

# **Planning Aspects of Solid Waste Management:**

**Literature Review**

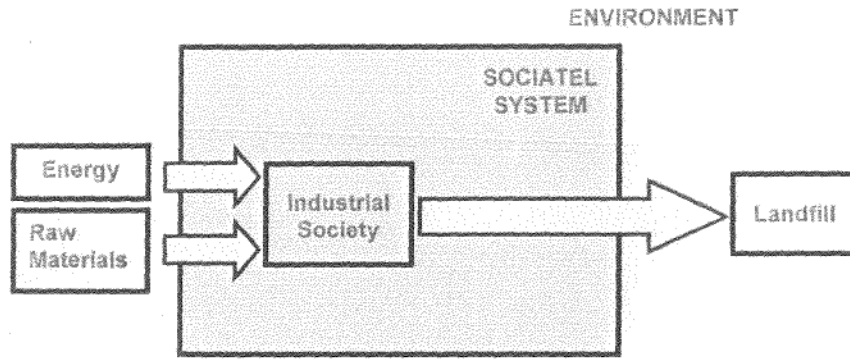
**Ahmed Gaber**

**January 1998**

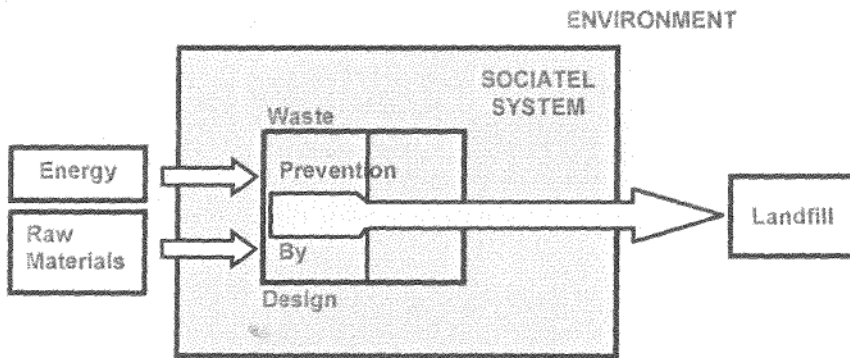
## **DEFINITION OF INTEGRATED SOLID WASTE MANAGEMENT SYSTEM**

1. ALL TYPES OF SOLID WASTE MATERIAL: MULTI MATERIAL APPROACH
2. ALL SOURCES OF SOLID WASTE: DOMESTIC, COMMERCIAL, INDUSTRIAL, INDUSTRIAL, INSTITUTIONAL, CONSTRUCTION AND AGRICULTURAL, HAZARDOUS WASTE (IN SEPARATE STREAM)
3. INCLUDES WASTE COLLECTION AND SORTING FOLLOWED BY ON OR MORE OF THE FOLLOWING OPTIONS:
  - RECOVERY OF SECONDARY MATERIALS (RECYCLING)
  - BIOLOGICAL TREATMENT OF ORGANIC MATERIAL: PRODUCE MARKETABLE COMPOST TO REDUCE THE VOLUME FOR DISPOSAL – THIS ALSO PRODUCES METHANE THAT CAN BE BURNED TO RELEASE ENERGY
  - THERMAL TREATMENT: THIS WILL REDUCE VOLUME AND MAY RECOVER ENERGY
  - LANDFILL
4. MARKET ORIENTED
5. FLEXIBILITY: CHANGE TO SOCIAL, ECONOMIC AND ENVIRONMENTAL CONDITION.
6. SCALE: THE BENEFIT OF ECONOMIES OF SCALE – REGIONAL SCALE. (500,000 PERSONS).

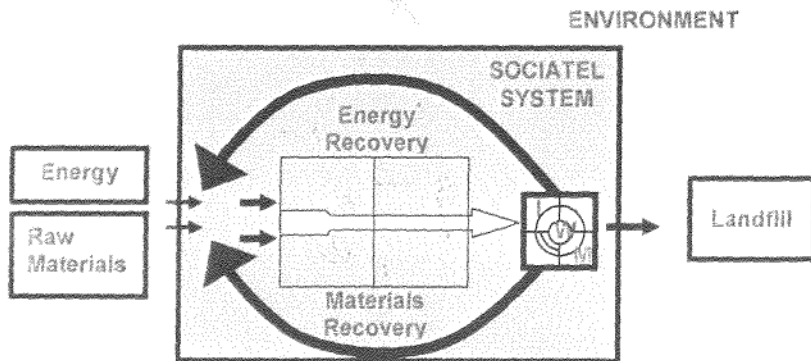
# WASTE MANAGEMENT



The Creation of Waste

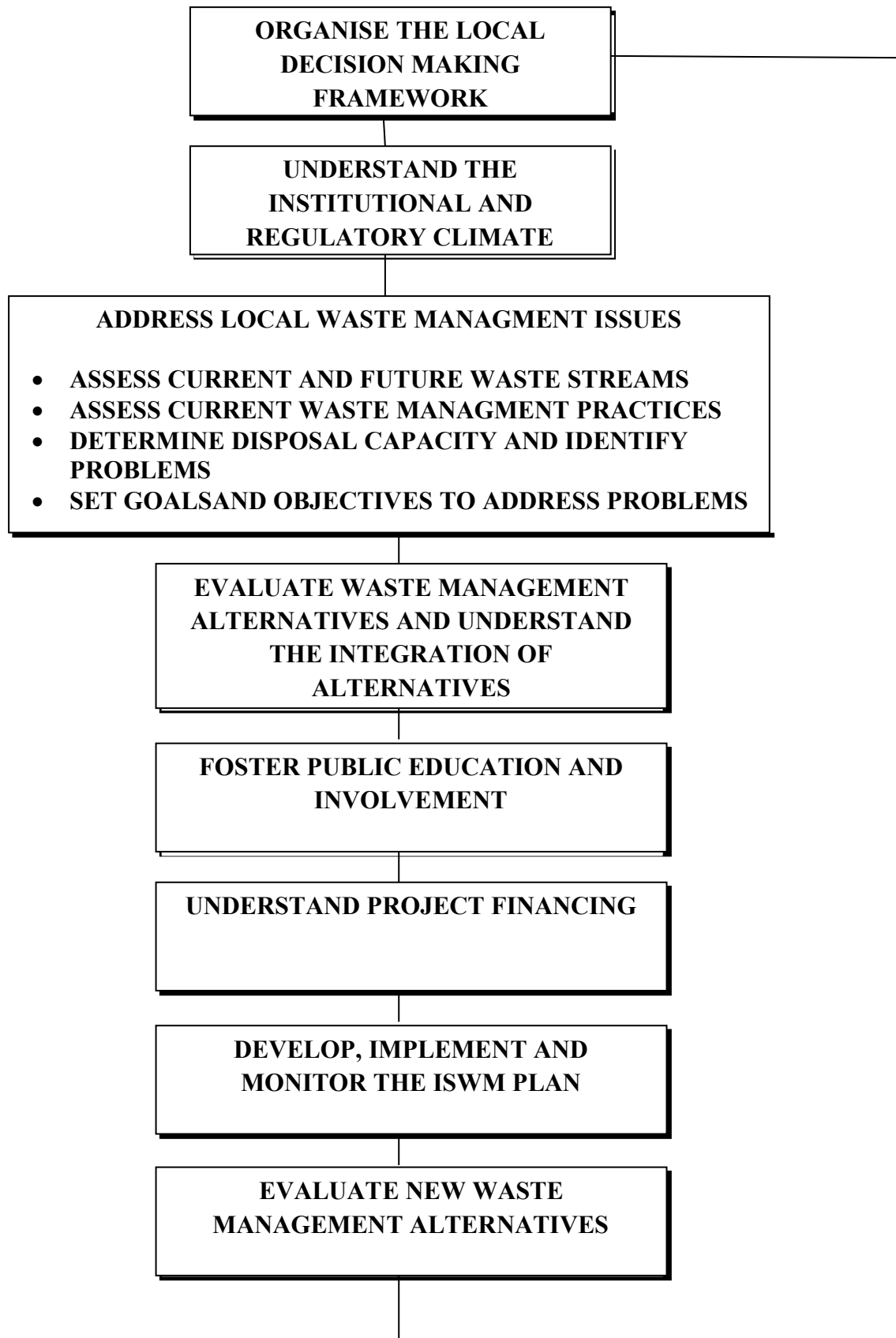


Role of Waste Prevention



Role of Integrated Waste Management

# INTEGRATED SOLID WASTE MANAGEMENT PLANNING

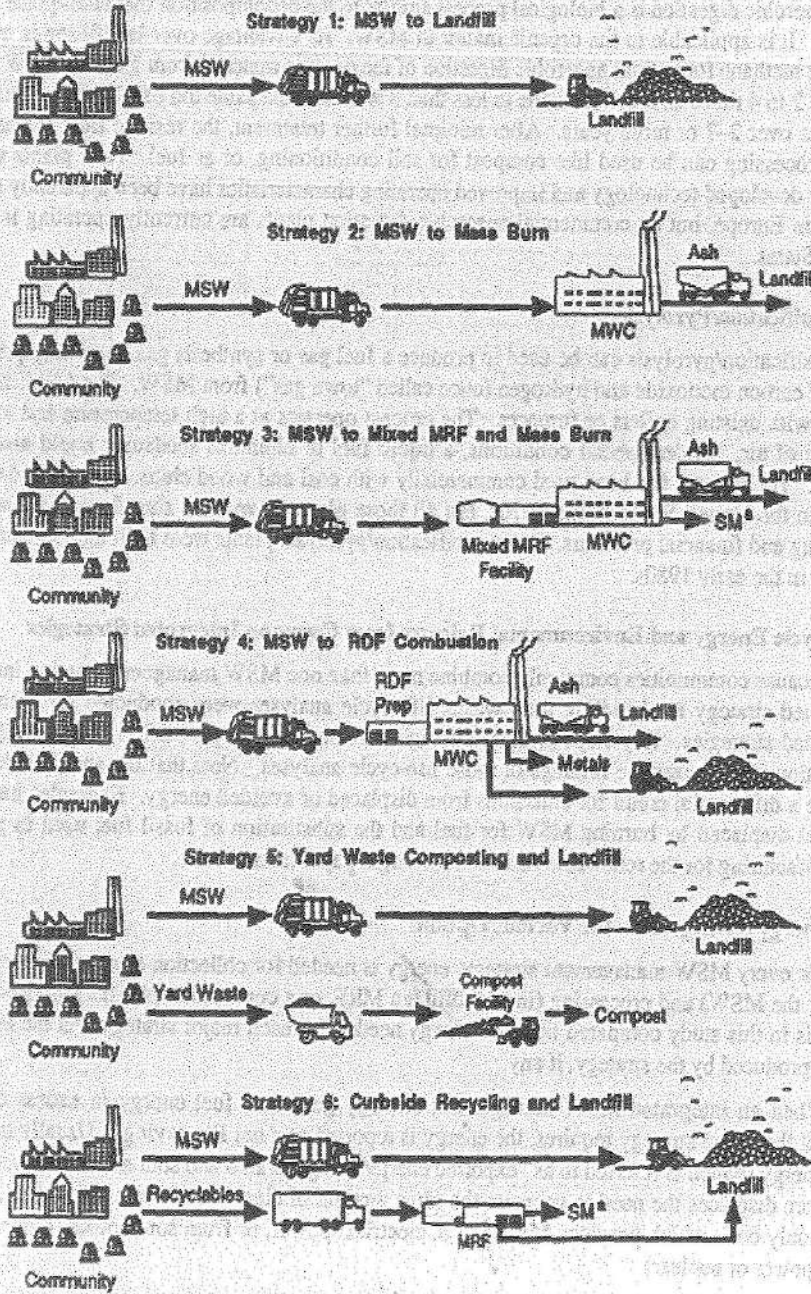


### Solid Waste Components (current trends)

<b>Solid Waste Components</b>	<b>Edfu/ Komombo/ Daraw</b>	<b>Fayoum</b>	<b>El Fashen Beni Suef</b>	<b>Mansoura</b>	<b>Ismailia</b>	<b>Aswan</b>
Source Reduction and Reuse	Household level  Reuse of building rubble in landfilling	At the household level	Household level  Reuse of building rubble in landfilling			
Recycling	Informal sorting activities	Informal sorting activities	Household separation of organic and non-organic waste	Informal sorting activities	Sorting at composting plant	Informal sorting activities
Composting			Low-tech. municipal compost system	Construct compost plant	Construct compost plant	
Combustion	Incinerator for hospital hazardous waste-after segregation	Incinerator for hospital waste	Incinerator for hospital waste	Assess existing incinerator for hospital waste	Incinerator for hospital waste	Incinerator for hospital waste
Landfill	Sanitary landfill including area for hospital hazardous waste	Recommend sanitary landfill	Sanitary landfill	Recommend feasibility of sanitary landfill	Improve existing dump site	Sanitary landfill

Figure ES.1

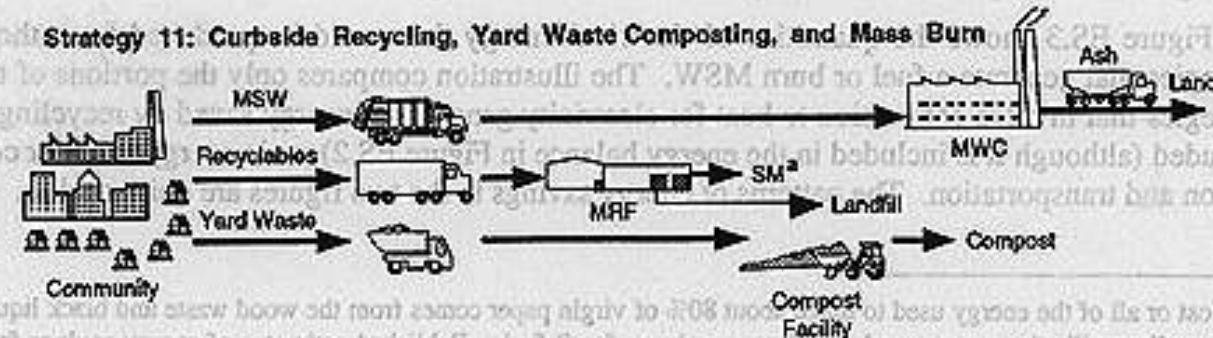
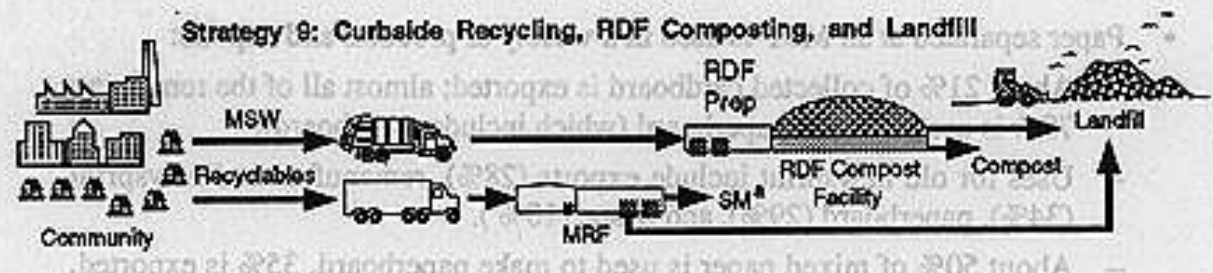
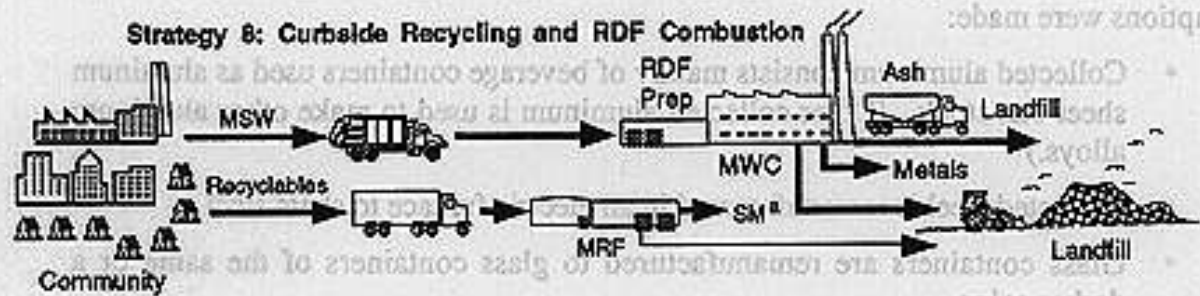
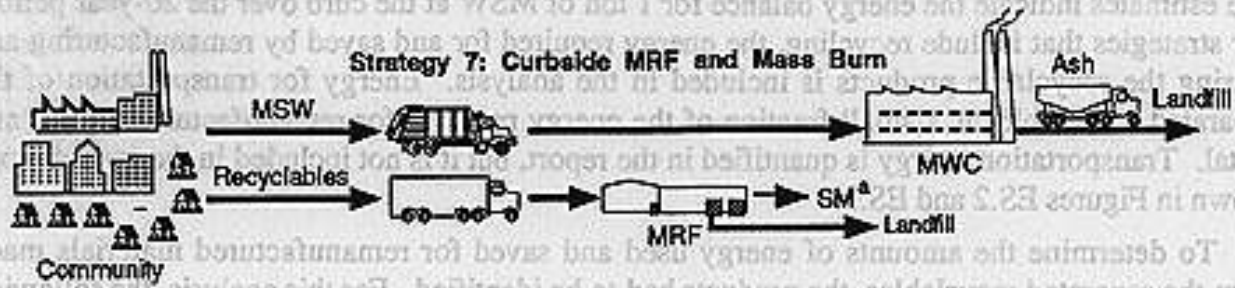
STRATEGIES BASED ON THE FIVE MAJOR OPTIONS



<sup>a</sup>MRF separated materials for processing by industry. These materials include paper, cardboard, glass, metal, plastic

Figure ES.1

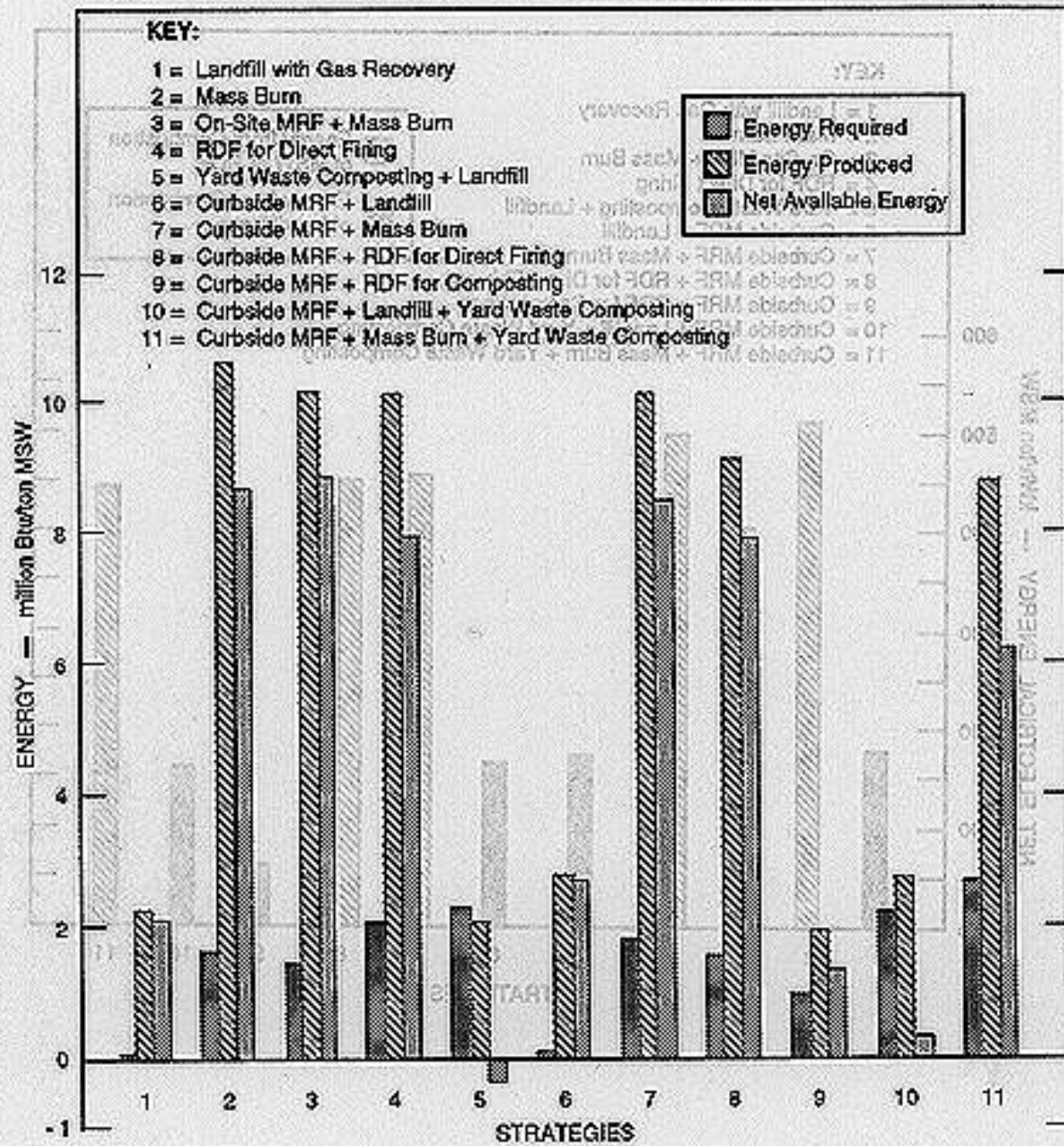
STRATEGIES BASED ON THE FIVE MAJOR OPTIONS (Concluded)



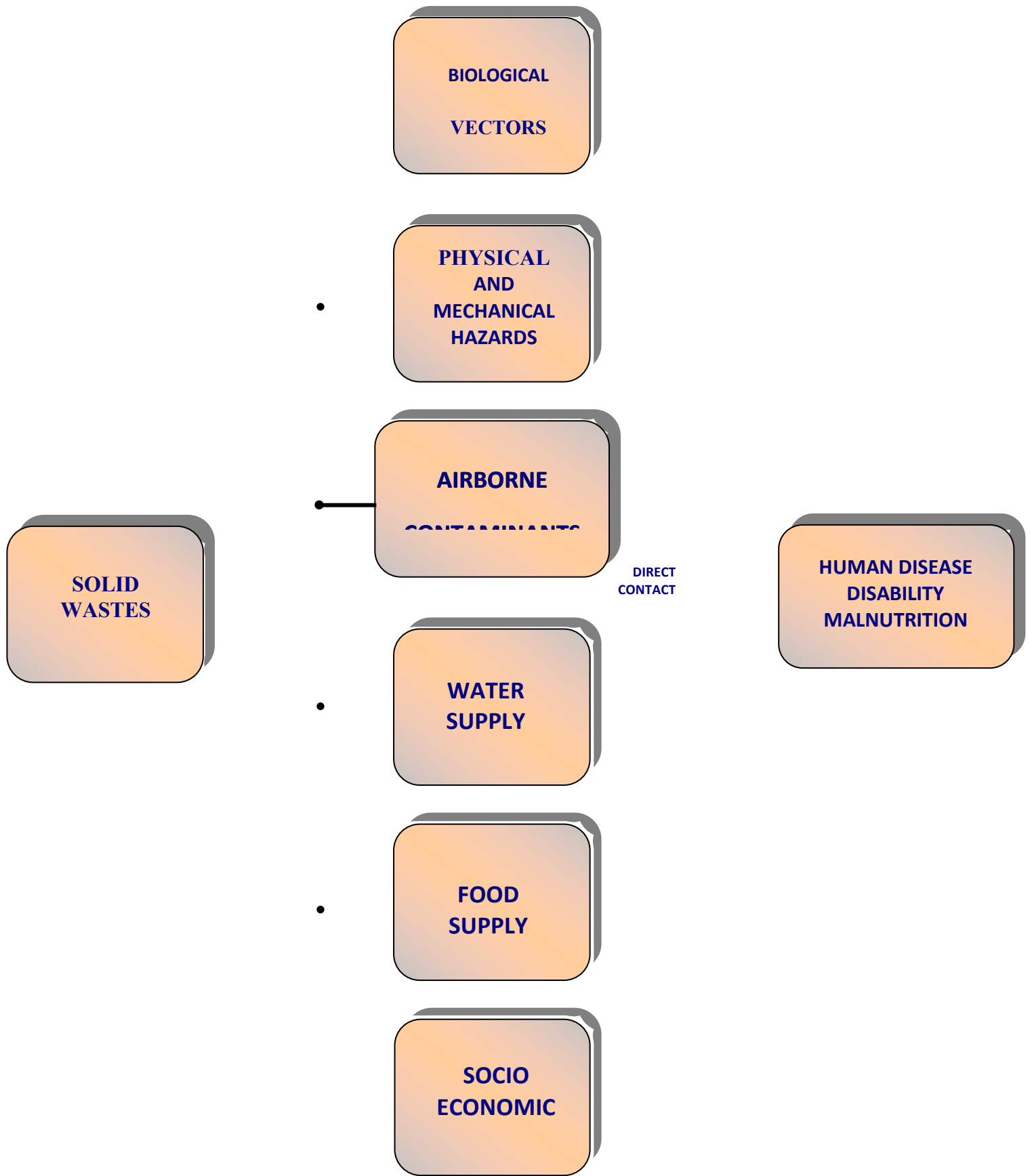
<sup>a</sup> MRF separated materials for processing by industry. These materials include paper, cardboard, glass, metal, plastic

Figure ES.2

ENERGY ANALYSIS FOR STRATEGIES BASED ON THE FIVE MAJOR OPTIONS  
(PER TON OF MSW)







**Solid waste/human disease pathways (postulated)**  
**Solid waste/human disease pathways (postulated)**

## SOLID WASTE MANAGEMENT – AN OVERVIEW

	<b>Developed Countries</b>	<b>Developing Countries</b>
Current situation	<p style="text-align: center;"><b><u>Integrated Solid Waste Management Systems</u></b></p> <p>Are used in most countries. ISWM is economically and environmentally sustainable:</p> <ul style="list-style-type: none"> <li>• It deals with all solid waste materials and sources</li> <li>• Integrated treatment methods</li> <li>• Market oriented</li> <li>• Flexible</li> </ul> <p><u>Regionalization</u> is emerging in many communities due to the complexity of SWM activities. Regionalization offers:</p> <ul style="list-style-type: none"> <li>• Economies of scale</li> <li>• Enhanced cost-effectiveness</li> <li>• Increased financial support</li> <li>• Increased flexibility – more options</li> <li>• Environmental improvements state of the art technologies</li> <li>• Increased participation</li> </ul>	<p style="text-align: center;"><b><u>Integrated Solid Waste Management Systems</u></b></p> <p>ISWM systems are being considered in the formulation of SW strategies. However, the existing legal and institutional framework and involvement of various stakeholders are not fully developed.</p>

## SOLID WASTE MANAGEMENT – AN OVERVIEW

	<b>Developed Countries</b>	<b>Developing Countries</b>
The Way Forward	<ul style="list-style-type: none"> <li>• Increased waste minimization</li> <li>• Resolution called for better enforcement of legislation and improves statistical data for solid waste</li> <li>• The increased need to use economic instruments</li> <li>• The control of trans-boundary movements</li> <li>• Implementation of the strategy for hazardous waste management</li> </ul>	<p><b><u>Private Sector Involvement</u></b> – There is need to reduce barriers for private sector involvement by developing suitable legislative, financial and administrative systems</p> <p><b><u>Informal Sector</u></b>: needs financial and institutional support to develop partnerships with local governments</p> <p><b><u>Community Participation &amp; Gender</u></b>: The need to increase CP and women in all stages of the project life cycle (i.e. prioritization) through capacity building.</p> <p><b><u>Indigenous Technology</u></b>: the need to support the development and use of labor-intensive approaches suitable to local needs.</p> <p><b><u>Environmental Awareness</u></b>: The need to increase environ. Awareness on SW health impacts to mobilize participation, WTP.</p> <p><b><u>Environmental Laws</u></b>: update legislation and introduce economic instruments.</p>

## SOLID WASTE MANAGEMENT – AN OVERVIEW

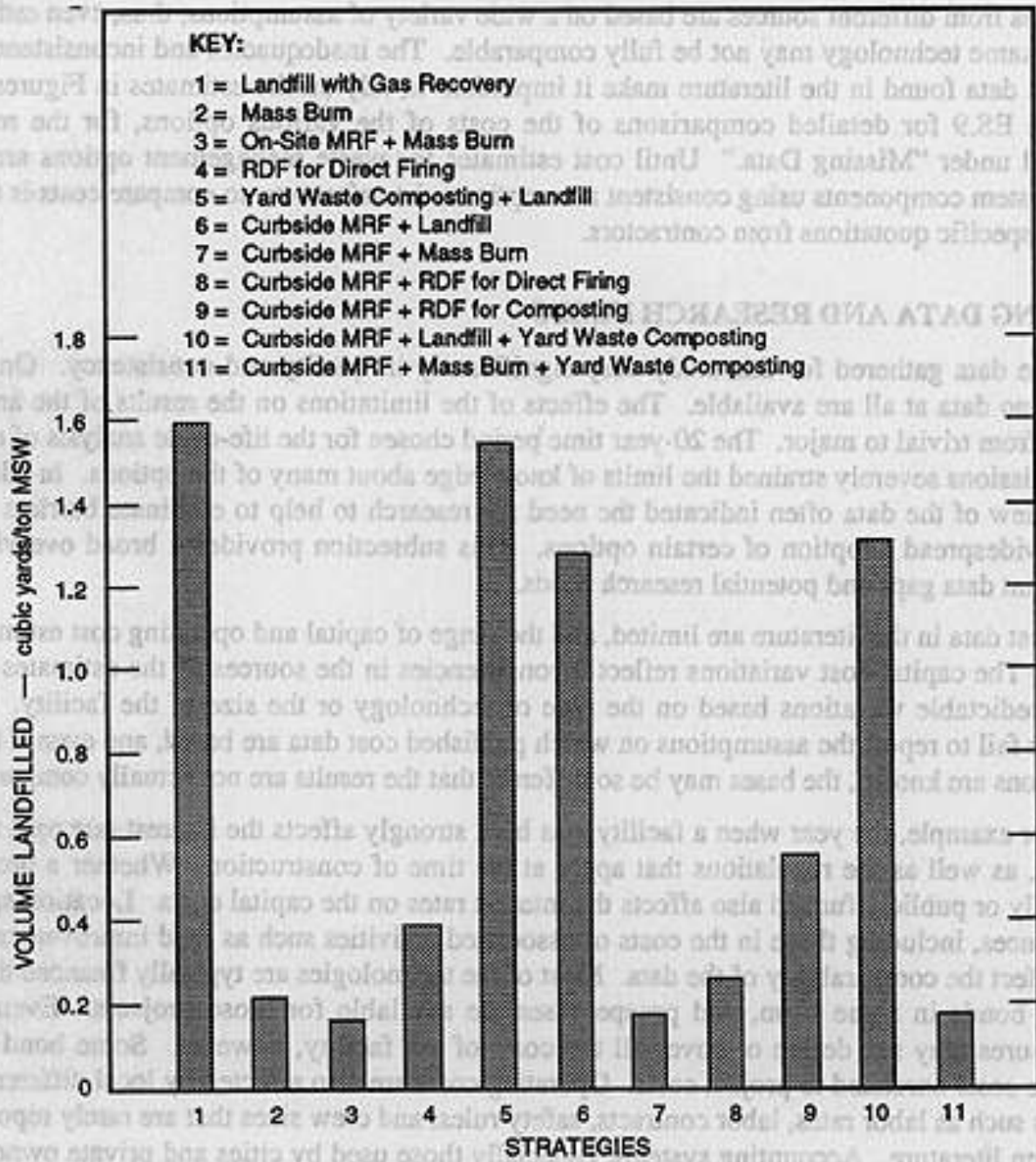
	<b>Developed Countries</b>	<b>Developing Countries</b>
Current Developments & Shifts	<p><u>Waste Minimization</u></p> <ul style="list-style-type: none"> <li>• Clean technologies – less resource use</li> <li>• Design products with no/little contribution to waste and pollution</li> <li>• Eco-labeling</li> <li>• Develop Techniques for disposal of hazardous waste</li> <li>• Recycling</li> </ul> <p><u>Regulatory Developments</u></p> <ul style="list-style-type: none"> <li>• EU in 1990: Basic Water Strategy</li> <li>• 1991 Directive: preparation of solid waste management plans and the development of a network of disposal installations</li> <li>• Development of technical guidelines for management of waste (Basel Convention-1996)</li> </ul>	<p><u>Private Sector Involvement is increasing.</u> Micro enterprises and cooperatives are playing a major role in SWM.</p> <p><u>Informal Sector involvement is well developed and active in many countries providing SWM services &amp; income opport.</u></p> <p><u>NGOs</u> are key to mobilizing the CBOs and micro enterprises in SWM projects.</p> <p><u>Community anticipation</u> is evident in the implementation phase of many SW projects. CBOs are supported by NGOs and Donors. Women are also playing a major role in SWM. (micro-enterprises, monitoring).</p> <p><u>Indigenous Technologies</u> Expensive capital intensive imported technologies are not sustainable (O&amp;M problems).</p> <p><u>Environmental Awareness:</u> Existing levels of environmental awareness are low. Some practices cause death and disability.</p> <p><u>Environmental Laws</u> Weak and inadequate regulatory framework. No mechanism for cost recovery.</p>

## SOLID WASTE MANAGEMENT – AN OVERVIEW

	<b>Developed Countries</b>	<b>Developing Countries</b>
Common Concerns	<ul style="list-style-type: none"> <li>• The environment's capacity to act as a sink for waste is questioned.</li> <li>• The world may see a five fold increase in waste generation by the year 2025.</li> <li>• Waste generation is increasing in tandem with growth in consumption.</li> <li>• Waste management is necessary for sustainable development – Chapter 20, 21 of Agenda 21: <u>Chapter 21: Solid Waste programs:</u> <ul style="list-style-type: none"> <li>• Waste minimization</li> <li>• Promotion of waste recycling and reuse</li> <li>• Safe waste disposal</li> <li>• Extending waste disposal coverage (developed countries)</li> <li>• Chapter 20: Hazardous Waste programs</li> <li>• Prevention of generation of Hazardous waste</li> <li>• Rehabilitation of contaminated sites.</li> </ul> </li> </ul>	
Specific Concerns	<ul style="list-style-type: none"> <li>• Existing trends indicate that there is a need to combat the Waste Disease through waste minimization</li> <li>• The increasing cost of SWM</li> <li>• Landfill capacity &amp; Hazardous waste</li> <li>• Stakeholder pressure</li> </ul>	<ul style="list-style-type: none"> <li>• In many countries existing approaches to solid waste management are unsustainable environmentally and economically. Major problem is collection and disposal.</li> <li>• Serious Public Health Impacts</li> <li>• The need to develop SWM strategies and the effective environmental management</li> </ul>

Figure ES.4

VOLUME LANDFILLED<sup>a</sup> (PER TON OF MSW)

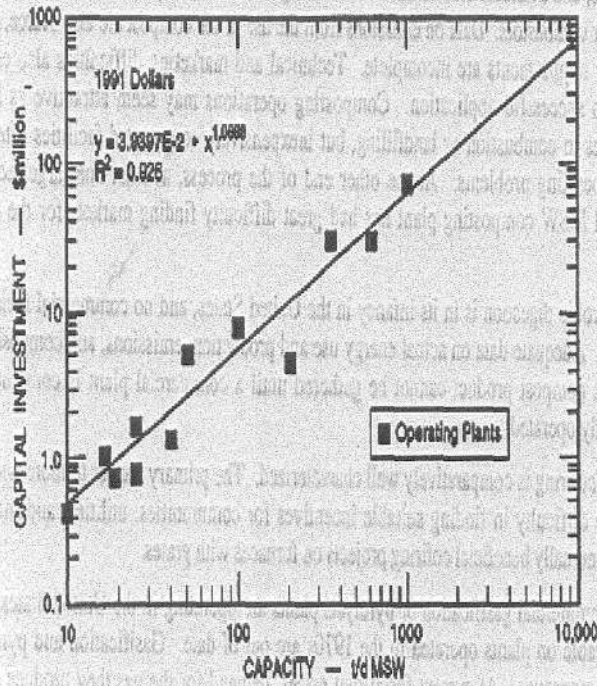


<sup>a</sup> Excludes volume required for residue from remanufacturing recyclables.

Figure ES.9

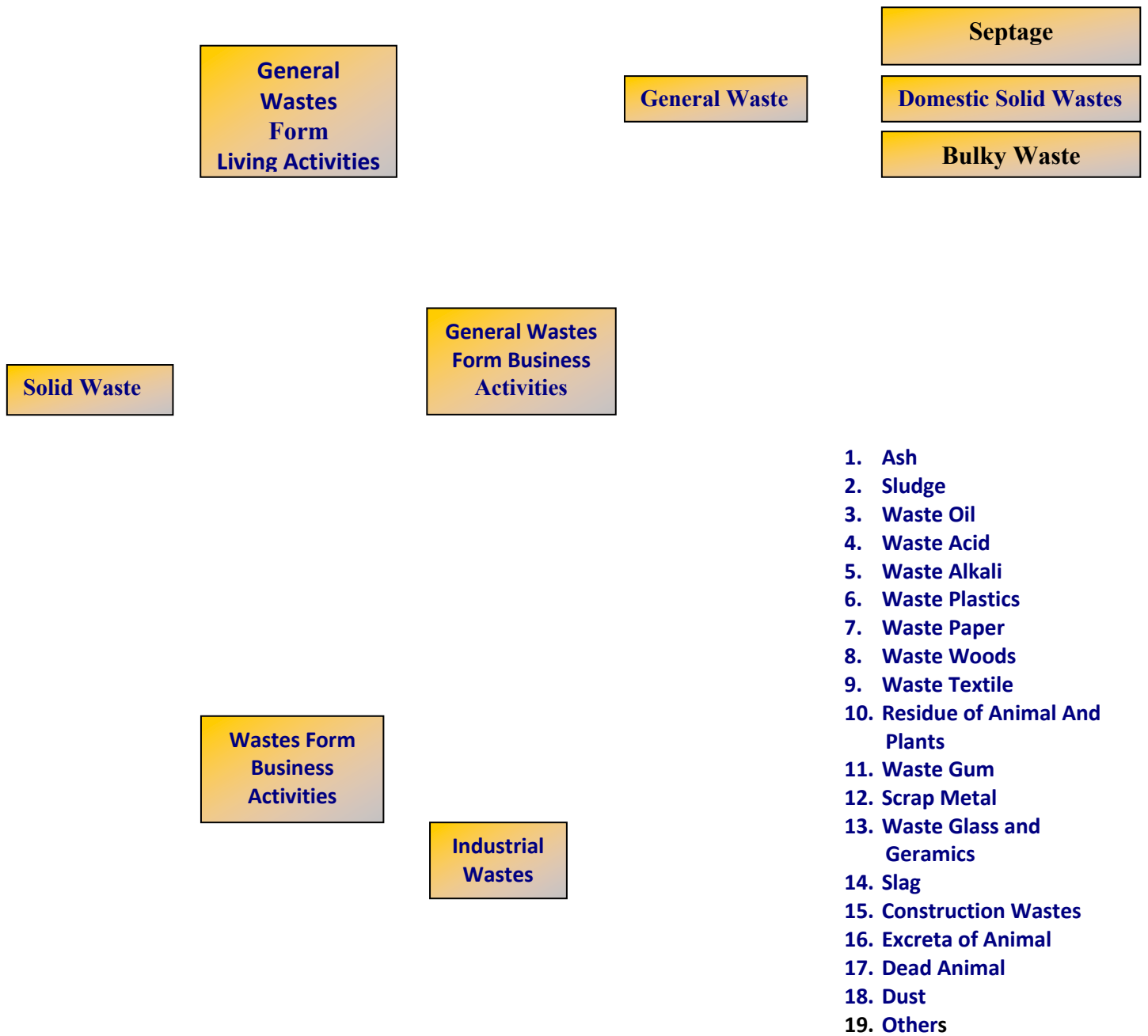
COMPOSTING OF MSW

EFFECT OF PLANT CAPACITY ON CAPITAL INVESTMENT\*



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\* Excluding cost associated with collection (e.g., trucks).



## Classification of Solid Waste



# **Comparison of Technologies for Managing Municipal Solid Waste**

**This report provides data for use in evaluating the proven technologies and combinations of technologies that might be considered for managing municipal solid waste (MSW). It covers five major methods for MSW management in common use today :**

- Landfilling**
- Mass combustion for energy recovery**
- Production of refuse-derived fuel (RDF)**
- Collection/separation of recyclables**
- Composting.**

**It also provides information on three MSW management technologies that are not widely used at present:**

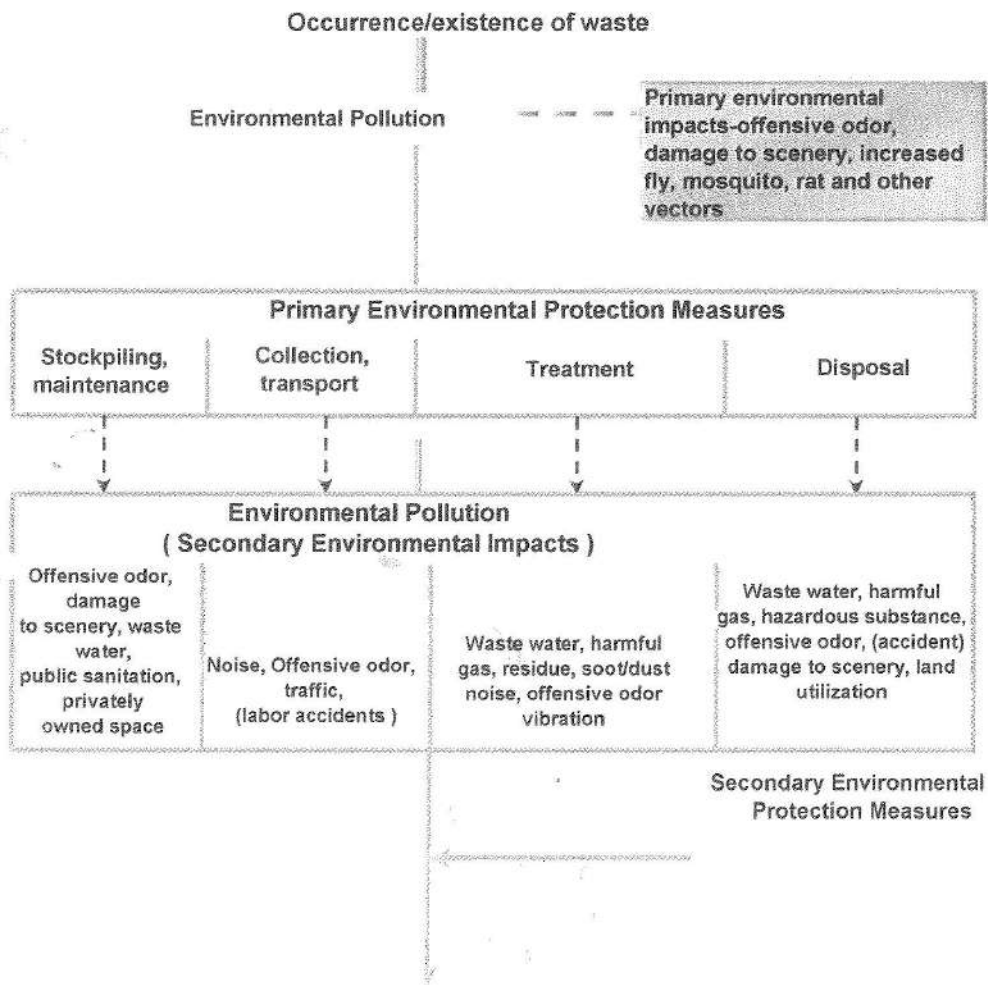
- Anaerobic digestion**
- Cofiring of MSW with coal**
- Gasification/pyrolysis.**

**To the extent possible with available reliable data, the report presents information for each proven MSW technology on:**

- Net energy balances**
- Environmental releases**
- Economics.**

**In addition to data about individual operations, the report presents net energy balances and inventories of environmental releases from selected combined MSW management strategies that use two or more separate operations.**

## Flow of Waste and environmental impacts



**Level 1**

**Waste Reduction**

**Level 2**

**Waste Recycling**

- a. Waste exchange, Sell, Give Away
- b. Collection of Usable Materials  
Waste Paper, Glass, Metal
- c. Material Recovery, Energy Recovery after Mixed Collection Waste

**Level 3**

**Stabilization**

**Efficient Solid Waste  
Management System from the  
collection to the final disposal**

**Level 4**

**Adequate Final Disposal  
with Consideration of  
Environmental Effects**

**System Approach to Solid Waste Management Problems**

## **CHARACTERISTICS OF EFFECTIVE SOLID WASTE MANAGEMENT**

- 1. ENSURE HUMAN HEALTH AND SAFETY**
- 2. ENVIRONMENTALLY SUSTAINABLE: REDUCE THE ENVIRONMENTAL IMPACTS OF WASTE MANAGEMENT, INCLUDING ENERGY CONSUMPTION, POLLUTION OF LAND, AIR AND WATER, AND LOSS OF AMENITY.**
- 3. ECONOMICALLY SUSTAINABLE: OPERATE AT A COST ACCEPTABLE TO THE COMMUNITY (HOUSEHOLD, BUSINESS AND GOVERNMENT).**

**UN COMMISSION ON SUSTAINABLE DEVELOPMENT  
INDICATORS BASED ON CHAPTERS OF  
AGENDA 21**

<b>CHAPTERS OF AGENDA 21</b>	<b>DRIVING FORCE INDICATORS</b>	<b>STATE INDICATORS</b>	<b>RESPONSE INDICATORS</b>
<b>Category: Environmental</b>			
Chapter 21: Environmentally sound management of solid wastes and sewage-related issues	<ul style="list-style-type: none"> <li>• Generation of industrial and municipal solid waste</li> <li>• Household waste disposed per capita</li> </ul>		<ul style="list-style-type: none"> <li>• Expenditure on waste management</li> <li>• Waste recycling and reuse</li> <li>• Municipal waste disposal</li> </ul>
Chapter 19: Environmentally sound management of toxic chemicals		<ul style="list-style-type: none"> <li>• Chemically induced acute poisonings</li> </ul>	<ul style="list-style-type: none"> <li>• Number of chemicals banned or severely restricted</li> </ul>
Chapter 20: Environmentally safe management of hazardous wastes	<ul style="list-style-type: none"> <li>• Generation of hazardous wastes</li> <li>• Imports and exports of hazardous wastes</li> </ul>		<ul style="list-style-type: none"> <li>• Expenditure on hazardous waste treatment</li> </ul>
Chapter 22: safe and environmentally sound management of radioactive wastes	<ul style="list-style-type: none"> <li>• Generation of radioactive wastes</li> </ul>	<ul style="list-style-type: none"> <li>• Area of land contaminated by hazardous wastes</li> </ul>	<ul style="list-style-type: none"> <li>• Expenditure on hazardous waste treatment</li> </ul>

## **INTEGRATED SOLID WASTE MANAGEMENT SYSTEM**

**WASTE IS AN INEVITABLE PRODUCT OF SOCIETY.**

**WHEN DEALING WITH WASTE THERE ARE TWO FUNDAMENTAL REQUIREMENTS:**

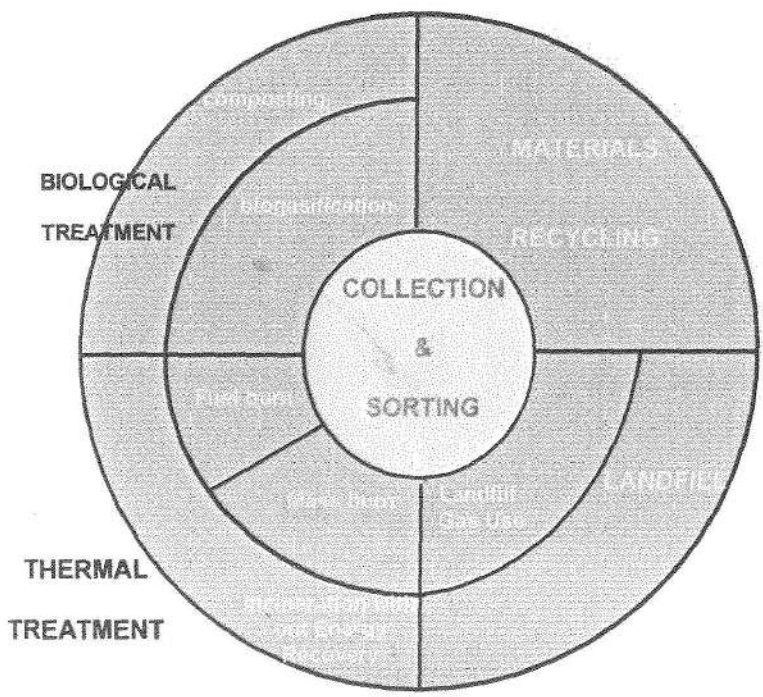
- 1. Less waste**
- 2. An effective system to manage the waste still produced**

The Brundland Report (Our Common Future 1987)

**Sustainable Development would only be achieved if society in general, and industry in particular, learned to produce "more with less"; more goods and services with less use of the world's resources and less pollution and waste.**



**Hierarchy of Solid Waste Management**



**The Elements of Integrated Waste Management**

## **DESIGNING AN EFFECTIVE SOLID WASTE MANAGEMENT SYSTEM**

### **1. STRIVE FOR BOTH OF THE FOLLOWING:**

- Environmental Sustainability                      Reduce Environmental Impact
- Economic Sustainability                              Drive Cost Out

### **2. TO ACHIEVE THESE THE SYSTEMS SHOULD BE**

- **INTEGRATED**      In waste materials  
                            In sources of waste  
                            In treatment methods
  1. anaerobic digestion
  2. composting
  3. energy recovery
  4. landfill
  5. recycling
- **MARKET ORIENTED**      materials and energy have end uses
- **FLEXIBLE**                      for constant improvements

### **3. TAKE CARE OF**

define clear objectives

design a total system against those objective

operate on a large enough scale

### **4. NEVER STOP LOOKING FOR IMPROVEMENTS IN ENVIRONMENTAL IMPACTS AND COST. THERE IS NO PERFECT SYSTEM**



## **ADVANTAGES OF THE HOLISTIC APPROACH:**

- 1. It gives an overall picture of the waste management process. This essential for strategic planning. Handling of each waste stream separately is ineffective.**
- 2. Environmentally, all waste management systems are part of the same system, the global ecosystem. Looking at the overall environmental burden of the system is the only rational approach.**
- 3. Economically, each individual unit in the waste management chain should run at a profit, or at least break even.**

# **INTEGRATED SOLID WASTE MANAGEMENT PLANNING PROCESS**

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- 1. ESTABLISH A COMMITTED STAFF WITHIN  
LOCAL GOVERNMENT AND BUILD LOCAL  
EXPERTISE IN SOLID WASTE MANAGEMENT**

## **Condition**

**In Egypt, many decision-makers are unfamiliar with waste management alternatives.**

## **Trends**

- Initiating low-technology waste management options such as source reduction education programs, neighborhood waste composting projects, pilot, scale recycling.**
- Promoting locally manufacture equipment**
- Technical assistance, training and public awareness**
- Private sector and NGO involvement.**

# **INTEGRATED SOLID WASTE MANAGEMENT PLANNING PROCESS**

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## **2. UNDERSTAND THE REGULATORY & INSTITUTIONAL CONTEXT**

### **Condition**

- **Lack of a financially and administratively independent division responsible for SW management**
- **Lack of legislation has led to fragmentation of responsibilities between authorities based on type of waste.**
- **Municipal solid waste management is the responsibility of the municipalities except for Cairo and Giza (cleaning authorities). They have no control on other types of wastes.**
- **No regulations pertaining to the management of industrial and hazardous wastes, hospital and laboratory waste.**

### **Trends**

- **Bi-laws have been issued for several cities for the establishment of solid waste management units**
- **EEAA has recommended regulate actions that will foster the development of ISWM systems such as:**
  - 1. Introduction of full coverage for management of municipal waste to reflect real costs.**
  - 2. Involvement of private companies licensed by municipalities with proper licensing and regulation.**
  - 3. The establishment of strategies for managing all types of wastes considering possibilities of waste reduction.**

# **INTEGRATED SOLID WASTE MANAGEMENT PLANNING PROCESS**

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## **3. ADDRESS LOCAL WASTE MANAGEMENT ISSUES DECISION MAKERS NEED TO HAVE GOOD DATA TO:**

- **Assess current and future waste streams**
- **Assess current waste management practices**
- **Determine disposal capacity and identify problems**
- **Set goals and objectives to address problems.**

### **Condition**

- **Existing data is not adequate to answer the above issues**
- **Active waste stream assessment is not a routine activity.**

### **Trends**

- **There is a need to establish systems for determining the quantity, composition, and sources of waste generated, volume of waste collected and volume of waste that needs disposal. Solid waste management is a management of present and future waste stream.**
- **Future population and economic trends must be accounted for in estimating future waste streams.**
- **Continues record-keeping for continues program planning and implementation.**

# **INTEGRATED SOLID WASTE MANAGEMENT PLANNING PROCESS**

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## **4. EVALUATE WASTE MANAGEMENT ALTERNATIVES & UNDERSTAND THE INTEGRATION OF ALTERNATIVES:**

**SWM system components include:**

- **SOURCE REDUCTION AND REUSE**
- **RECYCLING**
- **COMPOSITING**
- **COMBUSTION**
- **LANDFILL**

### **Condition & Trends**

- **There are no efforts directed to reduction of waste volume at the source. Source reduction is carried out at the HH.**
- **Recycling occurs informally at the HH level, streets and informal dump sites. In Cairo, the Informal Zabaleen System carry out sorting and selling of recyclables.**
- **To date, several of the composting plants (recommended in cities with high % of compostables in their waste stream and potential markets for compost) operate at a deficit.**
- **Many installed incinerators are not operating.**
- **Sanitary landfills are being established but siting remains a major problem.**

# **INTEGRATED SOLID WASTE MANAGEMENT PLANNING PROCESS**

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## **5. FOSTER PUBLIC EDUCATION AND INVOLVEMENT**

**Involvement of citizens in one of the most integral components of an ISWM system. Decision makers should:**

- **Involve the public early in the waste management planning process**
- **Tailor promotion and education programs to the needs of the community**
- **Understand the audience, prepare a formal plan and establish a method for evaluating programs**
- **Deliver educational messages, maintain program participation and funding**
- **The public has the right and the responsibility to understand the full costs and liabilities of managing the wastes they produce.**

### **Condition & Trends**

- **There is growing recognition of the importance of initiating public participatory approaches in SWM programs.**
- **There are many SWM projects that have initiate public participation.**
- **Many projects have demonstrated that education is the catalyst in project success through public involvement and leadership.**

## **SOLID WASTE MANAGEMENT IN EGYPT**

**EXISTING SOLID WASTE MANAGEMENT DOES NOT ADEQUATELY HANDLE THE VOLUME OF WASTE GENERATED (MUNICIPAL, INDUSTRIAL, INSTITUTIONAL, AGRICULTURE)**

- **Urban areas generate over 6 million tons a year of solid waste, at least 30 percent is not collected. This includes 13,000 tons of hazardous hospital waste.**
- **50,000 tons of harmful industrial wastes**
- **1 million ton of sludge are produced annually.**

**THESE WASTES POSE SEVERE HEALTH HAZARDS BECAUSE**

- **Dumping is the most common mode of disposal and is largely uncontrolled. Open burning of waste is also common. With the exception of Giza and Cairo, there is no systematic approach to collecting refuse. Poor areas in Giza and Cairo (with low value wastes) remain uncontrolled.**
- **Disposal of hazardous waste including hospital waste, with municipal wastes poses serious health implications.**