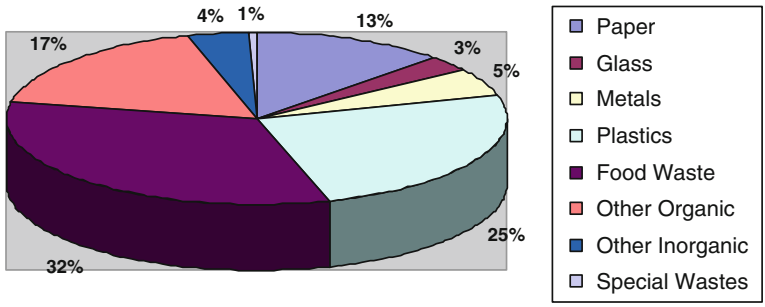

Fig. 2 Average % composition of metro manila wastes

(51.5 % in Makati; 49.5 % in Muntinlupa; 42 % in Pasig; 54.7 % in Quezon City and 52.2 in Valenzuela). The recyclables, including the plastic with 21–28 %, comprise around 42–49 % of the waste. Other inorganics and special wastes comprise about 2–6 % and 0.2–1.4 %, respectively.

The average percentage of the wastecomposition for the five (5) cities was taken in order to get the waste characterization of Metro Manila. Figure 2 shows the waste composition in percentages.

5 Legal Framework

The Ecological Solid Waste Management Act or Republic Act 9003 promotes a paradigm that waste is a resource that can be recovered. The Act puts source reduction and minimization of wastes generated at source and resource recovery, recycling and reuse of wastes as the most preferred options for solid waste management. RA 9003 placed legislated mandatory targets for solid waste diversion, at

25 % waste diversion in the first three years of the Act and increased every three years thereafter.

Other relevant laws enacted at the national level which are relevant to the implementation of RA 9003 are the following:

National law	Description
Republic Act No. 7160	The Local Government Code devolved certain powers to the local governments units, including that enforcement of laws and cleanliness and sanitation, solid waste management, and other environmental matters
Republic Act No. 9275	The Philippine Clean Water Act of 2004 provides for the protection, preservation, revival of quality of fresh, brackish and marine waters of the country to pursue economic growth
Republic Act No. 8749	The Clean Air Act of 1999 which directs all government agencies to adopt the integrated air quality framework as blueprint for compliance. Among its salient provisions are: "Polluters must pay" and the prohibition on the of the use of incineration method which is defined as the burning of municipal, biomedical and hazardous waste or process which emits poisonous and toxic fumes. The prohibition of burning does not apply to traditional small-scale method of community/neighborhood sanitation "siga", traditional agricultural, cultural, health, and food preparation and crematoria. It further mandated LGUs to promote, encourage, and implement segregation, recycling and composting within their jurisdiction. It also required the phasing out of incinerators by July 2003
Republic Act No. 6969	The Toxic Substances and Hazardous and Nuclear Waste Act of 1990. It calls for the regulation and restriction on the importation, manufacture, processing, sale, distribution, use and disposal of chemical substances and mixtures that pose risk and/or injury to health and environment. It prohibits the entry, transport of hazardous and nuclear wastes and disposal into the Philippine territory. It also mandates to provide advance studies and researches on toxic chemicals
Presidential decree No. 856	The Code of Sanitation of the Philippines prescribing Sanitation requirements for hospital, markets, port, airport, vessels, aircraft, food establishment, buildings, and other establishments. Refuse collection and disposal system in cities and municipalities are described in Chapter XVIII of the law.
Presidential decree No. 1586 of June 11,1978	Establishes and institutionalizes an environmental impact system where projects to be undertaken would be reconciled with the requirements of environmental quality. It requires proponents of critical projects and projects located in critical areas to secure an environmental compliance certificate (ECC) areas from the President or his duly authorized representative

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National law	Description
Presidential decree No. 1151	The Philippine Environment Policy whereby all national government agencies and its instrumentalities, government and private corporations, entities, firms are required to accomplish and submit Environmental Impact Statements (EIS) for every action, project or undertaking which significantly affect the quality of the environment
Presidential decree No. 1160	Vesting authority in Barangay Captains (also Barangay Chairmen) enforce pollution and environmental control laws. It also deputizes the Barangay Councilman and Barangay Zone Chairman as peace officers
Republic Act No. 9512	Refers to the Environmental Awareness and Education Act of 2008. This promotes environmental awareness through environmental education. It integrates environmental education in the school curricula at all levels, public or private, barangay day care and pre-school, non-formal, vocational, and indigenous learning

6 Current Waste Management System

The country's current waste management system is clearly defined in the existing primary law on solid waste management which is the Republic Act 9003 of 2000 (Fig. 3). The waste management system involves the formulation of guidelines and setting of targets for waste avoidance and volume reduction through source reduction and waste minimization measures including composting, recycling, re-use, recovery and other processes before collection, treatment and disposal in appropriate and environmentally sound solid waste management facilities.

Under the Act, the local government units are the primary institutional mechanisms for implementing RA 9003. However, the Act also promotes active collaboration between the local government units and the private sector and encourages partnership with cooperatives and associations working on solid waste management.

The waste management law promotes solid waste management following a hierarchy of options (Fig. 4). These options encompass the entire scope of activities involved in waste management starting from volume reduction up to the final waste disposal. The hierarchy also complements with the levels of governance starting from households up to the province or metro wide level of political units.

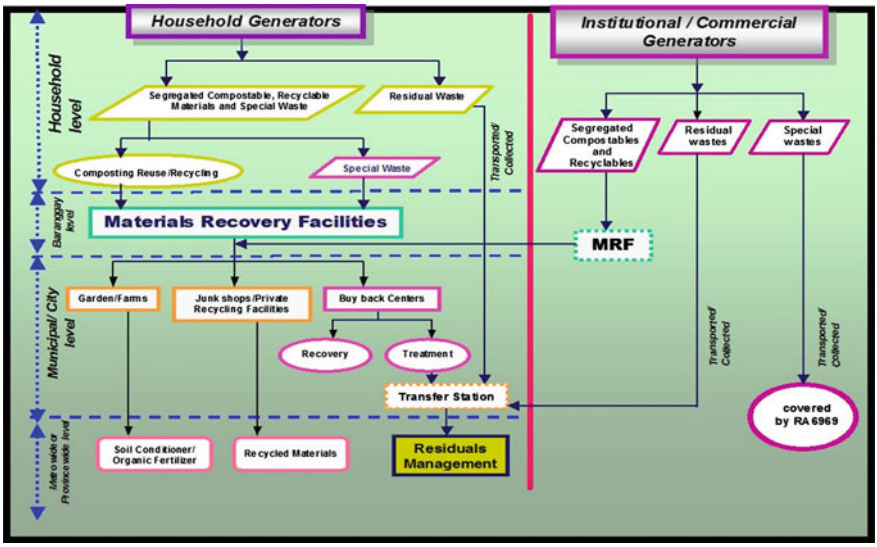


Fig. 3 The SWM system prescribed by Republic Act 9003

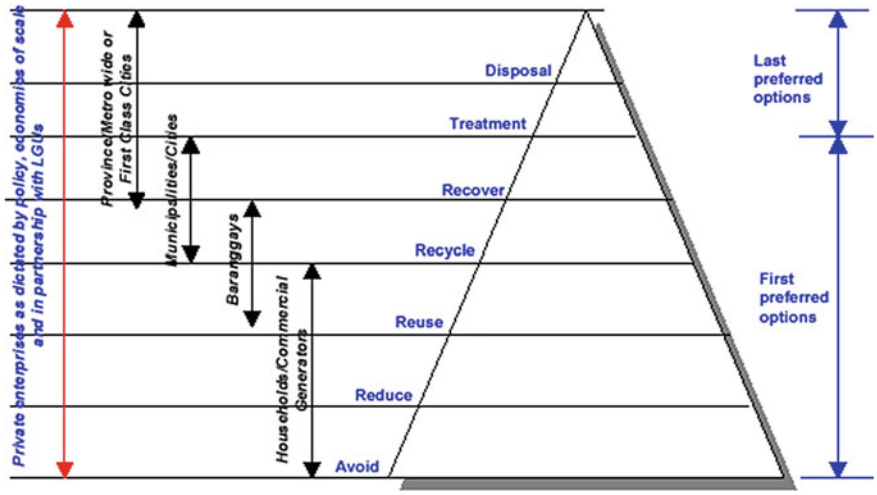


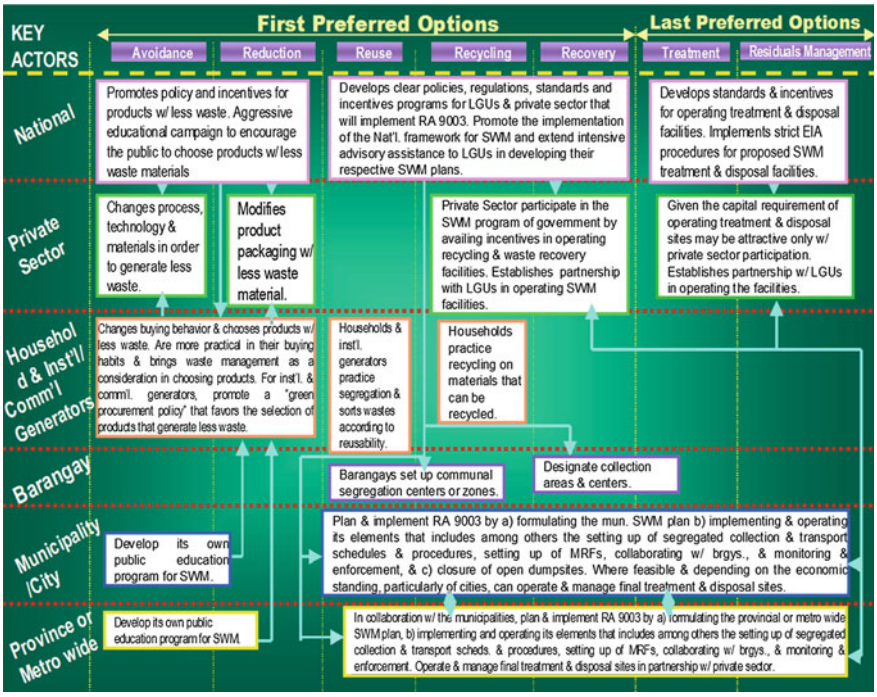
Fig. 4 Ecological solid waste management hierarchy (*Source*: The Philippine National Solid Waste Management Framework, DENR, NSWMC, UNDP 2005)

7 Roles of Local Government Units

The existing waste management system likewise delineates the roles of city or municipal government and the barangays in implementing waste diversion as follows:

a. barangays (or villages) are required to implement mandatory source segregation, to establish materials recovery facility, to collect and process the recyclables and biodegradables. The recyclables are further sorted in Material Recovery Facilities (MRF) and are sold to junkshops while the biodegradables are processed into composts
b. municipal/city government, on the other hand, is tasked to collect and disposed residual and special wastes. For the latter, municipal governments are required to set-up a separate and contained physical areas in their disposal facilities, and whenever feasible, encourage take-back schemes by manufacturers and traders, manage the control, transfer, transport, processing and disposal of solid wastes in the country. This delineation of roles is graphically presented in Table 3.

Table 3 Levels of governance in SWM



Source The National Solid Waste Management Framework

8 Waste Segregation and Volume Reduction at Source

Sorting and segregation of biodegradable and non-biodegradable wastes are done at the household level and all other sources. It is also mandated that wastes segregation shall primarily be conducted at the source, to include household, institutional, industrial, commercial and agricultural sources. Solid wastes shall be segregated and labelled with the following categories: "compostable", "non-recyclable", "recyclable", or "special waste".

The law defines segregation as a solid waste management practice of separating different materials found in waste stream in order to promote recycling and reuse of resources and to reduce the volume of waste for collection and disposal. Some LGUs have strictly enforced segregation at source coupled with segregated collection, through a "no segregation, no collection" ordinance. Compliance of LGUs on the mandatory segregation at source ranges from 53–100 % based on a validation conducted on selected LGUs identified as having good practices on solid waste management.

Role of Materials Recovery Facilities in Waste 3Rs

The law mandates that Material Recovery Facilities (MRFs) shall be established in every barangay or cluster of barangays, The MRF includes a solid waste transfer station or sorting station, drop-off center, a composting facility, and a recycling facility. MRFs serve to reduce the amount of wastes to be disposed of mainly through recycling, composting, and residual treatment. The combination of

Fig. 5 MRFs (Materials Recovery Facilities)

MRF, composting, and other processing activities in some cases are done in so-called Eco-parks.

According to the NSWMC Secretariat, as of 2010, a total of 6,957 MRFs have been established, serving a total of 7,939 barangays from 1,265 MRFs in 2006, serving a total of 1,672 barangays (villages), or an increase of 79 % in the number of barangays covered for a period of four years. Moreover, in recent years, MRFs have also been established in schools, malls, and other commercial establishments (Fig. 5).

9 Collection, Transport and Handling of Solid Wastes

The waste management law defines waste collection as the act of removing solid waste from the source or from a communal storage point. It also provides for a segregated collection of solid wastes. The law further mandates the use of separate collection vehicles, schedules and/or separate trucks or haulers for specific types of wastes.

The vehicles used for the collection and transport of solid wastes have the appropriate compartments to facilitate efficient storing of sorted wastes while in transit. LGUs are primarily responsible for the collection of solid wastes. At the barangay level, waste segregation and collection is conducted specifically for biodegradable/compostable and reusable/recyclable wastes (Rule VIII of the IRR). The cities and municipalities are responsible for the collection and disposal of non-recyclables (residuals) and special wastes using various methods such as: door-to-door collection; stationary collection through the MRFs; and mobile waste collection thru waste collection vehicles.

10 MSW and Climate Change

The results of the latest inventory of greenhouse gases in the Philippines shows that the waste sector contributes 9 % of the total GHG emission which is equivalent to 11,599.07 kilotonnes of CO_2-equivalent (Fig. 6).

But despite of this insignificant GHG emission from the waste sector, the National Climate Change Action Plan, 2011–2028 (NCCAP) recognizes the significance of ecological solid waste management in climate change mitigation and

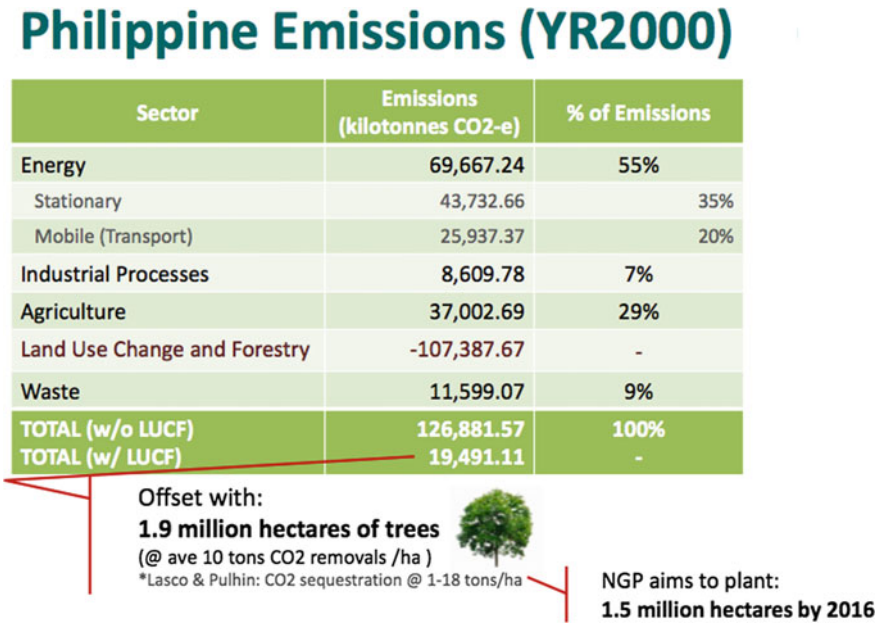


Fig. 6 MSW contribution to GHG emission (*Source*: The Philippine Second National Communication to the United Nations Framework Convention on Climate Change, Philippines, DENR/EMB-CCO 2012)

adaptation as one of its outputs. This is being considered in the Plan's immediate outcome to develop, promote and sustain green cities and municipalities. Relative to this, the following plan of action will be implemented:

a) intensify waste segregation at source, discard recovery, composting and recycling.
b) regulate the use of single-use and toxic packaging materials.
c) Close down polluting waste treatment and disposal facilities.

The specific activities and outputs of the NCCAP in relation to ecological solid waste management are presented in Table 4.

Table 4. National Climate Change Action Plan re SWM: Goals and Outcomes

Table 4 National climate change action plan re SWM: goals and outcomes

Activities	Outputs	2001–2016	2017–2022	2023–2028
3.3.1. Intensify waste segregation at source, discard recovery, composting, and recycling.				
a) Enforce Ra 9003 in every barangay and local government unit.	RA 9003 complied with by all LGUs.			
b) Conduct intensive IEC on waste reduction, segregation and composting.	IEC on waste reduction, segregation and composting conducted.			
c) Establish at-store recycling programs, especially for electronic wastes (e-waste) and low-value recyclables	At-store recycling program established.			
d) Organize informal waste workers-small/medium recyclers-business partnership program to support intensified waste recovery and recycling.	Partnership program between informal waste workers and small/medium recyclers organized.			
e) Design and implement incentive mechanisms to strengthen the local recycling industry and expand waste markets.	Incentive mechanisms studied, designed and implemented to strengthen the local recycling industry and expand waste markets.			
a) Identify and create an inventory of toxic and non-environmentally acceptable packaging materials.	Toxic and non-environmentally acceptable packaging materials indentified.			
b) Conduct a studey and develop a policy, s appropriate, on regulating single-use and toxic packaging materials.	Policy study on regulating single-use and toxic packaging materials conducted.			
c) Develop and implement a system of incentives for the use of reusable bags and containers.	System of incentives for the use of reusable bags and containers developed and implemented.			

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Table 4 (continued)

Activities	Outputs	2001–2016	2017–2022	2023–2028
d) Conduct, in partnership with the private sector and civil society organizations, an intensive IEC program on re-usable bags and "bring-your-own-bag" (BYOP) system.	Intensive IEC program on reusable bags and "BYOB" system conducted.			
e) Ratify the Basel Convention Ban Amendment, which bans hazardous wastes exports for final disposal and recycling from what are known as Annex VII countries (Basel convention parties that are members of the EU, OECD, Liechtenstein) to non-Annex VII countries (all other parties to the convention).	Basel convention ban amendment rectified by congress.			
3.3.3. Close down polluting waste treatment and disposal facilities.				
a) Close down all dumpsites and waste disposal facilities located in environmentally-critical areas.	Dumpsites and waste disposal facilities located in environmentally-critical areas closed.			
b) Implement policy for non-dumping of organic wastes in sanitary landfills.	Policy for non-dumping of organic wastes in sanitary landfills implemented.			

Source National Climate Change Action Plan 2011–2028. Climate Change Commission. 2011

11 Case Study: The Plastic Bag Reduction and Recovery Program of Quezon City

On October 2, 2012, the Quezon City local government passed the Ordinance No. SP-2140 or the Plastic Bag Reduction Ordinance, "An ordinance regulating the use of plastic bags and establishing an environmental fee for its use, providing mechanism for its recovery and recycling and providing penalties for violation thereof".

The city government was prompted to enact this Ordinance as a abatement measure to address the following results of the recent WACS it conducted such as:

Parameter	Value
waste intake at Payatas disposal facility	1,259 tons/day or 1,259,000 kgs/day
% and weight of assorted plastic materials in the waste stream	21 % or 264,390 kgs/day
% and weight of plastic bags in the waste stream	12 % or 151,080 kgs/day
density of waste	210 kgs/m^3
Volume of plastic bags in the waste stream	719 m^3 day or 45 10-wheeler truckload

The significant volume reduction of plastic bags in the waste stream as claimed by the city government would result to minimized litter nuisance and would avoid clogging up of sewerage systems and waterways that is causing floods.

Major implementers of the said ordinance are the "relevant retailers" or otherwise the establishments which are classified into two types such as:

	Establishment
Type 1	• shopping malls, supermarkets, department stores, fast food chains, food stalls, etc.
Type 2	• wet and dry markets, talipapa, tiangge, hawkers, etc.

Section 4. Regulations on the Use of Plastic Bags—The following regulations shall be imposed on the use of plastic bags as carryout bag:

a) Distribution of plastic bags by "Relevant Retailers" lower than the regulated thickness of 15 microns is prohibited under this Ordinance.
b) To ensure the recovery of plastic bags from the waste stream, consumers who will not bring with them "reusable bags" and/or redeem "used plastic bags" for a new plastic bag, shall be charged with a "plastic recovery system fee". Said fee shall be indicated in the customer's transaction receipt as a reminder that they can save money if they use reusable bags and/or if they bring used plastic bags in exchange for a new plastic bag.
c) Stall owners/lessees in wet and dry markets will not be allowed to directly distribute plastic bags… The market management shall assign areas within the market where these plastic bags may be purchased with corresponding transaction receipt.
d) Plastic bags with no handles, holes or strings commonly used for wrapping unpacked fresh foods and cooked foods at supermarkets, restaurants, canteen and the like shall not be included under the scheme as the usage of such plastic bag is justified on the grounds of public hygiene.

* * * *

Section 5. Purpose of the "Plastic Recovery System Fee". Primarily, the imposition of the "fee" seeks to change consumer behaviour rather than generate fund. It is a move towards shifting habits from mindless consumption to a lifestyle that is anchored on the 3 R's of Waste Management.

Further, this "Plastic Recovery System Fee" shall be earmarked for a "green fund" that shall be maintained by the stores to fund other initiatives that would benefit the environment.

Source Quezon City Ordinance No. SP-2140, S-2012.

A Plastic Bag Recovery System fee of •2.00 will be charged to consumers who are not using a reusable bag for every carryout bag that will be provided by the retailer. The fee can be refunded by the consumer if the used carryout bag will be brought back to the store provided that the bag is clean, dry and folded.

Retailers are also enjoined to formulate incentive system or point system for consumers who are using reusable bags or to have a "Green Lane" or special cash counters to facilitate store transactions by consumers who are complying with the city ordinance.

The following are the infraction and penalties that will be charged against any establishment that will violate the provisions of the city ordinance.

1st Offense	A fine not exceeding ₱1,000.00
2nd Offense	A fine not exceeding ₱3,000.00
3rd Offence	A fine not exceeding ₱5,000.00 and cancellation of business permit

The City Ordinance is one of the many options that tackles and deals with the "throw-away" mentality of product consumers through its intent of setting up a system of effective reduction and recovery scheme. The participation of both the citizens and the business sector is vital in effecting the regulation related to 3R's of waste management. This likewise requires utmost political will from government enforcers.

Regulations with monetary-based mechanism such as the imposition of an environmental fee could also address the senseless consumption and optimize the use of products. These would further mainstream the use of recyclable and reusable goods in consumption patterns and at the same time, entice significant participation from the general public in sustaining a clean and a healthy environment.

12 Conclusion

The Philippines, through the implementation of Republic Act 9003, adopts an ecological solid waste management program that would involve systematic and comprehensive approaches and procedures.

The provisions of the law would require environmentally-sound methods that optimize the utilization of resources and encourage resources conservation and recovery; set guidelines and targets for solid waste avoidance and volume reduction through source reduction and waste minimization measures; ensure the proper segregation, collection, transport, storage, treatment and disposal of solid waste through the formulation and adoption of the best environmental practices in ecological waste management; and encourage greater private sector participation in SWM; among others.

The enforcement of the law places greater burden on the hands of the local government units in finding ways and means in improving solid waste management at the local level. At the municipality and barangay levels, the local government units need to provide the leadership and persistence in ensuring that waste avoidance and reduction are in place.

Local ordinances that provide enabling mechanism for the effective implementation of national law, are important in promoting compliance with solid waste management rules and regulations. Complementing with the issuance of the ordinance, information and education campaign should be undertaken as a support mechanism.

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