

Bangkok, Thailand

City Information

Population: 10.60 million (Registered about 5.7 million persons, Non-registered about 4 million persons including the commuters from surrounding neighborhood cities, 2015). Population density in 2013 was 3,625 person/sq.m. ,with an increase of .98% per year, while the ethnic proportion is 80 % Thai, 10% Chinese, and 10% others .

Area (km²): 1,568.7



Climate: Generally hot and humid as located in the tropical area under the influence of Southeast Asian monsoon system, it can be divided into three seasons: “hot” season (March - June), rainy season (July - October), and “cool” season (November – February). Temperatures typically range from 19°C to 38°C (66-100 °F). During 2003 - 2012 the average minimum temperature trends to be higher than before year 1997. In according to that data, Meteorological Department (MED) presented in the 2013 technical paper that in year 2012 average temperature in Thailand was 0.6°C higher than normal. Recently, published Annual Weather Summary over Thailand in 2014 indicated that all months except January and February were warmer than normal for the 1981-2010 period, and this year was slightly above normal for many areas mainly in November. Besides this, there were no tropical cyclones hitting Thailand. Rainfall total for 2014 was 1520.4 millimeters, 4% below normal. A large contribution to the annual rainfall total came from monsoon trough and southwest monsoon accompanied by several cyclones dissipating nearby the country.

Main Economic Activities:

Bangkok has different income structure¹ from the other cities in the nation. The top 5 of non-agricultural activities are:

1. Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods (853,980)
2. Manufacturing (502,039)

¹ Gross Provincial Products (GPP) of Bangkok: Million baht

3. Real estate, renting and business activities (462,017)
4. Finance (442,327)
5. Transport, storage and communications (405,195)

While the agriculture gains only 2,837 million baht or 0.08 % total GPP of Bangkok².

City website: <http://www.bangkok.go.th/main>

Country Information

Population: 67.74 million with annual growth rate of about 1.3 %

Area (km²): 514,000

Economy and GNI/Capita

Upper middle income economies (\$4,126 -\$12,745)

Main Economic Activities

The Thai economy remains largely export driven and robust and is the second largest in Southeast Asia³. Thailand's export worth approximately USD 180 billion per annum, consist primarily of agricultural products, including fish and rice, the latter of which Thailand is one of the largest exporter of in the world, as well as textiles, rubber, automobiles, jewelry, and computers/electronic appliances.

To elaborate this and use the International Standard Industrial Classification of all Economic Activities (ISIC), those top 5 activities would rank as follow:

1. Manufacturing (e.g. Food product and beverage, motor vehicles, Chemicals and chemical products, Rubber and plastic products, Petroleum refinery, etc.) 27.7 %
2. Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods 14 %
3. Agriculture 11.3 %
4. Transport, storage and communications 7 %
5. Real estate, renting and business activities 6.9 %

Government Agencies responsible for guidance on waste legislation

There are several acts and several ministries involves in waste management and legislation related in Thailand⁴, namely,

Ministry of Natural Resources and Environment-The Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992) for issuing the ministerial regulations on the requirements over the procedures of collection and transportation of household hazardous waste and electronic waste;

² Office Statistics Thailand, retrieved from http://web.nso.go.th/en/stat_theme_eco.htm on the 11th July 2015 and <http://www.nesdb.go.th> on the 11th July 2015

³ The Eleventh National Economic and Social Development Plan B.E. 2555 – 2559 (A.D. 2012 – 2016)

⁴ www.pcd.go.th, www.anamai.moph.go.th, www.diw.go.th, and www.dla.go.th

Ministry of Public Health - The Public Health Act B.E. 2535 (1992) for issuing the ministerial regulations to stipulate waste collection charge range at the country level for local authorities to issue its own specific fee based on their cost;

Ministry of Industry- The Hazardous Substances Act B.E.2535 (1992) for issuing the ministerial regulation to control and manage all industrial wastes;

Ministry of Interior- The Town Planning Act B.E. 2518 (1975) for mandatory requirements of areas to be used as the site for integrated waste disposal;

- The Determination of Plan and Procedure in Decentralization of Authority to the Local Administrative Organizations Act, B.E. 2542 for

1. Administer the finances of Local Government Organizations.
2. Provide support for the preparation of Local Development Plans.
3. Handle waste management within governed areas.

The core agencies in charge of waste management (guidance, compliance and enforcement) under those mentioned acts are following;

1. Waste and Hazardous Substances Management Bureau, Pollution Control Department under Ministry of Natural Resources and Environment,
2. Bureau of Environmental Health, Health Department under Ministry of public Health,
3. Bureau of Industrial Waste, Department of Industrial Works under Ministry of Industry,
4. Bureau of Social Economic and Public Participation Development, Department of Local Administration under Ministry of Interior,

All the Acts and legislation related are available on website of those agencies but mainly published in Thai.

In 2015, the central government announced the waste and hazardous waste management roadmap to be implemented. The roadmap includes short term to long term measures and policy for the whole life cycle of production of waste. The related regulations are being reviewed for priority and need to be amended. Thus the technical and financial support is provided to the local government for the specified critical areas for waste management. In addition, waste management information is planned to be disseminated to build the capacity of local authorities as well as to promote the participation of the communities in the roadmap in order to achieve the goal together. In line with the roadmap, Ministry of Interior has developed the Action Plan for Waste Management for local authority implementation.

Classification of MSW

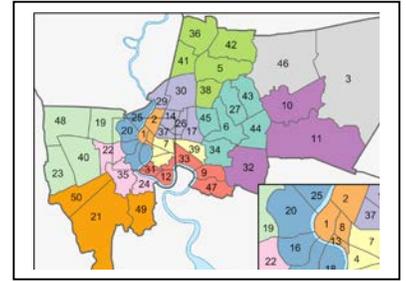
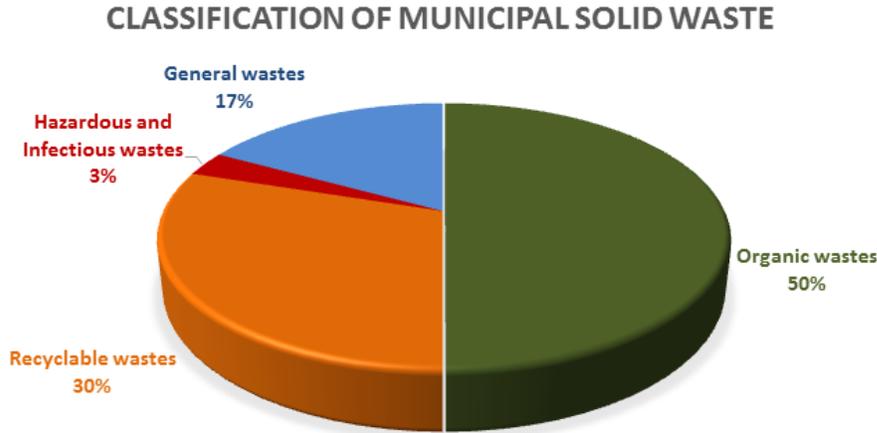
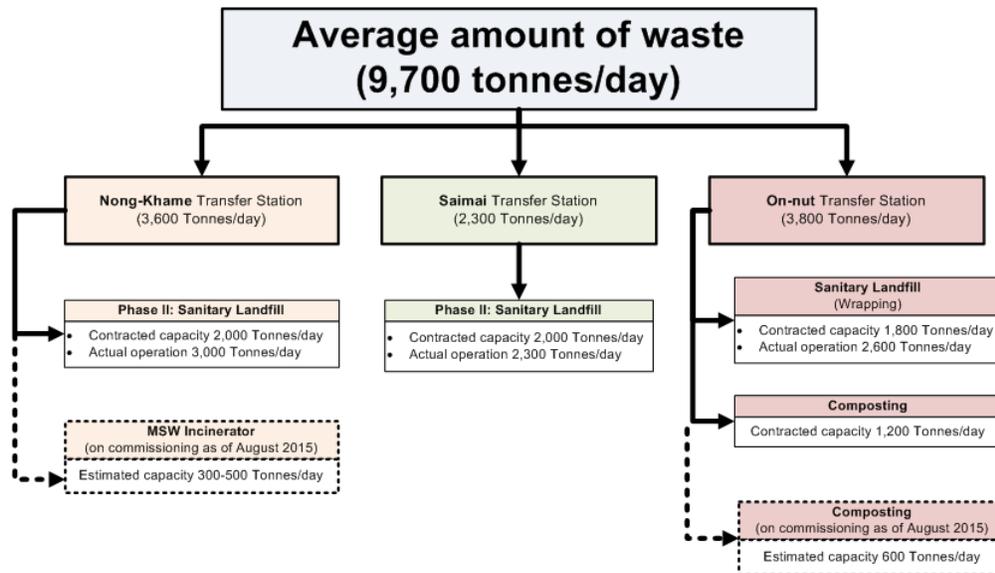


Figure 5: Classification⁵ of MSW by BMA

MSW Generation

In year 2014, BMA collected 9,940 tonnes per day of municipal waste⁶ on average or total in 3,628,100 tonnes/year. In regard to the population this can be calculated as 438 per capita in Kg/year].

All municipal solid wastes (MSW) classify into 4 categories/types by BMA. They consist of general solid waste, organic solid waste, recyclable solid waste, and household hazardous waste.



Source: Bangkok State of Environment 2012 (revised edition), modified by RRCAP study team

Figure 60 : Bangkok Metropolitan Administration Waste Management

⁵ Bangkok State of Environment 2012 (revised edition), modified by RRCAP study team

⁶ Bangkok State of Environment 2012 (revised edition), BMA

Collection Coverage and Type

All 50 district BMA offices mainly manage MSW collection⁷ for each household, community, building and commercial area. District offices provide proper bins to communities and buildings. All of those bins are placed at the selected positions for BMA collecting services. Targeting to achieve 100 % collection coverage, BMA has provided collection service in cooperation with the private sector with the rental trucks for ground base collection. Boats for picking waste from canals are also provided. BMA also outsources 2 private companies for waste transferring to disposal at the landfill sites outside of Bangkok.

Waste Composition

The waste stream has a high organic waste content, mainly food, branches and leaves, estimated to be around 48 % with significant levels of recyclable materials (14%) such as plastics, paper, glass, foam, and metal, while those non-recyclable wastes (38%) such as rubber, fabric and textiles have been transferred to landfill sites.



Source: Bangkok Climate Change of Master Plan Efficient Solid Waste Management and Wastewater Treatment Sector, July 2015, modified by RRCAP study team

Figure 8 : Waste Composition of 2014

Waste Management Practice

Sanitary landfill process is predominant practice while formal recycling and recovery rates are unknown. The types of materials reused and recycled have been promoted to several sectors such as public schools, local communities, offices, and factories.

BMA indicated the MSW process into 3 categories; [1] Waste minimization and separation, [2] Waste collection and transportation, [3] Waste treatment and disposal. That is different from

⁷

general MSW process, consisting of [1] Solid waste collection, [2] Solid waste transportation, [3] Treatment (including many technologies—i.e. recycling, etc.), [4] Disposal of solid waste.

Formal Waste Sector

Formal waste sector of BMA applies many of activities of MSW life cycle; segregation, collection, transfer and disposal. (Figure 12) BMA outsources the transfer and disposal process to private sector under the conditions of 100% MSW transferred to the transfer station daily.

Segregation:



Source: BMA, 2012

Figure 10 : Garbage bins for waste separation in public places. **Figure 11 :** BMA Bin for hazardous waste



BMA conducts many MSW preventive measures, 3R campaigns (Reduce, Reuse, Recycle), Community Based Solid Waste Management (CBM) Projects, Development of Solid Waste Management in the District Office, pilot projects at schools for waste separation and Integrated waste management projects, development of an integrated waste management system, sustainable organic waste management model, etc.

BMA MSW Management Campaign

1. Separation of MSW at sources
2. Effective routes and collecting points of MSW
3. Reduce and reuse food wastes
4. Recycle shop initiative
5. Separation and reuse of branches or trunk of trees
6. Collecting point and recycle of carton of drinks
7. Reduce plastic bag and foam by promote the use of bio-degradable
8. Promoting the environmental sound management at source
9. MSW management in school
10. Promoting to reduce and separation of MSW in large buildings
11. Route and collecting point of hazardous wastes
12. Separation of the electronics waste in household level

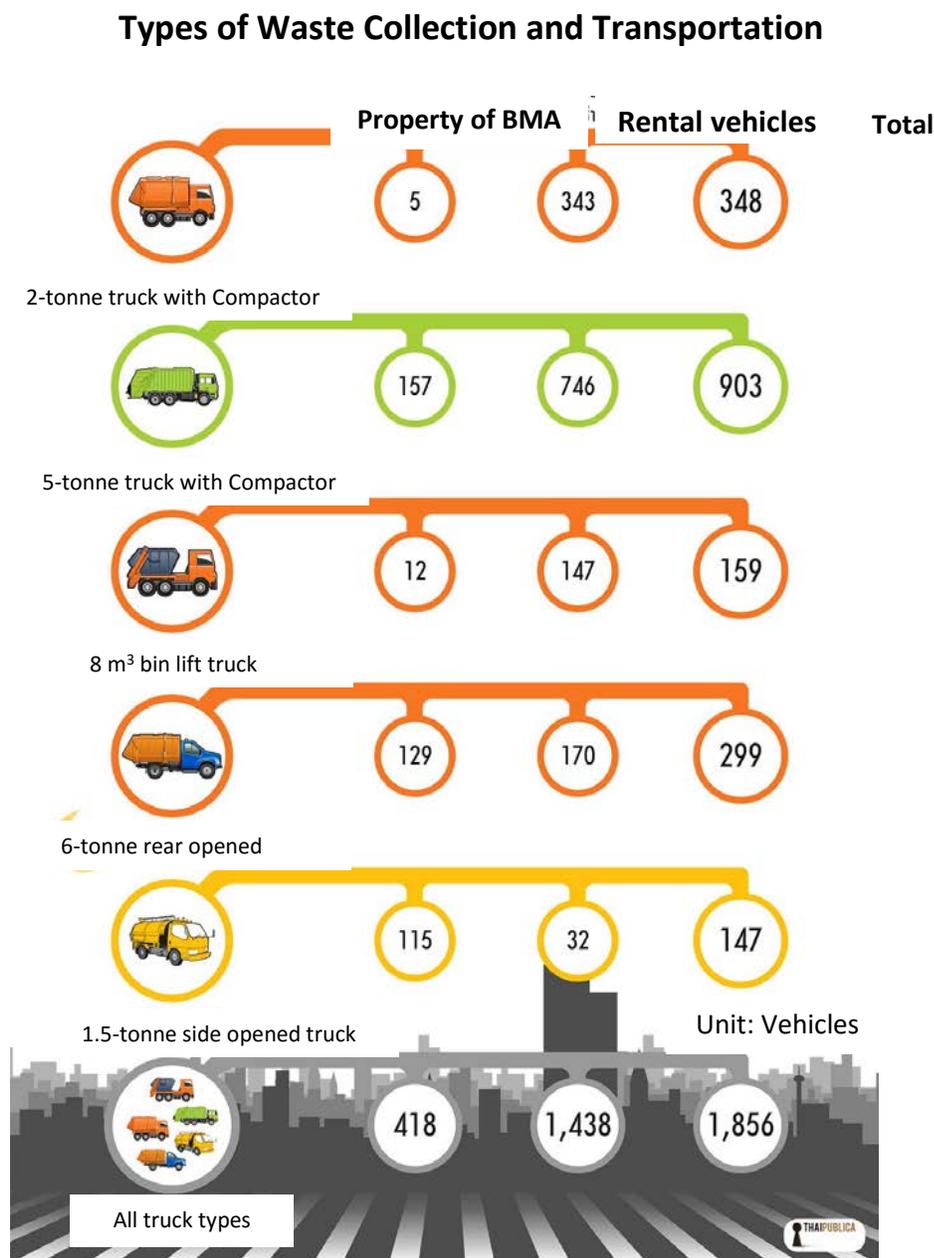
Source: Bangkok State of Environment 2012 (revised edition)

There are many types of the collection vehicles for MSW in BMA area; trucks, boats, specific trucks.

Hazardous Waste (3%) •Every 1 st and 15 th of each month	Organic Waste (50%) •Everyday	RecyclableWaste (30%) •Every Sunday	General Waste (17%) •Everyday or Every other day, depending on its location
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Source: MSW Master Plan of BMA B.E.2558-2562, modified by RRCAP study team

Figure 13 : Timetable of MSW Collection at BMA



Source: <http://thaipublica.org/>, modified by RRCAP study team
Figure 14 : Types of Municipal Solid waste Collection Trucks at BMA

There are three transfer stations in operation and a new transfer station near Rachavipa intersection is under commissioning. The details of some transfer stations are illustrated as below.

Nongkham station consists of a new MSW incinerator under construction and a transfer station of general waste to transfer to landfill outside Bangkok, Nakorn Pathom province.



Source: RRCAP, 2015
Figure 23: Transfer station (overflow collected mixed wastes, will be cleared daily)



Figure 24: Conventional push pit building at transfer site

Informal Waste Sector

The informal waste sector, consisting of junk shops, second handed/recyclable waste mobile shops, junk collectors, and sorting waste workers, are key actors of informal waste sector on MSW management in Thailand. There are none of primary data of informal waste sector on BMA report.

Financing of MSW

BMA charges for only the collection fee under the polluter-pay-principle (PPP) under the BMA Ordinances. (*Annex of Ministry of Public Health Regulation: Solid Waste and Night Soil Collection Fees B.E.2545* (Table 3). All of the collection charges are collected by sub-district offices under the BMA Environmental Bureau. There are no others charges.

Table 3: Collection fees

Amount of MSW	Collection Fee	Frequency
< 20 litres/day	20 THB/month	Every 6 months or yearly
< 500 litres/day	40 THB/month (every 20 litres by amount of MSW)	Every month or every year
> 500 litres/day (not exceeds 1,000 litres/day)	2,000 THB/month	Every month or every year
> 1,000 litres/day	2,000 THB/1,000 litre/month	Every month or every year
Remarks: BMA has assigned employee under the Cleaning Service and Public Park Section, e.g. garbage bin carriers, collection truck drivers, to collect the fee from household, those entrepreneurs or source owners		

Source: BMA, 2015

Waste Management Challenges

Primary database system

The District Offices take key roles in MSW management in BMA throughout the whole process of management. The primary data of MSW management is the most important to analyze and propose the better MSW management in the future, particularly to achieving the low carbon society goals. Many records are not collected in the constructive database system to be used for carbon consumption calculation.

The establishment of primary data of MSW management for examples; numbers of each collection vehicles and their fuel consumptions, numbers of each transportation vehicles and their fuel consumption, trip cycle and routes, fuel consumptions of each facilities in the process of sanitary landfill, logistic analysis for trip cycle and fuel consumptions, etc.

Segregation

There are many pilots or small projects of good practices of the segregation at its sources, however the sustainability of each program, particularly the public perception and understanding of how important to segregate MSW at its sources, remains unclear. BMA provides enough segregated collection vehicles at their front doors. The timetable of each type of waste collection in a weekly schedule or monthly schedule needs to be well informed to the public, repeatedly.

Composting facilities

There are hand sorting processes to separate non-composting solid wastes at the composting facilities. Machines need to be replaced to sort out non-composting solid waste.

Financing records

There are confusing and difficult to retrieve financing data records related to the MSW process management.

Good practices

BMA transfer and disposal approaches to guarantee 100% of MSW collection and transportation to sanitary landfill are the good practices in the collection and transfer process. The segregation is needed for more improvement to separate each types of MSW at its sources and to reduce loading of sanitary landfill disposal. The recycle sanitary landfills are also the good practices on disposal site. However, the other disposal technologies for examples MSW incinerators, composting technologies, and others are also put in place in order to reduce the transportation cost to landfill.

MSW Sector Overview: Country Level

General description and overview of common practice

Less than half of waste generated in local administration areas is collected and disposed of in a sanitary manner. Thus recycle waste centers are significantly presented nationwide. Those improper disposal methods include open burning, household burying, and open dumping along streams and roads are being used in the rural areas. Even then, some amount of collected waste is still waiting to be properly disposed.

Waste Generation (per capita/year)

In 2013, the Pollution Control Department conducted a survey on the volume of solid waste generated in the country using questionnaires and field surveying. The target group of the survey was 7,782 Local Administration Organizations (LAOs) throughout the country including 2,273 municipalities and Pattaya City, 5,508 Sub - district Administrative Organizations (SAO), and Bangkok Metropolitan Administration (BMA).

The result showed that the volume of MSW generated in 2013 was about 26.774 million tonnes, or about 73,355 tonnes a day. The volume can be divided into the solid waste generated in BMA at about 4.137 million tonnes (16%), the solid waste generated in municipalities and Pattaya City at about 10.241 million tonnes (38%), and the solid waste generated in SAO at about 12.396 million tonnes (46%).

Source: Thailand State of Pollution Report 2013, PCD, Thailand

Collection Coverage

Out of 7,782 local administration organizations, 4,179 (54%) of them provided waste transport and disposal services. About 7.421 million tonnes, or 20,332 tonnes a day, equal to 52% of the total volume of the collected waste is delivered to suitable waste management facilities. On the other hand, 6.938 million tonnes, or 19,008 tonnes a day, equal to 48% of the total volume of the collected waste, especially in small LAOs, were unsuitably disposed of by open burning or open dumping into old abandoned pits or undeveloped areas.

Number of Landfills/MSW Disposal rate (tonnes/year)

Recycling Rate

Waste management of Or In year 2013, only 53.6 % of total waste generation or 14.359 million tonnes of the collected solid waste was disposed of at one of the 2,490 waste management facilities scattered throughout the country. The waste management facilities can be divided into suitable disposal facilities and unsuitable facilities. Suitable waste disposal sites refer to 446 sanitary landfills, engineered landfills, control dumps with the capacity of less than 50 tonnes/day, incinerators with air pollution control systems, Waste to Energy Technology (WTE), composting, and mechanical biological treatment systems .

On the other hand, unsuitable waste disposal sites refer to 2,024 open dumps, control dumps with the capacity of at least 50 tonnes/day, open burning sites, and incinerators without air pollution control systems.

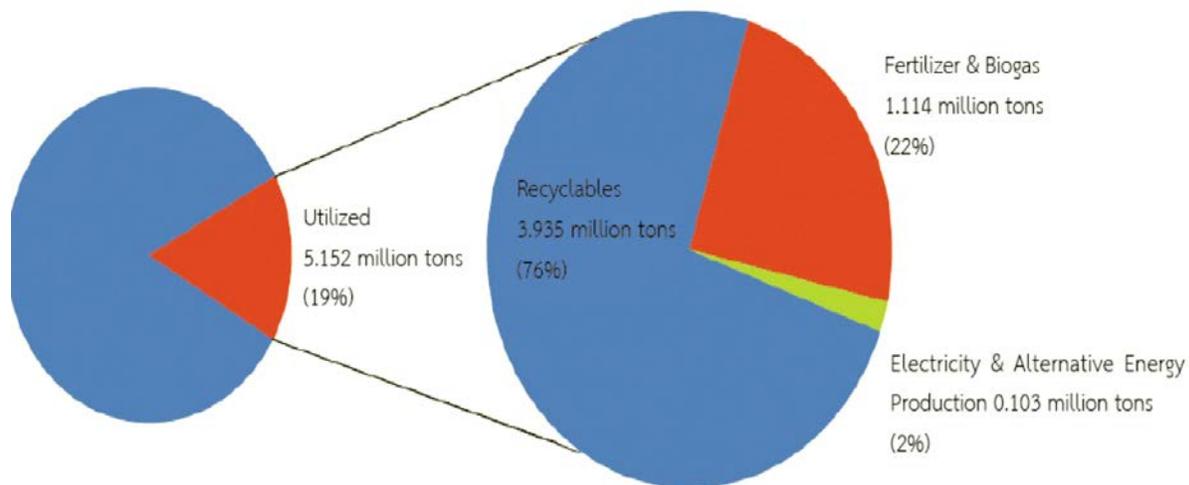
Source: Thailand State of Pollution Report 2013, PCD, Thailand

Waste management of Organic fraction (composting, anaerobic digestion)

Organic waste utilization is processed by sorting organic waste including food scraps, vegetables, and fruits in order to make compost and enzyme ionic plasma used as fertilizer, and to make biogas used as an alternative energy source. The volume of organic waste collected for this purpose was around 1.114 million tonnes

Source: Thailand State of Pollution Report 2013

Energy Recovery Rate



Source: Thailand State of Pollution Report 2013, modified by RRCAP study team

Figure 80 : The proportions of the utilized Municipal Solid Waste in 2013

Plans, Strategies, Policies (incl. financial instruments) & National Objectives

City Level

Aimed at improving Waste Management in General

The main objectives of the city strategic plan are to develop the environmental sound MSW management. The framework of MSW management is to focus on the separation of solid wastes at sources from collection to disposal; to reduce amount of solid wastes by enhancing 3Rs, and to implement the integration of multi-functional MSW management.

The targets set to achieve the amount of collected domestic solid wastes from household shall be reduced not less than 7% in comparison of total amount of the wastes in B.E.2556. The amount of collected hazardous waste from household shall be increased not less than 20% in B.E.2562, the amount of recycling shall be increased not less than 30% of the collected solid wastes in B.E.2556.

The existing BMA 3R campaign consists of the reduce and separation of MSW at its sources for reuse and recycle .



Source: BMA, July 2015

Figure 81: The Existing MSW Management of BMA

Aimed at addressing Climate change and reducing SLCPs through waste related activities

BMA proposed the BMA Master Plan B.E.2558-2562 under the concept of “Solid waste is the resources”. The 3R (Reuse, Reduce, Recycle) are promoted to primary sustainable solid waste management at BMA under reasonable environmental friendly technology, participating by all interested parties and to reduce the effects on global climate change.

Source: Municipal Solid Waste Master Plan of Bangkok Metropolitan Administration B.E.2558-2562 (2015 -2019)

Country Level

Aimed at improving Waste Management in General

As mentioned earlier, the government is implementing the Waste and hazardous waste management roadmap; as a result, the core ministries (MNRE, MOPH, MoIn, MOI) have elaborated the Roadmap by initiating various plans and activities to accomplish it. Those initiatives can be projected by the following items.

Strategy:

1. Social strategies
To promote participation between public sectors, private sectors and public awareness to reduce waste and to increase the utilization of organic wastes and recyclable wastes.
2. Economic strategies
To promote the investment of private sectors in using clean technology for goods production, waste treatment and disposal management. In addition, taxation might be used (if necessary) as a tool for reducing wastes generated from production process.
3. Legal strategies
Establish laws and revise existing laws and regulations as well as emphasize on law enforcement in order to make various steps of waste management more effective.
4. Supportive strategies

To support the research and development of appropriate technology for producing environmental friendly products

Recently, Pollution Control Department has organized a Public Hearing for Draft Master Plan for National Waste Management (2016 -2021) before the preparation to submit to the Cabinet, while Ministry of Industry has published the Strategic Plan for Industrial Waste within 5 years (2015 - 2019). In addition to that, every province has developed the provincial plan for waste management in according to the Roadmap.

Aimed at addressing Climate change and reducing SLCPs through waste related activities

There are many projects that will be implemented through the national Roadmap plan to change the open dumping and unsanitary mismanaged landfill into waste to energy conversion, which will reduce SLCPs (methane) from composting.

Legislation

City Level

Legislation governing MSW management

Bangkok Metropolitan Administration (BMA) using several Acts for handling with waste management scheme, more than 10,000 ton/day generated.

1. The Bangkok Metropolitan Administration Act B.E. 2528 (1985)
Section 92 authorize BMA to provide service to private sector, government agencies, state own organizations, or local administrations with service charge by issuing Bangkok Ordinances

Sector 97 those Ordinances must be approved from the Bangkok Assembly

As a result, the following BMA ordinances were announced;

- BMA Ordinance: Management of the Solid Waste or Nightsoil Collection/Disposal Operator or those who benefit from this service B.E. 2541(1998)
 - BMA Ordinance: Service Fee B.E.2543 (2000)
 - BMA Ordinance: Collection, transportation and disposal of night soil and waste B.E. 2544 (2001)
 - BMA Ordinance: Solid Waste and Nightsoil Collection Fee According to the Public Health Act (2003)
 - BMA Ordinance: Solid Waste and Nightsoil Collection Fee According to the Public Health Act (Second Issue) (2005)
 - BMA Ordinance: Criteria for the Solid Waste and Nightsoil Management of Building and Public Health Facilities (2002)
 - BMA Ordinance: Designate date Time and Place to Dispose Solid Waste for BMA Citizen
2. The Public Health Act B.E.2535 (1992) and the Amendment (Issue 2) B.E.2550 (2007)
Section 4 (definitions)

In this Act, “sewage” means excrement or urine, and including any other thing that is filthy or gives foul odor;

“waste” means waste paper, waste cloth, waste food, waste goods, waste materials, plastic bag, food container, soot, animal dung or carcasses, including any other thing swept away from road, market place, animal farm, or other places, and including infectious waste, toxic or hazardous waste from community;

- describe that the local administration has duty to handle waste from collecting, transportation, transfer and disposal
 - define 4 types of waste management for local administration, namely; self operation, outsourcing, collaboration with other government agency (ies) and licensing
 - specify the maximum limit of the service charge, only collecting fee at present but in the future there will be transportation and disposal fee as well.
3. The Public Cleansing and Orderliness Act B.E.2535 (1992)
- describe about the government function to keep public clean and in order

 - aim to control people behavior not littering or discharge excreta on road/ in public places
 - describe that the landlord or building owner shall prevent the excreta or waste dumping in their property.
4. The Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992)
- determine the environmental quality standard for water, air, noise, and other conditions of environment which are used as the general criteria for enhancement and conservation of environmental quality
5. The Private Investment in State Undertaking Act B.E.2556 (2013)
- designated private sector to invest in the provision of adequate infrastructure and public service to citizen thus the state resource is utilized worthily and efficiently and thereby enhancing the country's competitiveness and allows the liberalization of trade and investments with other countries.

Guidance for MSW management (after legislation, before inspection activities)

BMA has developed and published several guidance publications for public and children to raise awareness and provide technical information to promote waste management, several publications are listed below.

- Household Manual for Waste Separation
- Solid Waste Community Based Management guide book
- Manual for Handling Household Hazardous Waste
- Manual for Environmental Volunteer
- BMA Action Plan for Public Health and Environment
- etc

National Level

Legislation governing MSW management

- The Constitution B.E. 2550 (A.D.2007)
- Public Health Act B.E.2535 (A.D.1992)
- Enhancement and Conservation of National Environmental Quality Act B.E.2535 (A.D.1992)
- Public Cleansing and Order Act B.E.2535 (A.D.1992)
- Municipality Act B.E.2496 (A.D.1953)
- Sub-District Council & Local Administrative Organizations Act B.E.2537 (A.D.1994)
- Provincial Administrative Organization Act B.E.2542
- Determination of Plan and Steps in Decentralization of Authority to the Local Administrative
- Organizations Act B.E.2542 (A.D.1999)
- The Private Investment in State Undertaking Act B.E.2556 (2013)

Guidance for MSW management (after legislation, before inspection activities)

The core agencies have developed various guidelines and a manual for the relevant authorities and public interest, those documents have been disseminated through several channels such as hard copy, web sites, technical meeting/training, public seminar, etc. The following are several guidance publications:

1. Regulation and Guideline of Municipal Solid Waste Management
2. Guideline of Waste Management and Waste-to-Energy Technologies for Municipalities
3. Manual for Minimization, Utilization and Segregation of Municipal Solid Waste
4. Guideline and Requirement for Municipal Solid Waste Reduction Reuse and Recycling
5. Manual for Monitoring of Landfill Contaminated Groundwater
6. Guidelines and Code of Practice for Waste Minimization and Utilization
7. Guideline for Public Health Facilities to Develop the Standard Healthcare wasteManagement System
8. Success Stories from Pilot “Green and Clean” Hospitals
9. Code of Practice for Solid Waste and Night Soil Management

Inspection activities/supervision and enforcement of legislation

- For illegal dumping of waste, the relevant agencies in the area would collaborate to investigate the case such as waste composition, toxicity, etc, therefore they have enough evidence to take legal actions against landowners and order appropriate disposal of the waste.

Current Projects or Activities Aimed at Reducing SLCP Emissions

JICA – Master plan development for Bangkok city on climate change mitigation including waste sector 2013-2023.

Bangkok can severely be affected by negative impacts of climate change, it is also the case that Bangkok is contributing to the deteriorating climate change situation. In 2008 Thailand’s national GHG emission per capita was estimated at 3.54 tonne. It is still low comparing to other countries, however the GHG emission of Bangkok is higher in comparison of other capital city. It is expected to increase due to its

rapid economic growth. In other words, while Bangkok can be a victim of climate change, it is also responsible for climate change at the same time.

BMA decided to accelerate actions to respond climate change on the cooperation with JICA on the Bangkok Master Plan on Climate Change 2013-2023 Project to elaborate measures for mitigation and adaptation to climate change with its domestic and international partners.

There are five areas of study:

1. Environmentally sustainable transport
2. Energy efficiency and alternative energy
3. Efficient solid waste management and waste water treatment
4. Green urban planning
5. Adaptation

A future vision toward establishment of a low carbon and climate change resilient cities includes five keys as follows;

1. BMA in partnership with the national government ministries and agencies, take a major responsibility to mitigate and adapt to climate change.
2. BMA endeavors to establish well balanced action to harness economic and social development and climate change concerns.
3. BMA takes comprehensive approach to the low carbon and climate change-resilient urban development and action-oriented approach to the implementation of the Master Plan, as a vehicle in evolving nature.
4. BMA promotes actions by citizens, the private sector, academia, as well as other key players to mitigate and adapt to climate change, which should involve, multi-channel communication platform, innovative ways of promotional schemes and low carbon technology leapfrogging.
5. BMA, as a leading City of Southeast Asia and the world, takes proactive measures to mitigate and adapt to climate change in short, mid and long terms.

Key Stakeholders

- Bangkok Metropolitan Administration
<http://www.bangkok.go.th/main/page.php?306-%20Bangkok%20Environment>
- Pollution Control Department
Address: Phahon Yothin, Samsen Nai, Phaya Thai, Krung Thep Maha Nakhon 10400
Phone:02 298 2000
<http://www.pcd.go.th/indexEng.cfm>
- Ministry of Public Health
Department of Health , Ministry of Public Health
88/22 Tambon Talad Khwan , Amphur Muang , Tiwanond Road , Nonthaburi 11000 , Thailand
Tel: +66 2590 4000
<http://eng.anamai.moph.go.th/main.php?filename=index>
<http://www.moph.go.th>
- Ministry of Industry
Department of Industrial Works
Address: 76/5, Rama 6 Rd.,, Rajthevee, Bangkok,, 10400; Thailand, 10400
Phone:02 202 4000
<http://www.diw.go.th/hawk/default.php>

Private Sector/ subcontractor

- Pairoj Sompong
Address
17/7 Moo. 2 Petchkasem Rd., Aomyai, Samphan Nakornpathom,73160 Thailand
Email:info@pairoj.co.th
Tel:+662 4202370,+662 4202971
Fax:+662 8115132
<http://www.pairoj.co.th/en/index.php>
- Group 79 Co.,LTD.
Address: 127-9 Moo 1 Thammasala A. Muang Nakornpathom 73000. Tel : 66 34 395018
e-mail : info@group79.com
<http://www.group79.com/Sanitary.htm>
Wasaduphan-turakit Co.,Ltd.
Address: 1 127-9 Phetkasem Rd, Thammasala, Mueang Nakhon Pathom District, Nakhon Pathom
73000 Phone:034 248 003
- AKKHIE PRAKARN Public Company Limited
<http://www.irplus.in.th/listed/akp/history.asp>
- The Krungthep Thanakom Co.,Ltd
Address: 90 Cyber World Tower 38Fl., Tower A, Ratchadaphisek Rd., Huai Khwang, Bangkok
10310
Tel : 02 168 3368 Fax : 02 168 3369
<http://www.thanakom.co.th/thanakom/index.html>

Euro Waste Engineering Co., Ltd.
H/O: 120 Kasemkit Bldg., Silom Rd., Suriwong subdistrict, Bangrak district, Bangkok

C&G Environmental Protection (Thailand) Co., Ltd.
Address: 12th Floor, Panjathani Tower, 127/14 Nonsee (Ratchadapisek)
Rd., Chonnonsee, Yennawa, Bangkok
Tel: (66)2-294 8355
Fax: (66)2-294 7199
<http://www.cg-ep.com/>

50 District Communities

Additional Useful Information

State of Pollution in Thailand 2013 by Pollution Control Department
<http://infofile.pcd.go.th/mgt/report2556.pdf?CFID=21771363&CFTOKEN=79687886>

Bangkok State of Environment 2012
<http://203.155.220.174/pdf/BangkokStateOfEnvironment2012RevisedEdition.pdf>

Thailand Road Map for Waste Management 2014
http://www.pcd.go.th/info_serv/File/BoardDirectorsRoadmap1.pdf

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