

# WASTE MINIMISATION AND THE ENVIRONMENT

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## Abstract

There is a genuine concern on problems related to municipal solid waste (MSW) management in Malaysia. With waste generation rates of 0.76 kg/person/day, Malaysia will soon face serious problems handling and disposing these wastes.

This paper focuses on how the implementation of hierarchy of waste management options can improve the situation by reducing the amount of waste reaching the final disposal stage. The options include the well-known 5R principles – replace, reduce, re-use, recover and recycle. An integrated and comprehensive approach utilising regulatory and economic instruments is also discussed.

**Keywords:** municipal solid waste, regulatory and economic instruments, waste minimisation.

## INTRODUCTION

Development and the environment has always been regarded as two different faces of the same coin. Though it is impossible for the two faces to be presented simultaneously, there is no denying that both are essential in providing a complete and interdependent entity.

This paper is written against the background of increasing amount of MSW generated by the world's population. The increase is attributed to the compound effects of increasing population, affluence and technological advances that have made mass production economically possible. Table 1 compares the waste generation rate between

Malaysia and some of the developing and developed countries. The figures indicate that the generation rate in Malaysia is relatively high compared to other developing countries. MSW management practices in Malaysia have been very much inclined to the "end of pipe" approach, where all wastes will be treated and disposed off at the landfill. This gives rise to the high volume of wastes reaching landfills.

A typical material cycle leading to waste generation is shown in Figure 1. The figure shows that the amount of waste reaching final disposal can be reduced if a comprehensive and integrated approach of waste management involving all stakeholders is adopted. The long awaited Waste Act is expected to change the management practices on MSW in Malaysia. Although it was not known when it would be tabled in the Malaysian Parliament, it is anticipated that this Act will address the MSW management based on the concepts of Integrated Waste Management and Sustainable Waste Management. These concepts are based on the hierarchy of waste management options set out in the European Commission's Program 'Towards Sustainability' as shown in Figure 2. With the material flow diagram shown in Figure 1, and the waste management hierarchy shown in Figure 2, it is possible to introduce a system that enables wastes produced at different stages of the material flow to be more effectively handled. This approach, better known as the Cradle to Grave Waste Management concept, has been adopted by many industries in developed countries. This is essentially an analysis that encompasses the whole life cycle of a product. Normally the product is given an environmental consideration from the design, through manufacturing, storage, packaging, use and disposal.

TABLE 1 : MSW GENERATION RATES IN SELECTED DEVELOPING AND DEVELOPED COUNTRIES.

Country	Population (million)	MSW generation (kg/person/day)
Sri Lanka (Colombo)	17.19 (1991)	0.42
Thailand (Bangkok)	56.68	0.45
The Philippines (Manila)	62.69	0.50
Indonesia (Jakarta)	181.39	0.60
<b>Malaysia</b>	<b>18.29 (1995)</b>	<b>0.76</b>
Singapore	3.10	0.87
Japan	123.97 (1990)	1.12
Denmark	5.10 (1990)	1.30
USA	252.04 (1990)	1.97
United Kingdom	57.54 (1990)	0.95
Sweden	8.60	1.02

Source: Beede and Bloom (1995)

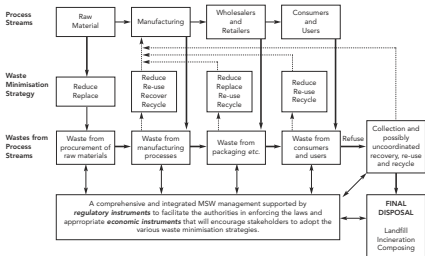


Figure 1: Material flow illustrating the processes stream, associated waste stream and appropriate waste minimisation strategies.

## MUNICIPAL SOLID WASTE IN MALAYSIA – A SNAPSHOT

Rapid economic growth experienced by the country in a relatively short duration has transformed Malaysia from an agricultural based economy to one of the most vibrant economy amongst the developing countries. Along with this transformation, Malaysians too have changed into a consumer society, which provides the market needed to fuel the local manufacturing and service sectors.

However, this consumer society also generates wastes that requires proper treatment and disposal. The amount of municipal solid waste (MSW) generated in Malaysia has been on the increase. This trend is expected to continue in future years. Figures released by the Ministry of Housing and Local Government (MOHLG) shown in Table 2, indicates that the amount of waste generation is projected to

TABLE 2 : ESTIMATED POPULATION AND WASTE IN MALAYSIA		
Year	Population (million)	Estimate Amount Of Waste (Tons/Year)
1991	17,567,000	4,488,369
1994	18,917,739	5,048,804
2015	31,773,889	7,772,402
2020	35,949,239	9,092,611

Source: MOHLG (1998)

increase at 3.4% per year (MOHLG, 1998).

Poor implementation of the waste management hierarchy system – reduce, replace, re-use, recover and recycle – in Malaysia may have caused this large amount of waste reaching the final disposal site. There are about 177 disposal sites in Peninsular Malaysia (CAP, 2001). A study by a private operator in the concession territory that includes Kuala Lumpur,

Selangor, Pahang, Terengganu and Kelantan indicated that out of the 83 landfills available in the concession territory 75% of the landfills were deemed not viable for continued used and the remaining 25% were deemed viable provided substantial investments are given (Budzik et al., 2003). Thus, it is clear that the problems related to MSW will become chronic in the near future.

Presently, the two main agendas

are being promoted: the implementation of a recycling campaign to reduce the amount of waste and the introduction of large scale incineration systems in order to reduce the amount of material reaching the landfills. Unfortunately, the response from the public on these two agendas has not been encouraging. Several successes on recycling have been reported, but tend to be localised in certain municipalities. Introduction of incinerators, too have faced several setbacks since the due to objections from the public.

Setting aside public response and perceptions on these agendas, the fact remains that there is a large room for improvement in the way we manage our MSW in Malaysia. Table 3 gives a comparison of waste composition between Malaysia and several selected Asian countries. The practice of recovering material from transfer stations and dumpsites by an

"informal sector" (waste pickers) in Indonesia and The Philippines had shown that 20% to 30% reduction of waste could be achieved when materials are recovered from the wastes. Table 3 shows that recoverable materials that can be recycled or re-used such as metal, glass/ ceramic, paper and plastics constitute 27% of the MSW in Malaysia. There is a very high potential for reducing the amount of waste by at least 20% at the final disposal stage if an effective re-use, recover and recycling policy can be implemented. Better results could be obtained if a more co-ordinated system as suggested in Figure 1 could be introduced by the authorities.

#### INTEGRATED USE OF REGULATORY AND ECONOMIC INSTRUMENTS

A mixture of regulatory and economic instruments can be

applied to effectively manage MSW incorporating the elements of reduce, re-use, recycle and recover in an integrated manner. Regulatory instruments rely on standards, parameter limits or permissible levels. This approach put the burden of waste reduction and pollution control on the government and stifles innovative management practices and technological development that may emerge from industries.

Reduction in waste generation can also be achieved through a number of economic instruments. Though regulatory instruments – the command and control approach – have been the predominant strategy in most countries, the economic instruments are now becoming more popular in developed countries (Bernstein, 1993). Economic instruments include the use of pollution charges, market creation, subsidies, deposit-refund systems

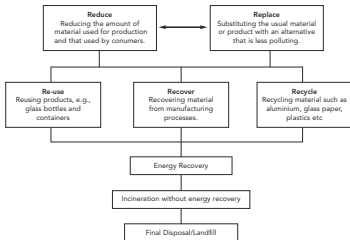


Figure 2: Hierarchy of waste management options set out in the European Commission's Program 'Towards Sustainability' (adapted from Wan Ramle, 1997)

TABLE 3: COMPOSITION OF MSW FOR SELECTED ASIAN COUNTRIES

Country	Composition (Weight percentage)									
	Metal	Glass/ ceramic	Food waste	Paper	Textiles	Plastic/ rubber	Misc. Combustibles	Misc. Incombustibles	Inerts <10mm	Others
Malaysia	6.4	2.5	64.0	11.7	-	7.0	7.8	-	-	0.9
Thailand	1.0	1.0	44.0	24.6	3.0	7.0	-	3.5	4.8	-
Japan	5.9	15.0	11.7	38.5	4.1	11.9	3.8	-	6.4	22.3
Singapore	3.0	1.3	4.6	43.1	9.3	6.1	3.9	-	6.4	22.3
Taiwan	1.1	2.8	24.6	7.5	3.7	7.3	-	56.0	-	13.7

Source: Beede and Bloom (1995)

and enforcement incentives. Economic instruments may stimulate the development of technology in private sectors related to re-use, recover and recycle of materials (OECD, 1989). However, the implementation of economic instruments cannot eliminate the need for regulatory instruments such as standards, environmental monitoring, enforcement and other forms of government participation. In fact, a successful implementation of economic instruments relies on standards, monitoring networks and enforcement policies. Figure 3 illustrates the various locations for imposing regulatory and economic instruments within the life cycle of products.

It is clear that, the combined use of regulatory and economic instruments provides a more integrated approach to MSW management. By taking into consideration the life cycle of the product, manufacturers tend to be more innovative and cost effective in selecting raw material and appropriate processes to minimise the costs of production and final disposal of their products. Not only that, consumers who use the product will have to pay directly for the disposal when product charges are incorporated into the system. This is a much

fairer system in the sense that the "user pays" principle is applied directly to the actual users rather than society as a whole.

#### WASTE MINIMISATION – WAY TO BETTER MSW MANAGEMENT

Experiences from developed countries have shown that mandatory source separation results in a very high reduction of waste reaching the landfill. However, it must be realised that this high level of success comes only as a consequence of high levels of education and civil discipline.

Attempts by many developing countries begin with voluntary source separation in parallel to bulk collection. This results in expensive infrastructure and separated waste components that are lacking both in quantity and quality to provide economy of scale for recycling, recovery and re-use (Fehr, 2003). The virtual failure of the parallel collection system was attributed to two factors: the population had not been guided to an attitude of conscious collaboration, and the recyclable portion of MSW represented only about 15 wt.% and thus, the expenditure and educational and administrative effort of collecting it was out of proportion with waste reduction achieved.

Furthermore, Fehr (2003) suggested that an efficient waste minimisation program had to consider the following factors: achieve maximum feasible amount of recycled matter with minimum feasible separation effort at the source; avoid thermodynamic and administrative contradictions such as mixing followed by separation; make the best use of existing infrastructure both in terms of equipment and people; consciously and insistently involve the population in the operation with long term perspectives; do not expect miraculous short term results; and build and use example cases to achieve public participation.

#### CONCLUDING REMARKS

The problems related to MSW in Malaysia require urgent attention. To ensure sustainability, the issue must be addressed in a comprehensive and integrated manner that focuses on the whole spectrum of the hierarchy of waste management options. It is now apparent that problems related to wastes are deemed to be less of a technical problem but more of a management problem. Malaysians must realise that the cost of neglect over the years will have to be paid – either now or later.

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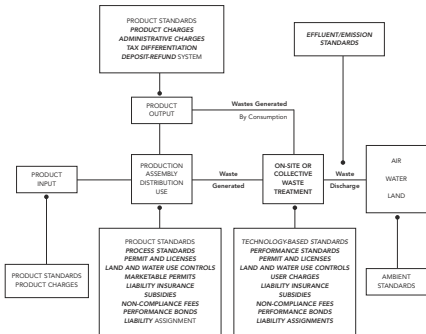


Figure 3: The use of combined regulatory and economic instruments in reducing wastes and pollution (adapted from Bernstein, 1989)