Municipal Solid Waste Management in Malaysia: Strategies in Reducing The Dependency on Landfills.

Fauziah S.H. and Agamuthu, P.
Institute of Biological Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia
fauziahsh@um.edu.my; agamuthu@um.edu.my

Abstract

Current municipal solid waste (MSW) generation in Malaysia ranged from 1.2–1.5 kg per capita resulting in the generation of 30,000 tonnes per day. Unfortunately due to the lack of integrated waste management system in the country, approximately 95% of the MSW are sent into the 230 operating landfills/dumps. This created various environmental issues namely pollution to the surrounding area including soil and rivers, and the rapid exhaustion of landfill space. This calls for the urgent need to strategize and improve the current waste management practices, particularly waste disposal options. This paper discussed the current challenges and the future scenario of waste management system in Malaysia. It also highlights the strategies proposed by the government in improving the waste management system in the country after the implementation of the Solid Waste and Public Cleansing Management Act 2007 (SWPCM Act 2007). The enforcement of SWPCM Act 2007 in September 2011 sees many improvements in waste management services particularly the collection system and commitment from the waste concessionaires. Yet, due to the lack of comprehensive and reliable data, proposed improvements can be very challenging. This is proven when many programs including recycling campaigns and installation of incineration failed to achieve the targets. Nevertheless, with the implementation of SWMPMC Act 2007, it is hoped that these challenges can be solved to a certain extent. The Act also imposes that only sanitary landfills are permitted to treat and dispose MSW in the country. As a result, more sanitary landfills with appropriate liners and amenities are being built while existing non-sanitary landfills are being upgraded to a Class IV of Malaysian non-sanitary landfills standard. Even though the construction of sanitary landfills promotes safe confinement for MSW, it is very costly. Financial aspect of the planning, constructing and managing sanitary landfills can be very challenging particularly to concessionaires without strong financial capability. From a different aspect, siting of new landfill has become a huge problem to many waste managers. Not-in-my-backyard (NIMBY) syndrome and the increase in price of land are among the major contributing factors that create dilemma and challenges to waste managers. Landfills managers need to ensure that their landfills can survive the intended period or life-span in order to generate revenue from their services. This is not an easy task since recycling rate is only 5% that diversion of MSW from disposal is nearly insignificant. Yet, the future seems more promising since the newly establish National Department of Solid Waste (NDSW) has initiated various strategic plans in improving the current waste management system. The strategies are committed via the strengthening of the SWPCM Act 2007 with the target to reduce 40% MSW from the landfill disposal. The strategies include the promotion of 3Rs and composting, waste-to-energy options including anaerobic digestion, and thermal treatment such as incineration. NDSW had conducted extensive programs to collate background information on waste management. This provides better foundation to improve the country’s waste management systems in the near future.

Keywords: MSW, Waste Management Policy, waste management hierarchy, Malaysia

Introduction

Waste generation is inevitable. This is so since all anthropogenic activity would result with the generation of waste. To certain extend, a sustainable ecosystem has a capacity to recycle complex waste and make it available in a simpler form. However, this is no longer applicable with the rapid growth in human population. Additionally, human intervention and alteration of the ecosystem has impeded the natural recycling process of waste material. Thus, waste generated need to be properly managed in order to prevent detrimental effects to human health and the environment.

Global municipal solid waste (MSW) generation is exceeding 1.3 billion tonnes due to the rapid human growth and the increase in the standard of living (World Bank, 2012). It was reported that the current average generation of MSW in the world is 1.2kg per capita per day and this is expected to reach 1.42kg per capita per day in 2025 (World Bank, 2012). As a result, by 2025, 2.2 billion tonnes of waste need to be dealt with by the cities in the world. This alarming situation has been given serious attention by the relevant authorities particularly in developed countries. Yet, similar consideration is not available in many parts of the developing nations.

This paper discusses the current challenges and the future scenario of waste management system in Malaysia. It will also highlight the strategies proposed by the government in improving the waste management system in the country after the implementation of the Solid Waste and Public Cleansing Management Act 2007 (SWPCM Act 2007).
**Municipal Solid Waste Generation in Malaysia**

Early management of MSW in Malaysia involved very little effort since waste was generated at a manageable level (Table 1) and generally consist of organic materials such as food waste, paper, wood and others (Fauziah and Agamuthu, 2012).

Table 1: Generation of MSW in major urban areas from 1970 to 2012 in Peninsular Malaysia (adapted from Agamuthu and Fauziah, 2011)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Kuala Lumpur</td>
<td>98.9</td>
<td>310.5</td>
<td>586.8</td>
<td>2754</td>
<td>3100</td>
<td>3387</td>
<td>3489</td>
<td>3701</td>
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<tr>
<td>Johor Bharu (Johor)</td>
<td>41.1</td>
<td>99.6</td>
<td>174.8</td>
<td>215</td>
<td>242</td>
<td>264</td>
<td>272</td>
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<tr>
<td>Ipoh (Perak)</td>
<td>22.5</td>
<td>82.7</td>
<td>162.2</td>
<td>208</td>
<td>234</td>
<td>256</td>
<td>264</td>
<td>280</td>
</tr>
<tr>
<td>Georgetown (P. Pinang)</td>
<td>53.4</td>
<td>83.0</td>
<td>137.2</td>
<td>221</td>
<td>249</td>
<td>272</td>
<td>280</td>
<td>297</td>
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<tr>
<td>Klang (Selangor)</td>
<td>18.0</td>
<td>65.0</td>
<td>122.8</td>
<td>478</td>
<td>538</td>
<td>588</td>
<td>606</td>
<td>643</td>
</tr>
<tr>
<td>Kuala Terengganu (Terengganu)</td>
<td>8.7</td>
<td>61.8</td>
<td>121.0</td>
<td>137</td>
<td>154</td>
<td>168</td>
<td>173</td>
<td>184</td>
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<td>Kota Bharu (Kelantan)</td>
<td>9.1</td>
<td>56.5</td>
<td>102.9</td>
<td>129.5</td>
<td>146</td>
<td>160</td>
<td>165</td>
<td>175</td>
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<td>Kuantan (Pahang)</td>
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<td>45.2</td>
<td>85.3</td>
<td>174</td>
<td>196</td>
<td>214</td>
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<td>Seremban (N. Sembilan)</td>
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<td>85.2</td>
<td>165</td>
<td>186</td>
<td>203</td>
<td>209</td>
<td>222</td>
</tr>
<tr>
<td>Melaka</td>
<td>14.4</td>
<td>29.1</td>
<td>46.8</td>
<td>562</td>
<td>632</td>
<td>691</td>
<td>712</td>
<td>755</td>
</tr>
</tbody>
</table>

* extrapolated figures

During 1970s when MSW collection was first introduced, the services were mainly catering the waste collection at public places such as wet-markets while irregular collection covered housing schemes in the urban areas. It mainly involved the hauling of waste from the collection areas to designated dumping grounds. This began to change with the growing population in late 1970s that simple waste management system was further improved to avoid the proliferation of disease and the deterioration of environmental quality through pollution (The Star, 2007). The earlier days saw that MSW collected consist mainly of food waste and other organic matters. Yet, after 1980s when plastic manufacturing began to influence the goods-making production, MSW generated becomes more and more complex. To date, MSW received by landfills in Malaysia consist of more than five types of plastics together with various components of plastic mixtures.

As the people become more educated, the demand for a more sustainable MSW management system became increasingly significant. The mushrooming of more housing estates escalates the need for regular and systematic waste collection system in the urban, sub-urban and rural areas. It compelled the local municipality in the country to provide satisfactory waste management services to the areas under their jurisdiction. It is crucial as the waste generation increased rapidly and improper handling of waste may result with health risk to the community (Agamuthu and Fauziah, 2011).

The cost for waste collection alone had utilized more than 70% of the local authorities funds (Nadzri, 2012). Due to the financial burden faced by the local authorities, the federal government initiated privatization of waste management in the country. The interim period contracted for the privatization was from 1994 to 2011. Under full privatization or the concession period, concessionaires were mandated to implement the best management practice and try to improve the waste management system in the country.

**Current Collection system**

To date, Malaysian waste management service providers are Alam Flora Pvt Ltd that caters the need of central and eastern region, E-Idaman Pvt Ltd catering the northern part, and Southern Waste Management Pvt Ltd for the southern region of Peninsular Malaysia. As for East Malaysia, the waste management is still under the responsibility of the local government.

Due to the privatization, waste collections have been significantly improved. This is partly due to the contract between the federal government and the concessionaires involving the fulfillment of the key performance index (KPI) and the revocation of the license. Privatization of the waste management in Peninsular Malaysia sees various improvement in the system namely the waste collection and waste disposal practices. Waste collection was recorded to be more systematic and efficient involving specific collection schedule at least twice a week in residential areas and daily collection for commercial and communal centers.

**Current MSW Treatment Technologies**
Daily generation of MSW in Peninsular Malaysia had exceeded 30,000 tonnes where at least 60% consisted of retrievable materials including organic matter, paper, plastic, metal and glass. However, the main bulk of the generated waste (95%) was sent to landfill for disposal. Approximately 14% paper, 15% plastic, 3% metal and 3% glass composed together with at least 25% organics were not tapped that all of these resources ended unutilized in the landfills. Figure 1 illustrates the composition of Malaysian MSW.

The dependency of waste disposal on landfill is contributed heavily by the lack of integrated waste management system in Malaysia. As a result, waste cells in landfills exhaust rapidly and more new areas are required to site new disposal facilities. To date more than 190 landfills are operating in Malaysia (Nadzri, 2012). Yet, less than 10% are sanitary landfills that risk of environmental contamination namely to water and soil is very high (Fauziah and Agamuthu, 2012). Improving the current waste management system in Malaysia is not an easy task. This is mainly due to the fact that various challenges need to be overcome. Among the most significant challenges are the financial constrains in improving waste management facilities and indifferent attitudes of the people.

Challenges in MSW Management in Malaysia
The challenges faced in MSW management in Malaysia become more evidence after the privatization of waste management services. As a result, the original two concessionaires namely Northern Waste Pvt. Ltd. and Eastern Waste Pvt. Ltd awarded with the waste management service concession failed to perform, and is being replaced by E-Idaman Pvt. Ltd. and the local government, respectively.

The taking over of waste management service resulting with the concessionaires having to deal with the old machineries such as garbage trucks and compactors inherited from the local authorities. As a result, the concessionaires have to invest on the maintenance and repairing. As for the income, the inconsistency of payment by the local authorities serviced by the concessionaires make the possibility to turn their capital very difficult. Consequently, this financial constrain caused the concessionaires without strong capital-backup failed to sustain. Furthermore, with such constrain, construction and alteration of solid waste management facilities are very impossible to be achieved.

Though the MSW contains high portion of recyclable items which if retrieved to the maximum can generate good income for the concessionaires, the task is extremely complicated due to the indiscriminate throwing habit of Malaysians. The practice of mixing all waste in a single garbage bags has been so deep among the citizen that sorting out recyclables from the waste stream is nearly impossible. It also reduced the quality of the recyclables to be marketed due to the impurities and moisture present. The practice of separating recyclables from the waste stream had been repeatedly encouraged via various recycling campaign. Yet, the response from the people is very low that to date official recycling rate is still at 5% since 2000. The indifferent attitude among Malaysians when it comes to waste separation is very difficult to be changed.

As for the lack of enforcement by the relevant authorities, it was due the lack of policy and regulations pertaining to waste management before 2007. The lack of specific regulations on waste disposal was the contributing factors for illegal dumping of MSW along roads and in secluded areas. The lack of monitoring capacity by the authorities is mainly due to the fact that no designated workforce are assigned to the task since no regulations were stipulated to cater that needs.
The MSW management issues become more prominent in 2007 when leachate contamination polluted the water catchment area in Klang valley that caused huge public uproar. As a result, the Solid Waste and Public Cleansing Management (SWPCM) Act, 2007 was passed by the parliament after a 10 years debating period. Ever since the passing of the SWPCM Act 2007, more significant improvement can be seen in the MSW management in the country.

**Solid Waste and Public Cleansing Management Act 2007**

The enforcement of SWPCM Act 2007 in September 2011 sees many improvements in waste management services particularly the collection system and commitment from the waste concessionaires. Yet, due to the lack of comprehensive and reliable data, proposed improvements can be very challenging. This is proven when many programs including recycling campaigns and installation of incineration failed to achieve the targets. Nevertheless, with the implementation of SWMPCM Act 2007, it is hoped that these challenges can be solved to a certain extent.

**Improvement on landfilling siting and management**

The Act imposes that only sanitary landfills are permitted to treat and dispose MSW in the country. As a result, more sanitary landfills with appropriate liners and amenities are being built while existing non-sanitary landfills are being upgraded to a Class IV of Malaysian non-sanitary landfills standard. Table 2 lists the existing sanitary landfills in Malaysia until 2010.

<table>
<thead>
<tr>
<th>Name of landfill</th>
<th>Status of disposal facilities</th>
<th>In Operation</th>
<th>Location (state)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bukit Tagar Sanitary Landfill</td>
<td>Operating</td>
<td>2006</td>
<td>Selangor</td>
</tr>
<tr>
<td>Air Hitam Sanitary Landfill</td>
<td>Closed</td>
<td>1995</td>
<td>Selangor</td>
</tr>
<tr>
<td>Jeram Sanitary Landfill</td>
<td>Operating</td>
<td>2008</td>
<td>Selangor</td>
</tr>
<tr>
<td>Seelang Sanitary Landfill</td>
<td>Operating</td>
<td>2004</td>
<td>Johor</td>
</tr>
<tr>
<td>Pulau Burong Sanitary Landfill</td>
<td>Operating</td>
<td>2001</td>
<td>Penang</td>
</tr>
<tr>
<td>Mambong Sanitary Landfill</td>
<td>Operating</td>
<td>2000</td>
<td>Sarawak</td>
</tr>
<tr>
<td>Bintulu Sanitary Landfill</td>
<td>Operating</td>
<td>2002</td>
<td>Sarawak</td>
</tr>
<tr>
<td>Sibu Sanitary Landfill</td>
<td>Operating</td>
<td>2002</td>
<td>Sarawak</td>
</tr>
<tr>
<td>Kota Kinabalu Sanitary Landfill</td>
<td>Operating</td>
<td>2001</td>
<td>Sabah</td>
</tr>
<tr>
<td>Tanjung Langsat Sanitary Landfill</td>
<td>Operating</td>
<td>2005</td>
<td>Johor</td>
</tr>
<tr>
<td>Tanjung 12 Sanitary Landfill</td>
<td>Operating</td>
<td>2010</td>
<td>Selangor</td>
</tr>
<tr>
<td>Miri Sanitary Landfill</td>
<td>Operating</td>
<td>2006</td>
<td>Sarawak</td>
</tr>
</tbody>
</table>

Even though the construction of sanitary landfills promotes safe confinement for MSW, it is very costly. Financial aspect of the planning, constructing and managing sanitary landfills can be very challenging particularly to concessionaires without strong financial capability. From a different aspect, siting of new landfill has become a huge problem to many waste managers. Not-in-my-back-yard (NIMBY) syndrome and the increase in price of land are among the major contributing factors that create dilemma and challenges to waste managers. Landfills managers need to ensure that their landfills can survive the intended period or life-span in order to generate revenue from their services. This is not an easy task since recycling rate is only 5% that diversion of MSW from disposal is nearly insignificant.

Therefore, under the provision of the SWPCM Act 2007 the National Department of Solid Waste (NDSW) has been established in 2007 to integrate the national solid waste management. NDSW has initiated various strategic plans in improving the current waste management system. Among the most crucial target is the reduction of 40% MSW from landfilling. The strategies are committed via the strengthening of the SWPCM Act 2007 from various aspects including licensing provision, charges for waste management services and research and development in MSW management in the country.

**Licensing Provision**

Under the licensing provision, licenses are compulsory to anyone who is involved in the waste management field including:

1. To undertake or provide any solid waste management services,
2. To manage or operate any solid waste management facilities; or
3. To undertake or provide any public cleansing management services.

With the provision, NDSW will be able to do proper monitoring and collate necessary information for future planning and improvement of MSW management system. Contravention to the license provision will be
convicted to a fine of RM50,000-RM100,000 (~EUR13,000- EUR 26,000), or imprisonment for a term not exceeding five years, or both. Also, mentioned under this provision is the power for NDSW to impose additional, vary or revoke conditions to the licensees (SWPCM Act, 2007). Therefore, the licensees are obliged to the regulations stipulated in the SWPCM Act 2007. This provision will enable the NDSW to continuously improve the condition to suit the availability of advanced technologies of global waste management. However, it is necessary that the requirement is not being impeded with other factors such as financial constrains and unavailability of technical expertise.

### Charges for Waste Management Services

To ensure the sustainability of the waste management service provider, their financial consideration is highly regarded by the government. This is to avoid failure to allow turn-over of the capital experienced by the waste management services providers during the interim period of the privatization in the 1990s from reoccurring.

Under the charges provision, authorization will be given to the Solid Waste and Public Cleansing Corporation (SWPCC) or relevant parties to demand, collect and retain the MSW charges, fees or levy in respect to the services provided. They are entitled to recover additional charges for late payment from the owner, occupier, local authority or any other person, from whom charges, fees or levy for MSW services is due and remains unpaid after a certain due date. This is to ensure that MSW generators are responsible to cover the cost of waste they generate. The additional payment of late charges is necessary as a fine to prevent accumulating debt among the waste generators.

Any person who fail or refuses without any acceptable reasons to pay the charges can be convicted to a liability of a fine of RM 5,000 (EUR1,300) and further fine of RM50 (EUR13) for everyday during which the offence is continued (SWPCM Act, 2007). A Tribunal for Solid Waste Management Services has been established to ensure the smoothness of the enforcement of the SWPCM Act 2007, particularly in dealing with the charges of MSW services. Additionally, the SWPCM also encourages the implementation of new and more efficient technology to improve the waste management system further. This is made possible with the allocation of fund under the SWPCC for research and development purposes.

A fund namely the Solid Waste and Public Cleansing Management Fund has been established which is controlled and operated by the SWPCC. The fund is meant to be expended to pay among other the charges, fees, or levy in relation to the waste management services to the waste management service providers. Additionally, various research and development can be carried out under this funding scheme as an effort to improve the waste management strategies in Malaysia. The most extensive commission carried out by the NDSW is the collation of background information on waste management in the country. This task is very crucial to develop effective planning strategies as an initiating step towards sustainable waste management system in Malaysia. From the compilation of data, various strategies have been identified.

### Strategies of the National Department of Solid Waste

Since the NDSW had targeted the diversion of 40% MSW from landfill stream, more emphasis have been directed to the reduction and recovery of MSW. Among others the strategies include the promotion of 3Rs and composting, waste-to-energy options including anaerobic digestion, and thermal treatment such as incineration.

#### Promotion of 3R activities

Various campaigns have been organized since 2000 to promote 3R activities among Malaysian. However, the recycling rate in particular has been very low and was not able to significantly reduce the volume of waste sent to landfills for disposal. Nevertheless, unofficial recycling was found to be more than 15% of the total waste generated. Yet, the refusal of the unregistered recyclers to participate in the data collection has disabled the capability of the NDSW to capture the actual recycling rate in the country. Thus, extensive campaigns have been launched since September 2011 to promote proper recycling activities. This campaign involved various mass media including advertisement in television, radio and websites.

Additionally, a range of incentives have been introduced to encourage the public to participate in the 3R activities. Promotions of these activities were carried out in schools and learning institutions, in government offices and residential areas, and in public places such as hypermarkets and shopping complexes. The promotion of the 3R activities also involves the participation of voluntary bodies including the non-governmental agencies (NGOs) and residential associations. Apart from recycling and the 3R activities, the NDSW also strategized the possibility of converting waste to value added products.

#### Waste to Value Options

Among the options taken into consideration by the NDSW to divert the MSW by 2015 are biological treatments of organic waste and thermal treatments. A huge discussion was organized by NDSW recently in April 2012 indicated their seriousness in finding the most appropriate technologies to solve the MSW issues in Malaysia. The discussion involved various stakeholders including relevant government agencies, research institutions,
industrial sectors and private entities in waste management, NGOs, media and others. The outcomes of the discussion include the identification of several strategies to be implemented by the government to enable the reduction of 40% MSW from landfill disposal. Among others are composting of the organic wastes and biogas generation.

Composting and anaerobic digestion are found feasible due to the fact that the technologies are rather simple and the resources are available. As for the capital investment, though composting plant incur smaller capital than anaerobic digestion plant, the latter has bigger market potential. This is so as biogas is more marketable in Malaysia than MSW compost. This is due to the recent government policy that promote the generation of renewable energy including energy from waste. Yet, both options were thoroughly analyzed and the implementation of these technologies would be dependent on its suitability to the regions.

Thermal treatment options were also looked into as an alternative to divert the waste from landfill. Incineration with energy conversion capacity is favorable due to the value creation. However, the feasibility study is necessary to determine its suitability to be implemented in Malaysia. This is due to the fact that the high moisture content of Malaysian MSW (~60%) lowered the calorific value of the incinerated materials. Thus, further study on this option has been proposed to avoid failure in its implementation.

Conclusion
The current challenges of waste management system in Malaysia need to be analyzed prior to any recommendation of improvement. Once identified, these challenges can be the foundation for the government to find appropriate mitigation measures to overcome the possible obstacles. With the implementation of the SWPCM Act 2007, various strategies have been proposed by the government in improving the waste management system in the country. SWPCM will enable the successful implementation of the strategies planned to tackle at least 40% MSW from the landfill stream thus promote more sustainable waste management in Malaysia.

References


