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Panel on Environmental Affairs

Meeting on 15 December 2005

Updated background brief on management of municipal solid waste in Hong Kong
(Position as at 8 December 2005)

Introduction

Between April 1989 and March 2000, more than $10.2 billion has been invested in new waste management facilities. These comprise three new sanitary landfills with leachate and gas collection; seven refuse transfer stations and refuse transfer facilities for the outlying islands; a chemical waste treatment centre; and a livestock waste composting plant. On the other hand, the amount of solid waste has been rising as a result of the continuous growth in population and economic activities. In 1999, the total amount of municipal solid waste (MSW) (which comprises domestic, commercial and industrial waste) generated was 5.2 million tonnes, representing a 45% increase over 1989. The amount of construction and demolition materials (which comprise soft inert materials, hard inert materials and non-inert waste) generated was 13.5 million tonnes, representing a 100% increase over 1989.

Strategies on waste management

2. To develop a range of new initiatives that would work together to bring about a major reduction in the volume of waste requiring disposal, the Administration commissioned the Waste Reduction Study in 1994 and consulted the public on recommendations of the Study in mid-1997. On the basis of the public response, as well as taking into account latest policy developments and technological renovation, the Administration issued the Waste Reduction Framework Plan (WRFP) in 1998. The objectives of the 10-year WRFP were as follows:

- to extend the useful life of existing landfills;

- to reduce the land required for new landfills in future;

- to reduce the annual waste management costs;

- to save resources by encouraging the use of less raw materials;

- to produce electricity for local consumption through waste-to-energy incineration;

- to create more job and trade opportunities through encouraging expansion of the recycling industry;

- to reduce the environmental impacts of waste management by cutting the vehicles transporting waste through Hong Kong;

- to reduce the production of greenhouse gases and leachate at landfills; and

- to enhance public awareness of environmental protection.

Municipal waste

3. The overall volume of waste has been increasing at an annual rate of 3.5%. For domestic waste alone, the average increase is 4% which is significantly higher than the average population growth of 0.9%. To this end, the Administration has adopted a number of measures to better manage and contain the increasingly serious problem on MSW. Given the far-reaching implications of the waste problem, this has been a major item for discussion at meetings of Council and the Panel on Environmental Affairs (EA Panel).

4. At the meeting of the Council on 23 February 2005, Members passed the following motion -

> "That this Council urges the Government to implement as early as possible a sustainable development plan that adheres to the waste disposal strategy premised on the reduction, recovery and reuse of wastes, which includes implementing the polluter-pays principle, formulating a long-term policy on the recycling industry, devising respective schemes on waste separation at source for various trades and communities, implementing the development plan of the "Recovery Park" (later renamed as "EcoPark"), considering the imposition of a reasonable green tax, priority should be given by government departments to using locally manufactured recycled products, and establishing a high-level departmental industries facilitation council to coordinate the communication and cooperation among various departments in a highly efficient manner so as to enhance public awareness of environmental protection and instill in them the correct attitude to handling wastes, with a view to solving the aggravating environmental pollution problem in Hong Kong as early as possible, as

well as creating business opportunities and increasing job opportunities; furthermore, the Government should also implement measures in order that the waste recycling and export industries can be retained and developed, and should set up larger regional recyclable collection centres outside the "Recovery Park" as well as establish a network for collecting recyclable waste in various districts across the territory, so as to increase the opportunities for grass-root workers and operators of small-scale enterprises to join the recycling industry.

Strengthening support for waste separation and recovery

5. Various waste recovery systems have been tested to identify the most cost-effective and suitable mode to develop a habit among the public to separate waste from recyclables at the point of disposal and not to discard recyclables as waste. These include the three-coloured separation bin scheme and the Wet/dry Waste Separation Pilot Programme (the Programme). At present, there are 28 000 three-coloured waste separation bins placed at some 9 300 points throughout the territory. In 2004, 140 000 tonnes of waste were collected for recycling through this scheme. The 16-month Programme was carried out in four housing estates from April 2003 to July 2004. Participating households separated wastes into wet and dry wastes which were then gathered at Refuse Collection Points of the estates by cleansing workers. Contractors of the Food and Environmental Hygiene Department then delivered the wastes to Island East Refuse Transfer Station for sorting. The sorted dry wastes were sold to recyclers. Revenue generated was used to offset the sorting cost. While the Programme in tandem with the three-coloured bin scheme in the four participating estates recovered 12% more recyclables than the three-coloured bin scheme alone in non-participating estates, it is considered not sustainable as the processing cost is high.

6. With the experience gained in the Programme, a 12-month pilot programme on Source Separation of Waste was launched in August 2004 in 13 housing estates in the Eastern District covering about 37 000 households and a population of about 120 000. The pilot programme aims to make it more convenient for residents to separate domestic waste at source by encouraging and assisting property management companies to provide waste separation facilities on each floor of the building. It also aims to expand the types of recyclables to be collected to include all plastics, all metals and other types of recyclables such as old clothing and waste electrical products. Under the pilot programme, recyclables are separated within each estate and sold to recyclers direct without having to be transported to a central location for additional sorting, which makes the operation more cost-effective. Initial results of the pilot scheme show that the volume of recovered recyclables has increased significantly. In view of the encouraging results, the Administration rolled out a territory-wide campaign in January 2005 to promote separation of domestic waste at source.

7. The subject of management of municipal waste was discussed at the meeting of the EA Panel on 28 February 2005. Given that the 28 000 three-coloured waste separation bins were only able to collect about 140 000 tonnes of waste in waste in 2004, equivalent to the amount of waste produced in Hong Kong in one and a half day, question was raised on the effectiveness of the three-coloured bin scheme. Some Panel members also opined that segregation of domestic waste at source might not be practicable given the space constraints of most households in Hong Kong. They therefore suggested that financial assistance should be provided to encourage more innovative recycling initiatives, such as new features in building design to facilitate waste segregation. Consideration should also be given to introducing legislation to require the provision of waste segregation facilities in new buildings.

Making available land for waste recovery operations

8. To ensure success of waste reduction, there is a need to develop the three inter-related components, namely recovery, recycling and reuse, in a coordinated fashion. Besides, the processes of collection, turning recovered materials into useable products and the sale of these products add values to the recovered materials and can create a circular economy that brings business and job opportunities. However, of the 2.4 million tonnes recyclable materials recovered from MSW annually, over 90% are exported for recycling. The over-dependence on export as an outlet for recovered materials makes the recycling industry insecure in the long run as the market demand for recyclable materials is highly volatile and the international trend is to increasingly restrict trans-boundary movement of waste, even recyclable waste. To address these problems and to realize the full potential of recycling, there a need to promote the local recycling industry so that recyclable materials can be turned into products that have higher economic values and more stable and reliable markets.

9. According to the existing recycling operators, high land and labour costs as well as insufficient recyclable materials collected are the major barriers to the growth of recycling industry in Hong Kong. In this connection, the Administration is developing a policy on promoting the recycling industry in Hong Kong. Apart from improving the collection network through separation of waste at source, the Government has been allocating suitable land for the recycling trade on short-term tenancies. So far, 29 sites totalling 5.6 hectares have been allocated to recyclers on short-term tenancies. To encourage long-term investments and provide incentives to establish higher end industries and downstream services, the Administration has set aside 20 hectares of permanent land in Tuen Mun Area 38 for setting up an EcoPark.

10. EcoPark will be developed for the sole use by the environmental and recycling industry. Individual recycling companies can acquire an area of land at affordable costs with tenures sufficiently long to justify their investments in value-adding and for higher end operations. The basic physical infrastructure of EcoPark will be built and funded by Government while the operation and management of EcoPark will be based on prudent commercial principles using a public/private partnership approach. An operator (the Operator) from the private

sector will be appointed to design and implement an effective marketing strategy to recruit and anchor a right mix of long-term tenants. In addition to the management of EcoPark, the Operator will be responsible for the overall performance of EcoPark in terms of its compliance with government requirements, including environmental measures set out in the Environmental Permit. The Operator will also need to provide technical assistance and advisory services, such as advice and assistance on permit issues, waste exchange programmes and access to information and markets on environmental and recycled products etc. Through special financial incentives allowed for in the contract and collaboration with tenants, the Operator will be encouraged to provide additional value-added services, such as organizing business conferences, undertaking joint marketing as well as joint research and development of new environmental technologies and product development etc.

11. The development of EcoPark was discussed by the EA Panel on 30 May 2005. While supporting the provision of EcoPark which was expected to benefit the recycling industry in Hong Kong, members queried about its modus operandi. They were concerned about monopolization of EcoPark by major overseas recyclers if the Operator might tend to recruit anchor tenants with a view to profiteering, thereby affecting the opportunity and survival of small local recyclers. The Administration was urged to incorporate proper safeguards in the tender document to prevent monopoly. To encourage the development of high-end industries, efforts should be made to ensure that technical aspects rather than price would be taken into account in assessing tenders for EcoPark.

Enhancing publicity and education

12. Publicity and public education programmes, including exhibitions, seminars, visits by a theme van on waste problems and solutions to shopping centres, schools and housing developments etc., have been organized to promote waste prevention and recovery. Workshops for teachers to enhance their knowledge and teaching skills in waste issues have also been organized. The Administration has further put in place a hotline service which provides information and advice on waste reduction and separation.

Government to take a leading role

13. All government bureaux and departments are urged to reduce photocopying paper consumption by 10% by 2006-07 i.e. an annual reduction of 2.5%, using 2002-03 as the base year. The recycled content required in the specification of recycled photocopying paper has also been revised from 50% to 80%. Also, the use of retreaded tyres has been extended to all government medium and heavy vehicles. Where practicable, departments involved in greening work are encouraged to use compost made from organic waste. The Government Logistics Department has also been updating product specifications and tender assessment criteria taking into account environmental considerations where practicable.

Product Responsibility Schemes (PRS)

14. PRS is one of the tools to enhance recovery, recycling and reuse of wastes. Under PRS, manufacturers, importers, retailers and consumers of goods are required to take responsibility for the collection and disposal of end-of-life products. As a first step, the Administration has conducted a Regulatory Impact Assessment (RIA) of PRS on tyres and rechargeable batteries. In April 2002, a voluntary PRS programme was launched to recover mobile phone rechargeable batteries. Since then, 8.6 tonnes of batteries have been collected for recycling in overseas facility. The scheme has been expanded in April 2005 to include other types of rechargeable batteries and to include more members of the trade. The RIA study to identify possible options of PRS for waste tyres and their impact on the trade and stakeholders is near completion. The Administration aims to commence public consultation in the second quarter of 2005 and to implement the PRS on waste tyres by late 2006. Another RIA study on the implementation of PRS for electrical and electronic equipment and for beverage containers will be conducted in 2005. Given the large amount of plastic bags being disposed of at landfills, the Administration will also study the overseas experience in putting a levy on plastic bags with a view to reducing plastic bag waste.

15. When the subject was discussed at the EA Panel meetings on 28 February and 23 May 2005, members were disappointed at the lack of concrete plans to take forward the recycling of batteries, computer parts and plastic bags etc which had been dragged on for a long time. They considered it necessary for the Administration to set out the respective timetables, priorities and target. Other members also pointed out that various pilot projects on waste recovery were piecemeal in nature, and that the general public might not be aware of the means through which recyclable wastes such as used mobile phone batteries should be dealt with. They opined that the Administration should work out a comprehensive and sustainable policy on waste recovery. Consideration should be given to introducing a deposit arrangement as in the case of overseas countries where a levy would be collected at the time of purchase of new appliances to finance recycling operations.

Closer cooperation with the business sector

16. Business sector, particularly management companies, restaurants and hotels, are encouraged to take a more active role in waste prevention. Examples include leftover food donation programme, furniture and plastic bottles and textile recycling programmes specially designed for hotels, plastic bag recovery programmes involving supermarket chains and mooncake containers recovery trial involving property management companies and restaurants.

Closer cooperation with District Councils

17. Collaboration with District Councils in carrying out various types of district-based waste prevention and recovery will continue as they are in a better position to assess the needs of the districts, and at the same time can mobilize the support of local residents.

Bulk reduction and disposal of unrecyclable waste

18. As a result the above measures, the quantity of MSW requiring disposal was maintained at 3.4 million tonnes each year from 2000 to 2003, comparing favourably with the 3.5% annual growth rate in the years before 2000. The overall MSW recovery rate rose from 34% to 36% in 2002 and to about 41% in 2003. The domestic waste recovery rate rose from 8% to 13% in 2002. Notwithstanding, there will still be large volumes of waste which cannot be recycled and need to be properly disposed of. Maintaining the current manner of disposing of waste without treatment at landfills and using landfill as the only waste management is not sustainable. Hence, there is need to explore new waste treatment technologies for the development of Integrated Waste Management Facilities (IWMF).

19. In late April 2002, the Administration launched an expression of interest (EoI) exercise to invite local and overseas suppliers and facility operators to propose waste treatment technologies for the development of IWMF in Hong Kong. A total of 59 submissions were received, in which six technology types, namely composting, anaerobic digestion, incineration, gasification, a combination of mechanical and biological treatment as well combustion of fuel derived from waste for the production of cement, were identified. Based on these technologies, the Advisory Group on Waste Management Facilities (AG) set up to assist in assessing EoI has further short-listed the following eight strategy options, some of which comprise more than one technology, that appear to be suitable for Hong Kong –

Option 1 – Incineration with energy recovery;

Option 2 – Gasification;

Option 3 – Close-coupled gasification-combustion;

Option 4 – Material Recovery and combustion of refuse derived fuel for cement production;

Option 5 – Mechanical-Biological Treatment (MBT);

Option 6 – Composting and Incineration;

Option 7 – Anaerobic Digestion and Incineration; and

Option 8 – MBT and Gasification

Details of these options are given in the **Appendix**.

20. Given that each option has its strengths and weaknesses, there is a need to take these into account when formulating the strategic implementation plan. In view of the heterogeneous nature of MSW in Hong Kong, AG has recommended that

Option 1 – Incineration with energy recovery

Incineration is a proven and reliable technology, and waste is combusted (typically over 850°C) to reduce its volume and hazardous properties, and to generate heat and/or electricity. The majority of MSW incinerators adopt the "mass burn" design which uses a large furnace with an inclined moving or roller grate system. The moving grate keeps the waste moving through the furnace during the combustion process.

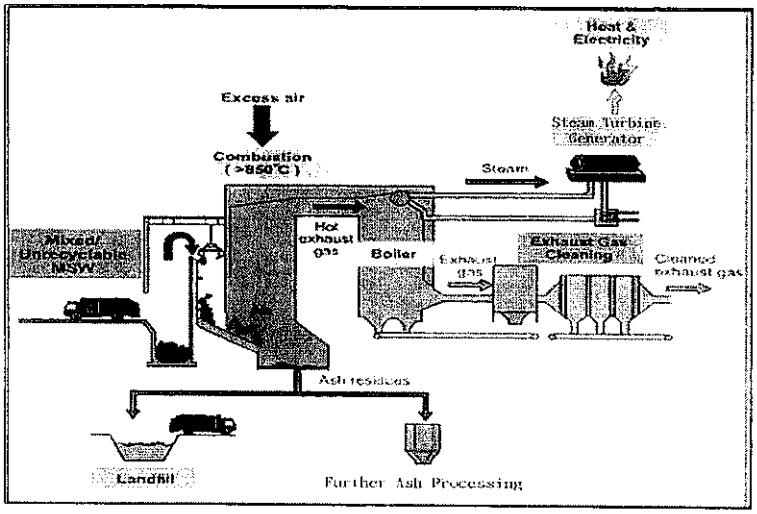

Fig.1 Process flow diagram of Mass-burn Incinerator with energy recovery

Modern incinerators adopt advanced process control measures to optimise the combustion at a temperature over 850°C with long residence time and high turbulence, so as to ensure complete destruction of organic pollutants. Coupled with advanced gas cleaning and pollution abatement equipment such as fabric filters, scrubbers and activated carbon powder injection system, modern incinerators can meet the most stringent emission standards adopted internationally.

Option 2 - Gasification

Waste is heated to a high temperature (typically over 1000°C) which volatilises the organic fraction of the waste to produce a combustible gas called syngas. The syngas is in turn combusted to generate heat energy or used as a fuel after cleansing to generate electricity. Unlike incineration, gasification occurs in an oxygen-deficient atmosphere, and this reduces the opportunity for the formation of combustion by-products such as dioxins and furans. Gasification is a relatively new technology and there are concerns about its cost.

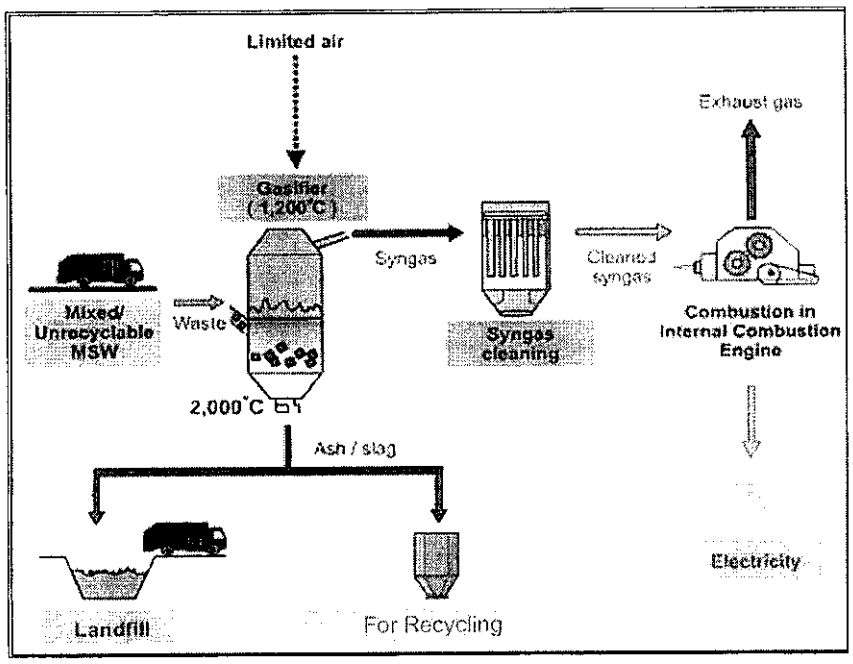

Fig.2 Process flow diagram of Gasification to produce syngas

Option 3 - Close-coupled gasification-combustion

Waste is heated to a relatively low temperature of 500 – 600°C to produce syngas. The gas together with the ashes will then enter a furnace where the combustion of syngas raises the temperature to over 1300°C and the ashes are melted to produce a residue which may be recycled as construction material.

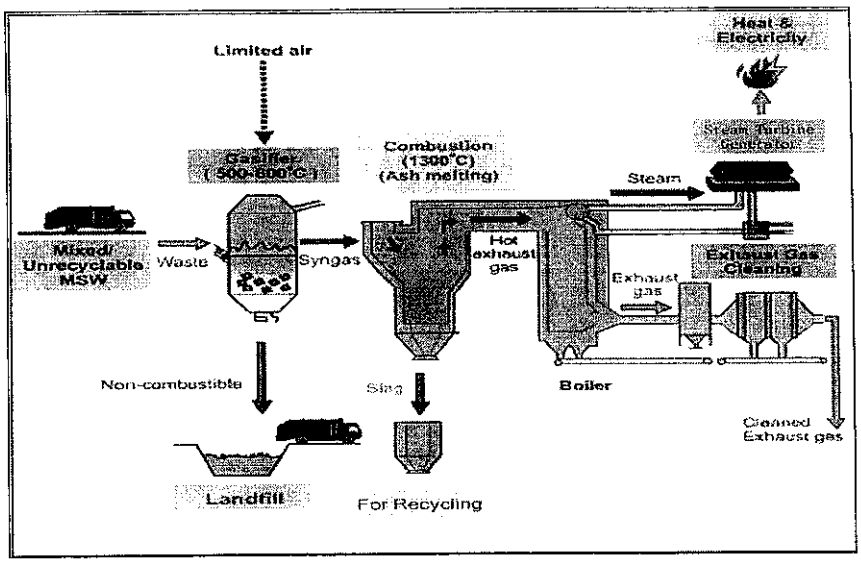

Fig.3 Process flow diagram of Close-coupled Gasification-combustion

Option 4 - Material Recovery and combustion of refuse derived fuel for cement production

Recyclable materials such as glass and metals are recovered from the waste using mechanical and manual sorting, and the non-recyclable materials are processed into refuse derived fuel (RDF[1]). The RDF is used as a fuel for co-combustion with coal for cement production.

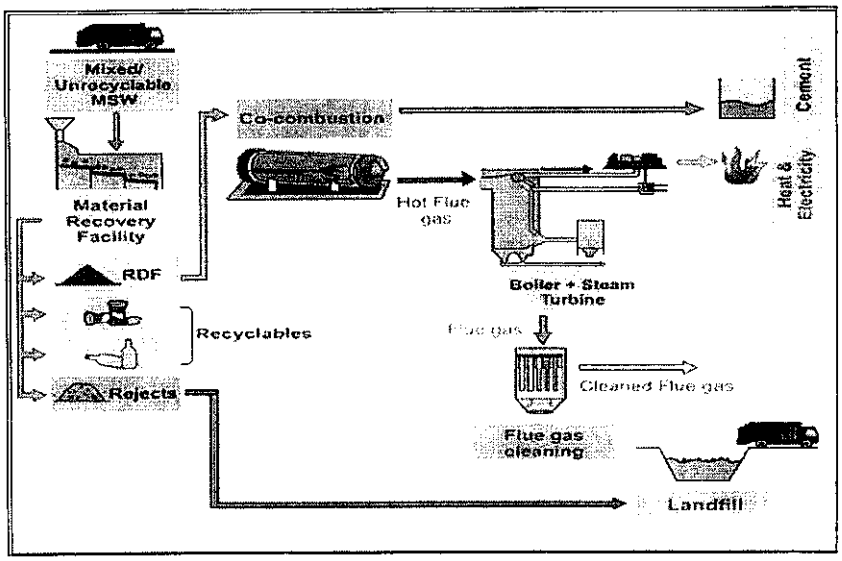

Fig.4 Process flow diagram of Material Recovery & combustion of RDF for cement production

[1] Refuse derived fuel consists of the combustible materials in MSW, for example paper and plastic, which are separated from the non-combustible fraction of mixed MSW. They are then shredded and pelletized to facilitate handling, transportation and storage.

Option 5 – Mechanical-Biological Treatment

Mixed waste is first treated through a series of mechanical operations separating them into recyclable materials such as metals and glass, and a biodegradable fraction which is treated and stabilized by a biological process such as composting or anaerobic digestion before application on land. However, the MBT process is only a separation process designed to recover recyclable materials and to treat the biodegradable fraction from mixed MSW. In term of waste reduction, it can only reduce the waste volume by about 50% but requires 2-3 times more land area than other technologies. Some MBT processes further convert the residues to RDF.

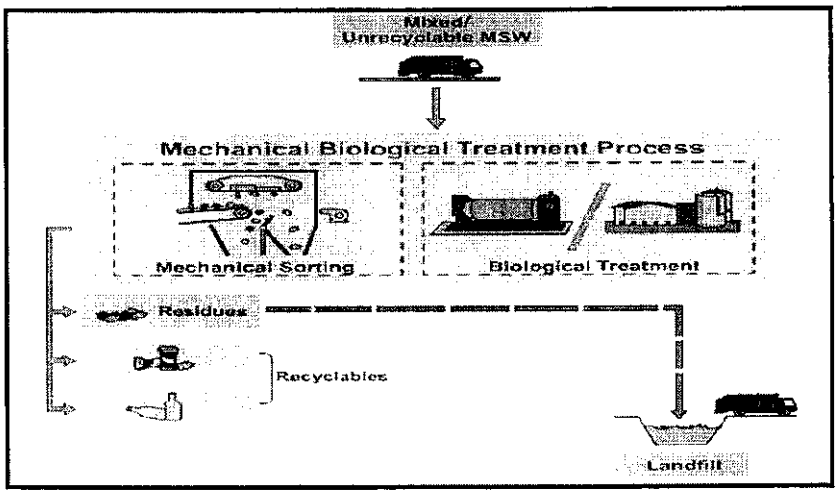

Fig.5 Process flow diagram of MBT

Option 6 – Composting and Incineration

Composting is a biological process to decompose organic matter to a residue that can be used as soil conditioner in the presence of oxygen through bacterial activity. The process will generate odour and gaseous emissions, and stringent control on the composting conditions and the emissions are exercised through "in-vessel" technology by total enclosure of the processing inside a drum. The volume of biodegradable waste which could be treated by composting depends on the available outlets for the compost, noting that the local market is limited and the Mainland has banned the import of compost produced from MSW due to public health concerns. Biodegradable waste such as food waste has to be separated at source prior to composting. The remaining mixed waste is treated by incineration.

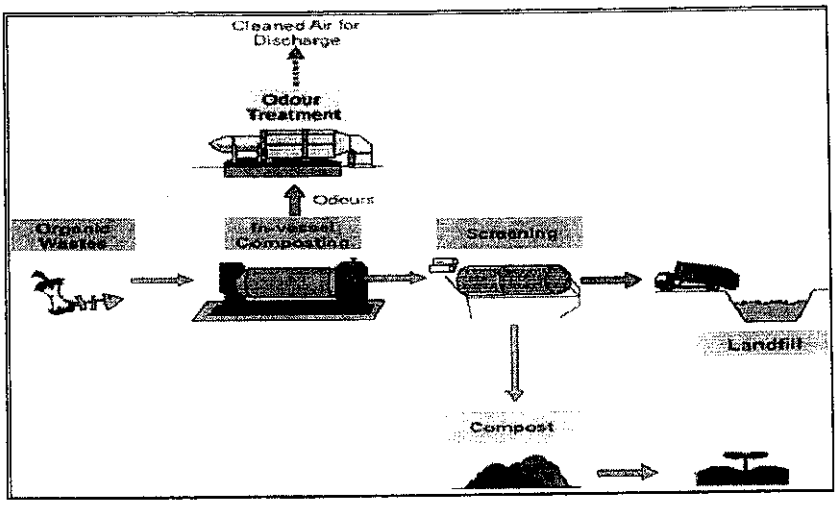

Fig.6 Process flow diagram of In-vessel Composting

Option 7 - Anaerobic Digestion and Incineration

Anaerobic digestion is a biological degradation process of organic materials by microbial activity in the absence of oxygen which produces biogas that can be used to generate heat or electricity, and organic residues that can be processed for use as soil conditioner. Compared with composting, anaerobic digestion requires less time for treatment but a higher level of technology and tighter process control on temperature and pH value. Biodegradable waste such as food waste has to be separated at source before anaerobic digestion. The remaining mixed waste is treated by incineration.

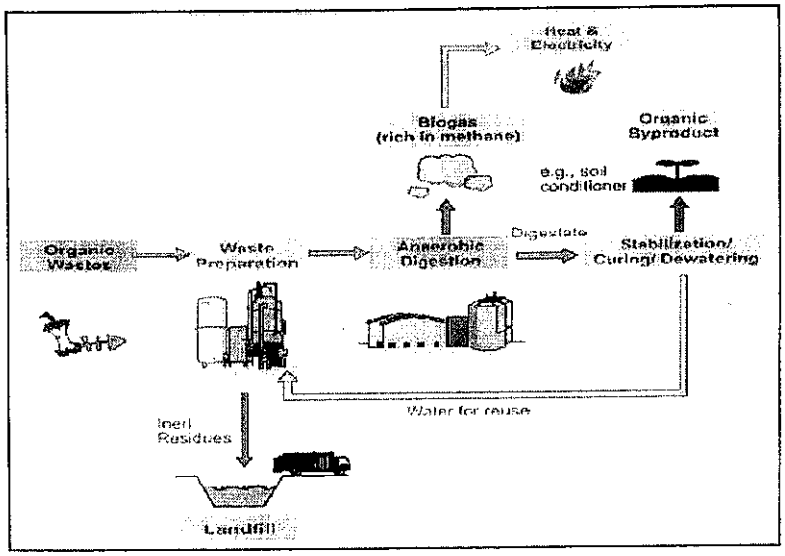

Fig.7 Process flow diagram of Anaerobic Digestion

Option 8 - MBT and Gasification

Mixed waste is first treated through a series of mechanical operations separating them into recyclable materials, non-recyclable materials that could be further processed to become RDF and a biodegradable fraction which is treated by anaerobic digestion to produce biogas. The RDF is then fed into a gasification process to produce syngas.

IWMF should adopt a multi-technology approach so that the most suitable technology could be applied to deal with different waste streams of MSW. The approach will be built upon and complement the existing efforts to promote waste reduction and recovery. Waste will be reduced as far as practicable through various measures such as economic incentives and community education. It is hoped that 50% recovery rate can be achieved by 2014. Through the separation of MSW at source, recyclable materials will be recovered for recycling. Biodegradable materials will be separately collected for biological treatment. The remaining mixed MSW may then be treated by both MBT and one of the thermal technologies. Experience in Europe suggests that some 50% to 60% of the residues will need to be disposed of at landfills if MBT technology alone is adopted. Hence, for the future IWMF, MBT cannot be used as the only method to treat mixed MSW, and its scale would depend on the available outlets for its residues. For the remaining portion of mixed waste, which is not treated by MBT, thermal technology should be considered. Incineration is considered the preferred technology as it is a technologically well-proven method adopted by many advanced countries in Europe and Asia. It is estimated that the MBT plant should be able to handle 1 000 tonnes of waste per day. The remaining 5 700 tonnes will be treated by incineration. An IWMF of this scale could be housed within an area of 35 hectares.

21. When the subject was discussed at the EA Panel meeting on 23 May 2005, members supported in principle a comprehensive waste management strategy comprising waste minimization, recovery and bulk reduction before final disposal of unrecyclable waste. Some members however expressed concern that the Administration was trying to push forward incineration as the way forward for resolving the waste problem. They reiterated that separation of waste at source and the development of recycling industry were best for Hong Kong. To this end, there was a need to revise the time table to expedite the pace of waste separation and recovery. Consideration should also be given to introducing regulatory measures for waste separation. As a consolidated view on the way forward for the management of MSW, members passed the following motion on 5 July 2005 -

> "That this Panel urges the Administration to include in parallel in the upcoming strategy document on municipal solid waste management a holistic and comprehensive plan, targets and timeframes for measures on waste avoidance and minimization; recovery, recycling and reuse; as well as bulk reduction and disposal of unrecyclable waste."

Council Business Division 1
Legislative Council Secretariat
8 December 2005